APPENDIX 6-2

BAT SURVEY REPORT

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1. INTRODUCTION

MKO was commissioned to complete a comprehensive assessment of the potential effects on bats, as part of an application for planning permission of a Proposed Development at Ballivor, Co. Meath and Co. Westmeath. This report provides details of the bat surveys undertaken, including survey design, methods and results, and the assessment of potential effects of the Proposed Development on bats. Where necessary, mitigation is prescribed to minimise any identified potential significant effects.

This report provides details of the bat surveys undertaken at the Site including survey design, methods and results, and the assessment of potential effects of the Proposed Development on bats. Surveys carried out in 2022 in accordance with NatureScot, 2021[1], form the core dataset for the assessment of effects on bats.

The 2022 results are supplemented by data collected during surveys undertaken on the Site in 2020 and designed in accordance with SNH, 2019[2] Guidelines. Existing Guidelines recommend the use of data no older than two years to carry out bat impact assessments. The 2020 data is presented in **Appendix 3**.

Bat surveys employed a combination of methods, including desktop study, habitat and landscape assessments, roost inspections, manual activity surveys and static detector surveys at ground level. Surveys undertaken in 2022 were based on a turbine layout of 26 turbines.

The assessment and mitigation provided in this report has been designed in accordance with NatureScot 2021. Consideration was also given to the Northern Ireland Environment Agency (NIEA) Natural Environment Division (NED) Guidance [3], which was produced in August 2021 (amended May 2022).

As detailed in Section 1.1.1 in Chapter 1 of the EIAR, for the purposes of this Bat Report, the various project components are described and assessed using the following references: 'Proposed Development', 'the Site', 'Wind Farm Site' and 'Grid Connection'. Where the 'the Site' is referred to, this relates to the primary study area for the Proposed Development, as delineated by the Wind Farm Site Boundary in green as shown on Figure 2-1. The actual site boundary for the purposes of the planning permission application occupies a smaller area within the primary Wind Farm Site Boundary.

Further details on project description and components are outlined in Chapter 4 of this EIAR.

1.1 Background

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

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

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

Pre-construction bat surveys are undertaken to provide a baseline to gain an insight into bat activity in the absence of turbines and to predict and mitigate against any future risks identified. Survey design and analyses of results at the Proposed Development site were undertaken with reference to the latest policy and legislation, scientific literature and industry guidelines. Any spatial, temporal or behavioural factors that may put bats at risk were fully considered.

1.2 Bat Survey and Assessment Guidance

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

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

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

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

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

European bats (Rodrigues *et al.* (2014)). The document guides the user through the key elements of survey, impact assessment and mitigation.

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

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

1.3 Statement of Authority

Scope development and project management was overseen by Aoife Joyce (BSc., MSc.) and John Hynes (BSc., MSc., MCIEEM).

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

Data analysis was undertaken, and results were compiled by Laura Gránicz (BSc., MSc.) and Impact assessment, the design of mitigation and final reporting was completed by Laura Gránicz under the supervision of Sara Fissolo (B.Sc.), Aoife Joyce, John Hynes and Pat Roberts (BSc., MCIEEM), who reviewed and approved the final document. Aoife has over four years' experience in ecological assessments and has completed CIEEM and BCI courses in Bat Impacts and Mitigation, Bat Tree Roost Identification and Endoscope training and Kaleidoscope Pro Analysis. John is a full member of the Chartered Institute of Ecology and Environmental Management (CIEEM) and has over 10 years' professional ecological consultancy experience. He is also a former member of the Bat Conservation Ireland management council. Pat has over 13 years' experience in management and ecological assessment.

1.4 Irish Bats: Legislation, Policy and Status

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

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

In addition, Irish species are further protected by national legislation (Wildlife Acts 1976-2022). Under this legislation, it is an offence to intentionally disturb, injure or kill a bat, or disturb its roost. Any work at a roost site must be carried out with the agreement of the National Parks and Wildlife Service (NPWS).

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

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

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

2. PROJECT DESCRIPTION

The Proposed Development is located approximately 2.5km south-southeast from Delvin, 3.7km east of Rahareny and 2.2km west of Ballivor, Co. Meath. The site is accessed via the R156 National Secondary Road which runs through the site, in addition to several other local roads in the surrounding area. The location of the Proposed Development is shown in Figure 2-1.

The land-use/activities within the proposed site predominantly consists of bare cut-away peat, re-vegetation of bare peat and scrub. Land-use in the surrounding landscape comprises a mix of agricultural land, cutaway peatlands, forestry, small village settlements and one-off rural housing.

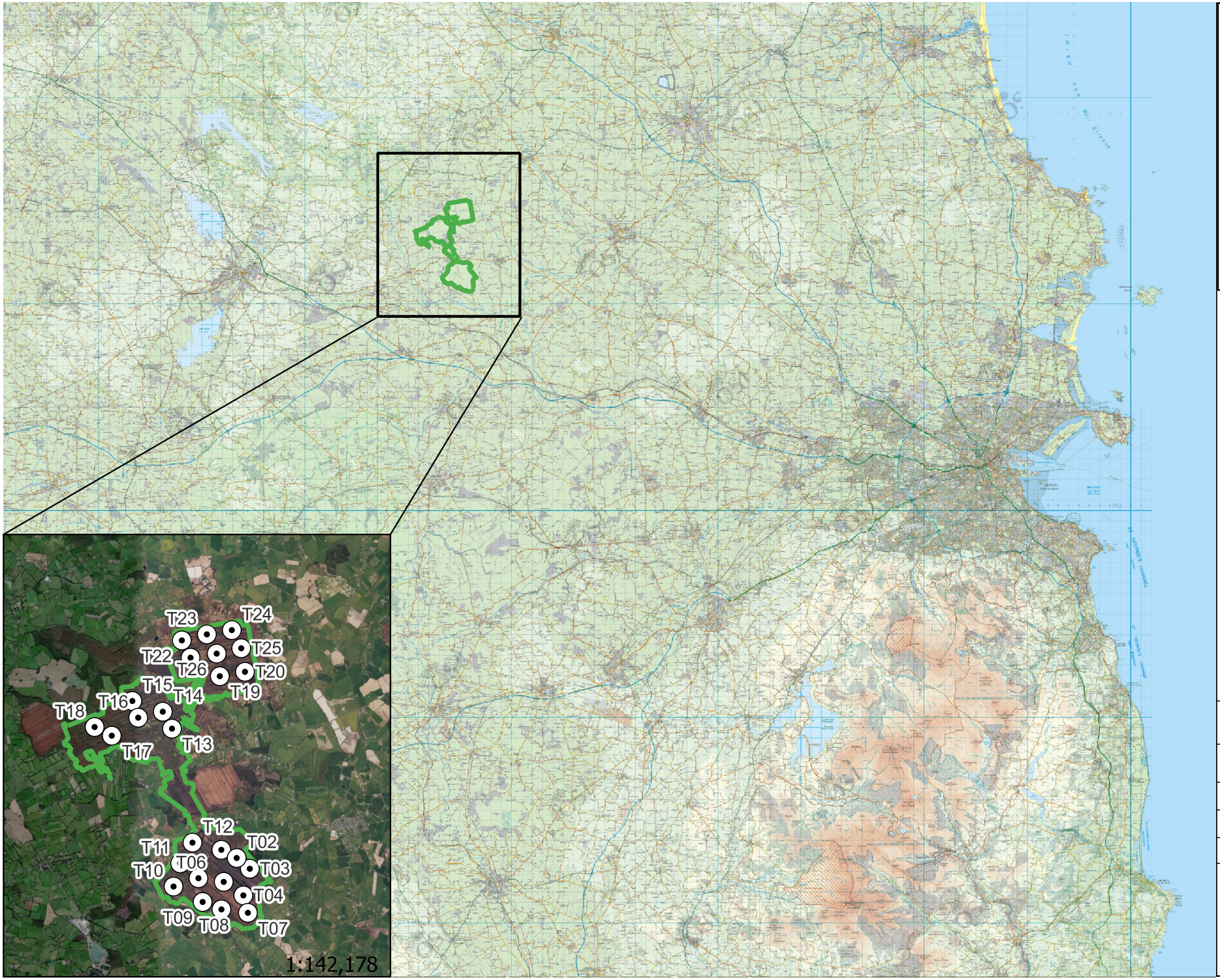
The Proposed Development comprises:

i. *26 No. wind turbines with a blade tip height of 200m and all associated hard-standing areas.*
ii. *2 No. permanent Meteorological Anemometry Masts with a height of 115 metres and removal of existing meteorological mast.*
iii. *4 No. temporary construction compounds, in the townlands of Bracklin and Grange More.*
iv. *5 No. temporary security cabins at the main construction site entrances as well as at a number of access points around the site, in the townland of Killagh, Grange More and Coolronan.*
v. *2 No. Borrowpits located in Carranstown Bog, and in third party land in the townland of Craddanstown; All works associated with the opening, gravel and spoil extraction, and decommissioning of the borrow pits.*
vi. *1 No. 110 kV electrical substation, which will be constructed in the townland of Grange More. The electrical substation will have 2 No. control buildings, a 36 metre high telecom tower, associated electrical plant and equipment, a groundwater well and a wastewater holding tank. All associated underground electrical and communications cabling connecting the turbines and masts to the proposed electrical substation, including road crossings at R156 and local road between Lisclogher and Bracklin Bogs, and all works associated with the connection of the proposed wind farm to the national electricity grid, which will be to the existing Mullingar – Corduff 110 kV overhead line via overhead line.*
vii. *Provision of new internal site access roads with passing bays measuring a total length of 28km and provision/upgrade of existing/new pathways for amenity use measuring a total length of approximately 3.3km and associated drainage.*
viii. *Temporary accommodating works to existing public road infrastructure to facilitate delivery of abnormal loads at locations on the R156 and R161 in the townlands of Doolystown and Moyfeagher;*
ix. *Accommodating works to widen existing site entrances off the R156 into Ballivor and Carranstown Bogs and reopen entrances at Lisclogher and Bracklin Bogs for use as construction site entrances and to facilitate delivery and movement of turbine components and construction materials; Entrances will be used for maintenance and amenity access during the operational period;*
x. *Permanent vertical realignment of the R156 in the vicinity of the site entrance to achieve required sight lines.*
xi. *Construction of permanent site entrances off a local road into Lisclogher and Bracklin Bogs to facilitate a crossing point for turbine components and construction materials and operation/amenity access;*
xii. *Provision of amenity access using existing entrances off the R156 and local roads in the townlands of Bracklin, Coolronan, Clondalee More and Craddanstown*;

xiii. *3 No. permanent amenity carparks in Ballivor Bog (50 car parking spaces), Carranstown (15 car parking spaces) and Bracklin Bog (15 car parking spaces) and the provision of bicycle rack facilities at each location.*

xiv. *All associated site works and ancillary development including access roads, amenity pathways, drainage and signage.*

xv. *A 10-year planning permission and 30-year operational life from the date of commissioning of the entire wind farm.*



Map Legend

- Wind Farm Site Boundary
- Proposed Turbine Layout

N

Drawing Title

Site Location

Project Title
Ballivor Wind Farm Development

Drawn by	Checked by
LG	AJ
Project No. 191137	Drawing No. Figure 2-1.
Scale 1:477,938	Date 24/02/2023

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3. METHODS

3.1 Consultation

A scoping exercise was undertaken as part of the EIAR for the Proposed Development. A Scoping Document, providing details of the application site and the Proposed Development, was prepared by MKO and circulated to consultees in May 2020, February 2021 and May 2021. As part of this exercise, prominent Irish conservation groups were contacted, and Bat Conservation Ireland (BCI) and National Parks and Wildlife Service (NPWS) were specifically invited to comment on the potential of the Proposed Development to affect bats.

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

3.2 Desk Study

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

3.2.1 Bat Records

The National Bat Database of Ireland holds records of bat observations received and maintained by BCI. These records include results of national monitoring schemes, roost records as well as ad-hoc observations. The most recent search examined bat presence and roost records within a 10 km radius of a central point within the Proposed Development (Grid Ref: N 64592 54895) (BCI 2012, Hundt 2012, NatureScot, 2021). Available bat records were provided by Bat Conservation Ireland on 23/02/2022. Results from the National Biodiversity Data Centre were also reviewed for bat species present within the relevant 10km grid squares of the Proposed Development.

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

3.2.2 Bat Species' Range

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

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

3.2.3 Designated Sites

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

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

3.2.4 Landscape Features

3.2.4.1 Ordnance Survey Mapping

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

3.2.4.2 Geological Survey Ireland

The Geological Survey Ireland (GSI) online mapping tool and University of Bristol Speleological Society (UBSS) Cave Database for the Republic of Ireland were consulted for any indication of natural subterranean bat sites, such as caves, within 10 km of the proposed site (BCI, 2012) (last searched on the 22nd February 2023). 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 22nd February 2023).

3.2.4.3 National Biodiversity Data Centre Bat Landscape Mapping

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

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

3.2.4.4 Additional Wind Energy Projects in the Wider Landscape

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

3.2.5 Multidisciplinary Surveys

Multidisciplinary walkover surveys were undertaken in 2020, 2021 and 2022 (Table 3-1). The site was systematically and thoroughly walked in a ground-truthing exercise with the habitats on the Proposed Development site assessed and classified. The habitats (including any culverts/bridges) were assessed for bat commuting, foraging and roosting suitability. The grid connection and haul routes were visited as part of the multidisciplinary surveys outlined below and in Chapter 6 of the main EIAR.

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

Table 3-1 Multidisciplinary Survey Effort

Multidisciplinary Survey	Dedicated Bat Survey
23rd April 2020	23rd April 2020
26th May 2020	7th May 2020
4th June 2020	4th June 2020
3rd September 2020	16th June 2020
26th May 2021	20th July 2020
27th May 2021	7th August 2020
8th July 2021	3rd September 2020
15th July 2021	13th September 2020
27th September 2021	8th April 2022
26th April 2022	26th April 2022
26th September 2022	20th June 2022
16th February 2023	19th July 2022
	6th October 2022
	20th October 2022
	25th October 2022

3.3 Field Surveys

3.3.1 Bat Habitat Suitability Appraisal

Bat walkover surveys were carried out throughout 2020 and 2022. During these surveys, habitats within the EIAR Study Area were assessed for their suitability to support roosting, foraging and commuting bats. Connectivity with the wider landscape was also considered. Suitability was assessed according to Collins (2016) which provides a grading protocol for roosting habitats and for commuting and foraging areas. Suitability categories are divided into *High, Moderate, Low* and *Negligible*, and are described fully in **Appendix 1**.

3.3.1.1 Roost Surveys

A search for roosts was undertaken within 200m plus the rotor radius (i.e. 85m) of the Proposed Development footprint (NatureScot, 2021). The aim was to determine the presence of roosting bats and the need for further survey work or mitigation. The site was visited in April, June, July and October 2022. A walkover was carried out and all structures and trees were assessed for their potential to support roosting bats (see **Appendix 1** for criteria in assessing roosting habitats).

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

3.3.2 Manual Transects

Manual activity surveys comprised walked transects at dusk. A series of representative transect routes were selected throughout the Proposed Development site. The aim of these surveys was to identify bat species using the site and gather any information on bat behaviour and important features used by bats. Transect routes were prepared with reference to the proposed layout, desktop and walkover survey results as well as any health and safety considerations and access limitations. As such, transect routes generally followed existing roads and tracks. Transect routes are presented in Figure 3-1.

Transects were walked by two surveyors, recording bats in real time. Dusk surveys commenced 30 minutes before sunset and were completed for up to 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. Transect surveys were undertaken in Spring, Summer and Autumn 2022. Table 3-2 summarises survey effort in relation to walked transects.

Table 3-2 Survey Effort - Manual Transects

Date	Surveyors	Sunrise/ Sunset	Type	Weather	Walked (km)
26th April 2022	Shane Connolly and Laura McEntegart	20:49	Dusk	10°C, dry, 25% cloud, calm air	7.9km
19th July 2022	Shane Connolly and Laura McEntegart	21:43	Dusk	18°C, dry, 90% cloud cover, calm air	11km
20th October 2022	Shane Connolly and Neil Campbell	18:20	Dusk	15°C dry, 80-100% cloud cover, calm/ light air	3.2km
Total Survey Effort					**22.1km**

3.3.3 Ground-level Static Surveys

Where developments have up to 10 turbines, NatureScot requires 1 detector per turbine plus a third of additional turbines. The scope of bat work was designed in 2020, prior to the finalising of the Proposed Development layout (i.e. 26 turbines). The surveys were designed for a potential layout of up to 35 turbines. The extent of the Proposed Development changed through the design process, and the number of turbines reduced to 26 turbines. In 2022 15 detectors were deployed following the change.

Automated bat detectors were deployed for at least 10 nights of suitable weather in spring (April-May), 20 nights in summer (June-mid August) and 10 nights in autumn (mid-August-October), (NatureScot, 2021). Detector locations were based on indicative turbine locations and differ slightly to the final Proposed Development turbine layout. Detector locations achieved a representative spatial spread in relation to proposed turbines and sampled the range of available habitats. Scrub habitat was present throughout the site in small linear pockets along drains and cutover bog. Figure 3-1 presents static detector locations in relation to the final proposed layout. Static detector locations are described in Table 3-3.

Table 3-3 Ground-level Static Detector Locations

ID	Location (ITM)	Habitat	Linear Feature within 50m	Corresponding/ Nearest Turbine(s)
D01	665161 753511	Cutover Bog (PB4)	Scrub (WS1)	T01 & T02
D02	665988 752966	Cutover Bog (PB4)	Scrub (WS1)	T02 & T03
D03	665928 751691	Cutover Bog (PB4), Dry Silicious Heath (HH1)	Scrub (WS1)	T07, T04 & T08
D04	663783 752452	Scrub (WS1), Dry Silicious Heath (HH1), Cutover Bog (PB4)	Scrub (WS1)	T10 & T06
D05	665231 752586	Cutover Bog (PB4), Dry Silicious Heath (HH1)	Scrub (WS1)	T05 & T04
D06	664616 752002	Cutover Bog (PB4), Dry Silicious Heath (HH1), Scrub (WS1)	Scrub (WS1)	T09 & T08
D07	664329 753720	Cutover Bog (PB4), Dry Silicious Heath (HH1)	Scrub (WS1)	T12

D08	663741 757005	Cutover Bog (PB4), Dry Silicious Heath (HH1), Wet Grassland (WS4), Scrub (WS1)	Scrub (WS1)	T13
D09	662766 757322	Cutover Bog (PB4), Dry Silicious Heath (HH1), Poor Fen and Flush (PF2)	Scrub (WS1)	T16
D10	661509 757054	Cutover Bog (PB4), Dry Silicious Heath (HH1), Poor Fen and Flush (PF2)	Scrub (WS1)	T18
D11	664025 759551	Cutover Bog (PB4), Poor Fen and Flush (PF2)	Scrub (WS1)	T22
D12	665118 758518	Cutover Bog (PB4), Poor Fen and Flush (PF2)	Scrub (WS1)	T19
D13	665850 758649	Cutover Bog (PB4), Poor Fen and Flush (PF2)	Scrub (WS1)	T20
D14	665471 759851	Cutover Bog (PB4), Poor Fen and Flush (PF2), Dry Silicious Heath (HH1)	Scrub (WS1)	T24
D15	665033 759184	Cutover Bog (PB4), Poor Fen and Flush (PF2)	Scrub (WS1)	T26

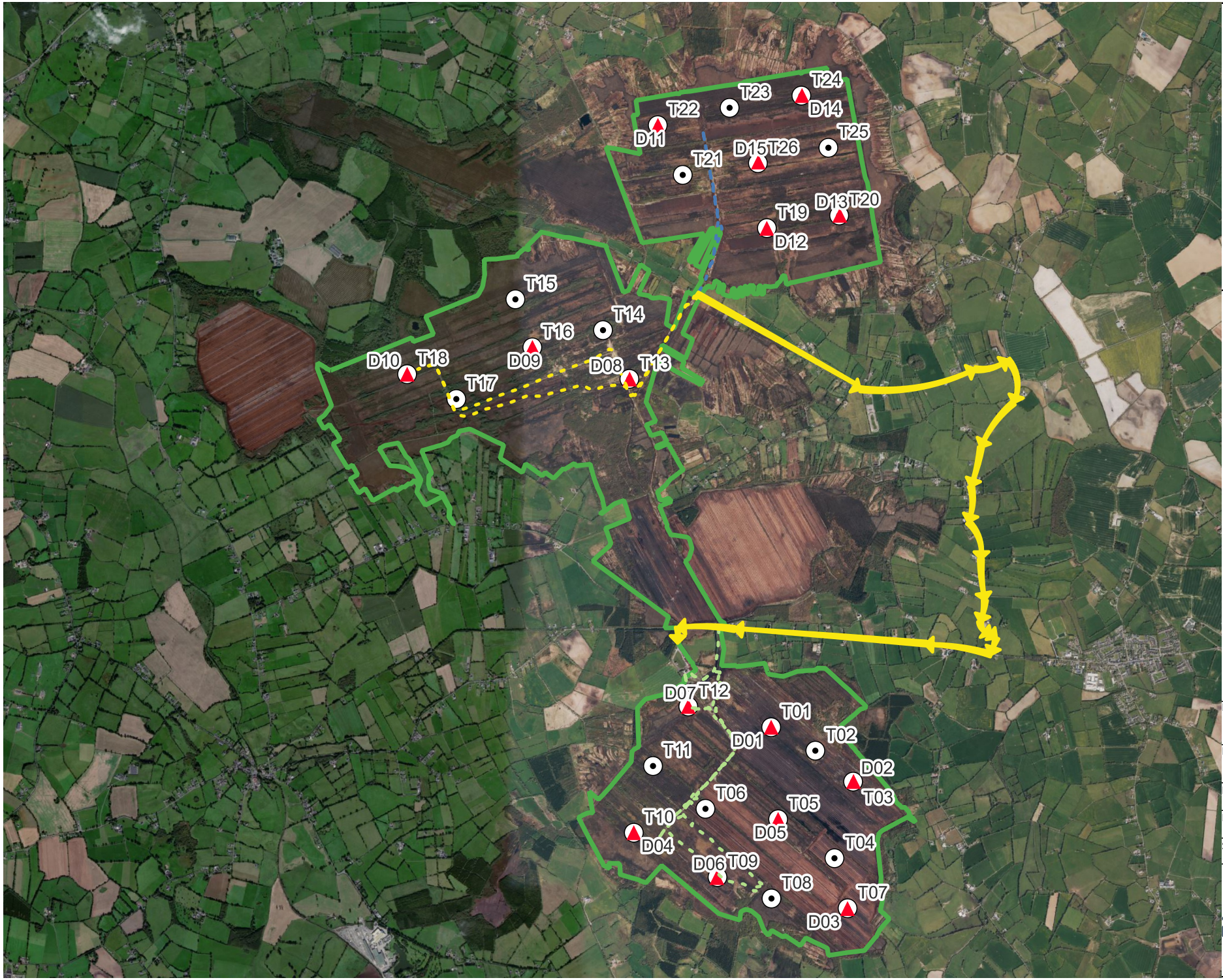
Full spectrum bat detectors, Song Meter SM4BAT (Wildlife Acoustics, Maynard, MA, USA), were employed using settings recommended for bats, with minor adjustments in gain settings and band pass filters to reduce background noise when recording. Detectors were set to record from 30 minutes before sunset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

Onsite weather monitoring was undertaken concurrently with static detector deployments. One Vantage Pro 2 (Davis Instruments, CA, UCS) was deployed each season and night-time hourly data was tracked remotely to ensure a sufficient number of nights (i.e. minimum 10 no.) with appropriate weather conditions were captured (i.e. dusk temperatures above 8˚C, wind speeds less than 5m/s and no or only very light rainfall). Table 3-4 summarises survey effort achieved in 2022 for each of the detector locations.

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

Season	Survey Period	Total Survey Nights per Detector Location	Nights with Appropriate Weather
Spring	8th April – 26th April *	18	16
Summer	20th June – 19th July	29	27
Autumn	6th October – 25th October	19	19
Total Survey Effort		**66**	**62**

*D09 failed and was redeployed from 26th April until 10th May 2022 (14 survey nights, 13 nights with appropriate weather).



