APPENDIX 6-3

BAT REPORT

Curraglass Renewable Energy Development, Co. Cork - EIAR

Curraglass Renewable Energy Development, Co. Cork

DOCUMENT DETAILS

Client:	**Wingleaf Ltd.**
Project Title:	**Curraglass Renewable Energy Development, Co. Cork**
Project Number:	**190301**
Document Title:	**Bat Survey Report**
Document File Name:	**Appendix 6-3 - Bat Report - F - 2020.06.19 - 190301**
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MKO Planning and Environmental Consultants

Rev	Status	Date	Author(s)	Approved By
01	Draft	02/12/2019	AJ	JH
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1. INTRODUCTION

MKO was commissioned to complete a comprehensive assessment of the potential effects on bats of a proposed renewable energy development at Curraglass, Co. Cork. This report provides details of the bat surveys undertaken, including survey design, methods and results, and the assessment of potential effects of the development on bats. Where necessary, mitigation is prescribed to minimise any identified significant effects.

Bat surveys were undertaken throughout 2019 and were designed in accordance with *Scottish Natural Heritage's guidance for bats and onshore wind turbines* (SNH 2019)[1]. Bat surveys employed a combination of methods, including desktop study, habitat and landscape assessments, roost inspections, manual activity surveys and static detector surveys at ground level and at height.

1.1 Background

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

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

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

1.2 Bat Survey and Assessment Guidance

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

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

[1] *Scottish Natural Heritage published Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation (SNH 2019).*

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 2019, Scottish Natural Heritage published *Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation* (SNH 2019). 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 survey scope, assessment and mitigation provided in this report is accordance with SNH 2019 Guidance.

1.3 Statement of Authority

Scope development and project management was undertaken by Dr. Úna Nealon. Úna's primary expertise lies in bat ecology. She completed her PhD with the Centre for Irish Bat Research, examining the impacts of wind farms on Irish bat species.

Bat surveys were conducted by MKO ecologists Aoife Joyce (BSc., MSc.), Claire Stephens (BSc.), Luke Dodebier (BSc.) and Sara Fissolo (BSc.). Staff have relevant academic qualifications and are competent experts in undertaking bat surveys to this level.

Data analysis was undertaken, and results were compiled by Aoife Joyce and Luke Dodebier. Impact assessment, the design of mitigation and final reporting was completed by Aoife Joyce and Luke Dodebier under the supervision of John Hynes (BSc., MSc.) and Pat Roberts (BSc., MCIEEM), who both reviewed and approved the final document. John is a full member of the Chartered Institute of Ecology and Environmental Management (CIEEM) and has over 7 years professional ecological consultancy experience. He is also a former member of the Bat Conservation Ireland management council. Pat has over 10 years' experience in management and ecological assessment. He has supervised the majority of ecological assessments (300+) completed by the company, including more recently, over 200 assessments required in accordance with Article 6(3) of the Habitats Directive.

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).

In addition, Irish species are further protected by national legislation (Wildlife Acts 1976-2019). 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)

<table>
<tr><th>Bat Species</th><th>Conservation Status</th><th>Principal Threats</th></tr>
<tr><td>Common pipistrelle
Pipistrellus pipistrellus</td><td>Favourable</td><td rowspan="9">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)</td></tr>
<tr><td>Soprano pipistrelle
Pipistrellus pygmaeus</td><td>Favourable</td></tr>
<tr><td>Nathusius' pipistrelle
Pipistrellus nathusii</td><td>Unknown</td></tr>
<tr><td>Leisler's bat
Nyctalus leisleri</td><td>Favourable</td></tr>
<tr><td>Daubenton's bat
Myotis daubentoni</td><td>Favourable</td></tr>
<tr><td>Natterer's bat
Myotis nattereri</td><td>Favourable</td></tr>
<tr><td>Whiskered bat
Myotis mystacinus</td><td>Favourable</td></tr>
<tr><td>Brown long-eared bat
Plecotus auritus</td><td>Favourable</td></tr>
<tr><td>Lesser horseshoe bat
Rhinolophus hipposideros</td><td>Inadequate</td></tr>
</table>