Map Legend

- Wind Farm Site Boundary
- Proposed Turbine Layout
- Static Detector Locations
- Spring Dusk Walked Transect
- Spring Driven Transect
- Summer Dusk Walked Transect
- Autumn Dusk Walked Transect

N

Drawing Title

2022 Survey Effort

Project Title

Ballivor Wind Farm Development

Drawn by	Checked by
LG	AJ
Project No. 191137	Drawing No. Figure 3-1.
Scale 1:49,510	Date 24/02/2023

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3.4 Bat Call Analysis

All recordings from 2022 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 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 (peak frequency of maximum energy in search flight) frequencies of ~55 kHz and ~46 kHz respectively (Jones & van Parijs, 1993).

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

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

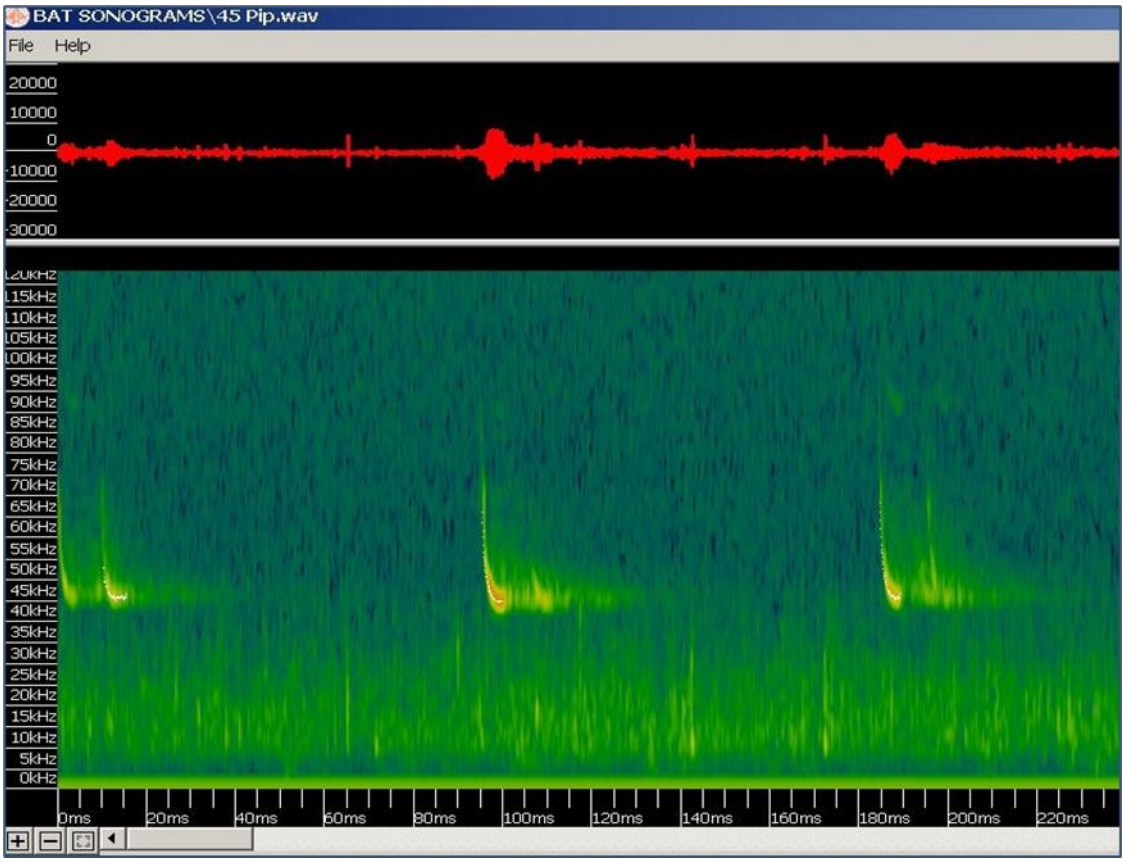


Plate 3-1 Sonogram of Echolocation Pulses of Common pipistrelle (Peak Frequency 45kHz)

3.5 Assessment of Bat Activity Levels

In 2020 the static detector monitoring results were uploaded to the online database tool Ecobat (mammal.org.uk). Table 3-5 defines bat activity levels as they relate to Ecobat percentile values (NatureScot, 2021). Results of this assessment are presented in **Appendix 3** and detailed in **Appendix 4**.

Table 3-5 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.

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) across the site, divided into tertiles. The use of bat passes per hour rates was deemed more appropriate to account for seasonal changes in night length. 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 was then assessed as Low, Medium or High activity for each season recorded based on the quartile ranges identified. Table 3-6 presents activity ranges per species group identified:

Table 3-6 Site-specific 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	< 3.6	< 0.5	< 0.2
Medium	5.5 – 16.5	3.6 – 10.9	0.5 – 1.6	0.2 – 0.7
High	16.5 <	10.9 <	1.6 <	0.7 <

3.6 Assessment of Collision Risk

3.6.1 Population Risk

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

In Plate 3-2, an adapted assessment of vulnerability of wind turbine collision for Irish bat populations is provided. This adaptation of the NatureScot Guidance Table 2 was based on collision risk and species abundance of Irish bat populations. Species' collision risk follows those described in NatureScot (2021).

Relative abundance for Irish species was determined in accordance with Wray *et al.* (2010) using population data available in the 2019 Article 17 reports (NPWS, 2019). Feeding and commuting behaviours, and habitat preferences for bat species in Ireland were also considered.

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

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

3.6.2 Site Risk

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

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

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

3.6.3 Overall Risk Assessment

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

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

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

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

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

3.7 Limitations

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

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

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

4. SURVEY RESULTS

4.1 Consultation

4.1.1 Bat Conservation Ireland

Bat Conservation Ireland were invited to comment on the potential of the Proposed Development to affect bats. As of 23/03/2023, no response has been received.

4.1.2 Development Applications Unit - NPWS

A detailed scoping exercise was undertaken for the Proposed Development. A response from the Department of Culture, Heritage and the Gaeltacht (Ref: G Pre00073/2020) provided recommendations regarding nature conservation, including bats. The relevant excerpts, specifically relating to bats, are summarised below and the full results of the scoping and consultation exercise are described in the main EIAR. The response was received on the 26/06/2020 and the letter is provided in Appendix 2-1 of the EIAR.

Bats

"Passive bat surveying at height should be undertaken to document highflying species such as Leisler bat. Risk to bats in terms of collision and barotrauma should be addressed."

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

No response was received to the scoping and consultation requests sent in February and May 2021.

4.2 Desk Study

4.2.1 Bat Records

Bat Conservation Ireland

Based on the size of the proposed site, two searches were made with The National Bat Database of Ireland for bat records within a 1km and 10km radius of the proposed site (IG Ref: E 263983 N 259683 and E 265634 N 251541; last search (23/02/23)).

A data request was also sent to Bat Conservation Ireland for records of bat activity and roosts within a 1km and 10km radius of the Site. Available bat records were provided by Bat Conservation Ireland on 01/03/2022. The search yielded no results of roosts within a 1km radius of the Proposed Development. Six bat species were recorded within a 10km radius of the site, Common pipistrelle (*Pipistrellus pipistrellus*), Leisler's bat (*Nyctalus leisleri*), Brown-eared bat (*Plecotus auritus*), Soprano pipistrelle (*Pipistrellus pygmaeus*), Daubenton's bat (*Myotis daubentonii*) and Natterer's bat (*Myotis nattereri*), and some instances of *Myotis* bats were only identified at genus level. The results of the database search are provided in Table 4-1.

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

Northern Section of Proposed Site (IG Ref: E 263983 N 259683)				
Record	Species	Grid Reference	Date	Location

	Plecotus auritus	N6854	N/A	Ballivor, Co. Meath
	Pipistrellus pygmaeus	N6568	N/A	Clonmellon, Castlepollard, County Westmeath
Roost	*Plecotus auritus*	N7258	N/A	Kildalkey, County Meath
	Plecotus auritus	N5651	N/A	Killucan, Mullingar, County Westmeath
	Plecotus auritus	N5458	N/A	Castlepollard, County Westmeath
	Myotis daubentonii, Unidentified bat, *Pipistrellus pygmaeus, Pipistrellus pipistrellus* (45kHz)	N7202163568	N/A	Athboy Bridge Transect
	Unidentified bat, Myotis daubentonii	N7145364744	N/A	Athboy Bridge Transect spot 1
	Myotis daubentonii, Unidentified bat	N7197763830	N/A	Athboy Bridge Transect spot 10
	Myotis daubentonii, Unidentified bat	N7194263934	N/A	Athboy Bridge Transect spot 2
	Myotis daubentonii, Unidentified bat	N7191864026	N/A	Athboy Bridge Transect spot 3
	Myotis daubentonii, Unidentified bat	N7182964149	N/A	Athboy Bridge Transect spot 4
	Myotis daubentonii, Unidentified bat	N7169164250	N/A	Athboy Bridge Transect spot 5
	Myotis daubentonii	N7159764384	N/A	Athboy Bridge Transect spot 6
Transect	*Myotis daubentonii, Unidentified bat*	N7152464653	N/A	Athboy Bridge Transect spot 7
	Myotis daubentonii, Unidentified bat	N7148964653	N/A	Athboy Bridge Transect spot 8
	Unidentified bat, Myotis daubentonii, Nyctalus leisleri	N6430061900	N/A	Athboy Bridge Transect spot 9
	Myotis daubentonii, Unidentified bat	N592498	N/A	Coxtown Transect
	Pipistrellus pipistrellus (45kHz), Pipistrellus spp. (45kHz/55kHz), Nyctalus leisleri	N7339569390	N/A	DArcys Bridge Transect
	Pipistrellus pipistrellus (45kHz), Pipistrellus spp. (45kHz/55kHz), Nyctalus leisleri	N7357764382	N/A	N74 (3) 2006-
	Pipistrellus pipistrellus (45kHz), Pipistrellus spp. (45kHz/55kHz), Pipistrellus pygmaeus, Nyctalus leisleri, Unidentified bat	N7327557662	N/A	N74 (4) 2006-
	Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus, Nyctalus leisleri, Pipistrellus spp. (45kHz/55kHz)	N7332753266	N/A	N74 (5) 2006-
	Pipistrellus pygmaeus, Nyctalus leisleri, Pipistrellus pipistrellus (45kHz), Pipistrellus nathusii, Pipistrellus spp. (45kHz/55kHz), Unidentified bat	N734526	N/A	N74 (6) 2006-
	Myotis daubentonii, Unidentified bat	N7145364744	N/A	Scarrif Bridge (Meath) Transect
	Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus, Nyctalus leisleri	N6864654122	23/08/2018	Consultancy Surveys
	Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus, Nyctalus leisleri, Myotis spp.	N6772154194	23/08/2018	Consultancy Surveys

	Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus	N6841754164	23/08/2018	Consultancy Surveys
	Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus, Nyctalus leisleri	N6844254095	23/08/2018	Consultancy Surveys
	Myotis daubentonii	N710564	11/10/2009	BATLAS 2010
	Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus	N716642	20/09/2009	BATLAS 2010
	Pipistrellus pygmaeus, Myotis daubentonii	N708667	20/09/2009	BATLAS 2010
	Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus	N736676	20/09/2009	BATLAS 2010
	Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus, Myotis daubentonii	N6552161153	13/07/2017	BATLAS 2010
	Myotis daubentonii	N5851549989	25/09/2015	BATLAS 2020
	Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus, Nyctalus leisleri, Pipistrellus spp. (45kHz/55kHz)	N5796050836	25/09/2015	BATLAS 2020
	Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus, Nyctalus leisleri, Myotis spp.	N5438552353	18/08/2015	BATLAS 2020
	Pipistrellus pygmaeus, Myotis daubentonii	N6003253032	15/08/2016	BATLAS 2020
	Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus	N6331053309	15/08/2016	BATLAS 2020
	Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus, Pipistrellus spp. (45kHz/55kHz)	N5652353332	18/09/2015	BATLAS 2020
	Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus, Plecotus auritus, Myotis spp.	N6785054205	21/09/2018	BATLAS 2020
	Nyctalus leisleri	N6171854227	16/08/2016	BATLAS 2020
	Pipistrellus pygmaeus	N6591454415	21/09/2018	BATLAS 2020
	Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus	N5453355765	30/09/2015	BATLAS 2020
	Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus	N6084555945	27/09/2018	BATLAS 2020
	Pipistrellus pipistrellus (45kHz), Pipistrellus nathusii	N6934556105	21/09/2018	BATLAS 2020
	Pipistrellus pipistrellus (45kHz)	N5546856382	26/09/2015	BATLAS 2020
	Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus, Nyctalus leisleri, Plecotus auritus, Myotis spp.	N6520457382	22/09/2018	BATLAS 2020
	Pipistrellus pygmaeus, Nyctalus leisleri	N5845357619	26/09/2015	BATLAS 2020
	Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus, Nyctalus leisleri	N6255858610	22/09/2018	BATLAS 2020
Ad-Hoc	*Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus*	N7073959394	20/08/2018	BATLAS 2020
	Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus, Myotis daubentonii, Myotis spp.	N5781059945	09/10/2015	BATLAS 2020
	Pipistrellus pipistrellus (45kHz)	N6473660827	13/07/2017	BATLAS 2020
	Pipistrellus pygmaeus, Myotis daubentonii	N5637162568	27/06/2017	BATLAS 2020
	Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus, Myotis daubentonii	N6204462577	13/07/2017	BATLAS 2020
	Pipistrellus pipistrellus (45kHz)	N5676363989	27/06/2017	BATLAS 2020
	Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus, Nyctalus	N7168664269	19/08/2018	BATLAS 2020

	leisleri, Myotis daubentonii, Plecotus auritus			
	Pipistrellus pygmaeus	N6571264430	13/07/2017	BATLAS 2020
	Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus	N5580865499	27/06/2017	BATLAS 2020
	Pipistrellus pygmaeus, Pipistrellus spp. (45kHz/55kHz)	N6139866125	14/07/2017	BATLAS 2020
	Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus, Nyctalus leisleri	N7075266653	19/08/2018	BATLAS 2020
	Pipistrellus pygmaeus, Pipistrellus spp. (45kHz/55kHz)	N6228467284	14/07/2017	BATLAS 2020
	Pipistrellus pygmaeus, Myotis daubentonii	N6748069165	13/07/2017	BATLAS 2020
	Pipistrellus pipistrellus (45kHz)	N6632869554	14/07/2017	BATLAS 2020
	Plecotus auritus	N684653	17/07/2005	Consultancy Surveys
	Nyctalus leisleri, Pipistrellus pipistrellus (45kHz)	N6800054000	27/06/2007	Brown long-eared Roost Monitoring Scheme
	Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus, Plecotus auritus	N5485065500	20/05/2003	Consultancy Surveys
	Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus, Plecotus auritus, Nyctalus leisleri	N5680051850	06/09/2007	Consultancy Surveys
	Myotis natterreri, Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus, Nyctalus leisleri	N7109358118	26/03/2012	Consultancy Surveys
Southern Section of Proposed Site (IG Ref: E 265634 N 251541)				
Record	Species	Grid Reference	Date	Location
	Nyctalus leisleri, Pipistrellus spp. (45kHz/55kHz)	N7313742708	N/A	Enfield, County Meath
	Plecotus auritus	N6854	N/A	Ballivor, Co. Meath
Roost	*Pipistrellus pygmaeus*	N7551	N/A	Doolystown, Trim, County Meath
	Pipistrellus spp. (45kHz/55kHz)	N6844	N/A	Ballynakill, Longwood, County Meath
	Pipistrellus pygmaeus	N6849	N/A	Killyon, County Meath
	Plecotus auritus	N5743	N/A	Kinnegad, County Meath
	Plecotus auritus	N7258	N/A	Kildalkey,County Meath
	Plecotus auritus	N5651	N/A	Killucan, Mullingar, County Westmeath
	Unidentified bat	N6087346115	N/A	Ballivor Road Bridge Transect spot 1
	Unidentified bat	N6077245970	N/A	Ballivor Road Bridge Transect spot 3
	Unidentified bat,Myotis daubentonii	N6071345902	N/A	Ballivor Road Bridge Transect spot 4
	Myotis daubentonii,Unidentified bat	N6064245796	N/A	Ballivor Road Bridge Transect spot 5
	Myotis daubentonii	N6010045717	N/A	Ballivor Road Bridge Transect spot 6
	Myotis daubentonii,Unidentified bat	N592498	N/A	DArcys Bridge Transect
Transect	*Unidentified bat,Myotis daubentonii*	N7220042600	N/A	Moyvalley Bridge Transect
	Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus, Nyctalus leisleri, Pipistrellus spp. (45kHz/55kHz)	N7327557662	N/A	N74 (5) 2006-

	Pipistrellus pygmaeus, Nyctalus leisleri, Pipistrellus pipistrellus (45kHz), Pipistrellus nathusii, Pipistrellus spp. (45kHz/55kHz), Unidentified bat	N7332753266	N/A	N74 (6) 2006-
	Pipistrellus pipistrellus (45kHz), Pipistrellus spp. (45kHz/55kHz), Pipistrellus pygmaeus, Nyctalus leisleri, Plecotus auritus, Unidentified bat	N7559147955	N/A	N74 (8) 2006-
	Pipistrellus spp. (45kHz/55kHz), Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus, Nyctalus leisleri	N7273944501	N/A	N74 (9) 2006-
	Myotis daubentonii, Unidentified bat	N734526	N/A	Scarrif Bridge (Meath) Transect
	Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus, Nyctalus leisleri	N6864654122	23/08/2018	Consultancy Surveys
	Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus, Nyctalus leisleri, Myotis spp.	N6772154194	23/08/2018	Consultancy Surveys
	Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus	N6841754164	23/08/2018	Consultancy Surveys
	Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus, Nyctalus leisleri	N6844254095	23/08/2018	Consultancy Surveys
	Myotis daubentonii	N710564	11/10/2009	BATLAS 2010
	Pipistrellus pygmaeus, Pipistrellus pipistrellus (45kHz)	N7562957770	11/10/2009	BATLAS 2010
	Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus, Myotis daubentonii	N6552161153	13/07/2017	BATLAS 2010
	Pipistrellus pygmaeus, Nyctalus leisleri	N7371442396	23/08/2018	BATLAS 2020
	Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus	N5785742916	11/09/2018	BATLAS 2020
	Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus, Nyctalus leisleri	N7183143465	26/09/2018	BATLAS 2020
	Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus, Myotis spp.	N6262544714	12/09/2018	BATLAS 2020
	Pipistrellus pygmaeus, Pipistrellus spp. (45kHz/55kHz)	N7231645158	23/08/2018	BATLAS 2020
	Pipistrellus spp. (45kHz/55kHz)	N7557245429	23/08/2018	BATLAS 2020
	Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus	N6476647081	29/09/2018	BATLAS 2020
	Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus	N6113149273	29/09/2018	BATLAS 2020
	Pipistrellus pygmaeus, Plecotus auritus	N5972949371	29/09/2018	BATLAS 2020
	Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus, Myotis daubentonii	N6637349447	29/09/2018	BATLAS 2020
	Myotis daubentonii	N5851549989	25/09/2015	BATLAS 2020
	Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus, Nyctalus leisleri, Pipistrellus spp. (45kHz/55kHz)	N5796050836	25/09/2015	BATLAS 2020
	Pipistrellus pygmaeus, Myotis daubentonii	N6003253032	15/08/2016	BATLAS 2020
	Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus	N6331053309	15/08/2016	BATLAS 2020
	Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus, Pipistrellus spp. (45kHz/55kHz)	N5652353332	18/09/2015	BATLAS 2020

	Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus, Plecotus auritus, Myotis spp.	N6785054205	21/09/2018	BATLAS 2020
	Nyctalus leisleri	N6171854227	16/08/2016	BATLAS 2020
	Pipistrellus pygmaeus	N6591454415	21/09/2018	BATLAS 2020
Ad-Hoc	*Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus*	N6084555945	27/09/2018	BATLAS 2020
	Pipistrellus pipistrellus (45kHz), Pipistrellus nathusii	N6934556105	21/09/2018	BATLAS 2020
	Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus, Nyctalus leisleri, Plecotus auritus, Myotis spp.	N6520457382	22/09/2018	BATLAS 2020
	Pipistrellus pygmaeus, Nyctalus leisleri	N5845357619	26/09/2015	BATLAS 2020
	Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus, Nyctalus leisleri, Myotis daubentonii, Plecotus auritus	N7550957732	20/08/2018	BATLAS 2020
	Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus, Nyctalus leisleri	N6255858610	22/09/2018	BATLAS 2020
	Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus	N7073959394	20/08/2018	BATLAS 2020
	Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus, Myotis daubentonii, Myotis spp.	N5781059945	09/10/2015	BATLAS 2020
	Pipistrellus pipistrellus (45kHz)	N6473660827	13/07/2017	BATLAS 2020
	Nyctalus leisleri, Pipistrellus pipistrellus (45kHz)	N6800054000	27/06/2007	Brown long-eared Roost Monitoring Scheme
	Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus, Plecotus auritus, Nyctalus leisleri	N5680051850	06/09/2007	Consultancy Surveys
	Myotis nattereri, Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus, Nyctalus leisleri	N7109358118	26/03/2012	Consultancy Surveys
	Pipistrellus pipistrellus (45kHz)	N5800048000	23/06/2002	Consultancy Surveys
	Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus, Myotis daubentonii	N5800049000	23/06/2002	Consultancy Surveys
	Nyctalus leisleri, Pipistrellus pipistrellus (45kHz), Pipistrellus pygmaeus	N572432	13/06/2000	Consultancy Surveys

National Biodiversity Data Centre

The National Biodiversity Data Centre was searched for records of bat activity and roosts within a 10km radius of the Proposed Development site (last search 22/02/2023). Hectads N65, N66 and N55 lie within 10km of the EIAR Study Area. Five of Ireland's nine resident bat species were recorded within 10 km of the proposed works. The results of the database search are provided in

Table 4-2.

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

Hectad	Species	Database	Designation
N55, N65	Common pipistrelle *Pipistrellus pipistrellus*	National Bat Database of Ireland	HD Annex IV, WA
N55, N65, N66	Leisler's bat *Nyctalus leisleri*	National Bat Database of Ireland	HD Annex IV, WA

N55, N65, N66	Brown long-eared bat *Plecotus auritus*	National Bat Database of Ireland	HD Annex IV, WA
N55, N66	Soprano pipistrelle *Pipistrellus pygmaeus*	National Bat Database of Ireland	HD Annex IV, WA
N55, N66	Daubenton's Bat *Myotis daubentonii*	National Bat Database of Ireland	HD Annex IV, WA

4.2.2 Bat Species Range

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

The Proposed Development site is located outside the current range for lesser horseshoe bat, Nathusius' pipistrelle, Natterer's bat and Whiskered bat. The Proposed Development site is within the range of all other species.

4.2.3 Designated Sites

Within Ireland, the lesser horseshoe bat is the only bat species requiring the designation of Special Areas of Conservation (SACs) and the Proposed Development site is situated outside the known range of this species.

Natural Heritage Areas (NHAs) and proposed Natural Heritage Areas (pNHAs) may be designated for any bat species. A search of NHAs and pNHAs within a 10km radius of the Study Area found no sites designated for the conservation of bats.

4.2.4 Landscape Features and Habitat Suitability

A review of mapping and photographs provided insight into the habitats and landscape features present at the Proposed Development site. In summary, the primary land use within the proposed site commercial peat extraction. There is also a small area of woodland including coniferous plantation.

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

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

A review of the NBDC bat landscape map provided a habitat suitability index of 16.67 (green) to 24.56 (yellow). This indicates that the Proposed Development area has low to moderate habitat suitability for bat species.

4.2.5 Other Wind Energy Developments

Table 4-3 provides an overview of wind farms in the vicinity of the proposed wind farm.

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

Wind Farm Name and Location	No. Turbines	Status
Within 5km of Proposed Ballivor Wind Farm		
Bracklyn	9	Granted

Within 10km of Proposed Ballivor Wind Farm		
Crowenstown	3	Not Operational

4.3 Overview of Study Area and Bat Habitat Appraisal

The site comprises four large cutover raised bogs classified as ***Cutover Bog (PB4).*** Large areas of the cutover bog have been in commercial peat production by Bord na Móna until relatively recently (up to 2020) and are characterised by bare peat. Where areas of the cutover bog have been out of commercial peat production for a significant period of time, these areas have since largely revegetated, primarily by ***Dry Heath (HH1)*** type vegetation and pioneer common cottongrass (*Eriophorum angustifolium*) dominated ***Poor Fen (PF2)*** or a mosaic of both.

Where peat production/extraction has ceased for some time, e.g. much of Bracklyn Bog as well as southern extent of Ballivor Bog and Lisclogher, mosaics of well-established secondary dry heath and poor fen type communities as well as birch (*Betula pubescens*) dominated ***Scrub (WS1)*** and dry ***Bog woodland (WN7)*** are present.

Bog woodland within the site is generally dominated by downy birch (*Betula pubescens*) with some willows (*Salix* sp.), and occasional lodgepole pine (*Pinus contorta*), rowan (*Sorbus aucuparia*) and sitka spruce (*Picea sitchensis*). The shrub layer is mostly dominated by brambles (*Rubus fruiticosus agg.*) with ivy (*Hedera helix*) and bracken (*Pteridium aquilinum*) also occurring frequently and bilberry (*Vaccinium myrtillus*) occasionally. Areas of bog woodland within the site are generally small in size, often comprising wide linear strips running parallel to drainage ditches, however larger more extensive areas of bog woodland are present in some areas, including at the southern and northern ends of Bracklyn Bog, at the southern end of Ballivor Bog and at the eastern extent of Carranstown Bog.

Waterbodies within the site include a network of drainage ditches, small streams/watercourses classified as lowland depositing rivers, small areas of standing open water and artificial silt ponds. ***Drainage ditches (FW4)*** ranged from approximately 0.3m in width to approximately 3m in width. Silt ponds are present at various locations throughout the site and have been classified as Other ***Artificial lakes and Ponds (FL8).*** The study area is drained by a number of watercourses classified as ***Lowland depositing streams (FW2)*** within and surrounding the site including the Cartenstown stream, Stonestown river, Ballinn stream, Bolandstown river, Woodtown West stream, Stonyford river, Carranstown Little river, Killaconnigan stream, Kilballivor stream, Ballivor river and two unnamed tributaries, Graffanstown stream, Ballynaskeagh Stream, Mucklin Stream, River Deel, Craddanstown stream and Clondalee More stream.

The majority of grassland areas are classified as ***Dry Meadows and Grassy Verges (GS2).*** Smaller areas of ***Dry calcareous and neutral grassland (GS1)*** were also present throughout the site. The Ballivor Bog group is surrounded by agricultural fields classified as ***Improved agricultural grassland (GA1)*** and ***Wet grassland (GS4).*** Small areas of Improved agricultural grassland are present in the study area, close to the entrance to Ballivor Bog at its northern extent and at the southern extent of Lisclogher. A small area of ***Amenity grassland (GA2)*** is present at the northern extent of Ballivor Bog in the built area around the Bord na Móna buildings.

Two small mineral islands are located on the Carranstown Bog site; these areas contain woodland that is dominated by Hazel, birch and some oak. ***Oak-ash-hazel woodland (WN2)*** is present on a mineral island at the location of one of the proposed Borrowpits at Carranstown Bog.

A small woodland copse area with elements of oak-ash-hazel woodland is also present at Bracklyn Bog where it has developed on a mound close to the remains of an old Famine House. There are several

mature Sycamore (*Acer pseudoplatanus*) trees around the house forming the woodland copse. Other species present include hazel (*Coryllus avelana*), holly (*Ilex aquifolium*), hawthorn (*Crataegus monogyna*) and ash (*Fraxinus excelsior*).

In addition to the habitats of the cutover bog, there are also a number of small areas of remnant uncut raised bog ***(PB1)*** at various locations throughout the site, predominantly but not exclusively at the edges of the site.

Small areas of ***Conifer plantation (WD4)*** are present at the very northern extent of Ballivor Bog. A larger area of conifer plantation is also present along the northern boundary of Lisclogher West Bog.

Existing unpaved access tracks throughout the study area are classified as ***Spoil and bare ground (ED2).*** Areas of spoil and bare ground and recolonising bare ground are also present in works areas associated with the Bord na Móna buildings at the northern extent of Ballivor Bog.

There are some areas of ***Buildings and artificial surfaces (BL3).*** The majority of the artificial surfaces are associated with existing Bord na Móna works area buildings, the railway infrastructure and existing local roads throughout the study area.

Further details on habitats within the site can be found in Chapter 6 of the main EIAR.

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

With regard to foraging and commuting bats, areas of cutover bog, dry heath, poor fen, spoil and bare ground, and grassland habitats were considered to have *Low* suitability, i.e. suitable but isolated habitat that could be used by small numbers of commuting or foraging bats (Collins, 2016). Scrub, bog woodland, oak-ash-hazel woodland, conifer/forestry edge habitats, lowland depositing streams, drainage ditches and artificial lakes/ponds were assessed as having *Moderate* potential for commuting or foraging bats (i.e. habitat that is connected to the wider landscape that could be used by bats for foraging bats such as trees, scrub grassland or water (Collins, 2016)). However, these habitats are surrounded by wide expanses of cutover bog habitat. A hedgerow located within proposed Borrowpit No. 2, which is proposed to be removed, was assessed as having *Moderate* potential for commuting and foraging bats.

Roost Surveys

No potential roosting sites were identified within 285m of the proposed turbines.

With regard to roosting bats, an assessment of the various woodland and forestry habitats was undertaken. Trees present on site comprise a mixture of mature and immature birch, willow, hazel, ash, oak, sycamore, rowan, commercial coniferous species. Overall, the majority of trees within the site did not provide optimal habitat for roosting bats and were assessed as having *Negligible – Low* roosting potential. Trees with *Low* potential include a small number of ivy covered ash trees located within the hedgerow to be removed within Borrowpit No. 2.

Structures within the Proposed Development site include Bord na Móna outbuildings, storage containers and railway crossings which support *Negligible-Low* roosting potential. These structures are being fully retained and will be avoided by the Proposed Development.

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

4.3.2 Grid Connection and Haul Route

Grid Connection

The 110kV substation is located within the Proposed Development site and as such, all grid connection infrastructure is located within the EIAR study area. Thus, it was assessed as part of the surveys of the site and there was no requirement for additional surveys off the site.

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

With regard to roosting bats, habitat features along the overhead line connection, including cutover peatland and associated habitats, were assessed as having *Negligible* suitability i.e. Negligible habitat features likely to be used by roosting bats. (Collins, 2016).

Haul Route

The haul route was the subject of an ecological multi-disciplinary walkover survey and assessment for its potential to impact on roosting, commuting and foraging bats (as discussed in Chapter 6 and Appendix 6-2).

The proposed haul route is located primarily within the existing road infrastructure classified as Buildings and artificial surfaces (BL3). The haul route traverses small areas of Improved agricultural grassland (GA1), Recolonising bare ground (ED3) and Dry meadows and grassy verges (GS2), Treeline (WL2) and Hedgerow (WL1). Small pockets of short hawthorn hedgerow will be removed as part of the proposed haul route.

With regard to commuting and foraging bats, the haul route was assessed as having *Low-Moderate* suitability. With regard to roosting bats, most habitat features along the haul route, including hedgerows, were assessed as having *Negligible* suitability. One mature ash tree with extensive ivy cover located within the north-to-south hedgerow within the northern land-take area was identified as having *Moderate* potential for roosting bats (IG Ref: N 72887 53184). Another *Moderate* mature ash tree was identified in west of the land-take areas (IG Ref: N 72645 53122), outside of the Site Boundary.

4.4 Manual Transects

Manual transect surveys were undertaken in Spring, Summer and Autumn in 2022. Bat activity was recorded on all surveys, a total of 108 bat passes were recorded. In general, Common pipistrelle was recorded most frequently (n=96), followed by Leisler's bat (8) and Soprano pipistrelle (n=4). Species composition across all manual surveys is presented in Plate 4-1. Low activity was recorded across the site. Species composition and activity levels did not vary significantly between surveys. In spring and autumn, Common pipistrelle and Soprano pipistrelle were observed on the border or close to bog woodlands, where they were foraging and commuting. In summer Common pipistrelle, Soprano pipistrelle and Leisler's bat were observed. Pipistrelle species were concentrated along scrub lines, where they were foraging and commuting. Leisler's bat occurred next to linear features (bog woodland) and above open habitats (cutover bog).

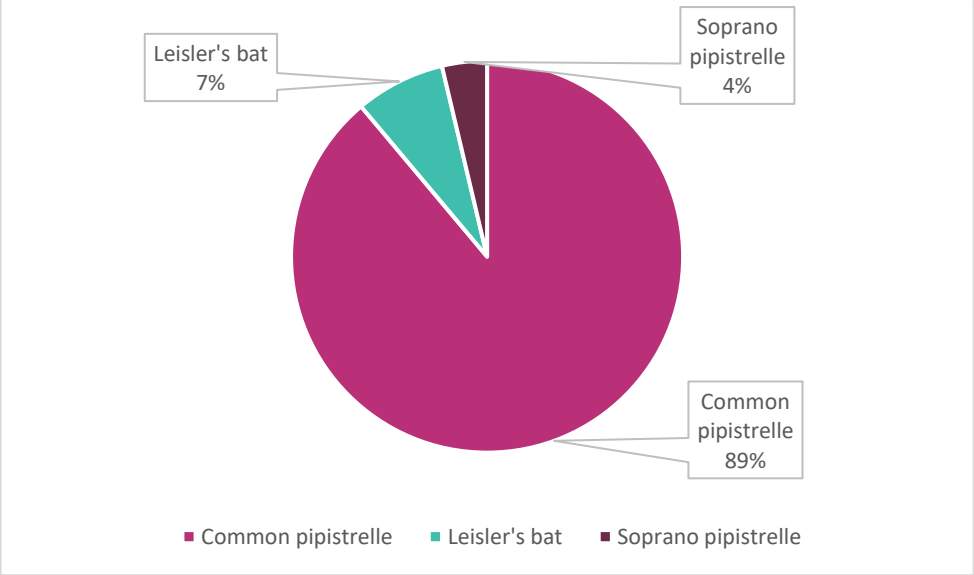


Plate 4-1 2022: Species Composition for Manual Transects, Spring, Summer, Autumn

Transect survey results were calculated as bat passes per km surveyed (to account for differences in survey effort). Plate 4-2 presents results for individual species per survey period.

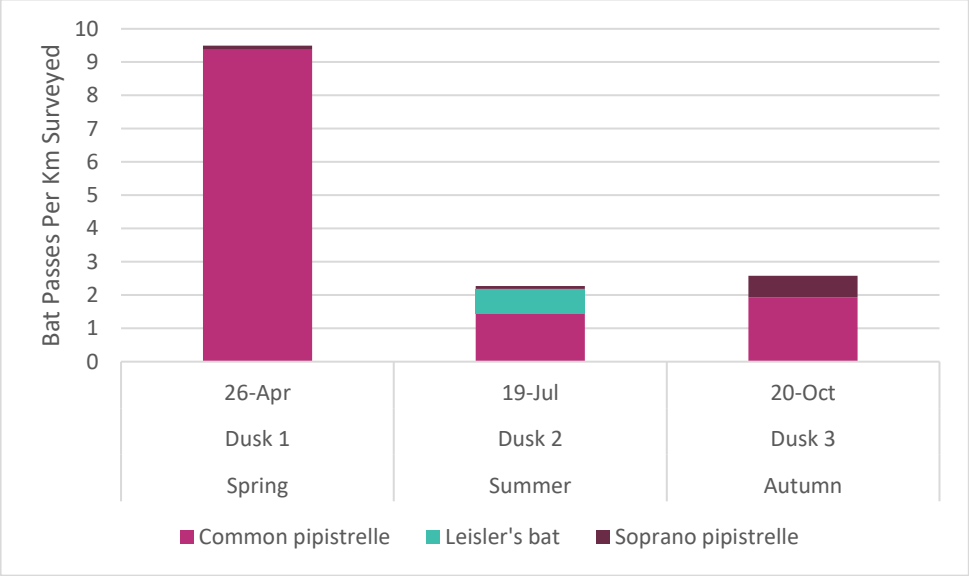
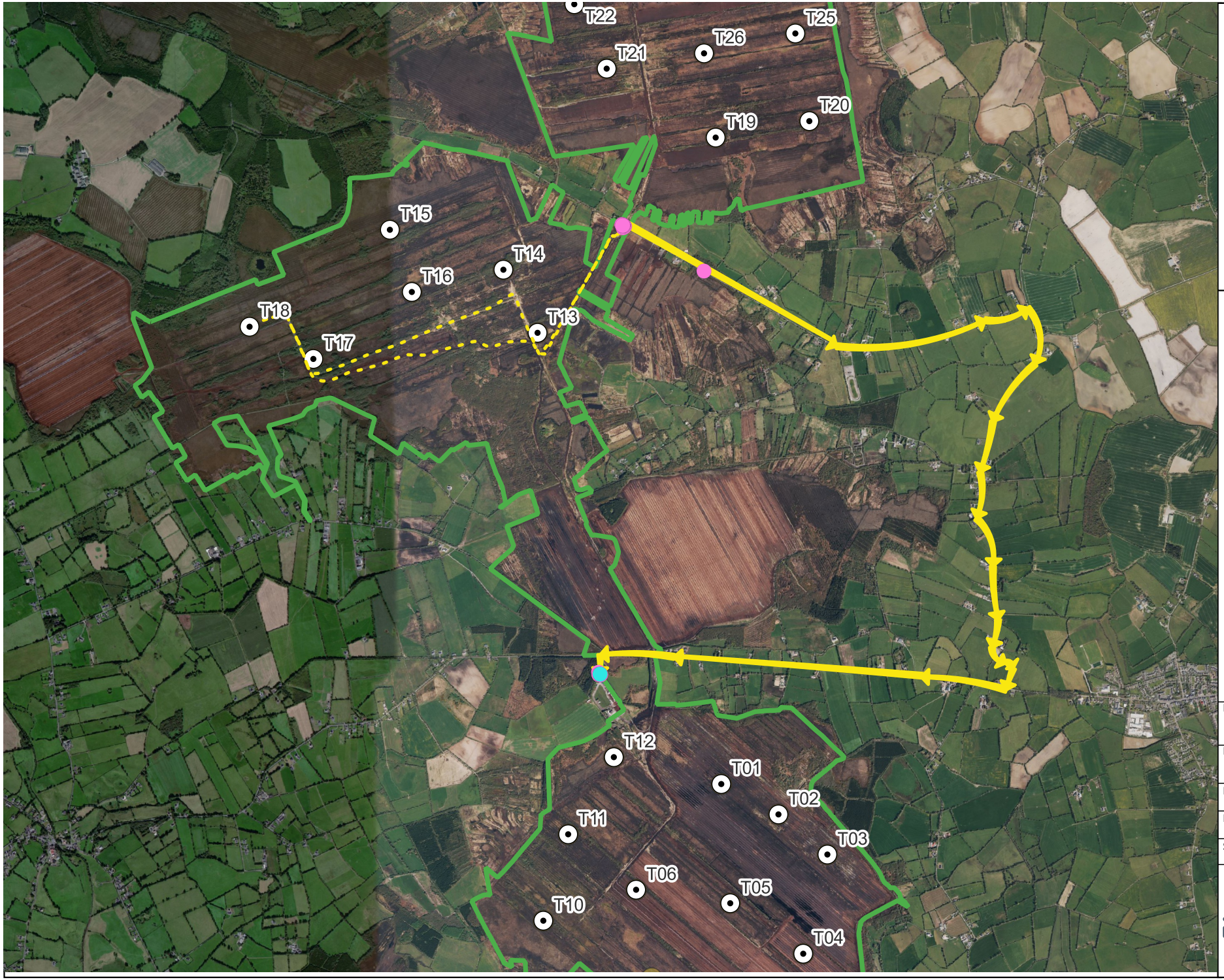


Plate 4-2 2022 Transect Results – Species Composition Per Survey Period



Map Legend

- Wind Farm Site Boundary
- Proposed Turbine Layout
- Spring Dusk Walked Transect 26th April 2022
- Spring Dusk Driven Transect 26th April 2022

Spring Dusk Manual Results

- Common pipistrelle
- Soprano pipistrelle

N

Drawing Title
2022 Spring Results

Project Title
Ballivor Wind Farm Development

Drawn by	Checked by
LG	AJ
Project No. 191137	Drawing No. Figure 4-1.
Scale 1:38,245	Date 24/02/2023

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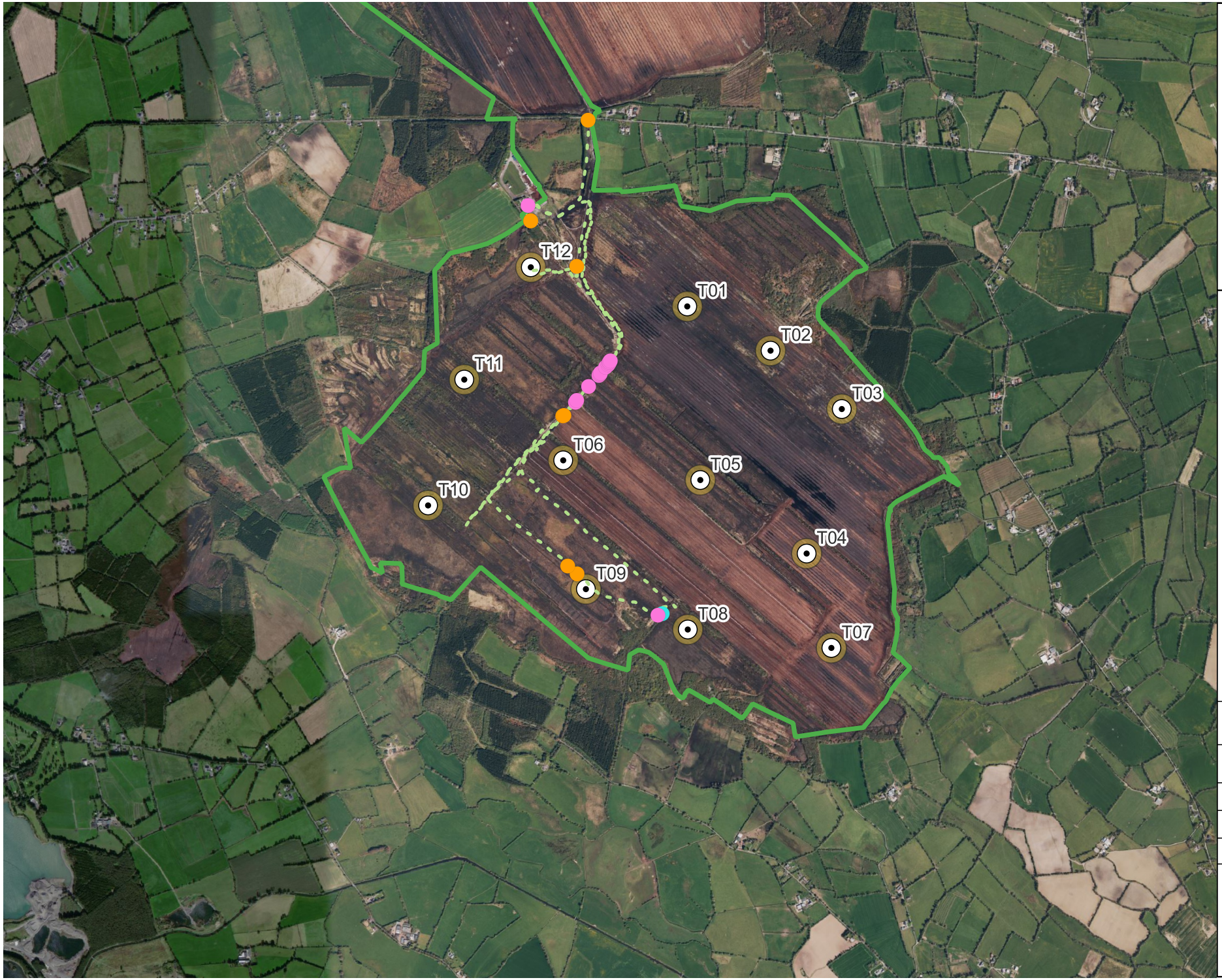

Map Legend

- Wind Farm Site Boundary
- Proposed Turbine Layout
- Summer Dusk Transect 19th July 2022

Summer Dusk Manual Results

- Leisler's bat
- Common pipistrelle
- Soprano pipistrelle

N

Drawing Title
2022 Summer Results

Project Title
Ballivor Wind Farm Development

Drawn by	Checked by
LG	AJ
Project No. 191137	Drawing No. Figure 4-2.
Scale 1:26,245	Date 24/02/2023

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Map Legend

- Wind FArm Site Boundary
- Proposed Turbine Layout
- Autumn Dusk Transect 20th October 2022

Autumn Dusk Manual Results

- Common pipistrelle
- Soprano pipistrelle

N

Drawing Title
2022 Autumn Results

Project Title
Ballivor Wind Farm Development

Drawn by	Checked by
LG	AJ
Project No. 191137	Drawing No. Figure 4-3.
Scale 1:17,606	Date 24/02/2023

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4.4.1 Ground-level Static Surveys

In total, 44,101 bat passes were recorded across all deployments during 2022. In general, Common pipistrelle (n=24,670) occurred most frequently, followed by Soprano pipistrelle (n=11,871) and Leisler's bat (n=6,711). Instances of *Myotis* spp. (n=645), Brown long-eared bat (n=192) were significantly less and Nathusius' pipistrelle (n=12) were rare. Plate 4-3 presents species composition across all ground-level static detectors.

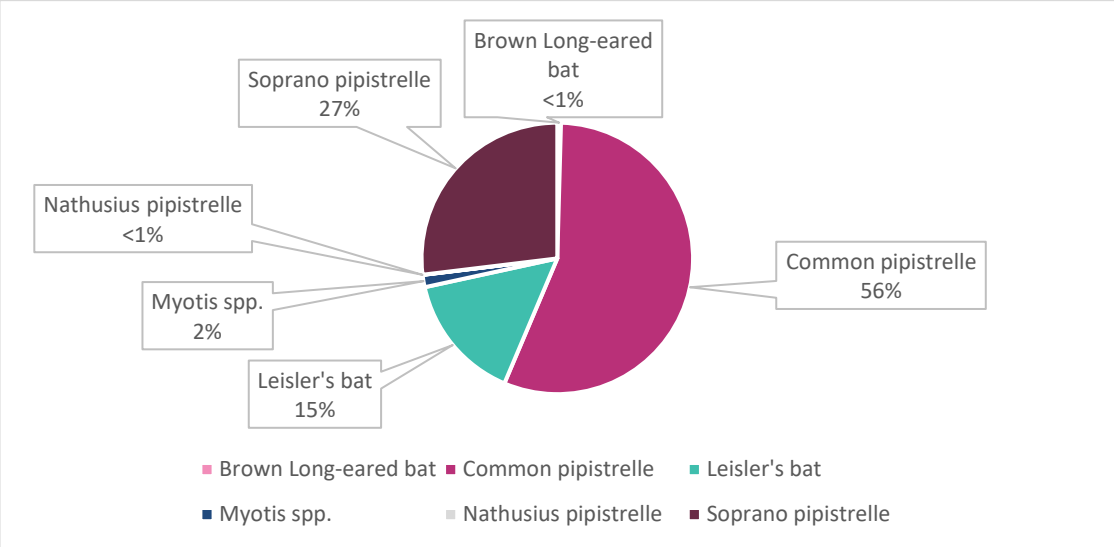


Plate 4-3 2022 Static Detector Surveys: Species Composition Across All Deployments (Total Bat Passes)

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.

Table 4-4 present these results for each species in 2022. Species composition was similar across seasons, however relative activity was high in Summer, low in Spring and very low in Autumn. No instances of Nathusius' pipistrelle were recorded in Autumn, and activity by all other species declined relative to Spring and Summer. In terms of total passes, Brown long-eared bat activity remained constant between Summer and Autumn, and *Myotis* spp. activity slightly increased between seasons through the year. 2022 activity was lower than levels recorded in 2020 for all three seasons, with bpph more than halving throughout the site (Appendix 6-2-3).