2. PROJECT DESCRIPTION

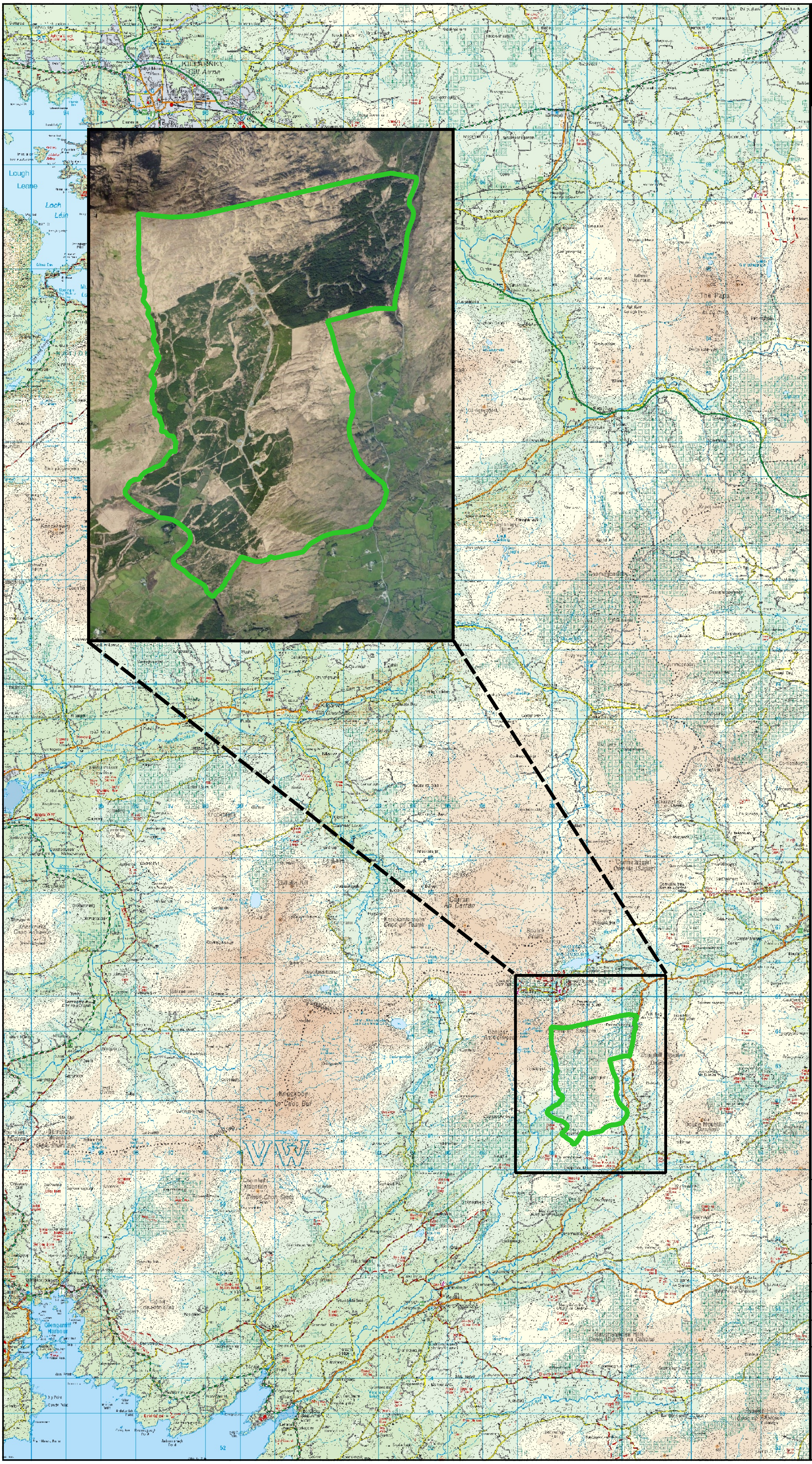
The Proposed Development site is located approximately 5.6km northeast of Kealkill and 5.5km southwest of the village of Ballingeary, located in the townlands of Cappaboy Beg, Derreendonee and Curraglass, Co. Cork (Grid Ref: E109655, N063555) (Figure 2-1).

The previous wind turbines at the site were granted planning permission in 2002 and the site was constructed and became operational in 2006. The turbines were removed in June 2018 as they had reached the end of their productive lifespan. The previous development consisted of 10 turbines, with a hub height of 50m and a total tip height of 75m. The basic infrastructure of the previous wind farm including access track, turbine bases and substation remain within the current site. The site is accessed via the existing Coillte entrance site entrance, located off the R584 Regional road.

The land use/activities of the surrounding habitats within the site largely comprise Coillte forestry and peatland habitats. Land-use in the surrounding landscape comprises a mix of agriculture, commercial forestry, cutover bog and low-density housing.

The Proposed Development comprises:

1. *Up to 7 no. wind turbines with an overall blade tip height of up to 178.5 metres and all associated foundations and hard-standing areas;*
2. *2 No. borrow pits;*
3. *1 No. permanent meteorological mast with a maximum height of up to 112 metres;*
4. *Upgrade of existing and provision of new site access roads;*
5. *Upgrade to existing access junction;*
6. *A 38kV electricity substation, including 4 no. battery storage containers, 1 no. control building with welfare facilities, associated electrical plant and equipment, security fencing, wastewater holding tank,*
7. *Forestry Felling;*
8. *A temporary construction compound;*
9. *Site Drainage;*
10. *All associated internal underground cabling, including underground grid connection cabling to the existing overhead line; and*
11. *All associated site development and ancillary works.*



Map Legend

EIAR Site Boundary

Drawing Title
Proposed Site Location

Project Title
Curraglass Renewable Energy Development, Co. Cork

Drawn By	Checked By
AJ	JH
Project No. 190301	Drawing No. Figure 2-1
Scale 1:146506	Date 12.06.2020

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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 December 2019. As part of this exercise, prominent Irish conservation groups were contacted, and Bat Conservation Ireland (BCI) and National Parks and Wildlife Service (NPWS) were specifically invited to comment on the potential of the proposed development to affect bats.

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

3.2 Desk Study

A desk study of published and unpublished 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 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 (SNH, 2019).

3.2.2 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, SNH 2019). This included European designated sites, i.e. SACs, and nationally designated sites, i.e. NHAs and pNHAs.

3.2.3 Landscape Features

3.2.3.1 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.

3.2.3.2 Geological Survey Ireland

The Geological Survey Ireland (GSI) online mapping tool and University of Bristol Spelaeological Society (UBSS) Cave Database for the Republic of Ireland were consulted for any indication of natural subterranean bat sites, such as caves, within 10 km of the Study Area (BCI, 2012) (last searched on the 12th June 2020). 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 12th June 2020).

3.2.3.3 Additional Wind Energy Projects in the Wider Landscape

A search for existing and permitted wind energy developments within 10km of the proposed site was undertaken (SNH, 2019). Other infrastructure developments and proposals (e.g. roads) were also noted. Information on the location and scale of these developments was gathered to inform cumulative effects.

3.2.3.4 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).

The location of the proposed wind farm was reviewed in relation to bat habitat suitability indices. The aim of this was to assess habitat suitability for all bat species within the 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.

3.3 2019 Surveys to SNH Guidance

3.3.1 Bat Habitat Suitability Appraisal

Bat walkover surveys were carried out throughout 2019. During these surveys, habitats within the Study Area were assessed for their suitability to support roosting, foraging and commuting bats. Connectivity with the wider landscape was also considered. Suitability was assessed according to Collins (2016) which provides a grading protocol for roosting habitats and for commuting and foraging areas. Suitability categories, divided into *High*, *Moderate*, *Low* and *Negligible*, are described fully in **Appendix 1**.