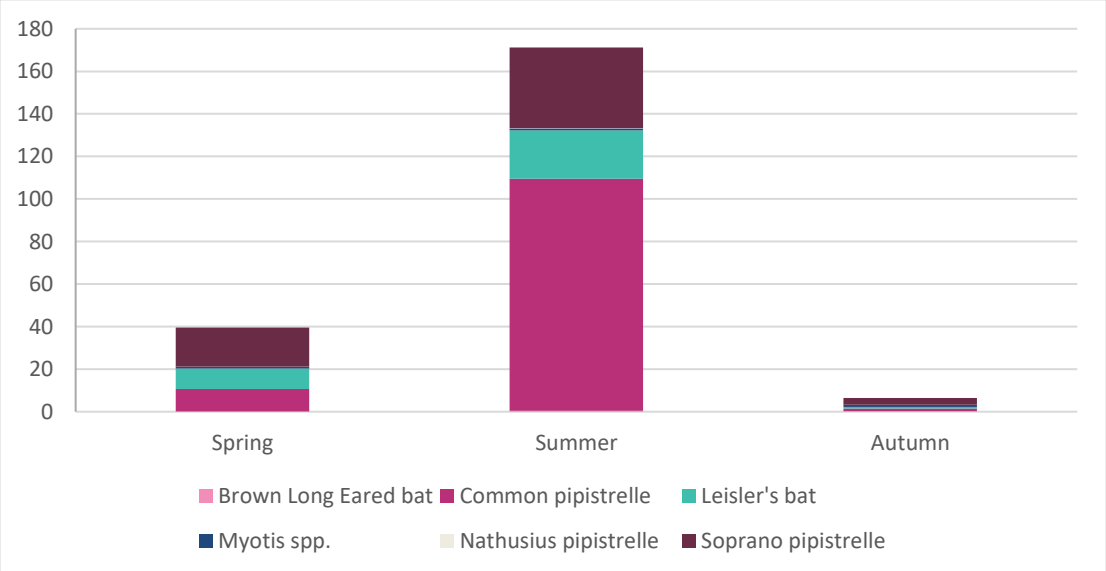


Plate 4-4 Static Detector Surveys: Species Composition Across All Deployments (Total Bat Passes Per Hour, All Nights)

Table 4-4 2022 Static Detector Surveys: Species Composition Across All Deployments (Total Bat Passes Per Hour, All Nights)

	Spring		Summer		Autumn	
Total Survey Hours	***176.9***		***205.8***		***253.8***	
Species	*Passes*	*Bpph*	*Passes*	*Bpph*	*Passes*	*Bpph*
Myotis spp.	157	0.89	210	1.02	269	1.06
Leisler's bat	1,696	9.59	4,665	22.67	174	0.69
Nathusius' pipistrelle	4	0.02	8	0.04	Nil	Nil
Common pipistrelle	1,869	10.57	22,448	109.09	304	1.20
Soprano pipistrelle	3,250	18.38	7,818	37.99	797	3.14
Brown long-eared bat	14	0.08	89	0.43	89	0.35

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 4-5 illustrates the median Nightly Pass Rate per species per deployment. Zero data, when a species was not detected on a night, was also included. Differences in activity between nights and per-detector are further assessed below.

Spring activity was dominated by Leisler's bats at most detectors, with activity overall being low for all species, with one exception (at D12 Soprano pipistrelle had moderate activity).

Summer activity was largely dominated by Common pipistrelle at most detectors, with detectors D03, D07 and D08 presenting slightly higher Leisler's bat activity, with low bpph recorded for this species. Higher total bat passes were recorded at detectors D02, D04, D05, D12, D13. These detectors were all located in proximity of scrub features suitable for foraging, in particular detector D05, corresponding to proposed turbine T5, which is located in proximity to a well-developed linear patch of scrub and deep trench. This detector recorded the most activity across the site throughout the survey season, followed by D04.

In Autumn, median bat activity was low at all detectors and for all species recorded. Species composition was more variable in Autumn at detectors, with detector D08, D14 and D15 recording relatively higher *Myotis* spp. activity and Brown long-eared bats being recorded throughout, whereas they were virtually absent in Spring.

Plate 4-5 shows median bat passes per night at each detector deployed throughout the site. Bat nightly activity, as bat passes per hour, across the site is presented in Plate 4-6 and is paired with weather data for the three survey periods, which is presented in Plate 4-7.

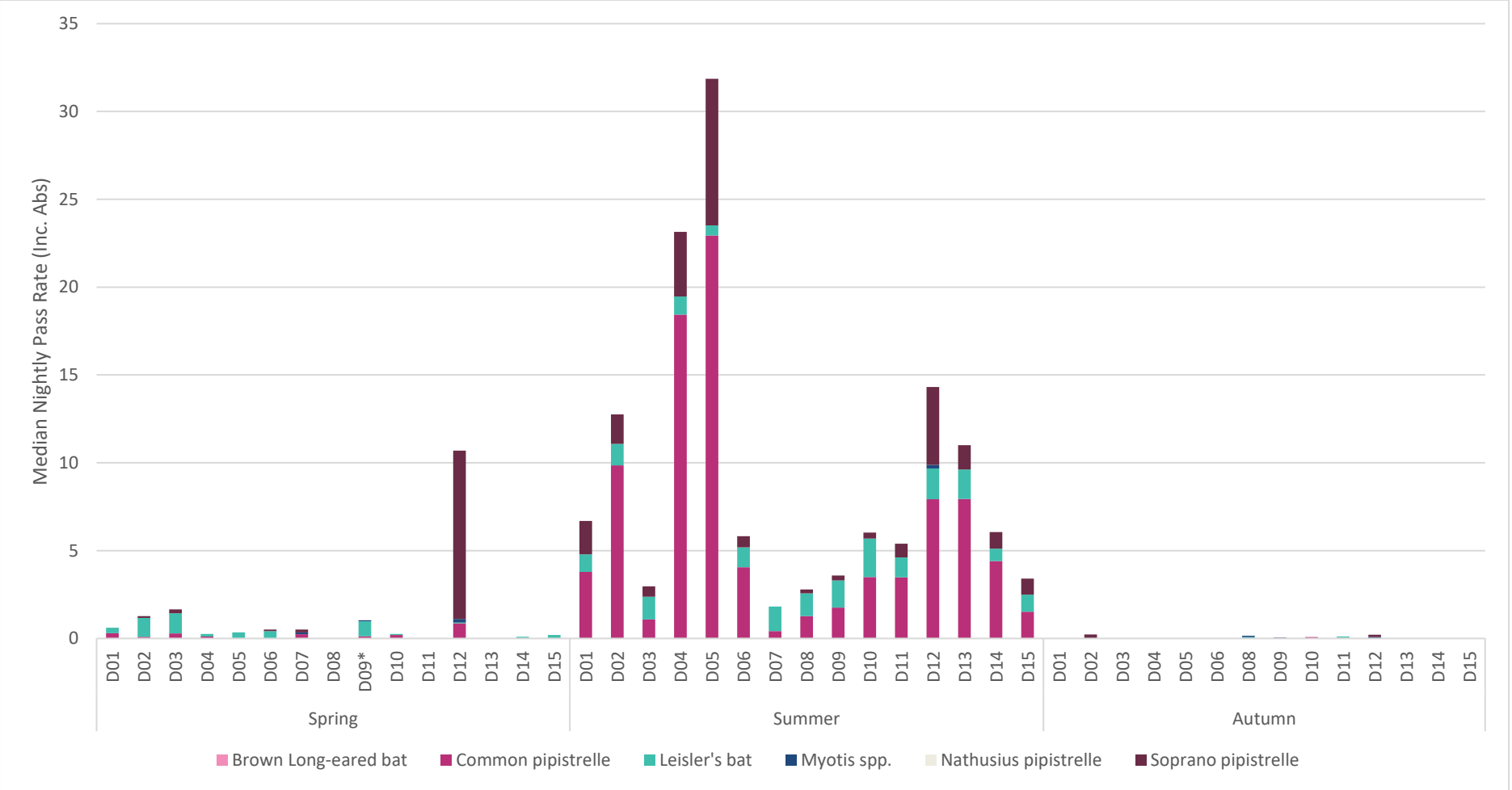


Plate 4-5 Static Detector Surveys: Median Nightly Pass Rate (bpph) Including Absences, Per Location Per Survey Period. (D09: redeployed detector)*

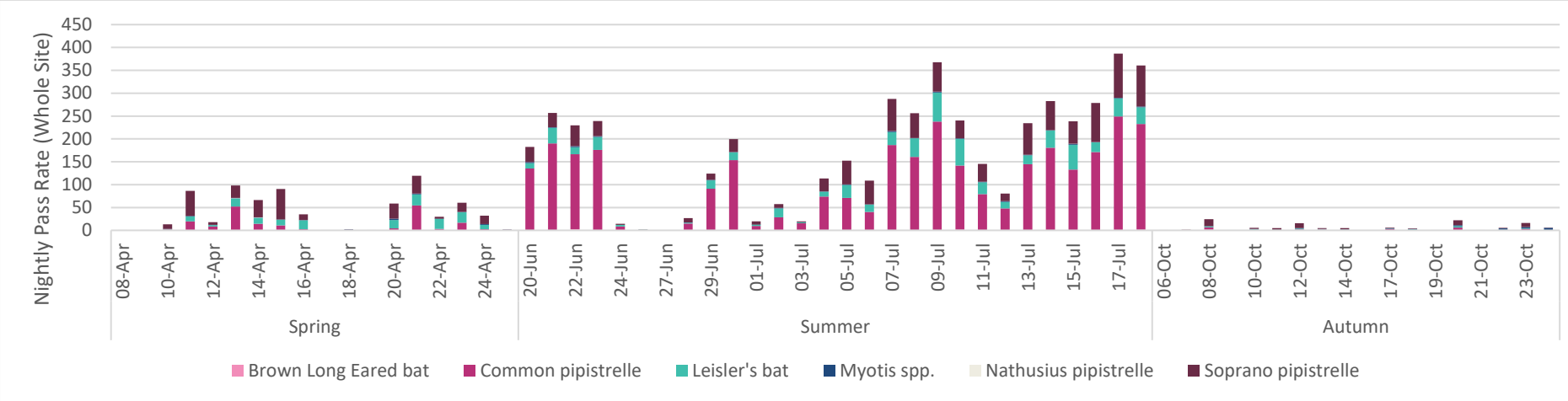


Plate 4-6 Species Passes per Hour (bpph) per Night, during Spring, Summer and Autumn Across All Detectors.

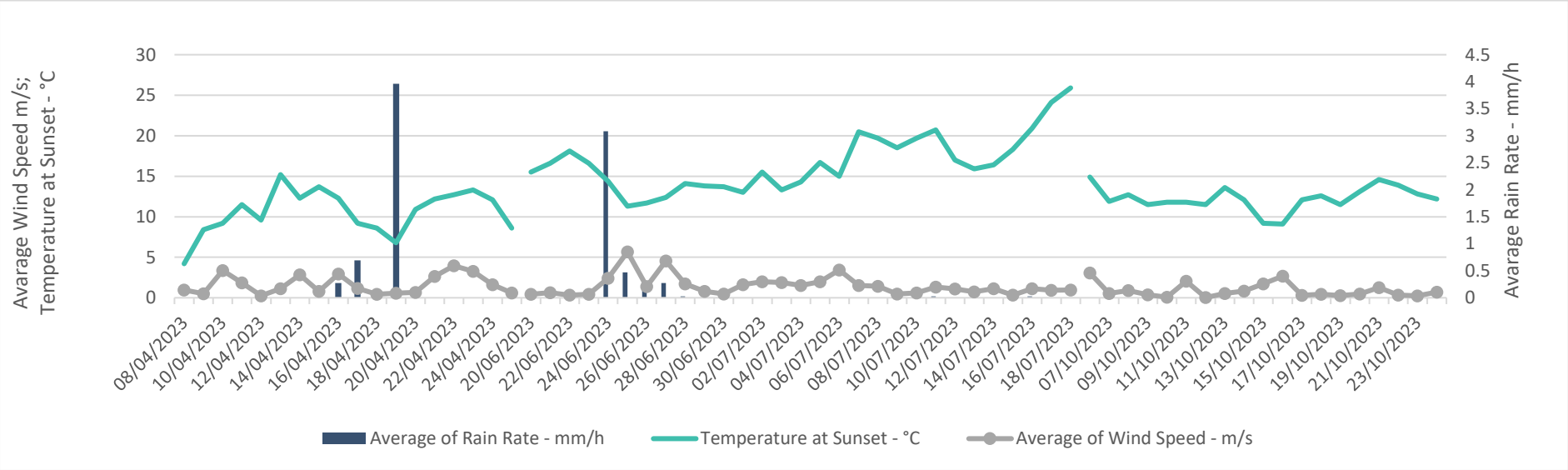


Plate 4-7 Night Weather Data Collected across the Survey Period.

Bat activity patterns varied across night during all seasons. Peaks of bat activity corresponded with higher temperature records whereas lower activity levels matched days of high precipitation and sunset temperatures lower than 10°C. Nights of high winds (>5 m/s on average) recorded in Summer corresponded with high precipitation, no correlation with high wind speed was available. However, where relatively high winds (>3.5m/s) were recorded in spring in conjunction with high temperatures, total bat activity was recorded at higher levels.

4.4.2 Assessment of Bat Activity Levels

4.4.2.1 Ecobat Analysis

Ecobat was not available for analysis of 2022 data as the website is undergoing continued maintenance. Ecobat analysis carried out in 2020 for this site has been taken into account for the assessment.

In 2020, Median activity levels for common pipistrelle peaked at ***High*** for Spring and Summer. Median activity levels for soprano pipistrelle and Leisler's bat peaked at ***Moderate to High*** for at least two seasons. Median activity levels for Nathusius' pipistrelle peaked at ***Moderate*** for two seasons. Brown long-eared bat and *Myotis sp.* peaked with ***Low to Moderate*** activity for at least one season. Maximum activity levels peaked with ***High*** activity for all species for at least one season, with the exception of brown long-eared bat, which peaked at ***Moderate to High***. (**Appendix 3**). **Appendix 4** shows 2020 percentile results per detector.

4.4.2.2 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). Table 4-5 show the results of the site-level assessment. Where no median activity at a detector is reported, no data was recorded for that species throughout the deployment. Spring data for detector D09 was collected on a separate deployment and as such was kept separate from the rest.

Leisler's bat recorded ***High*** maximum activity at D03 in Spring, whereas maximum activity was ***Moderate*** in summer at most detectors.

Common pipistrelle recorded ***High*** median activity in Summer at D04 and D05, while maximum ***High*** activity was recorded at D01 and D12 in Spring, and at D01, D02, D04, D05, D12, D13 and D14 in Summer. Median activity was ***Low*** throughout Spring and Autumn.

No median ***High*** activity was recorded for Soprano pipistrelle across the site, with D12 in Spring and D05 in Summer recording ***Moderate*** median activity. D12 in Spring recorded ***High*** maximum activity in Spring, while in summer activity peaks were recorded at D01, D04, D05 and D12. These four detectors and D02 recorded the highest combined pipistrelle activity in Summer.

While relatively low in comparison to other species, on a site-specific level *Myotis* spp. recorded ***High*** maximum activity at D07 in Spring, and at D08, D14 and D15 in Autumn. Brown long-eared bats also presented relatively ***High*** peaks (0.98 bpph) for this species in Autumn, at D11.

Table 4-5 Static Detector Surveys: Detector-level Passes Analysis. Activity Low, Moderate, High

Species	Season	Bat Activity (bpph)	D01	D02	D03	D04	D05	D06	D07	D08	D09	D09*	D10	D11	D12	D13	D14	D15
Brown long-eared bat	Spring	Median							0.0	0.0					0.0	0.0		
		Maximum							0.2	0.1					0.2	0.2		
	Summer	Median	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
		Maximum	0.3	0.1	0.1	0.1	0.1	0.3	0.3	0.1	0.3		0.3	0.4	0.6	0.3	0.1	0.3
	Autumn	Median	0.0	0.0	0.0	0.0		0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
		Maximum	0.1	0.1	0.1	0.1		0.1		0.1	0.2		0.2	1.0	0.2	0.1	0.1	0.1
Common Pipistrelle	Spring	Median	0.3	0.1	0.3	0.1	0.0	0.0	0.2	0.0		0.1	0.2	0.0	0.9	0.0	0.0	0.0
		Maximum	27.8	1.5	4.1	2.6	0.3	0.7	6.4	1.3		2.0	4.6	0.1	29.1	2.3	0.4	0.7
	Summer	Median	3.8	9.9	1.1	18.4	22.9	4.1	0.4	1.3	1.8		3.5	3.5	7.9	7.9	4.4	1.5
		Maximum	31.7	50.2	9.2	56.6	55.2	12.3	2.7	4.7	5.6		6.0	13.8	53.9	30.3	27.8	8.3
	Autumn	Median	0.0	0.0	0.0	0.0	0.0			0.0	0.0		0.1	0.0	0.0	0.0	0.0	0.0
		Maximum	0.5	1.6	0.1	0.2	2.1			0.1	3.5		0.5	1.0	1.5	0.1	0.4	0.1
Leisler's bat	Spring	Median	0.3	1.1	1.1	0.2	0.4	0.4	0.0	0.0		0.9	0.0		0.0	0.0	0.1	0.2
		Maximum	5.4	6.2	14.5	2.6	1.5	2.5	0.8	0.8		5.8	0.6		3.0	1.6	1.5	2.8
	Summer	Median	1.0	1.2	1.3	1.0	0.6	1.1	1.4	1.3	1.5		2.2	1.1	1.8	1.7	0.7	1.0
		Maximum	4.3	3.8	6.1	5.4	3.2	4.9	4.6	5.7	5.6		6.0	4.3	9.1	8.0	4.9	4.9
	Autumn	Median	0.0	0.0	0.0	0.0	0.0	0.0		0.1	0.0		0.0	0.1	0.0	0.0	0.0	0.0
		Maximum	0.2	0.2	0.1	0.3	0.1	0.2		0.2	0.2		0.6	0.2	0.4	0.5	0.5	0.2
Myotis sp.	Spring	Median			0.0	0.0		0.0	0.1	0.0		0.1	0.0	0.0	0.2	0.0	0.0	0.0
		Maximum			0.2	0.2		0.1	1.8	0.2		0.3	0.2	0.1	1.3	0.1	0.2	0.2
	Summer	Median	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.2	0.0	0.0	0.0
		Maximum	0.1	1.5	0.1	0.3	0.1	0.3	0.1	0.4	0.4		0.1	0.1	1.1	0.4	0.3	0.3
	Autumn	Median	0.0		0.0	0.0	0.0	0.0		0.1	0.0		0.0	0.0	0.1	0.0	0.0	0.0
		Maximum	0.1		0.1	0.2	0.1	0.1		1.7	0.3		0.5	0.2	0.5	0.1	0.8	2.1
Nathusius' Pipistrelle	Spring	Median	0.0				0.0											
		Maximum	0.2				0.1											
	Summer	Median	0.0				0.0									0.0		
		Maximum	0.1				0.1									0.8		
Soprano Pipistrelle	Spring	Median	0.0	0.1	0.2	0.0	0.0	0.1	0.2	0.0		0.0	0.0	0.0	9.6	0.0	0.0	0.0
		Maximum	3.8	2.0	2.0	4.5	0.3	0.4	2.7	0.2		0.2	0.4	0.1	51.5	13.2	0.3	0.2
	Summer	Median	1.9	1.7	0.6	3.7	8.4	0.6	0.0	0.2	0.3		0.3	0.8	4.4	1.4	0.9	0.9
		Maximum	26.2	10.4	6.5	24.3	48.5	4.3	2.3	2.5	2.1		2.0	6.7	17.6	9.0	5.5	4.5
	Autumn	Median	0.0	0.2	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	0.1	0.0	0.0	0.0
		Maximum	0.4	8.6	0.1	1.0	7.4	0.2		0.2	0.5		0.8	0.5	0.6	3.3	0.1	0.1

*Detector re-deployed in Spring.

4.5 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 study area are utilized by a regularly occurring bat population of Local Importance.

No roosting site of National Importance (i.e. site greater than 100 individuals) was recorded within the Site. The Proposed Development site does not support roosting sites.

5. RISK AND IMPACT ASSESSMENT

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

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

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

5.1 Collision Mortality

5.1.1 Assessment of Site-Risk

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

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

Criteria	Site-specific Evaluation	Site Assessment
Habitat Risk	No roosting sites were identified within the Proposed Development site. The habitats within the site provide potential suitable foraging habitat for bats and is connected to the wider landscape by linear features such as bog woodland edge, tracks, drains and scrub. However, it does not provide an extensive and diverse habitat mosaic of high quality for foraging bats or meet any of the criteria of a high-risk site as set out in Table 3a of NatureScot, 2021.	Moderate
Project Size	Following the criteria set out in NatureScot, 2021 the project is of Medium scale as it consists of 26 no. turbines. Whilst those turbines are over 100m in height, it is well below the number of turbines that would constitute a Large development (NatureScot, 2021). Some proposed other wind energy developments within 5km. Comprising turbines >100 m in height	Medium
Site Risk Assessment (from criteria in Plate 3-3)		**Medium Site Risk (3)**

The site of the Proposed Development is located in an area of predominantly cut-over bog and scrub. As per table 3a of the NatureScot Guidance (2021), it has a *Moderate* habitat risk score. As per Table 3a, the Proposed Development is a *Medium* project size (26 turbines). The cross tabulation of a *Medium* project on a *Moderate* habitat risk site results in an overall risk score of **Medium** (NatureScot Table 3a).

5.1.2 Assessment of Collision Risk

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

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

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

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

During the extensive suite of surveys undertaken that following low risk species were recorded:

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

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

5.1.2.1 Leisler's bat

This site is within the current range of the Leisler's bat (NPWS, 2019). Leisler's bats are classed as a rarer species of a high population risk which have a high collision risk (Plate 3-4). Leisler's bats were recorded during activity surveys across the Proposed Development site. When assessed in the context of the identified site risk and in line with Table 3b (NatureScot, 2021) overall activity risk for Leisler's bat was found to be ***Low*** at typical activity levels and ***High*** in Spring, ***Medium*** in Summer and ***Low*** in Autumn at peak activity levels (See Table 5-2 below). 2020 Ecobat results presented a typical risk level for this species as Medium during all three seasons.

Based on site visit and survey data, including walked transects, it is determined that the Typical Activity (i.e. Median) is reflective of the nature of the site, which is cutover bog, heath and scrub with low to moderate levels of bat activity recorded during the walked transects undertaken.

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

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

Survey Period	Site Risk	Typical Activity (Median)	Typical Risk Assessment (as per Table 3b NatureScot 2021)	Activity Peaks (Maximum)	Peak Risk Assessment (as per Table 3b NatureScot 2021)
Spring	Medium (3)	Low (1)	Typical Risk is Low (3)	High (5)	Peak Risk is High (15)
Summer		Low (1)	Typical Risk is Low (3)	Moderate (3)	Peak Risk is Medium (9)
Autumn		Low (1)	Typical Risk is Low (3)	Low (1)	Peak Risk is Low (3)

5.1.2.2 Nathusius' pipistrelle

This site is within the current range of the Nathusius' pipistrelle bat (NPWS, 2019). Nathusius pipistrelle bats are classed as a rarer species of a high population risk which have a high collision risk (Plate 3-4). Nathusius' pipistrelle bats were recorded during activity surveys across the proposed site. When assessed in the context of the identified site risk and in line with Table 3b (NatureScot, 2021) overall activity risk for Nathusius' pipistrelle bats was ***Low*** for Spring, Summer and Autumn at typical and peak activity levels (See Table 5-3 below). 2020 Ecobat results presented a typical risk level for this species as Medium in Spring and Summer and Low in Autumn.

Based on site visit and survey data, including walked transects, it is determined that the Typical Activity (i.e. Median) is reflective of the nature of the site, which is cutover bog, heath and scrub with low to moderate levels of bat activity recorded during the walked transects undertaken.

Thus, there is *Low* collision risk level assigned to the local population of Nathusius' pipistrelle bat in Spring and Summer. The species was not recorded at the site in Autumn.

Table 5-3 Nathusius pipistrelle - Overall Risk Assessment

Survey Period	Site Risk	Typical Activity (Median)	Typical Risk Assessment (as per Table 3b NatureScot 2021)	Activity Peaks (Maximum)	Peak Risk Assessment (as per Table 3b NatureScot 2021)
Spring	Medium (3)	Low (1)	Typical Risk is Low (3)	Low (1)	Peak Risk is Low (3)
Summer		Low (1)	Typical Risk is Low (3)	Low (1)	Peak Risk is Low (3)
Autumn		Nil (0)	Typical Risk is Nil (0)	Nil (0)	Peak Risk is Nil (0)

5.1.2.3 Soprano pipistrelle

This site is within the current range of the Soprano pipistrelle bat (NPWS, 2019). Soprano pipistrelle bats are classed as a common species of a medium population risk which have a high potential collision risk (Plate 3-4). Soprano pipistrelle was recorded during activity surveys across the proposed site. When assessed in the context of the identified site risk and in line with Table 3b (NatureScot, 2021) overall activity risk for Soprano pipistrelle was found to be ***Low*** at typical activity levels and ***Medium*** in Summer and ***Low*** in Spring and Autumn at peak activity levels (See Table 5-4 below). 2020 Ecobat results presented a typical risk level for this species as Medium during all three seasons.

Based on site visit and survey data, including walked transects, it is determined that the Typical Activity (i.e. Median) is reflective of the nature of the site, which is cutover bog, heath and scrub with low to moderate levels of bat activity recorded during the walked transects undertaken.

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

Table 5-4 Soprano pipistrelle - Overall Risk Assessment

Survey Period	Site Risk	Typical Activity (Median)	Typical Risk Assessment (as per Table 3b NatureScot 2021)	Activity Peaks (Maximum)	Peak Risk Assessment (as per Table 3b NatureScot 2021)
Spring	Medium (3)	Low (1)	Typical Risk is Low (3)	Low (1)	Peak Risk is Low (3)
Summer		Low (1)	Typical Risk is Low (3)	Moderate (3)	Peak Risk is Medium (9)
Autumn		Low (1)	Typical Risk is Low (3)	Low (1)	Peak Risk is Low (3)

5.1.2.4 Common pipistrelle

This site is within the current range of the Common pipistrelle bat (NPWS, 2019). Common pipistrelle bats are classed as a common species of a medium population risk which have a high collision risk (Plate 3-4). Common pipistrelles were recorded during activity surveys across the Proposed Development site. When assessed in the context of the identified site risk and in line with Table 3b (NatureScot, 2021) overall activity risk for Common pipistrelle was found to be ***Low*** at typical activity levels in Spring and Autumn and ***Medium*** in Summer. Peak activity levels were ***High*** in Summer, ***Medium*** in Spring and ***Low*** in Autumn (See Table 5-5 below). 2020 Ecobat results presented a typical risk level for this species as High in Spring and Summer and Medium in Autumn.

Based on site visit and survey data, including walked transects, it is determined that the Typical Activity (i.e. Median) is reflective of the nature of the site, which is cutover bog, heath and scrub with low to moderate levels of bat activity recorded during the walked transects undertaken.

Thus, there is Low collision risk level assigned to the local population of Common pipistrelle in Spring and Autumn and a *Medium* collision risk level assigned to the local population in Summer.

Table 5-5 Common pipistrelle - Overall Risk Assessment

Survey Period	Site Risk	Typical Activity (Median)	Typical Risk Assessment (as per Table 3b NatureScot 2021)	Activity Peaks (Maximum)	Peak Risk Assessment (as per Table 3b NatureScot 2021)
Spring	Medium (3)	Low (1)	Typical Risk is Low (3)	Moderate (3)	Peak Risk is Medium (9)
Summer		Moderate (3)	Typical Risk is Medium (9)	High (5)	Peak Risk is High (15)
Autumn		Low (1)	Typical Risk is Low (3)	Low (1)	Peak Risk is Low (3)

5.2 Loss or damage to Commuting and Foraging Habitat

In absence of appropriate design, the loss or degradation of commuting/foraging habitat has potential to reduce feeding opportunities and/or displace bat populations. Scrub, bog woodland, oak-ash-hazel woodland, conifer/forestry edge habitats, lowland depositing streams, drainage ditches and artificial lakes/ponds were assessed as having *Moderate* potential for commuting or foraging bats (i.e. habitat that is connected to the wider landscape that could be used by bats for foraging bats such as trees, scrub grassland or water (Collins, 2016)). However, with regard to foraging and commuting bats, the infrastructure is primarily located in areas of cutover bog, dry heath, poor fen, spoil and bare ground, and grassland habitats, which were considered to have *Low* suitability, i.e. suitable but isolated habitat that could be used by small numbers of commuting or foraging bats (Collins, 2016).

Approximately 1ha of woodland is expected to be lost as part of the Proposed Development footprint. An additional 1.5ha will be removed as part of the proposed bat buffering, for a total of 2.5ha of lost woodland. The Proposed Development will only involve the loss of a negligible percentage of the available habitat within the site and vegetative connectivity will be largely retained. Replanting options have been proposed and are detailed in Chapter 6. No net loss of commuting and foraging habitats is anticipated.

In addition to the above the Proposed Development will result in the loss of approximately 203m of hedgerow habitat with scattered ash trees as well as 60m of conifer treeline habitat within the Windfarm Site Boundary to facilitate the construction of the proposed Borrowpit No. 2 to the south of Bracklin Bog and to facilitate the construction of the access road between Carranstown and Ballivor Bogs. The loss of hedgerow and conifer treeline habitat represents only a minor loss of the overall extent of

suitable commuting and foraging habitat within the site. While no significant effects are anticipated as a result of the loss of these habitats, these linear features will be fully re-instated by replanting of the same lengths of hedgerow and treeline at the locations where they were lost following the completion of works.

Haul Route

The land-take areas considered for the proposed haul route include a total of approximately 112m of hedgerows which will be removed as part of the proposed works. These are distributed across three land-take areas and do not constitute a significant loss at the local scale. These linear features will be fully re-instated by replanting of the same lengths of hedgerow at the locations where they were lost following the completion of works.

No significant effects with regard to loss of commuting and foraging habitat are anticipated as a result of the Proposed Development.

5.3 Loss of, or Damage to, Roosts

No bat roosts were identified within the Proposed Development site. Trees present consist primarily of immature conifers and deciduous trees and as such do not provide potential roosting habitat for bats. A small number of trees assessed as having *Low* potential are located along a hedgerow within Borrowpit No. 2 will be removed. They provide potential for opportunistic use and as such a potential to harm roosting bats present within the trees has been identified. Mitigation measures have been provided in Section 6.1.4 below. No significant effect on roosting bats is anticipated following the mitigations provided.

The grid connection route and proposed internal roads are mostly confined to areas of bogland and as a result there will be no loss of significant tree roosting habitat or linear landscape connectivity associated with these works. Consequently, there is no potential for significant effect with regard to the loss or disturbance of roosting habitat along the grid connection route.

Haul Route

A single ash tree identified as having *Moderate* potential to host roosting bats was identified within the haul route land-take area. The potential to harm roosting bats present within the trees has been identified. Mitigation measures have been provided in Section 6.1.4 below. No significant effect on roosting bats is anticipated following the mitigations provided.

5.4 Displacement of Individuals or Populations

The Proposed Development is predominantly located within an area of commercial cutover bog. There will be no significant loss of linear landscape features for commuting and foraging bats and there will be no loss of roosting sites. The habitats on the site will remain suitable for bats and no significant displacement of individuals or populations is anticipated.

6. BEST PRACTICE AND MITIGATION MEASURES

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

6.1 Standard Best Practice Measures

6.1.1 Noise Restrictions

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

6.1.2 Lighting Restrictions

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

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

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

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

No significant effects on bats are anticipated as a result of lighting.

6.1.3 Buffering

In accordance with NatureScot Guidance, a minimum 50m buffer to all habitat features used by bats should be applied to the siting of all wind turbines (See example provided in Plate 6-1 below). Eurobats No. 6 guidance and NIEA recommend increased buffers around woodland/forestry areas, however due to the nature of the site the 50m buffer was considered appropriate. The buffer will be revised if necessary following post-construction monitoring.

NatureScot recommends that a distance of 50m between turbine blade tip and nearest scrub habitat is adequate mitigation. This 50m buffer will be implemented from the outset and monitored as per the post construction monitoring. Where possible, the proposed location of turbines has accounted for the least possible loss of scrub and woodland habitat as they provide suitable habitat for other species. Where linear scrub features are located at the edge of the felling buffers, the option to maintain the features has been considered. All buffer zones will be maintained vegetation-free for the duration of the project. The success of the buffer mitigation will be assessed as part of post construction monitoring and updated where necessary. A total of approximately 0.4ha of woodland will be cleared as part of these buffers (Figure 6-1 to 6-3). Re-planting of oak-ash woodland and bog woodland is proposed and detailed in Chapter 6.

The formula below is presented to provide appropriate mitigation in relation to bats, and the relevant input required from turbine parameters, is the combination of the blade length and hub height. In this context, the worst-case scenario arises from the longest blade on the lowest hub. The turbine model to be installed on the site will have an overall ground-to-blade tip height of 200m, a rotor diameter of 170m and hub height of 115m.

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

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

Where, bl =Blade length, hh = hub height, fh = feature height all in metres. E.g. (below) b = 74m (Plate 6-1)

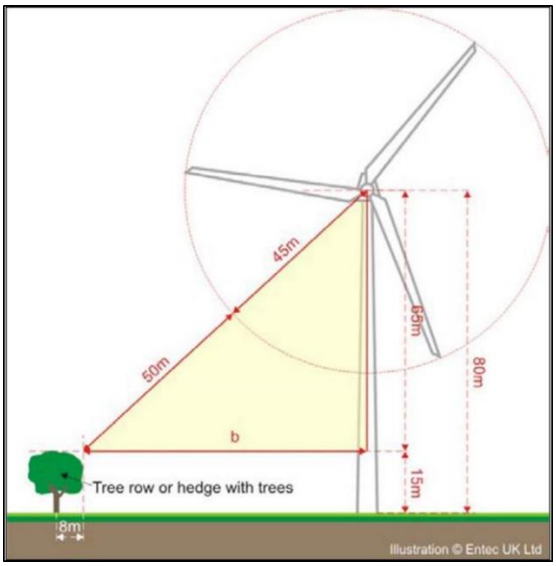
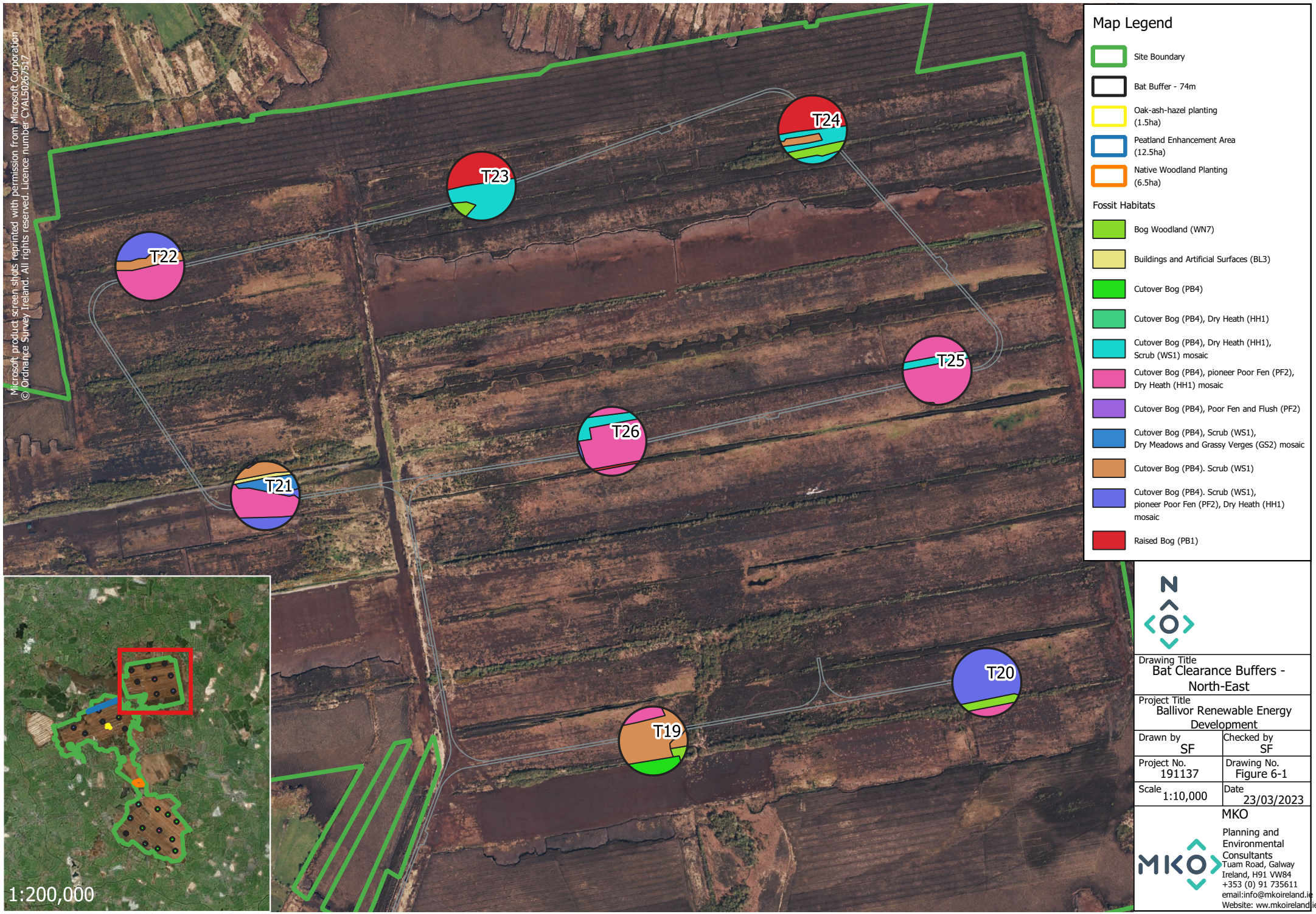


Plate 6-1 Calculate buffer distances (Natural England, 2014)



Map Legend

- Site Boundary
- Bat Buffer - 74m
- Oak-ash-hazel planting (1.5ha)
- Peatland Enhancement Area (12.5ha)
- Native Woodland Planting (6.5ha)

Fossit Habitats

- Bog Woodland (WN7)
- Buildings and Artificial Surfaces (BL3)
- Cutover Bog (PB4)
- Cutover Bog (PB4), Dry Heath (HH1)
- Cutover Bog (PB4), Dry Heath (HH1), Scrub (WS1) mosaic
- Cutover Bog (PB4), pioneer Poor Fen (PF2), Dry Heath (HH1) mosaic
- Cutover Bog (PB4), Poor Fen and Flush (PF2)
- Cutover Bog (PB4), Scrub (WS1), Dry Meadows and Grassy Verges (GS2) mosaic
- Cutover Bog (PB4). Scrub (WS1)
- Cutover Bog (PB4). Scrub (WS1), pioneer Poor Fen (PF2), Dry Heath (HH1) mosaic
- Raised Bog (PB1)

N

Drawing Title: Bat Clearance Buffers - North-East

Project Title: Ballivor Renewable Energy Development

Drawn by	Checked by
SF	SF
Project No. 191137	Drawing No. Figure 6-1
Scale 1:10,000	Date 23/03/2023

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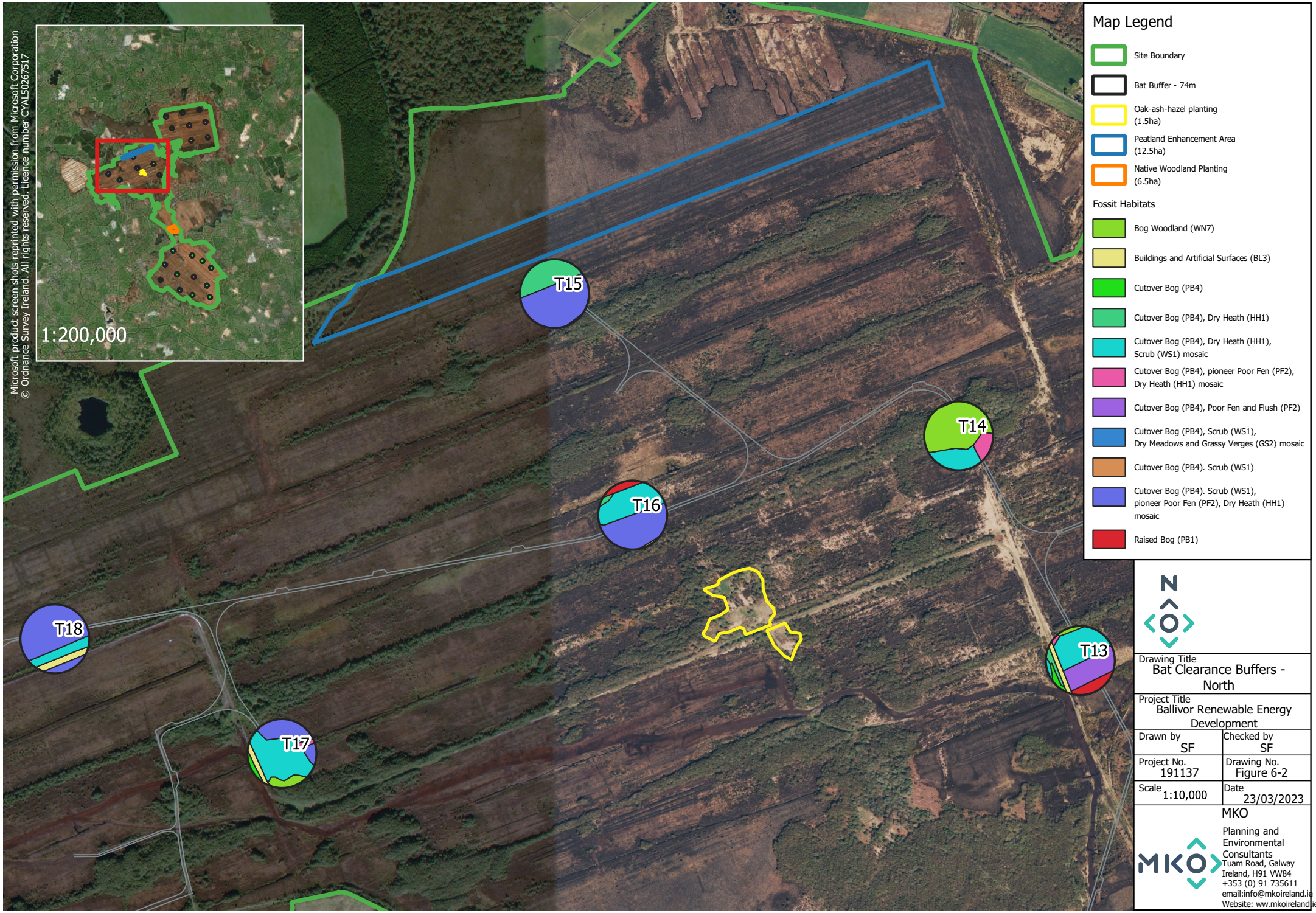
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Map Legend
Site Boundary
Bat Buffer - 74m
Oak-ash-hazel planting (1.5ha)
Peatland Enhancement Area (12.5ha)
Native Woodland Planting (6.5ha)
Fossit Habitats
Bog Woodland (WN7)
Buildings and Artificial Surfaces (BL3)
Cutover Bog (PB4)
Cutover Bog (PB4), Dry Heath (HH1)
Cutover Bog (PB4), Dry Heath (HH1), Scrub (WS1) mosaic
Cutover Bog (PB4), pioneer Poor Fen (PF2), Dry Heath (HH1) mosaic
Cutover Bog (PB4), Poor Fen and Flush (PF2)
Cutover Bog (PB4), Scrub (WS1), Dry Meadows and Grassy Verges (GS2) mosaic
Cutover Bog (PB4). Scrub (WS1)
Cutover Bog (PB4). Scrub (WS1), pioneer Poor Fen (PF2), Dry Heath (HH1) mosaic
Raised Bog (PB1)
N
Drawing Title
Bat Clearance Buffers - North
Project Title
Ballivor Renewable Energy Development
Drawn by SF
Checked by SF
Project No. 191137
Drawing No. Figure 6-2
Scale 1:10,000
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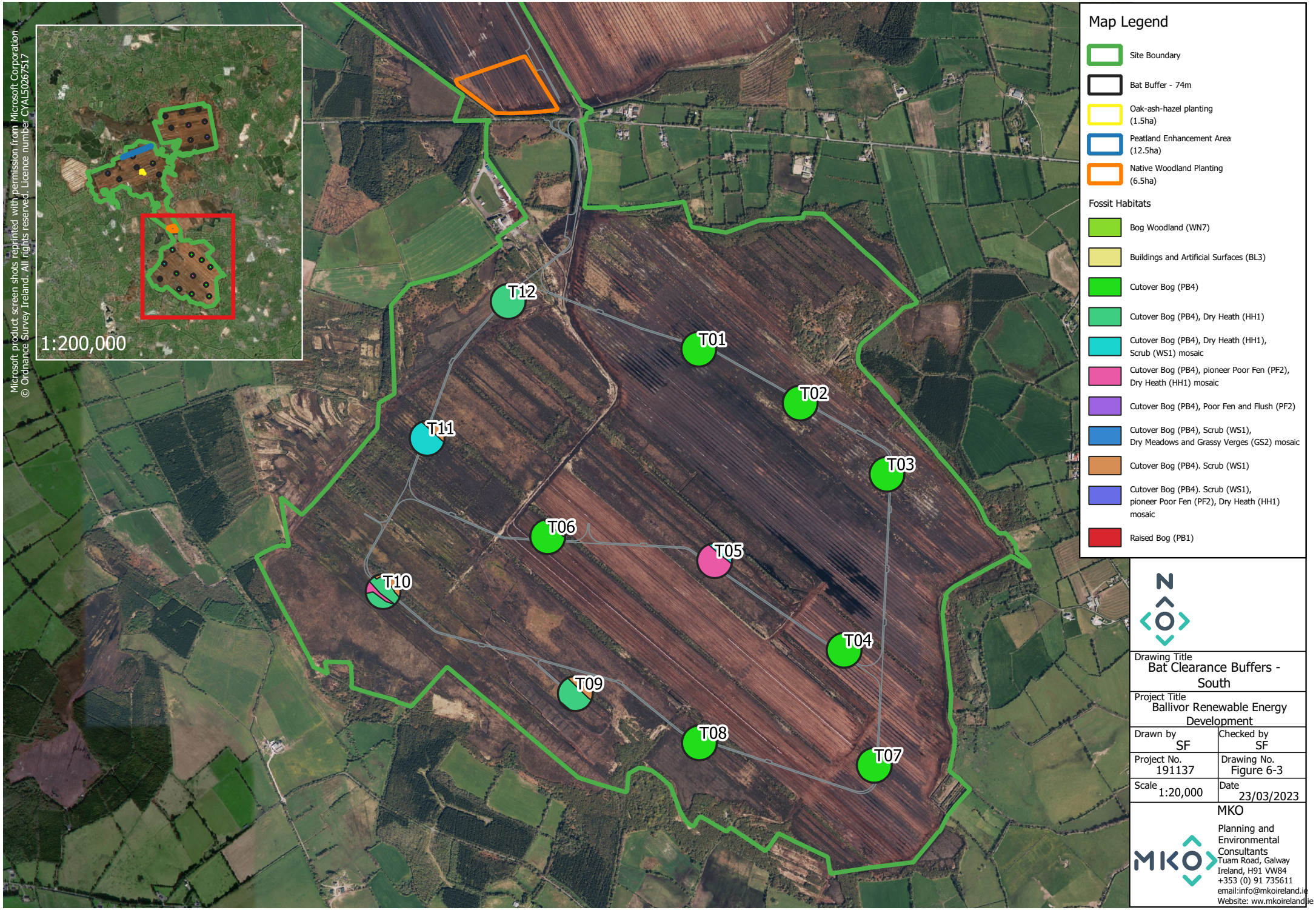
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Map Legend
Site Boundary
Bat Buffer - 74m
Oak-ash-hazel planting (1.5ha)
Peatland Enhancement Area (12.5ha)
Native Woodland Planting (6.5ha)
Fossit Habitats
Bog Woodland (WN7)
Buildings and Artificial Surfaces (BL3)
Cutover Bog (PB4)
Cutover Bog (PB4), Dry Heath (HH1)
Cutover Bog (PB4), Dry Heath (HH1), Scrub (WS1) mosaic
Cutover Bog (PB4), pioneer Poor Fen (PF2), Dry Heath (HH1) mosaic
Cutover Bog (PB4), Poor Fen and Flush (PF2)
Cutover Bog (PB4), Scrub (WS1), Dry Meadows and Grassy Verges (GS2) mosaic
Cutover Bog (PB4). Scrub (WS1)
Cutover Bog (PB4). Scrub (WS1), pioneer Poor Fen (PF2), Dry Heath (HH1) mosaic
Raised Bog (PB1)
N
Drawing Title
Bat Clearance Buffers - South
Project Title
Ballivor Renewable Energy Development
Drawn by SF
Checked by SF
Project No. 191137
Drawing No. Figure 6-3
Scale 1:20,000
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6.1.4 Vegetation Clearance

A small number of trees presenting potential roosting features were identified within the Proposed Development site, along the haul route, and trees within the Borrowpit n.2 are proposed for felling. No bat roost was identified, however bats comprise mobile species that can move regularly between tree roosts. As such, the trees with potential roosting features have been considered as a "roost resource" and compensation will be provided to cover for the loss of the resource. Tree-felling of deciduous trees will be carried out according to the following standard mitigating procedures:

- Trees with suitable potential roost features proposed for felling will be checked for bats by a suitably qualified arborist at the time of felling.
- Trees will be nudged two or three times prior to limb removal, with a pause of 30 seconds in between, to allow any bats potentially roosting to wake and move.
- Rigged felling shall be used to lower the limbs and trunk carefully to ground level and cavities searched by a qualified ecologist.
- Felled trees will be left in-situ for a minimum of 24 hours prior to sawing or mulching, to allow any bats present to escape (National Roads Authority, 2006).
- Any tree felling will be undertaken outside the bat maternity season (May-August) and the hibernation period (December-February) (Marnell, Kelleher and Mullen, 2022).
- Woodcrete bat boxes will be provided to compensate for the loss of trees with roosting features and installed on retained trees at least 3m high.