3.3.2 Roost Surveys

A search for roosts was undertaken within 200m plus the rotor radius (i.e. 75 m) of the boundary of the proposed development (SNH, 2019). The aim was to determine the presence of roosting bats and the need for further survey work or mitigation. The site was visited in July and October 2019. A walkover was carried out and all structures and trees were assessed for their potential to support roosting bats (see **Appendix 1** for criteria in assessing roosting habitats).

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

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

No roosts or areas with potential bat roost features were identified.

3.3.3 Manual Transects

Manual activity surveys comprised walked and driven transects at dusk. 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.

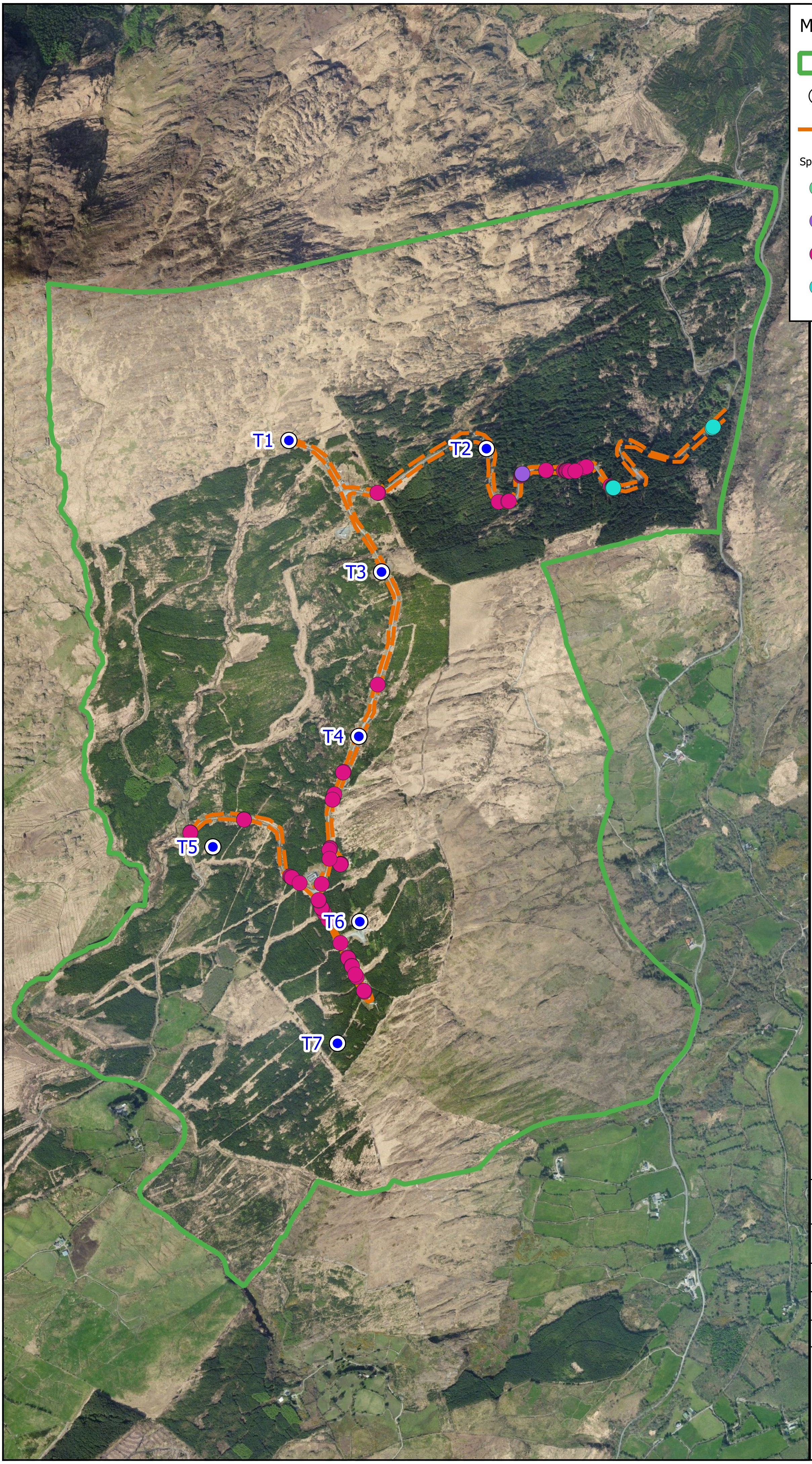
A series of representative transect routes were selected throughout the proposed wind farm site. Transect routes were prepared with reference to the proposed layout, desktop and walkover survey results as well as any health and safety considerations and access limitations. As such, transect routes generally followed existing roads and tracks. Transect routes are presented in Figures 3-1 - 3-3.

Transects were walked or driven by two surveyors, recording bats in real time. Driven transects followed the methodology described by Roche *et al.* (2012). Surveys commenced within 30 minutes before sunset and were completed for 3 hours after sunset. Surveyors were equipped with active full spectrum bat detectors, the Batlogger M bat detector (Elekon AG, Lucerne, Switzerland) and all bat activity was recorded for subsequent analysis to confirm species identifications. Transects surveys were undertaken in July and October 2019. Table 3-1 summarises survey effort in relation to manual transects.

Table 3-1 2019 Survey Effort - Manual Transects

Date	Surveyor	Type	Sunset	Weather	Transect (km)
2nd July 2019	Luke Dodebier & Sara Fissolo	Dusk	21:55	14-16˚C; dry; light breeze	9.79
17th July 2019	Luke Dodebier & Aoife Joyce	Dusk	21:47	13-18˚C; dry; calm with occasional light breeze	9.79

16th October 2019	Aoife Joyce & Claire Stephens	Dusk	18:42	9-11˚C; drizzle; gentle-moderate breeze	9.81
Total Survey Effort					**29.39**



Map Legend

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

Spring Transect Results

- Myotis sp.
- Leisler's Bat
- Common pipistrelle
- Soprano pipistrelle

N

Drawing Title	
Spring Transect Results	
Project Title	
Curraglass Renewable Energy Development, Co. Cork	
Drawn By: AJ	Checked By: JH
Project No.: 190301	Drawing No.: Figure 3-1
Scale: 1:17226	Date: 12.06.2020

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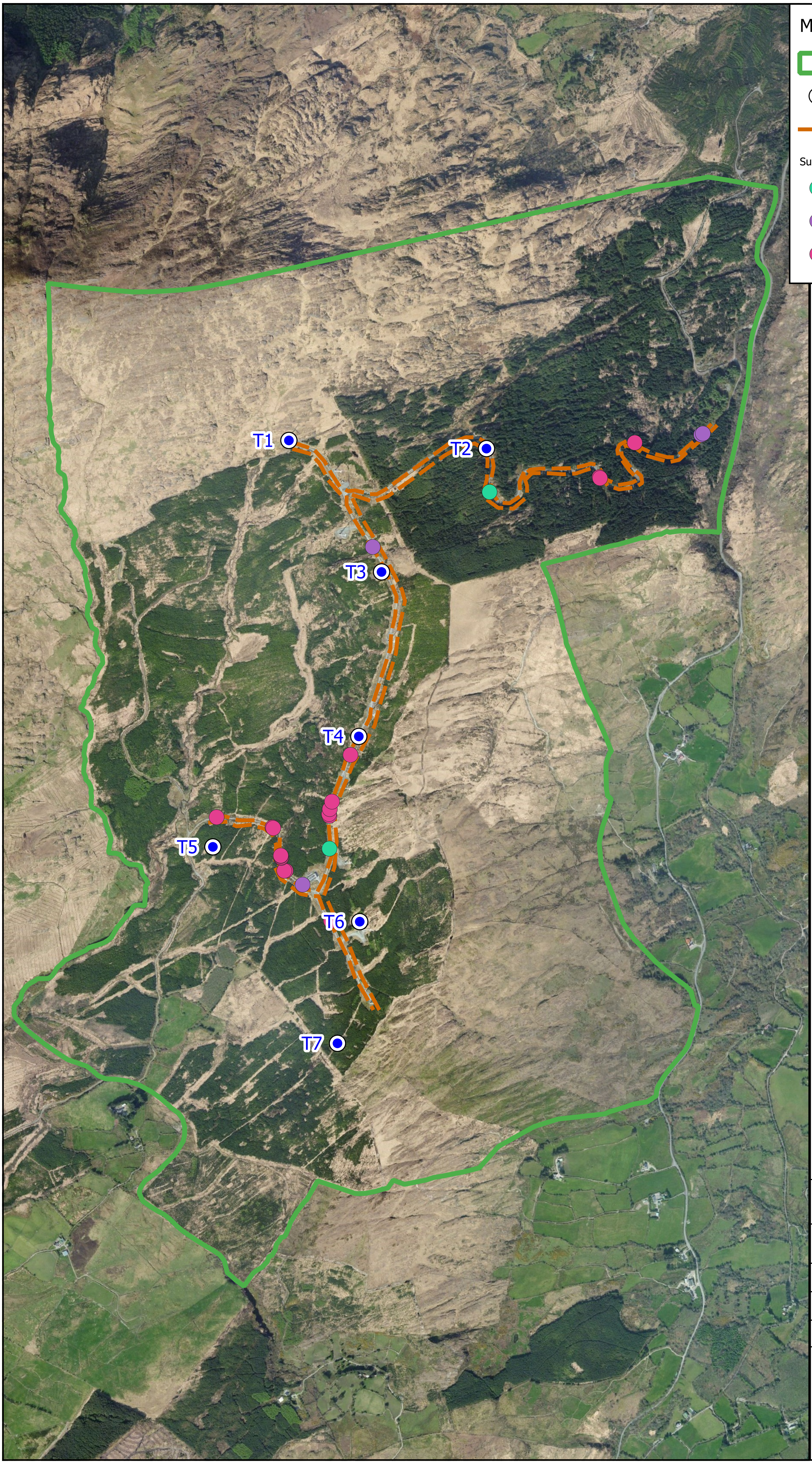