6.1.5 Blade Feathering

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

In accordance with NIEA Guidelines, blade feathering will be implemented as a standard across all proposed turbines when wind speeds are below the cut-in speed of the turbine (i.e. 3.5 m/s).

6.2 Bat Mitigation and Monitoring Plan

Overall risk levels for high collision risk bat species was typically ***Low*** or ***Medium***, with the exception of common pipistrelle which had a ***High*** risk level for Summer at peak activity levels. A low risk level is reflective of the nature of the site, which is a commercial cutover bog with low to moderate levels of bat activity recorded during the walked transects undertaken.

However, taking a precautionary approach, given that high collision risk was recorded at peak activity levels, and since higher risk per species was usually identified by the software Ecobat in 2020, an adaptive monitoring and mitigation strategy has been devised for the Proposed Development, in line with the case study example provided in Appendix 5 of the NatureScot, (2021) and based on the site-specific data.

6.2.1 Operational Monitoring

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

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

The results of post construction monitoring shall be utilised to assess changes in bat activity patterns post construction and to monitor the implementation of the mitigation strategy. At the end of Year 1, and if a curtailment requirement is identified (i.e. significant bat fatalities encountered), a curtailment programme shall be devised around key activity periods and weather parameters in accordance with NIEA Guidance. The performance of any curtailment programme in terms of its ability to respond to the changes in bat abundance based on temperature and wind speed would be analysed to confirm the efficacy of the curtailment during different periods of bat activity. At the end of each subsequent year of monitoring, the efficacy of the curtailment programme will be reviewed, and any identified efficiencies incorporated into the curtailment programme. This approach allows for an evidence-based review of the potential or bat fatalities at the site, post construction, to ensure that the necessary measures, based on a new baseline post-construction, are implemented for the protection of bat species locally.

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

6.2.1.1 Monitoring Year 1

6.2.1.1.1 *Bat activity surveys*

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

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

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

6.2.1.1.2 *Carcass searches*

Carcass searches, to monitor and record bat fatalities, shall be conducted at each turbine in accordance with NIEA Guidance (See section 6.2.2.3 below). This shall include searcher efficiency trials and an assessment of scavenger removal rates to determine the appropriate correction factor to be applied in relation to determining an accurate estimate of collision mortality. Casualty searches shall use a method with high observer efficiency (>50% as per NatureScot). NED guidance acknowledges that trained dog search teams are "*significantly more efficient and faster at finding carcasses than human surveyors"* and NatureScot guidance states that conservation dogs "*should preferably be used to achieve more robust results*". Therefore, the use of conservation dogs will be necessary where observed human searcher efficiency is less than 50%.

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

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

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

6.2.1.2 Monitoring Years 2 & 3

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

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

At the end of each year, the efficacy of the curtailment programme shall be reviewed, and any identified efficiencies incorporated into the curtailment programme.

6.2.1.3 Carcass Search Survey Methodology

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

Daily searches are recommended in order to refine mitigation. At other sites, searches at 2-4 day intervals are acceptable, based on the predation rates observed at most locations in the National Bats and Wind Turbines study (NatureScot, 2021). Data will be obtained from the turbine operators on whether or not the target turbine was operational on the night preceding the search, with the surveying protocol being adjusted as necessary if the turbines were either non-operational or were not rotating because of a lack of wind. To maximise the duration of monitoring during each season, whilst maintaining low carcass removal rates, surveying can be split into blocks as illustrated in Table 6-1.

Table 6-1 Proposed survey effort approach to maximise the duration of monitoring during each season (NatureScot, 2021)

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

Searcher efficiency trials

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

Scavenger removal rates

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

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

6.3 Residual Impacts

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

6.4 Cumulative effects

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

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

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

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

7. CONCLUSION

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

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

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APPENDIX 1

BAT HABITAT SUITABILITY APPRAISAL

HABITAT SUITABILITY ASSESSMENT

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

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

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

APPENDIX 2

SITE RISK ASSESSMENT

SITE RISK ASSESSMENT

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

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

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

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

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

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

APPENDIX 3

2020 BAT RESULTS

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1. INTRODUCTION

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

This appendix provides supplementary data that was derived from bat activity surveys undertaken on the Site in 2020, which were designed in accordance with Scottish Natural Heritage Guidance (SNH 2019).

The following surveys were undertaken in 2020:

- Manual Transect Surveys
- Ground-level Static Surveys
- Static Surveys at Height

The scope and results are provided in the sections below.

2. 2020 FIELD SURVEYS TO SNH GUIDANCE

2.1 Bat Habitat Suitability Appraisal

Bat walkover surveys were carried out in 2020. During these surveys, habitats within the Wind Farm Site Boundary a were assessed for their suitability to support roosting, foraging and commuting bats. Suitability was assessed according to Collins (2016) which provides a grading protocol for roosting habitats and for commuting and foraging areas. Additionally, a search for roosts was undertaken within the boundary of the Site (SNH, 2019), and identified structures and trees were subject to a preliminary roost assessment. Suitability categories are divided into *High, Moderate, Low* and *Negligible*, and are described fully in **Appendix 1**.

2.2 Manual Activity Surveys

Manual surveys carried out in Ballivor were transect surveys. Table 2-1 summarises the manual survey effort.

Table 2-1 2020 Survey Effort - Manual Activity Surveys

Date	Surveyors	Sunrise/ Sunset	Type	Weather	Walked (km)
23rd April 2020	Aoife Joyce and Luke Dodebier	20:45	Dusk	15°C, dry, calm/light air	8.8km
14th April 2020	Aoife Joyce and Luke Dodebier	06:06	Dawn	6°C, dry, 70 % cloud cover, calm/ light air.	3.8km
4th June 2020	Luke Dodebier and Claire Stephens	21:50	Dusk	12°C, dry, 40% cloud cover, calm/light air	8.9km
5th June 2020	Luke Dodebier and Claire Stephens	05:03	Dawn	10°C, dry, 100% cloud cover, calm/ light air	6.3km
3rd September 2020	Neil Campbell Cathal Bergin	20:13	Dusk	15°C dry, 20-30% cloud cover, calm/ light air	6km
3rd September 2020	Neil Campbell Cathal Bergin	06:42	Dawn	10°C, dry, 50% cloud cover, calm/ light air	4.2km
Total 2020 Survey Effort					**38km**

Manual Transects

Manual activity surveys comprised walked transects at dusk and dawn. A series of representative transect routes were selected throughout the 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, they generally followed existing roads and tracks. 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. Dawn surveys commenced 2 hours before sunrise and were completed at sunrise. All bat activity was recorded for subsequent analysis to confirm species identifications.

2.3 Ground-level Static Activity Surveys

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

The scope of bat work was designed in 2020, prior to the finalising of the Proposed Development layout (i.e. 26 turbines). The surveys were designed for a potential layout of up to 35 turbines. Given that 35 turbines were initially proposed, 18 detectors were deployed to ensure compliance with SNH guidance. The extent of the Proposed Development changed through the design process, and the number of turbines reduced to 26 turbines.

Automated bat detectors were deployed at 18 no. locations for at least 10 nights in each of spring (April-May), summer (June-mid August) and autumn (mid-August-October) (NatureScot, 2021). Detector locations were based on indicative turbine locations and differ slightly to the final proposed layout. Detector locations achieved a representative spatial spread in relation to proposed turbines and sampled the range of available habitats. Figure 2-1 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 in 2020

ID	Location (ITM)	Habitat	Linear Feature within 50m	Corresponding/ Nearest Turbine(s)
D01	E263932 N253362	Cutover bog (PB4) and Dry Heath (HH1)	Scrub (WS1) and Bog Woodland (WL7)	T11 & T12
D02	E265751 N253404	Cutover bog (PB4) and Scrub (WS1)	Scrub (WS 1) and Bog Woodland (WL7)	T02 & T03
D03	E264423 N252765	Cutover bog (PB4) and Dry Heath (HH1)	Scrub (WS1)	T06
D04	E265509 N252511	Cutover bog (PB4), Dry Heath (HH1) and Scrub (WS1)	Scrub (WS1)	T04 & T05
D05	E264778 N253113	Cutover bog (PB4), Dry Heath (HH1) and Scrub (WS1)	Scrub (WS1)	T01 & T06
D06	E265222 N251902	Cutover bog (PB4) and Scrub (WS1)	Scrub (WS1)	T08
D07	E265752 N255265	Cutover bog (PB4) and Bog Woodland (WL7)	Bog Woodland (WL7)	-
D08	E264404 N255086	Cutover bog (PB4)	-	-
D09	E260726 N256967	Cutover bog (PB4), Dry Heath (HH1) and Scrub (WS1)	Scrub (WS1)	T18

D10	E263439 N258094	Cutover bog (PB4), Dry Heath (HH1) and Scrub (WS1), Pioneer Poor Fen (PF2)	Scrub (WS1)	T15
D11	E262276 N256716	Bog Woodland (WN7), Buildings and Artificial Surfaces (BL3)	Bog Woodland (WN7) and Scrub (WS1)	T17
D12	E263865 N257216	Cutover Bog (PB4), Dry Heath (HH1) and Scrub (WS1)	Scrub (WS1)	T13 & T14
D13	E262863 N256958	Bog Woodland (WN7), Buildings and Artificial Surfaces (BL3)	Bog Woodland (WN7)	T16
D14	E265175 N259460	Cutover bog (PB4) and Scrub (WS1)	Scrub (WS1)	T23 & T24
D15	E262494 N258935	Cutover bog (PB4) and Scrub (WS1)	Scrub (WS1)	-
D16	E265594 N258520	Cutover bog (PB4), Dry Heath (HH1) and Pioneer Poor Fen (PF2)	Bog Woodland (WN7) and Scrub (WS1)	T19 & T20
D17	E264336 N259062	Cutover bog (PB4), Scrub (WS1), Dry Meadows and Grassy Verges (GS2)	Scrub (WS1)	T21
D18	E265262 N258967	Cutover bog (PB4), Dry Heath (HH1) and Pioneer Poor Fen (PF2)	Scrub (WS1)	T25 & T26

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

Onsite weather monitoring was undertaken concurrently with static detector deployments. One Vantage Pro 2 (Davis Instruments, CA, UCS) was deployed each season and night-time hourly data was tracked remotely to ensure a sufficient number of nights (i.e. minimum 10 no.) with appropriate weather conditions were captured (i.e. dusk temperatures above 8˚, wind speeds less than 5m/s and no or only very light rainfall). Table 2-3 summarises survey effort achieved in 2020 for each of the 18 no. detector locations.

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

Season	Survey Period	Total Survey Nights per Detector Location	Nights with Appropriate Weather
Spring	23rd April – 6th May 2020	14	14
Summer	4th June – 16th June 2020	12	12
Autumn	3rd September – 14th September 2020	11	11
Total Survey Effort		**37**	**37**

2.4 Static Surveys at Height

Monitoring at height can provide useful information on bat activity within the rotor sweep area and is particularly relevant at proposed key-holed sites (NatureScot, 2021). Simultaneous surveying at ground level and at height was undertaken throughout 2020. One Song Meter SM3BAT (Wildlife Acoustics, Maynard, MA, USA) was installed on a meteorological mast within the Proposed Development site (Grid Ref: E264783 N258983). The detector was equipped with two microphones; one at ground level

and one at height (approx. 98 m above ground level) to allow for simultaneous surveying. Table 2-4 describes survey effort in relation to surveys at height and the location of the met mast is illustrated in Figure 2-1.

Table 2-4 2020 Survey Effort - Static Surveys at Height

ID	Survey Period	Total Survey Nights
Deployment - 1	20th July – 5th August 2020	17
Deployment - 2	7th August – 21st August 2020	15
Deployment - 3	3rd September – 13th September 2020	10
Total Survey Effort		**42**

2.5 Bat Call Analysis

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

2.6 Assessment of Bat Activity Levels

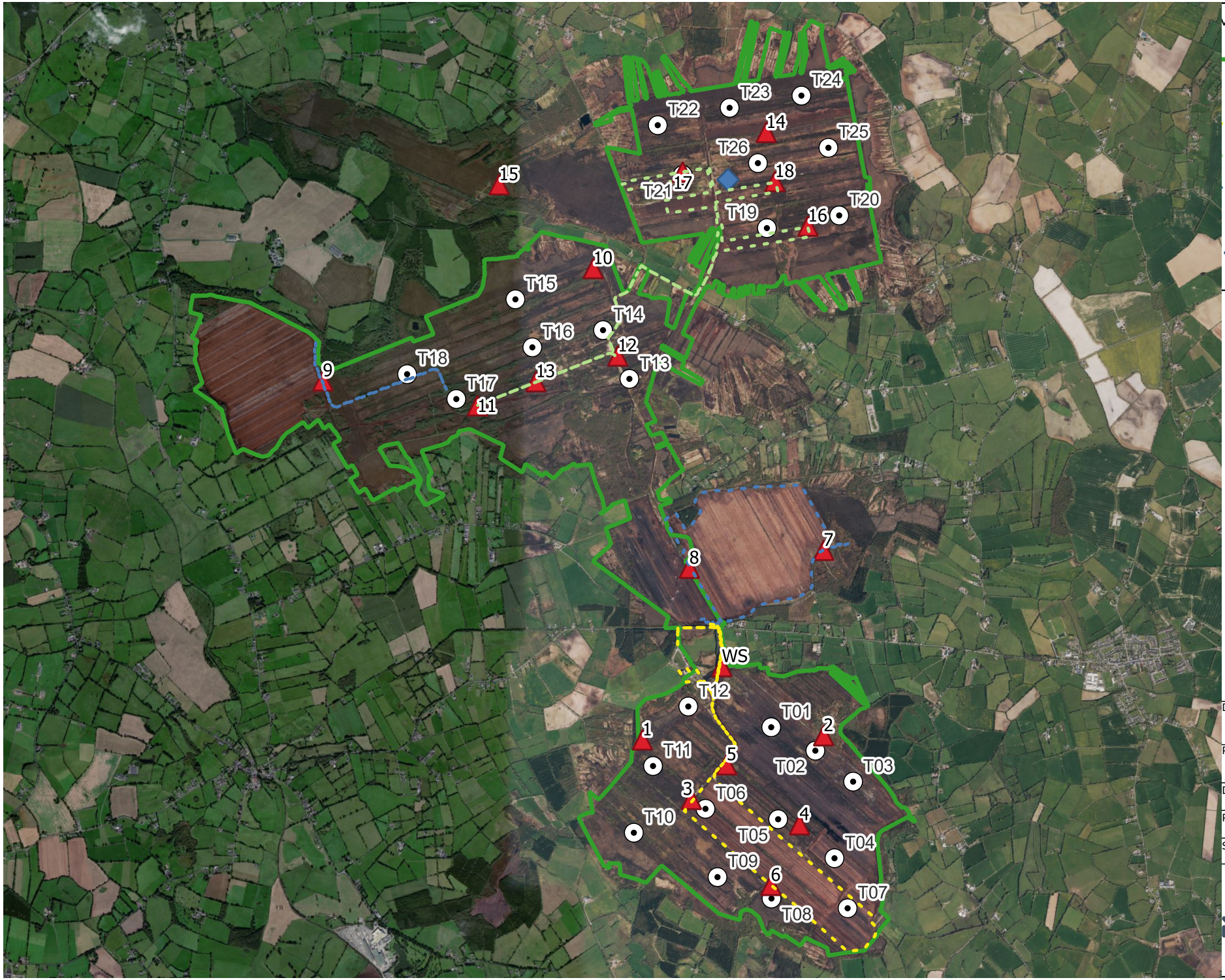
Static detector monitoring results were uploaded to the online database tool Ecobat (ecobat.org.uk). Static detector at ground level results for the Proposed Development were uploaded in November 2021. Database records used in analyses were limited to those within a similar time of year (within 30 days) and a within a similar geographic region (within 200km).

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

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 (SNH, 2019).

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



Map Legend

- Site Boundary
- Final Detector Locations
- Spring Dusk Transect Route
- Summer Transect Route
- 2022 Autumn Transect Route
- Proposed Turbine Layout
- Ballivor Meteorological Mast_Bat Surv

N

Drawing Title

2020 Survey Effort

Project Title

Ballivor Renewable Energy Development

Drawn by	Checked by
LG	AJ/SF
Project No. 191137	Drawing No. Figure 3-1.
Scale 1:49,510	Date 24/02/2023

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3. RESULTS

3.1 Bat Habitat Suitability Appraisal

With regard to foraging and commuting bats, areas of cutover bog, dry heath, poor fen, spoil and bare ground, and grassland habitats were considered to have Low suitability, i.e. suitable but isolated habitat that could be used by small numbers of commuting or foraging bats (Collins, 2016). Scrub, bog woodland, oak-ash-hazel woodland, conifer/forestry edge habitats, lowland depositing streams, drainage ditches and artificial lakes/ponds were assessed as having Moderate potential for commuting or foraging bats (i.e. habitat that is connected to the wider landscape that could be used by bats for foraging bats such as trees, scrub grassland or water (Collins, 2016)). However, these habitats are surrounded by wide expanses of cutover bog habitat.

With regard to roosting bats, an assessment of the various woodland and forestry habitats was undertaken. Trees present on site comprise a mixture of mature and immature birch, willow, hazel, ash, oak, sycamore, rowan, commercial coniferous species. Overall, the majority of trees within the site did not provide optimal habitat for roosting bats and were assessed as having Negligible – Low roosting potential. Structures within the Proposed Development site include Bord na Mona site buildings, which support low roosting potential (Collins 2016).

All other habitats present were assigned a Negligible value.

3.2 Manual Transect Surveys

Manual transects were undertaken in Spring, Summer and Autumn 2020. Bat activity was recorded on all surveys. A total of 535 bat passes were recorded. In general, Common pipistrelle (n=230) was recorded most frequently, followed the Soprano pipistrelle (n=169) and Leisler's Bat (n=132). Brown long-eared bat (n=3) and *Myotis sp.* (n=1) were rare. Species composition across all manual surveys is presented in Plate 3-1.

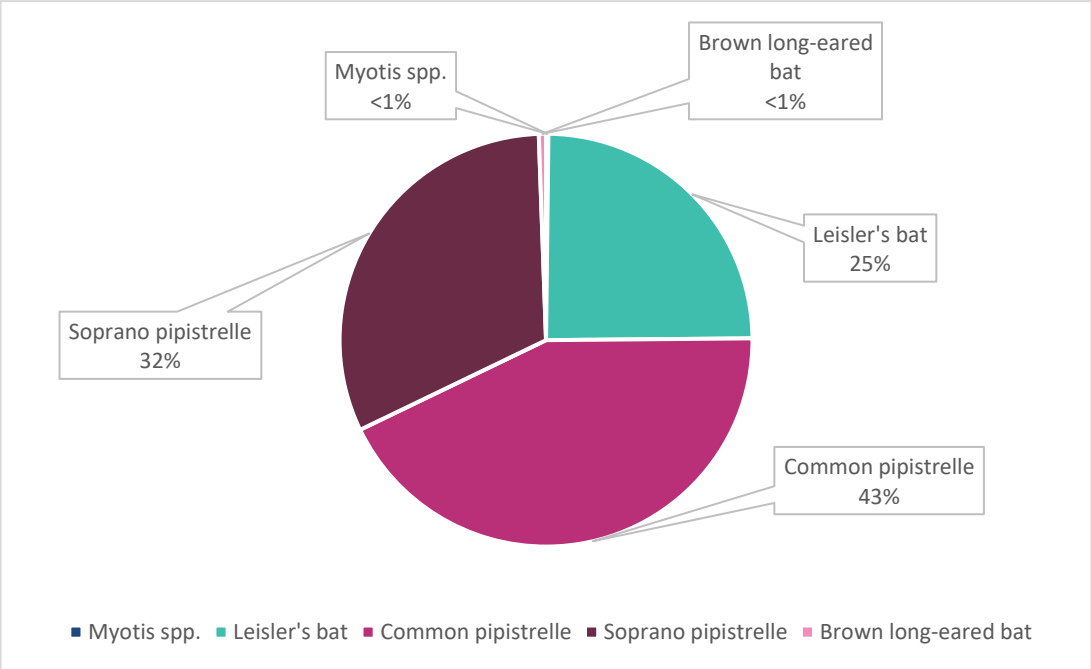


Plate 3-1 2020 Species Composition for Manual Transects, Spring, Summer, Autumn

Species composition and activity levels varied significantly between surveys. Transect survey results were calculated as bat passes per km surveyed (to account for differences in survey effort). Plate 3-2 present the results for individual species per survey period. High bat activity was recorded along mature treelines and continuous linear features.