Map Legend

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

Summer Transect Results

- Myotis sp.
- Leisler's Bat
- Common pipistrelle

N

Drawing Title	
Summer Transect Results	
Project Title	
Curraglass Renewable Energy Development, Co. Cork	
Drawn By	Checked By
AJ	JH
Project No.	Drawing No.
190301	Figure 3-2
Scale	Date
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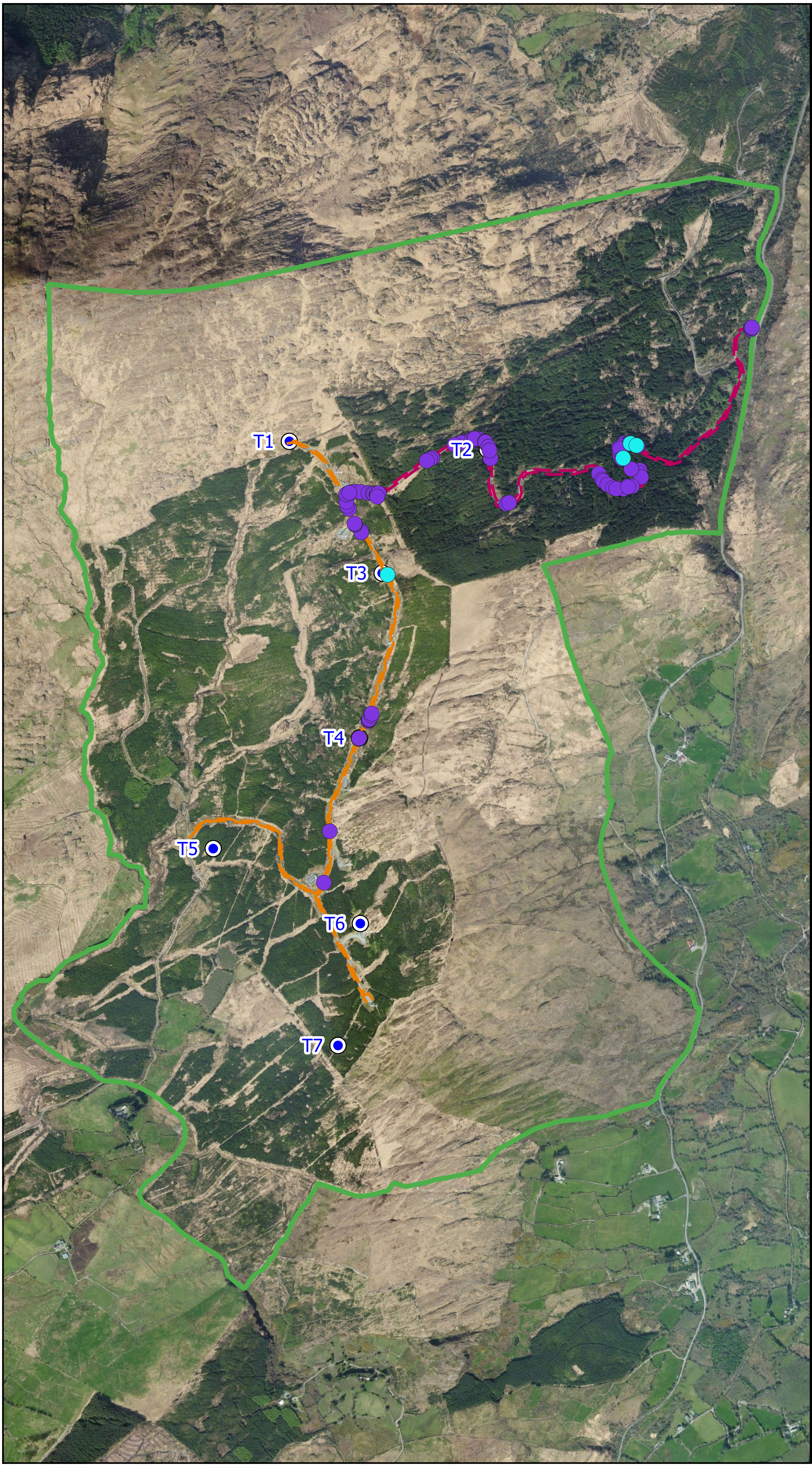

Map Legend

- EIAR Site Boundary
- Proposed Turbine Locations
- Walked Transect Route
- Driven Transect Route

Autumn Transect Results

- Common pipistrelle
- Soprano pipistrelle

Drawing Title	
Autumn Transect Results	
Project Title	
Curraglass Renewable Energy Development, Co. Cork	
Drawn By: AJ	Checked By: JH
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3.3.4 Ground-level Static Surveys

Where developments have more than 10 turbines, SNH requires 1 detector per turbine up to 10 plus a third of additional turbines. Given that 7 turbines are proposed 7 detectors were deployed to ensure compliance with SNH guidance.

Automated bat detectors were deployed at 7 no. locations for at least 10 nights in each of spring (April-May), summer (June-mid August) and autumn (mid-August-October) (SNH, 2019). Detector locations were based on indicative turbine locations and differ slightly to the final proposed layout. Detector locations achieved a good spatial spread in relation to proposed turbines and sampled the range of available habitats. Figure 3-4 presents static detector locations in relation to the final proposed layout.

Keyholing may be required where turbines are proposed in areas of forestry within the site. This involves only felling an area required to construct the turbine and associated infrastructure thus creating open areas, within the forest, around proposed turbines (IWEA, 2012). The 'keyhole' size is typically 50m from turbine blade tip to forestry edge, and these keyhole areas usually remain open during the wind farm lifetime.

Where keyholing is proposed, detectors were located along nearby forestry edge in order to more closely reflect the likely post-construction habitat. Static detector locations are described in Table 3-2 and presented in Figure 3-4.