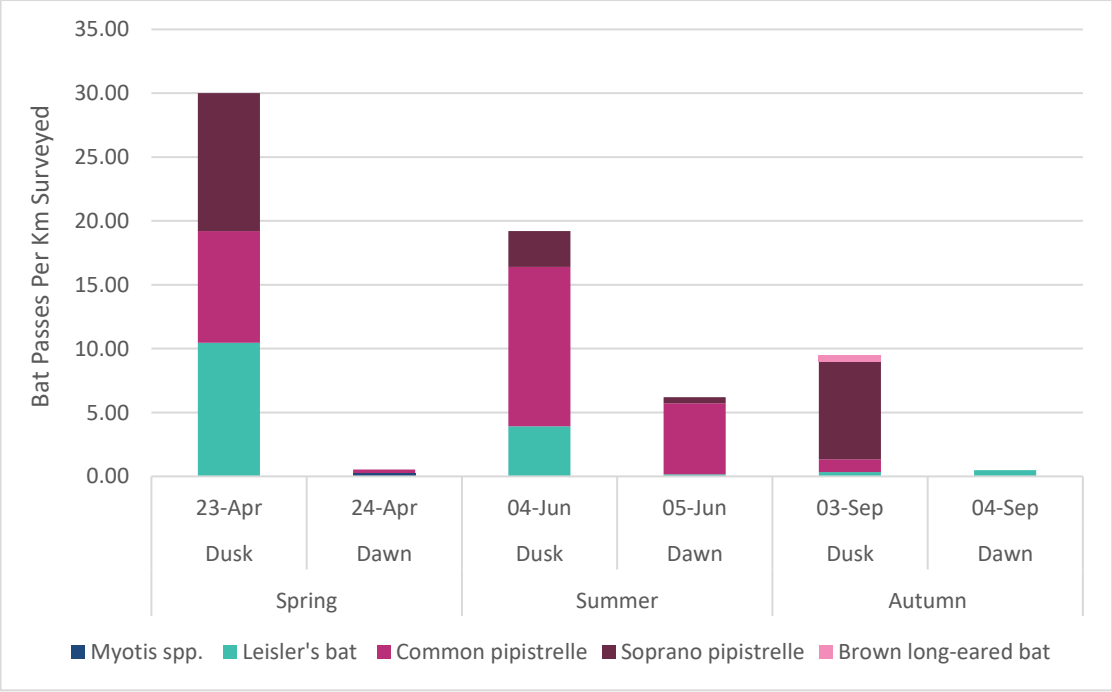
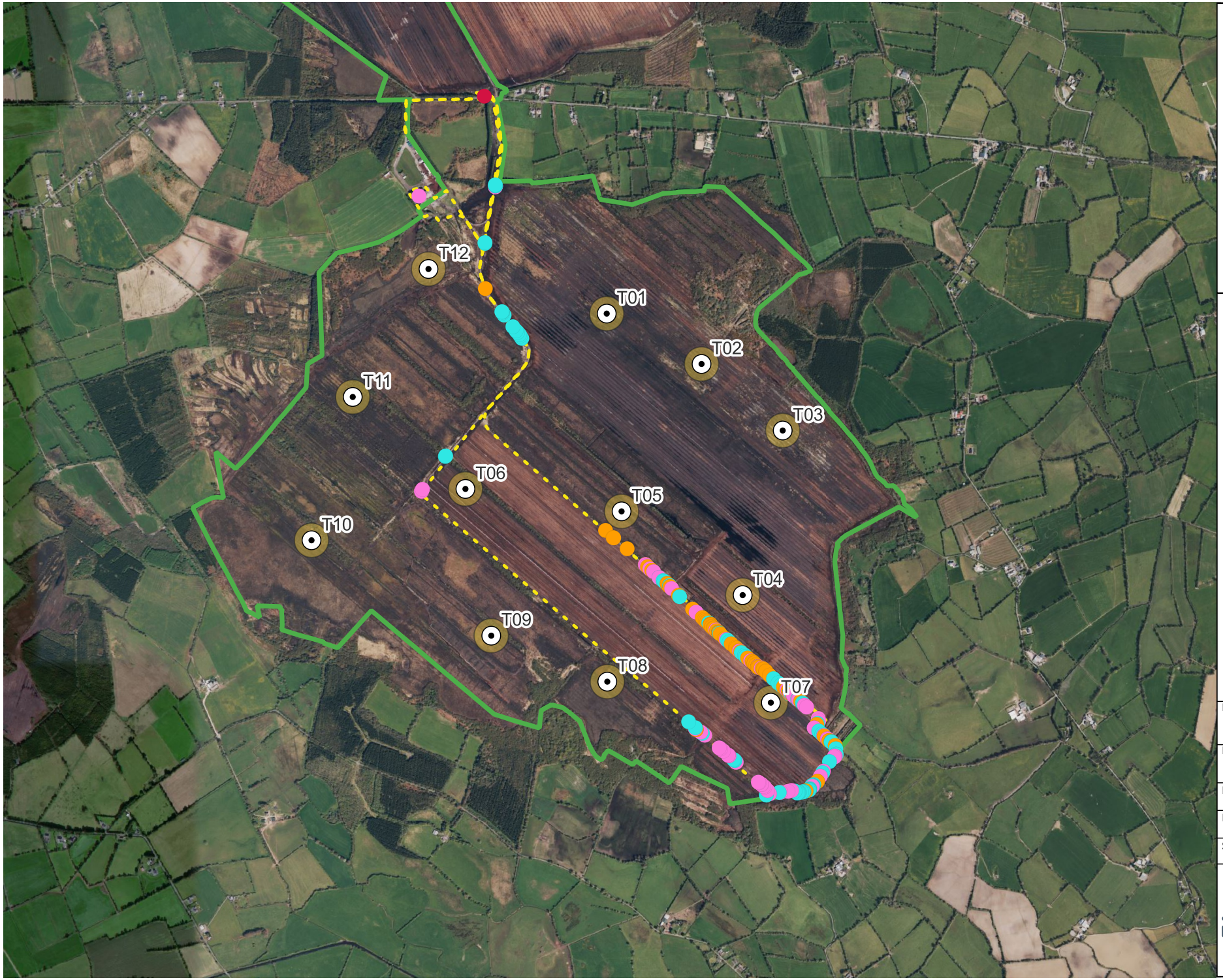


Plate 3-2 2020 Manual Results – Species Composition Per Survey Period

Figure 3-1, Figure 3-2 and Figure 3-3 present the spatial distribution of bat activity across the 2020 surveys. Bat activity was concentrated along hedgerows, scrub and linear (road/track) habitats. There were less Leisler's bat and Common pipistrelle present in the Autumn surveys than the Spring and Summer, whereas Brown long-eared bat was only recorded in this season.



Map Legend

- Wind Farm Site Boundary
- Proposed Turbine Layout
- Spring Dusk and Dawn Transect

Spring Dusk and Dawn Manual Results

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

N

Drawing Title

2020 Spring Results

Project Title

Ballivor Wind Farm Development

Drawn by	Checked by
LG	AJ
Project No. 191137	Drawing No. Figure 3-1.
Scale 1:23,038	Date 24/02/2023

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Map Legend

- Wind Farm Site Boundary
- Proposed Turbine Layout
- Summer Dusk and Dawn Transect

Summer Dusk and Dawn Manual Results

- Leisler's bat
- Common pipistrelle
- Soprano pipistrelle

N

Drawing Title

2020 Summer Results

Project Title: Ballivor Wind Farm Development	
Drawn by: LG	Checked by: AJ
Project No.: 191137	Drawing No.: Figure 3-2.
Scale: 1:36,748	Date: 24/02/2023

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Map Legend

- Wind Farm Site Boundary
- Turbine Layout
- 2020 Autumn Transect Routes

Autumn Dusk Manual Results

- Leisler's bat
- Common pipistrelle
- Soprano pipistrelle
- Brown long-eared bat

N

Drawing Title

2020 Autumn Results

Project Title: Ballivor Wind Farm Development	
Drawn by: LG	Checked by: AJ/SF
Project No.: 191137	Drawing No.: Figure 3-3.
Scale: 1:30,000	Date: 24/02/2023

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3.3 Ground Level Static Surveys

In total, 96,711 bat passes were recorded across all deployments. In general, Common pipistrelle (n=61,883) occurred most frequently, followed by Soprano pipistrelle (n=18,637) and Leisler's bat (n=12,712). Instances of Nathusius' pipistrelle (n=2,360), *Myotis* sp. (n=696) and Brown long-eared bat (n=423) were significantly less. Plate 3-3 presents species composition across all ground-level static detectors.

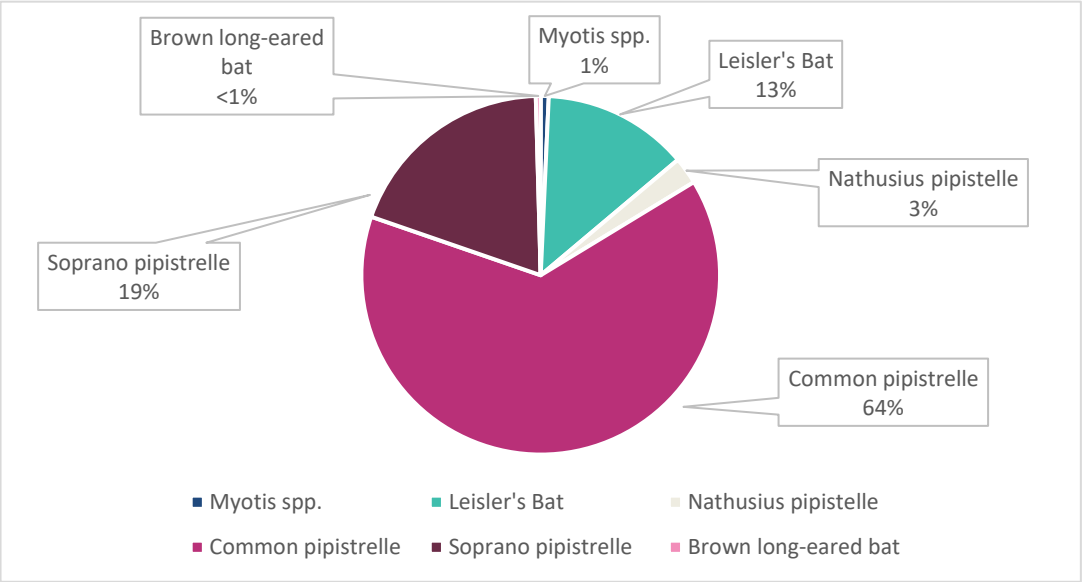

Plate 3-3 Static Detector Surveys: Species Composition Across All Deployments (Total Bat Passes)

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. Table 3-1 and Plate 3-4 present these results for each species. No significant variability in species composition was recorded between seasons, however higher activity was recorded in Summer than during the rest of the year.

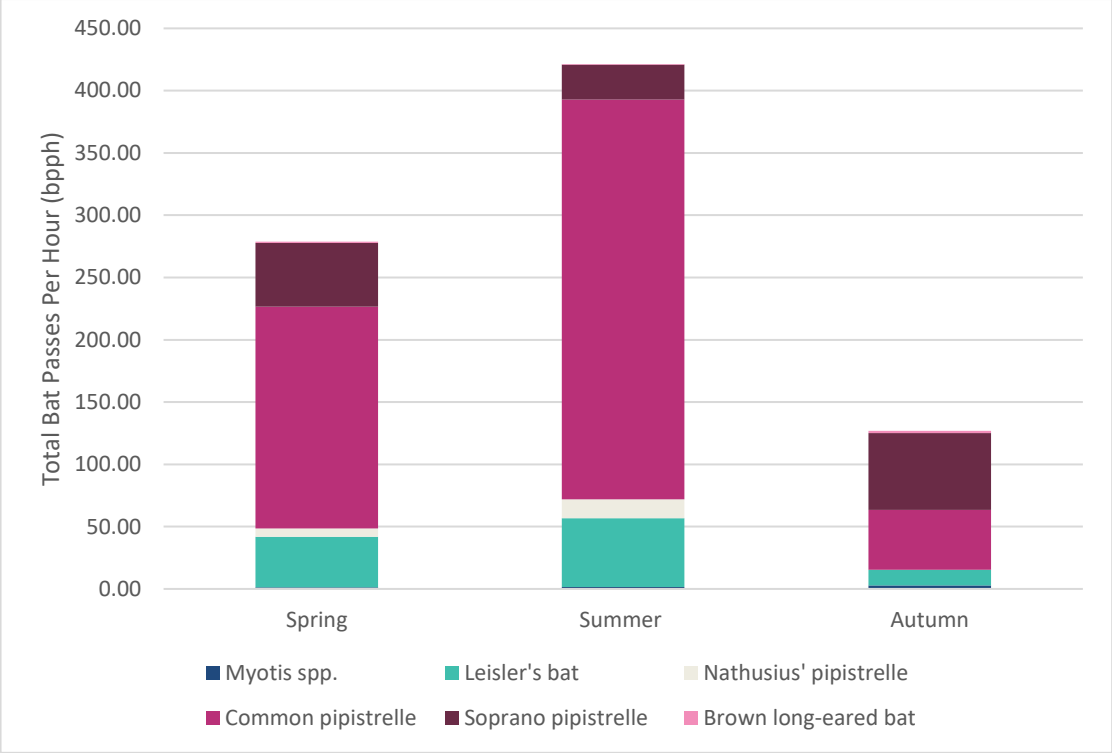

Plate 3-4 Static Detector Surveys: Species Composition Across All Deployments

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

	Spring	Summer	Autumn
Total Survey Hours	**143.7**	**92**	**140.9**
Myotis sp.	1.16	1.43	2.82
Leisler's bat	40.65	55.41	12.58
Nathusius' pipistrelle	6.7	15.10	0.06
Common pipistrelle	178.10	321.01	47.96
Soprano pipistrelle	51.23	27.91	61.80
Brown long-eared bat	0.93	0.41	1.79

The Nightly Pass Rate (i.e. total bat passes per hour, per night) was used to determine typical bat activity at the Proposed Development site. Activity is often variable between survey nights. Therefore, the median Nightly Pass Rate was used as the most appropriate measure of bat activity (Lintott & Mathews, 2018).

Plate 3-5 illustrates the median Nightly Pass Rate per species per deployment. Zero data, when a species was not detected on a night, was also included.

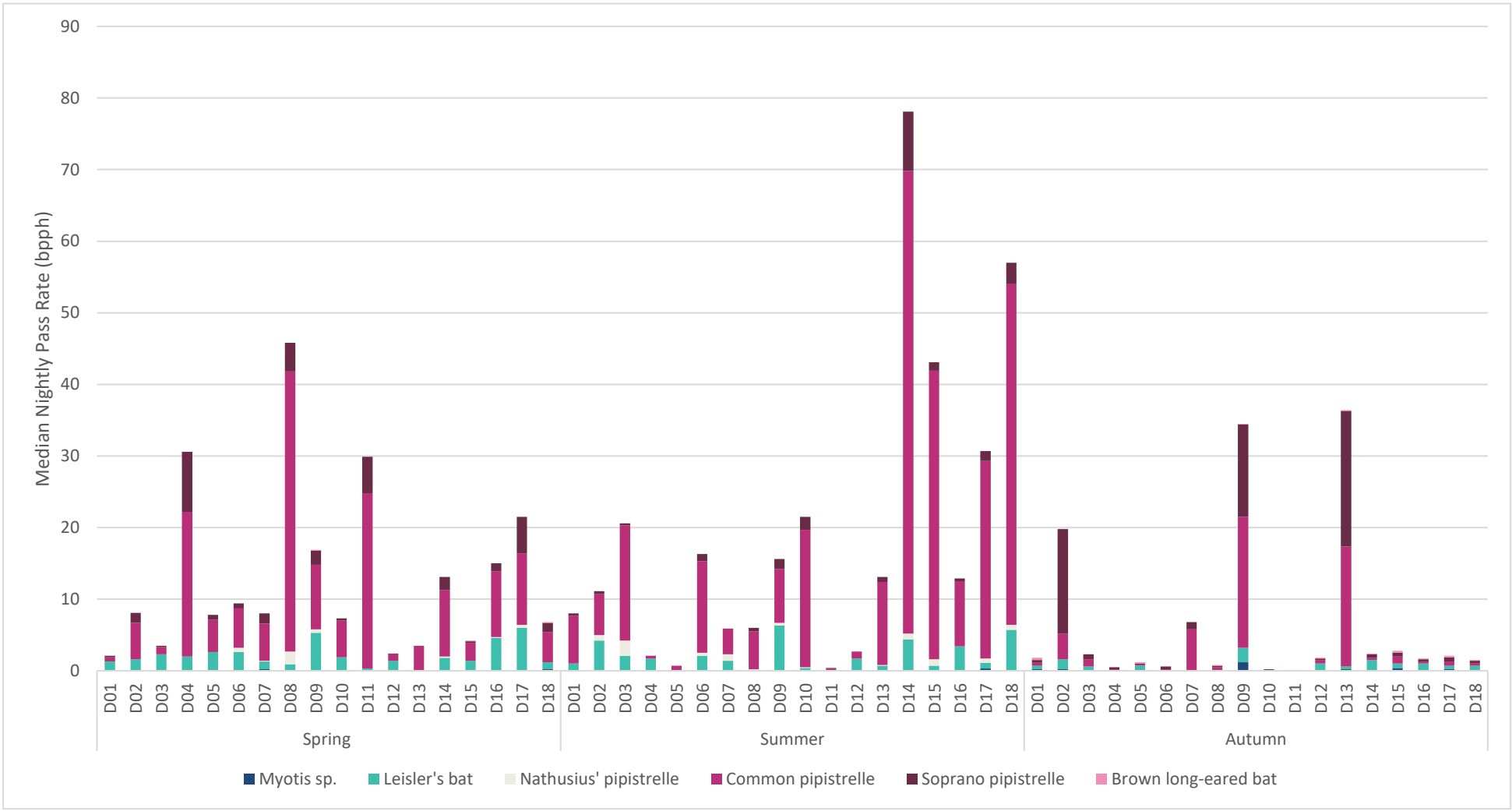

Plate 3-5 Static Detector Surveys: Median Nightly Pass Rate (bpph) per Detector, per Survey Period. Data Includes Absences.

Common pipistrelle bats were predominant at the majority of detectors during the Spring and Summer survey periods. Autumn activity varied at each detector with Soprano pipistrelle, Common pipistrelle and Leisler's bat as the dominant species.

Bat activity levels were objectively assessed against a reference dataset using Ecobat. Table 3-2 presents the results of Ecobat analysis for each species per season on a site-level.

According to the Ecobat analysis carried out, Median activity levels for Common pipistrelle peaked at ***High*** for Spring and Summer. Median activity levels for Soprano pipistrelle and Leisler's bat peaked at ***Moderate to High*** for at least two seasons. Median activity levels for Nathusius' pipistrelle peaked at ***Moderate*** for two seasons. Brown long-eared bat and *Myotis sp.* peaked with ***Low to Moderate*** activity for at least one season. Maximum activity levels peaked with ***High*** activity for all species for at least one season, with the exception of brown long-eared bat, which peaked at ***Moderate to High***.

Table 3-2 Static Detector Surveys: Site-level Ecobat Analysis

Survey Period	Median Percentile	Median Bat Activity	Max Percentile	Max Bat Activity	Nights Recorded	Ref Range
Common pipistrelle						
Spring	83	High	99	High	248	4594
Summer	88	High	99	High	219	6918
Autumn	68	Moderate - High	98	High	172	6220
Soprano pipistrelle						
Spring	61	Moderate - High	98	High	212	4523
Summer	56	Moderate	91	High	175	6244
Autumn	65	Moderate - High	99	High	176	6604
Nathusius' pipistrelle						
Spring	43	Moderate	87	High	118	1240
Summer	49	Moderate	92	High	137	1575
Autumn	17	Low	37	Low - Moderate	7	1464
Leisler's bat						
Spring	69	Moderate - High	92	High	230	4594
Summer	65	Moderate - High	96	High	195	6145
Autumn	66	Moderate - High	91	High	155	4740
***Myotis* sp.**						
Spring	27	Low - Moderate	70	Moderate - High	76	3062
Summer	28	Low - Moderate	82	High	34	3929
Autumn	37	Low - Moderate	85	High	105	4764
Brown long-eared bat						
Spring	9	Low	55	Moderate	73	1531
Summer	10	Low	44	Moderate	27	2062
Autumn	37	Low - Moderate	70	Moderate - High	106	3217

Appendix 4 presents results per detector. Leisler's bat, Common pipistrelle, Soprano pipistrelle and Nathusius' pipistrelle are considered as high-risk species in Collision risk. Leisler's bat recorded ***High***

median activity at D09 throughout all seasons, at D16 and D17 in Spring and at D18 in Summer. More than 75% of the static detectors recorded at least ***Moderate*** or ***Moderate-High*** activity of Leisler's bat in each season. Common pipistrelle recorded ***High*** median activity in Spring at 13 detector locations, in Summer at 10 locations, while in Autumn at 4 locations. ***High*** median activity was recorded at D02 throughout all seasons. Soprano pipistrelle ***High*** median activity levels varied throughout the seasons, with ***High*** activity being recorded at D04, D08, D11 and D17 in Spring, at D14 in Summer and at D02, D09 and D13 in Autumn. Nathusius' Pipistrelle recorded ***Moderate-High*** activity at D08, D13 and D17 in Spring, and at D03 in Summer. At the other locations during all seasons the median activity levels of the species were lower.

Myotis sp. and Brown long-eared bat are considered as low-risk species in Collision risk. During the autumn survey period *Myotis* sp. activity was ***Moderate-High*** at D09 location and lower activity was recorded, between ***Low*** and ***Moderate*** median activity, at the other locations during all season. Brown long-eared bat activity only reached ***Moderate*** value at D05 during Autumn.

3.3.1 Surveys at Height

Simultaneous surveying at ground level and at height was undertaken using a SM3 static bat detector. One U1 microphone was attached at height (approx. 98m) on the meteorological mast (Grid Ref: E264783 N258983) while another U1 microphone was placed 2m from ground level.

In 2020, 42 nights of simultaneous bat monitoring at ground level and at height was achieved. In total, 1,339 bat passes were recorded with bat activity higher at ground level (69%) compared to activity at height (31%) (Plate 3-6). Leisler's bats (n=409) were predominantly recorded at height with small numbers of common pipistrelle (n=9) also present. *Myotis* sp. (n=1) and soprano pipistrelle (n=1) were also recorded at height.

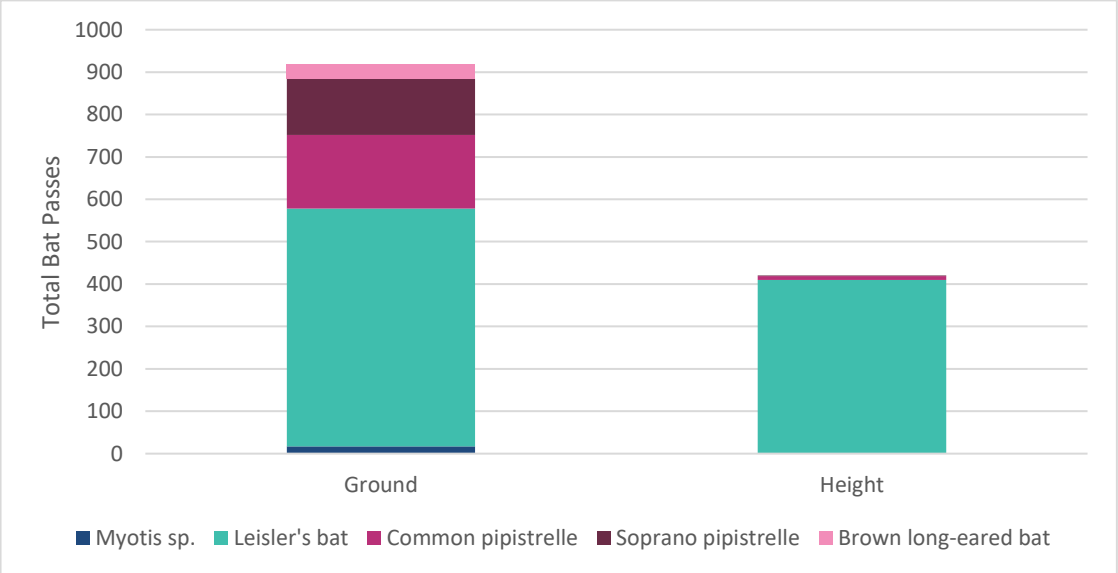

Plate 3-6 Surveys at Height: Overall Species Composition Per Microphone

Table 3-3 presents met mast monitoring as total bat passes. All individual bat records arising from static detector monitoring are appended to this report as **Appendix 4.** Plate 3-7 presents total bat passes per night. Activity was dominated by Leisler's bat.