Table 3-2 2019 Ground-level Static Detector Locations

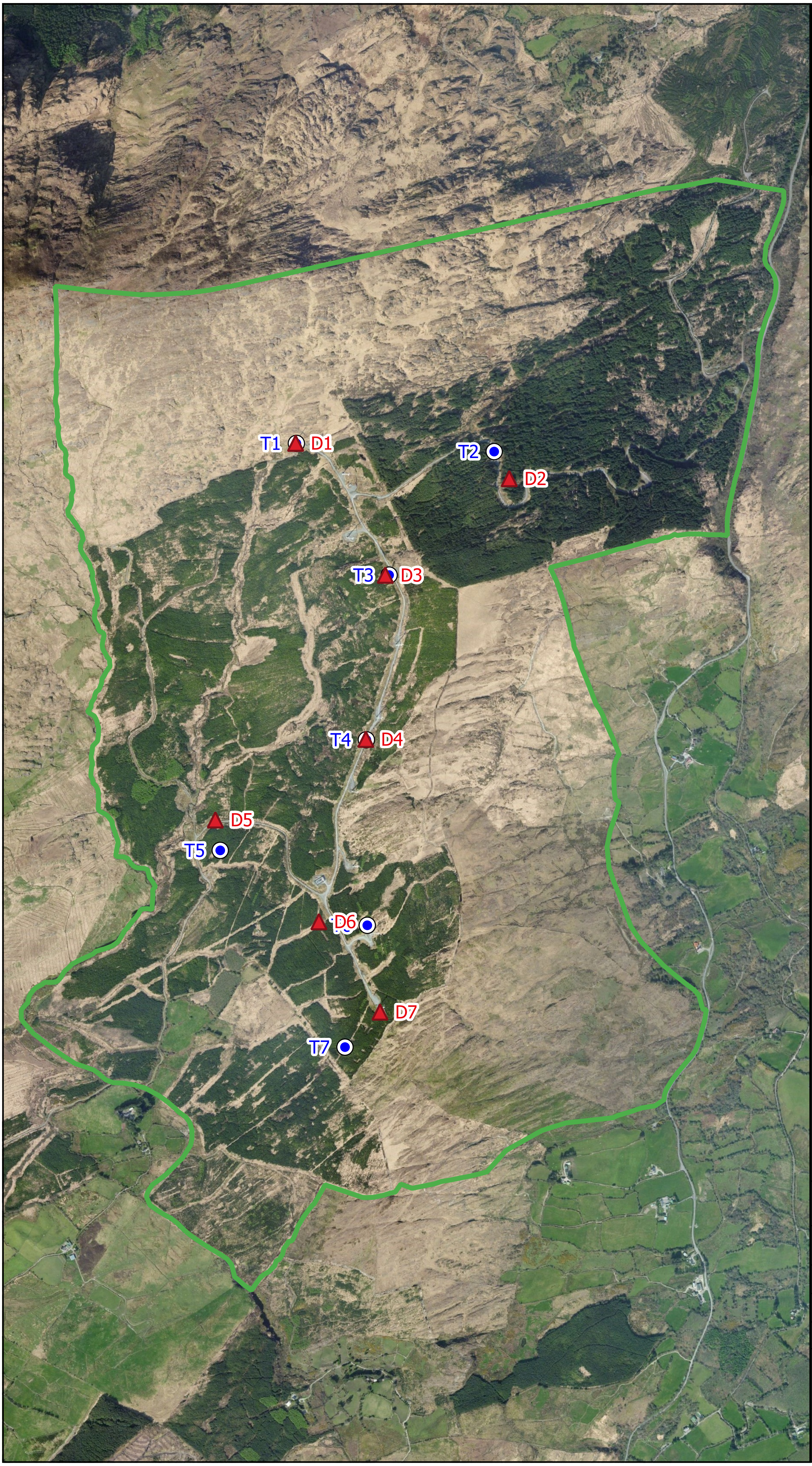
ID	Location	Habitat	Linear Feature within 50m
D01	E108790 N63587	Disturbed ground. Access track	Conifer forestry, Road
D02	E109514 N63467	Clear fell	Conifer forestry, Road
D03	E109094 N63140	Disturbed ground, mature WD4 edge	Conifer forestry, Road
D04	E109028 N62584	Access track (bog and WD4 adjacent)	Conifer forestry, Road
D05	E108518 N62311	Mature WD4 edge, access track	Conifer forestry, Road
D06	E108869 N61966	Forestry ride, mature WD4	Conifer forestry, Road
D07	E109076 N61660	Disturbed ground, mature WD4 edge	Conifer forestry, Road

Full spectrum bat detectors, Song Meter SM4BAT (Wildlife Acoustics, Maynard, MA, USA), were employed. Settings used were those recommended by the manufacturer 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 3-3 summarises survey effort achieved for each of the 7 no. detector locations.

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

Season	Survey Period	Total Survey Nights per detector location	Nights with Appropriate Weather
Spring	22nd April – 7th May 2019	15	7
Summer	2nd July – 17th July 2019	15	14
Autumn	25th September – 16th October 2019	21	18
Total Survey Effort		**51**	**39**



Map Legend

EIAR Site Boundary

Proposed Turbine Locations

Static Detector Locations

N

Drawing Title

Static Detector Locations

Project Title

Curraglass Renewable Energy Development, Co. Cork

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Project No. 190301	Drawing No. Figure 3-4
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3.4 Bat Call Analysis

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

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

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

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

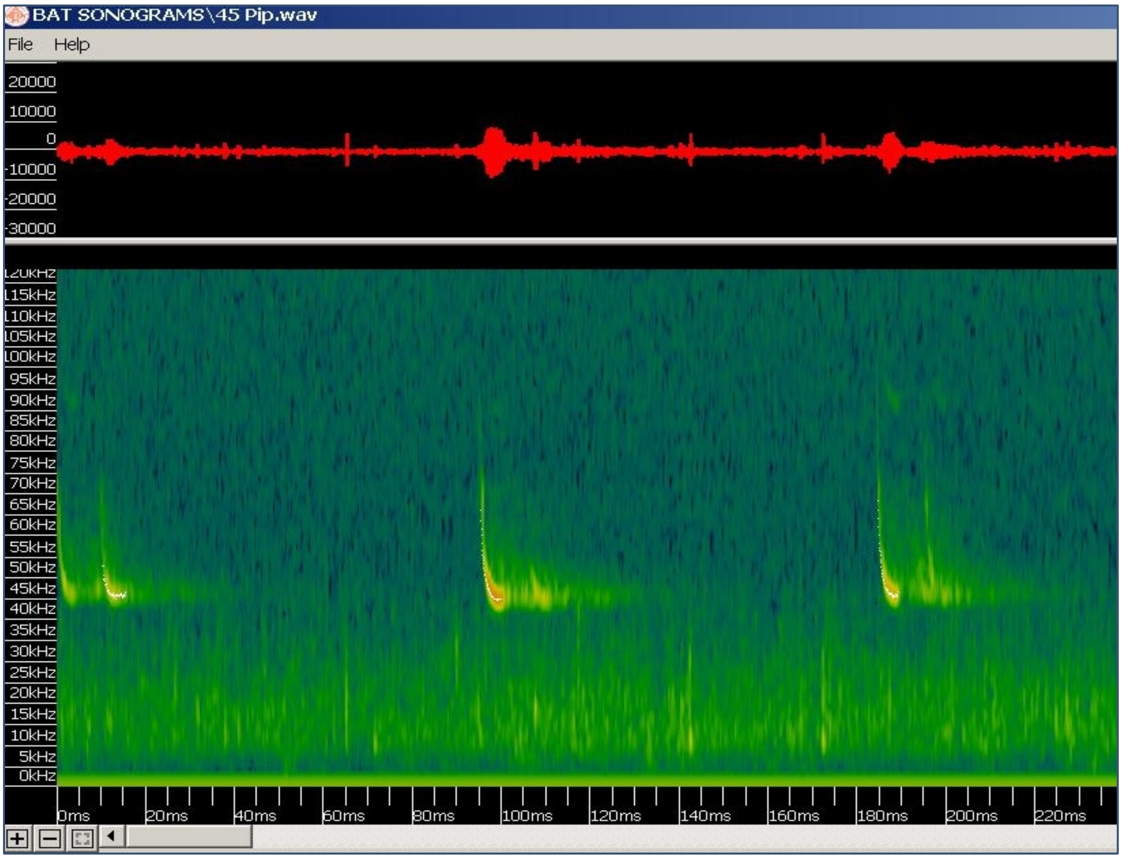

Plate 3-1 Sonogram of Echolocation Pulses of Common pipistrelle (Peak Frequency 45kHz)

3.5 Assessment of Bat Activity Levels

Static detector monitoring results were uploaded to the online database tool Eco bat (ecobat.org.uk). This web-based interface, launched in August 2016, allows users to upload activity data and to contrast results with a comparable reference range, allowing objective interpretation. Uploaded data then contributes to the overall dataset to provide increasingly robust outputs. Ecobat generates a percentile rank for each night of activity and provides a numerical way of interpreting levels of bat activity in order to provide objective and consistent assessments. Table 3-4 defines bat activity levels as they relate to Ecobat percentile values (SNH, 2019).

Static detector at ground level results for the proposed wind farm were uploaded on the 14th October 2019. 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 200 km).

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

Although there is an increased uptake in the use of Ecobat in Ireland, some of the reference ranges remain below 2000. As Ecobat continues to be utilised in Ireland the accuracy of data outputs and results will improve over time. Results of Ecobat analysis for the proposed development site can be found in Table 4-5 in the results section below.

Table 3-4 Ecobat Percentile Score and Categorised Level of Activity (SNH, 2019)

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

3.6 Assessment of Collision Risk

3.6.1 Population Risk

SNH (2019) provides a generic assessment of bat collision risk for UK species, based on species behaviour and flight characteristics. In the guidelines, this measure of collision risk is used, in combination with relative abundance, to indicate the potential vulnerability of British bat populations. No such assessment is provided for Irish bat populations.

In Plate 3-2, we provide an assessment of vulnerability for Irish bat populations. This adaptation of the SNH Guidance Table 2 was based on collision risk and species abundance of Irish bat populations. Species' collision risk follows those described in SNH (2019). 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 SNH, 2019)

3.6.2 Bat Records

The National Bat Database of Ireland holds records of bat observations received and maintained by BCI. These records include results of national monitoring schemes, roost records as well as ad-hoc observations. A search of the National Bat Database of Ireland was last carried out on the 12th June 2020 and examined bat presence and roost records within a 10 km radius of a central point in the Study Area (Grid Ref: E109655, N063555) (BCI 2012, Hundt 2012, SNH 2019).

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.

3.6.3 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 (SNH, 2019). 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 SNH (2019) 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, SNH, 2019)

3.6.4 Overall Risk Assessment

An overall assessment of risk was made by combining the site risk level (i.e. Medium) 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 (SNH, 2019). The assessment was carried out for both median and maximum Ecobat activity categories in order to provide insight into typical bat activity (i.e. median values) and activity peaks (i.e. maximum values).

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

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

Plate 3-4 Overall Risk Assessment Matrix (Table 3b, SNH, 2019)

This exercise was carried out for each high collision risk species, i.e. Common, soprano and Nathusius' pipistrelles, and Leisler's bat. 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 have been undertaken at the Proposed Development site in 2019. The surveys undertaken in 2019, in accordance with SNH Guidance, provide the information necessary to allow a complete, comprehensive and robust assessment of the potential impacts of the Proposed Development on bats receptors.

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

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

4. RESULTS

4.1 Consultation

A detailed scoping exercise was undertaken for the proposed wind farm. These results are described fully in the main EIAR and no specific recommendations were made in relation to bats. BCI and NPWS were invited to comment on the proposed development and potential effects on bats. However, no response was received as of 12th June 2020.

4.2 Desk Study

4.2.1 Bat Records

The National Bat Database of Ireland was searched for records of bat activity and roosts within a 10 km radius of the proposed site (IG Ref: E109655, N063555). Available bat records were provided by Bat Conservation Ireland on 12/06/2020. A number of observations have been recorded within 10km; eight roosts, three transects and eleven ad-hoc observations. At least five of Ireland's nine resident bat species were recorded within 10 km of the proposed works including Common and Soprano pipistrelle, Leisler's bat, brown long-eared bat and Daubenton's bat. The results of the database search are provided in Table 4-1.

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

Record	Species	Grid Reference	Date	Location
Roost	Pipistrellus spp. (45kHz/55kHz)	W1567	N/A	Ballingeary; Macrom; Co. Cork.
Roost	Plecotus auritus	V9955	N/A	Dromkeal; Glengarrif; Co. Cork.
Roost	Pipistrellus spp. (45kHz/55kHz)	W0073	N/A	Kilgarvan; Co. Kerry
Roost	Nyctalus leisleri; Pipistrellus pipistrellus (45kHz); Pipistrellus pygmaeus; Pipistrellus spp. (45kHz/55kHz); Plecotus auritus	W0255	N/A	Pearson's Bridge; Ballylicky; Bantry; Co. Cork.
Roost	Pipistrellus spp. (45kHz/55kHz)	W1165	N/A	Inchinossig; Ballingeary; County Cork
Roost	Pipistrellus pygmaeus; Plecotus auritus	W0271	N/A	Kilgarvan; Co. Kerry
Roost	Pipistrellus spp. (45kHz/55kHz)	V9972	N/A	Kilgarvan; CO. Kerry
Roost	Pipistrellus spp. (45kHz/55kHz); Plecotus auritus	V9972	N/A	Kilgarvan; Co. Kerry
Transect	Myotis daubentonii; Unidentified bat	W0484656566	N/A	Carriganass Bridge R584
Transect	N/A	W0234554515	N/A	Pearson's Bridge Transect
Transect	Pipistrellus pipistrellus (45kHz); Pipistrellus pygmaeus	W0076073265	N/A	V96 (11) 2004-2004
Ad-hoc	Pipistrellus pipistrellus (45kHz); Pipistrellus pygmaeus	W1354456854	04/09/2008	BATLAS 2010
Ad-hoc	Myotis daubentonii; Myotis spp.; Nyctalus leisleri; Pipistrellus	W1665355170	21/08/2008	BATLAS 2010