Table 3-3 Static Detector Surveys at Height: 2020 Total Bat Passes

Species	Ground Level	At Height	Total
Myotis sp.	17	1	**18**
Leisler's bat	561	409	**970**
Common pipistrelle	174	9	**183**
Soprano pipistrelle	132	1	**133**
Brown long-eared bat	35	-	**35**
Total	**919**	**420**	**1339**

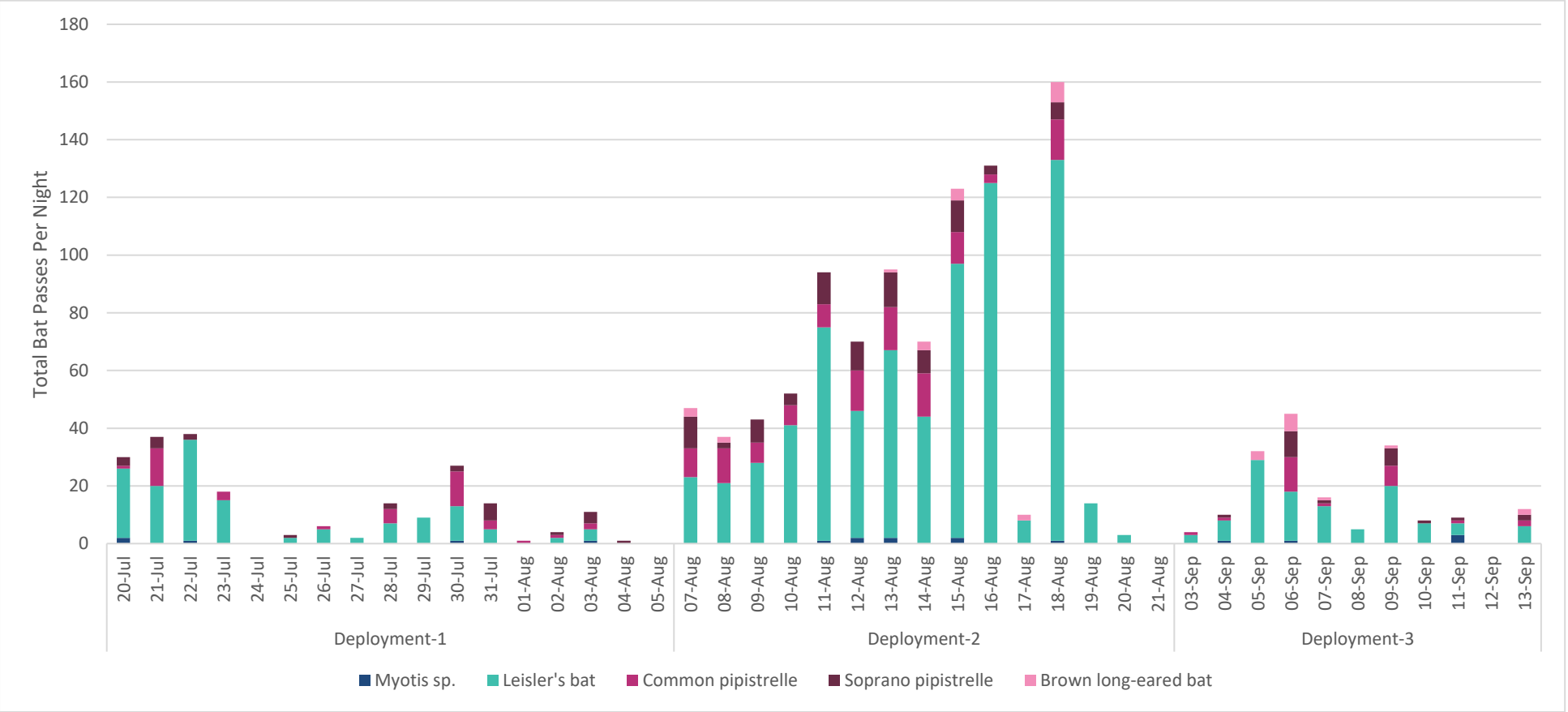

Plate 3-7 Surveys at Height: Overall Species Composition Per Microphone

4. SUMMARY OF RESULTS

Bat surveys in 2020 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 September 2020, this work included a desktop study, habitat and landscape assessments, manual activity surveys and static detector surveys at ground level and at height.

The Site is suitable for foraging and commuting bats, with the network of linear features present within the Site providing connectivity with the wider landscape. Following a search for roosts in 2020, no structures containing potential suitable bat roost features were identified within 200m plus the rotor radius of the Proposed Development footprint and no trees with significant roosting features were identified within the site.

During manual surveys Common pipistrelle was recorded most frequently, followed the Soprano pipistrelle and Leisler's Bat. Brown long-eared bat and *Myotis sp.* were rare. During manual transects surveys the species composition differed from the species composition recorded at static surveys.

During static surveys Leisler's bat comprised the vast majority of activity recorded both at ground level and at height. Regarding to other species Static detector surveys and Surveys at Height differed in species composition. Common pipistrelle and Soprano pipistrelle were the most frequently recorded species after Leisler's bat. Both species were less frequently recorded at Height, than on ground level. Brown long-eared bat and *Myotis* sp. were rare on ground level and only *Myotis* sp. was recorded (n=1) during the Static Surveys at Heigh.

According to the Ecobat analysis carried out on Site-level, maximum activity levels peaked with ***High*** activity for all species for at least one season, with the exception of Brown long-eared bat, which peaked at ***Moderate to High***. Median activity levels for Common pipistrelle peaked at ***High*** for Spring and Summer. Median activity levels for Soprano pipistrelle and Leisler's bat peaked at ***Moderate to High*** for at least two seasons. Median activity levels for Nathusius' pipistrelle peaked at ***Moderate*** for two seasons.

Ecobat analysis per Detector showed ***High*** or ***Moderate High*** median activity of Leisler's bat at more than 50% of the detectors in each season, while at D09 throughout all season the activity remained ***High***. Common pipistrelle and Soprano pipistrelle had ***High*** and ***Moderate-High*** median activity at several locations in all seasons, for Common Pipistrelle at D02 throughout all season the activity remained ***High***. Nathusius' pipistrelle recorded ***Moderate-High*** activity at 3 locations in Spring and at one location in Summer. From low-risk species the peak was ***Moderate-High*** median activity for *Myotis* sp at D09 during autumn period. Per-detector data shows high activity correlated with suitable habitats identified within the Site. Detector locations in the vicinity of treelines and other linear features presented higher values.

The 2020 data has been utilised as a supplement to data collected in 2022 to inform the impact assessment of the Proposed Ballivor Wind Farm and to provide relevant mitigations for the protection of bats.

APPENDIX 4

ECOBAT 2020 PER DETECTOR RESULTS

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

LEISLER'S BAT							
Survey Period	Nights Recorded	Ref Range	Detector ID	Median Bat Activity	Median Bat Activity	Max Bat Activity	Max Bat Activity Level
Spring	14	4594	D01	64	Moderate to High	74	Moderate to High
Spring	14	4594	D02	67	Moderate to High	81	High
Spring	13	4594	D03	74	Moderate to High	87	High
Spring	15	4594	D04	70	Moderate to High	87	High
Spring	12	4594	D05	77	Moderate to High	86	High
Spring	13	4594	D06	76	Moderate to High	86	High
Spring	14	4954	D07	61	Moderate to High	78	Moderate to High
Spring	14	4954	D08	58	Moderate	84	High
Spring	14	4594	D09	84	High	91	High
Spring	13	4594	D10	70	Moderate to High	88	High
Spring	10	4594	D11	48	Moderate	69	Moderate to High
Spring	12	4594	D12	65	Moderate to High	78	Moderate to High
Spring	1	4594	D13	37	Low to Moderate	37	Low to Moderate
Spring	14	4594	D14	70	Moderate to High	88	High
Spring	14	4594	D15	66	Moderate to High	82	High
Spring	14	4594	D16	83	High	92	High
Spring	15	4594	D17	84	High	92	High
Spring	13	4594	D18	61	Moderate to High	78	Moderate to High
Summer	12	6145	D01	60	Moderate	73	Moderate to High
Summer	13	6145	D02	79	Moderate to High	96	High
Summer	11	6145	D03	69	Moderate to High	94	High
Summer	13	6145	D04	65	Moderate to High	80	Moderate to High
Summer	5	6145	D05	28	Low to Moderate	49	Moderate
Summer	12	6145	D06	71	Moderate to High	90	High
Summer	13	6145	D07	62	Moderate to High	87	High
Summer	6	6145	D08	10	Low	28	Low to Moderate
Summer	12	6145	D09	84	High	94	High
Summer	11	6145	D10	49	Moderate	77	Moderate to High
Summer	13	6145	D12	65	Moderate to High	78	Moderate to High
Summer	11	6145	D13	49	Moderate	73	Moderate to High
Summer	13	6145	D14	80	Moderate to High	94	High
Summer	13	6145	D15	49	Moderate	67	Moderate to High
Summer	13	6145	D16	76	Moderate to High	93	High
Summer	11	6145	D17	53	Moderate	75	Moderate to High

Summer	13	6145	D18	83	High	96	High
Autumn	11	4740	D01	63	Moderate to High	77	Moderate to High
Autumn	12	4740	D02	78	Moderate to High	89	High
Autumn	10	4740	D03	66	Moderate to High	81	High
Autumn	4	4740	D04	59	Moderate	72	Moderate to High
Autumn	12	4740	D05	64	Moderate to High	82	High
Autumn	3	4740	D06	17	Low	17	Low
Autumn	9	4740	D08	47	Moderate	68	Moderate to High
Autumn	12	4740	D09	82	High	91	High
Autumn	12	4740	D12	73	Moderate to High	90	High
Autumn	12	4740	D13	54	Moderate	79	Moderate to High
Autumn	12	4740	D14	77	Moderate to High	87	High
Autumn	10	4740	D15	69	Moderate to High	86	High
Autumn	12	4740	D16	73	Moderate to High	85	High
Autumn	12	4740	D17	61	Moderate to High	85	High
Autumn	12	4740	D18	66	Moderate to High	85	High

MYOTIS SP.

Survey Period	Nights Recorded	Ref Range	Detector ID	Median Bat Activity	Median Bat Activity	Max Bat Activity	Max Bat Activity Level
Spring	2	3062	D01	18	Low	27	Low to Moderate
Spring	1	3062	D02	9	Low	9	Low
Spring	2	3062	D03	32	Low to Moderate	37	Low to Moderate
Spring	2	3062	D04	9	Low	9	Low
Spring	3	3062	D05	9	Low	27	Low to Moderate
Spring	12	3062	D07	40	Low to Moderate	70	Moderate to High
Spring	6	3062	D09	9	Low	27	Low to Moderate
Spring	3	3062	D10	9	Low	9	Low
Spring	3	3062	D11	9	Low	27	Low to Moderate
Spring	1	3062	D12	9	Low	9	Low
Spring	8	3062	D14	9	Low	37	Low to Moderate
Spring	7	3062	D15	27	Low to Moderate	27	Low to Moderate
Spring	5	3062	D16	9	Low	27	Low to Moderate
Spring	9	3062	D17	27	Low to Moderate	37	Low to Moderate
Spring	12	3062	D18	27	Low to Moderate	63	Moderate to High
Summer	2	3929	D01	10	Low	10	Low
Summer	1	3929	D05	10	Low	10	Low
Summer	4	3929	D09	10	Low	38	Low to Moderate

Summer	1	3929	D10	10	Low	10	Low
Summer	2	3929	D12	10	Low	10	Low
Summer	8	3929	D13	28	Low to Moderate	58	Moderate
Summer	4	3929	D14	33	Low to Moderate	38	Low to Moderate
Summer	2	3929	D15	10	Low	10	Low
Summer	2	3929	D16	48	Moderate	58	Moderate
Summer	8	3929	D17	51	Moderate	82	High
Autumn	8	4764	D01	37	Low to Moderate	59	Moderate
Autumn	8	4764	D02	37	Low to Moderate	47	Moderate
Autumn	8	4764	D03	17	Low	37	Low to Moderate
Autumn	3	4764	D04	47	Moderate	47	Moderate
Autumn	7	4764	D05	17	Low	54	Moderate
Autumn	5	4764	D06	17	Low	17	Low
Autumn	2	4764	D08	17	Low	17	Low
Autumn	12	4764	D09	75	Moderate to High	85	High
Autumn	5	4764	D12	37	Low to Moderate	37	Low to Moderate
Autumn	7	4764	D13	47	Moderate	59	Moderate
Autumn	10	4764	D14	37	Low to Moderate	54	Moderate
Autumn	10	4764	D15	59	Moderate	70	Moderate to High
Autumn	4	4764	D16	47	Moderate	54	Moderate
Autumn	9	4764	D17	47	Moderate	66	Moderate to High
Autumn	7	4764	D18	17	Low	47	Moderate

SOPRANO PIPISTRELLE

Survey Period	Nights Recorded	Ref Range	Detector ID	Median Bat Activity	Median Bat Activity	Max Bat Activity	Max Bat Activity Level
Spring	13	4523	D01	37	Low to Moderate	57	Moderate
Spring	14	4523	D02	69	Moderate to High	82	High
Spring	10	4523	D03	46	Moderate	80	Moderate to High
Spring	14	4523	D04	89	High	98	High
Spring	11	4523	D05	73	Moderate to High	88	High
Spring	11	4523	D06	57	Moderate	74	Moderate to High
Spring	13	4523	D07	69	Moderate to High	81	High
Spring	13	4523	D08	81	High	95	High
Spring	14	4523	D09	72	Moderate to High	95	High
Spring	12	4523	D10	43	Moderate	67	Moderate to High
Spring	12	4523	D11	86	High	95	High
Spring	8	4523	D12	32	Low to Moderate	52	Moderate

Spring	5	4523	D13	37	Low to Moderate	43	Moderate
Spring	13	4523	D14	70	Moderate to High	88	High
Spring	9	4523	D15	43	Moderate	57	Moderate
Spring	14	4523	D16	61	Moderate to High	92	High
Spring	13	4523	D17	94	High	99	High
Spring	13	4523	D18	64	Moderate to High	83	High
Summer	12	6244	D01	28	Low to Moderate	64	Moderate to High
Summer	12	6244	D02	41	Moderate	70	Moderate to High
Summer	9	6244	D03	49	Moderate	68	Moderate to High
Summer	4	6244	D04	10	Low	10	Low
Summer	5	6244	D05	10	Low	28	Low to Moderate
Summer	10	6244	D06	60	Moderate	79	Moderate to High
Summer	6	6244	D07	19	Low	60	Moderate
Summer	9	6244	D08	56	Moderate	67	Moderate to High
Summer	13	6244	D09	62	Moderate to High	87	High
Summer	13	6244	D10	67	Moderate to High	84	High
Summer	3	6244	D11	10	Low	28	Low to Moderate
Summer	6	6244	D12	10	Low	28	Low to Moderate
Summer	12	6244	D13	49	Moderate	87	High
Summer	13	6244	D14	87	High	91	High
Summer	12	6244	D15	60	Moderate	75	Moderate to High
Summer	10	6244	D16	51	Moderate	81	High
Summer	13	6244	D17	62	Moderate to High	91	High
Summer	13	6244	D18	74	Moderate to High	88	High
Autumn	11	6604	D01	54	Moderate	74	Moderate to High
Autumn	12	6604	D02	95	High	98	High
Autumn	12	6604	D03	67	Moderate to High	84	High
Autumn	7	6604	D04	54	Moderate	93	High
Autumn	8	6604	D05	47	Moderate	66	Moderate to High
Autumn	10	6604	D06	55	Moderate	78	Moderate to High
Autumn	10	6604	D07	75	Moderate to High	88	High
Autumn	11	6604	D08	47	Moderate	86	High
Autumn	12	6604	D09	95	High	99	High
Autumn	1	6604	D10	37	Low to Moderate	37	Moderate
Autumn	10	6604	D12	47	Moderate	76	Moderate to High
Autumn	12	6604	D13	96	High	99	High
Autumn	12	6604	D14	61	Moderate to High	93	High
Autumn	12	6604	D15	59	Moderate	77	Moderate to High
Autumn	11	6604	D16	47	Moderate	84	High

Autumn	12	6604	D17	65	Moderate to High	86	High
Autumn	13	6604	D18	54	Moderate	86	High

COMMON PIPISTRELLE							
Survey Period	Nights Recorded	Ref Range	Detector ID	Median Bat Activity	Median Bat Activity	Max Bat Activity	Max Bat Activity Level
Spring	13	4963	D01	57	Moderate	76	Moderate to High
Spring	14	4963	D02	84	High	93	High
Spring	13	4963	D03	61	Moderate to High	86	High
Spring	15	4963	D04	93	High	98	High
Spring	13	4963	D05	82	High	93	High
Spring	15	4963	D06	83	High	93	High
Spring	15	4963	D07	82	High	95	High
Spring	15	4963	D08	97	High	99	High
Spring	14	4963	D09	89	High	97	High
Spring	14	4963	D10	83	High	95	High
Spring	13	4963	D11	95	High	96	High
Spring	13	4963	D12	57	Moderate	81	High
Spring	11	4963	D13	78	Moderate to High	92	High
Spring	14	4963	D14	91	High	97	High
Spring	14	4963	D15	75	Moderate to High	91	High
Spring	15	4963	D16	89	High	96	High
Spring	13	4963	D17	94	High	99	High
Spring	14	4963	D18	83	High	94	High
Summer	13	6918	D01	84	High	96	High
Summer	13	6918	D02	82	High	96	High
Summer	13	6918	D03	92	High	98	High
Summer	11	6918	D04	44	Moderate	65	Moderate to High
Summer	11	6918	D05	49	Moderate	77	Moderate to High
Summer	13	6918	D06	90	High	97	High
Summer	13	6918	D07	77	Moderate to High	98	High
Summer	11	6918	D08	84	High	98	High
Summer	13	6918	D09	85	High	98	High
Summer	13	6918	D10	93	High	98	High
Summer	4	6918	D11	28	Low to Moderate	53	Moderate
Summer	13	6918	D12	56	Moderate	65	Moderate to High
Summer	13	6918	D13	89	High	97	High
Summer	13	6918	D14	98	High	98	High

Summer	13	6918	D15	96	High	99	High
Summer	13	6918	D16	87	High	97	High
Summer	13	6918	D17	95	High	98	High
Summer	13	6918	D18	97	High	98	High
Autumn	12	6220	D01	54	Moderate	78	Moderate to High
Autumn	12	6220	D02	88	High	94	High
Autumn	10	6220	D03	75	Moderate to High	94	High
Autumn	7	6220	D04	47	Moderate	74	Moderate to High
Autumn	7	6220	D05	37	Low to Moderate	72	Moderate to High
Autumn	8	6220	D06	37	Low to Moderate	68	Moderate to High
Autumn	11	6220	D07	91	High	94	High
Autumn	11	6220	D08	54	Moderate	90	High
Autumn	12	6220	D09	96	High	98	High
Autumn	3	6220	D11	17	Low	17	Low
Autumn	11	6220	D12	59	Moderate	84	High
Autumn	12	6220	D13	96	High	98	High
Autumn	11	6220	D14	54	Moderate	83	High
Autumn	12	6220	D15	73	Moderate to High	83	High
Autumn	10	6220	D16	70	Moderate to High	86	High
Autumn	12	6220	D17	63	Moderate to High	85	High
Autumn	11	6220	D18	47	Moderate	80	Moderate to High

NATHUSIUS' PIPISTRELLE

Survey Period	Nights Recorded	Ref Range	Detector ID	Median Bat Activity	Median Bat Activity	Max Bat Activity	Max Bat Activity Level
Spring	3	1240	D01	27	Low to Moderate	43	Moderate
Spring	6	1240	D02	18	Low	43	Moderate
Spring	7	1240	D03	27	Low to Moderate	43	Moderate
Spring	7	1240	D04	27	Low to Moderate	87	High
Spring	3	1240	D05	37	Low to Moderate	48	Moderate
Spring	9	1240	D06	57	Moderate	74	Moderate to High
Spring	8	1240	D07	37	Low to Moderate	64	Moderate to High
Spring	11	1240	D08	77	Moderate to High	80	Moderate to High
Spring	14	1240	D09	53	Moderate	81	High
Spring	5	1240	D10	43	Moderate	55	Moderate
Spring	3	1240	D11	27	Low to Moderate	43	Moderate
Spring	2	1240	D12	18	Low	27	Low to Moderate
Spring	2	1240	D13	65	Moderate to High	71	Moderate to High

Spring	9	1240	D14	37	Low to Moderate	55	Moderate
Spring	5	1240	D15	9	Low	37	Low to Moderate
Spring	8	1240	D16	48	Moderate	68	Moderate to High
Spring	13	1240	D17	64	Moderate to High	76	Moderate to High
Spring	3	1240	D18	9	Low	27	Low to Moderate
Summer	1	1575	D01	10	Low	10	Low
Summer	13	1575	D02	53	Moderate	78	Moderate to High
Summer	13	1575	D03	69	Moderate to High	90	High
Summer	3	1575	D04	10	Low	10	Low
Summer	2	1575	D05	10	Low	10	Low
Summer	8	1575	D06	47	Moderate	70	Moderate to High
Summer	11	1575	D07	58	Moderate	92	High
Summer	6	1575	D08	49	Moderate	75	Moderate to High
Summer	11	1575	D09	38	Low to Moderate	80	Moderate to High
Summer	9	1575	D10	28	Low to Moderate	64	Moderate to High
Summer	5	1575	D12	10	Low	38	Low to Moderate
Summer	8	1575	D13	28	Low to Moderate	87	High
Summer	10	1575	D14	59	Moderate	77	Moderate to High
Summer	11	1575	D15	58	Moderate	83	Moderate to High
Summer	5	1575	D16	28	Low to Moderate	58	Moderate
Summer	11	1575	D17	49	Moderate	80	Moderate to High
Summer	10	1575	D18	54	Moderate	78	Moderate to High
Autumn	1	1464	D03	17	Low	17	Low
Autumn	1	1464	D09	37	Low to Moderate	37	Low to Moderate
Autumn	1	1464	D12	17	Low	17	Low
Autumn	1	1464	D13	17	Low	17	Low
Autumn	1	1464	D14	17	Low	17	Low
Autumn	1	1464	D16	17	Low	17	Low
Autumn	1	1464	D17	17	Low	17	Low

BROWN LONG-EARED BAT

Survey Period	Nights Recorded	Ref Range	Detector ID	Median Bat Activity	Median Bat Activity	Max Bat Activity	Max Bat Activity Level
Spring	3	1531	D01	9	Low	27	Low to Moderate
Spring	3	1531	D02	9	Low	27	Low to Moderate
Spring	4	1531	D03	9	Low	9	Low
Spring	7	1531	D04	37	Low to Moderate	52	Moderate
Spring	3	1531	D05	9	Low	27	Low to Moderate

Spring	1	1531	D06	37	Low to Moderate	37	Low to Moderate
Spring	7	1531	D07	9	Low	52	Moderate
Spring	4	1531	D08	9	Low	9	Low
Spring	10	1531	D09	18	Low	37	Low to Moderate
Spring	2	1531	D10	23	Low to Moderate	37	Low to Moderate
Spring	1	1531	D11	9	Low	9	Low
Spring	2	1531	D12	9	Low	9	Low
Spring	2	1531	D14	18	Low	27	Low to Moderate
Spring	9	1531	D15	9	Low	27	Low to Moderate
Spring	3	1531	D16	9	Low	52	Moderate
Spring	3	1531	D17	37	Low to Moderate	55	Moderate
Spring	9	1531	D18	9	Low	48	Moderate
Summer	1	2062	D02	10	Low	10	Low
Summer	2	2062	D03	10	Low	10	Low
Summer	1	2062	D06	10	Low	10	Low
Summer	3	2062	D07	10	Low	10	Low
Summer	4	2062	D09	19	Low	44	Moderate
Summer	4	2062	D13	10	Low	10	Low
Summer	1	2062	D14	10	Low	10	Low
Summer	6	2062	D15	19	Low	44	Moderate
Summer	1	2062	D16	10	Low	10	Low
Summer	3	2062	D17	10	Low	28	Low to Moderate
Summer	1	2062	D18	10	Low	10	Low
Autumn	11	3217	D01	47	Moderate	66	Moderate to High
Autumn	4	3217	D02	27	Low to Moderate	47	Moderate
Autumn	4	3217	D03	17	Low	17	Low
Autumn	1	3217	D04	37	Low to Moderate	37	Low to Moderate
Autumn	8	3217	D05	42	Moderate	59	Moderate
Autumn	1	3217	D07	17	Low	17	Low
Autumn	7	3217	D08	17	Low	54	Moderate
Autumn	9	3217	D09	37	Low to Moderate	47	Moderate
Autumn	7	3217	D12	17	Low	47	Moderate
Autumn	7	3217	D13	37	Low to Moderate	47	Moderate
Autumn	8	3217	D14	27	Low to Moderate	59	Moderate
Autumn	12	3217	D15	47	Low to Moderate	63	Moderate to High
Autumn	10	3217	D16	37	Low to Moderate	66	Moderate to High
Autumn	9	3217	D17	37	Low to Moderate	70	Moderate to High
Autumn	8	3217	D18	17	Low	59	Moderate

APPENDIX 5

OVERALL SITE RISK ASSESSMENT

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

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

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

Overall assessment:

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

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