	pipistrellus (45kHz); Pipistrellus pygmaeus			
Ad-hoc	Pipistrellus pipistrellus (45kHz); Pipistrellus pygmaeus	W0885359019	04/09/2008	BATLAS 2010
Ad-hoc	Myotis daubentonii; Pipistrellus pipistrellus (45kHz); Pipistrellus pygmaeus	W1891656093	21/08/2008	BATLAS 2010
Ad-hoc	Myotis daubentonii; Myotis spp.; Pipistrellus pipistrellus (45kHz); Pipistrellus pygmaeus	W1872856687	21/08/2008	BATLAS 2010
Ad-hoc	Pipistrellus pipistrellus (45kHz); Pipistrellus pygmaeus	W0646456642	04/09/2008	BATLAS 2010
Ad-hoc	Pipistrellus pipistrellus (45kHz)	W1638066254	10/06/2018	BATLAS 2020
Ad-hoc	Myotis daubentonii; Nyctalus leisleri; Pipistrellus pipistrellus (45kHz); Pipistrellus pygmaeus	W1461366623	11/06/2018	BATLAS 2020
Ad-hoc	Nyctalus leisleri; Pipistrellus pipistrellus (45kHz); Pipistrellus pygmaeus	W0060072900	14/09/2019	BATLAS 2020
Ad-hoc	Myotis daubentonii; Nyctalus leisleri; Pipistrellus pipistrellus (45kHz); Pipistrellus pygmaeus	W1637866399	11/06/2018	BATLAS 2020
Ad-hoc	Myotis daubentonii; Nyctalus leisleri; Pipistrellus pipistrellus (45kHz); Pipistrellus pygmaeus	W1461266638	10/06/2018	BATLAS 2020

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 (SNH, 2019). 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 site is located within the current range for Lesser horseshoe bat, Common pipistrelle, Soprano pipistrelle, Daubenton's bat, Brown long-eared bat and Leisler's bat. The proposed site is outside the known range for Natterer bat, Nathusius' pipistrelle and Whiskered bat.

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). The proposed site is situated within the known range of this species. Natural Heritage Areas (NHAs) and proposed Natural Heritage Areas (pNHAs) may be designated for any bat species. A search of NHAs within a 10 km radius of the Study Area found no sites designated for the conservation of bats. One SAC and one pNHA were identified as being designated for bats, the results of which can be seen in Table 4-2.

Glanlough Woods SAC is designated for Lesser horseshoe bat. The proposed development site is located outside of the 2.5km core foraging range for this species (NPWS, 2018). No potential for direct or indirect effects on this Qualifying Interest species as a result of disturbance from the proposed development exists.

Table 4-2 Designated Bat Sites within 10km of the Proposed Site

Site Code	Site Name	Results	Distance from site boundary
002315	Glanlough Woods SAC	[1303] Lesser Horseshoe Bat	8.8km
002099	Carriganass Castle pNHA	Nursery roost of Daubenton's bats (n=60) in a ruined castle	5.1km

4.2.4 Landscape Features

A review of mapping and photographs provided insight into the habitats and landscape features present at the proposed development site. In summary, the primary land use within the proposed site is commercial coniferous forestry.

A review of the GSI online mapper did not indicate the possible presence of any subterranean sites within the 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 site or within 10km of the site boundary.

A review of the NBDC bat landscape map provided a habitat suitability index of 16.22 (green). This indicates that the proposed development area has low habitat suitability for bat species.

4.2.5 Other Wind Energy Developments

Table 4-3 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 Site

Wind Farm Name and Location	No. Turbines	Status
Within 5 km of proposed Curraglass Wind Farm		
Grousemount, Co. Kerry	9 within 5km, 15 within 10km Total Turbines: 24	Permitted
Shehy More, Co. Cork	3 within 5km, 9 within 10km. Total Turbines: 12	Permitted
Within 10 km of proposed Curraglass Wind Farm		
Silahertane (Coomagearlaghy II), Co. Kerry	10	Existing
Derragh, Co. Cork	6	Permitted
Derreenacrinnig West, Co. Cork	7	Permitted
Midas Wind Farm, Co. Kerry	12 within 10km, 11 outside 10km. Total Turbines: 23	Existing
Inchee Extension, Co. Kerry	1 within 10km 2 outside 10km. Total Turbines: 3	Permitted
Derreenacrinning West, Co. Cork	7	Permitted

4.3 Overview of Study Area and Bat Habitat Appraisal

The site comprises an area that previously supported a wind farm. The basic infrastructure of the previous wind farm including access track, turbine bases and substation remain within the current site. The current proposal has been designed to minimise impacts on the receiving environment and maximises the use of existing infrastructure at the site including internal access tracks and grid connection. Consequently, the Proposed Development footprint is dominated by modified habitats associated with the existing infrastructure and conifer plantation.

Turbines 1, 3, 4 and 6 are located in close proximity to former turbine locations. Turbines 2, 5 and 7 are at new locations but access to these areas will primarily be facilitated by the network of internal tracks. The temporary compound also makes use of existing hard stand area.

The Proposed Development site is located in an upland area, within the townlands of Cappaboy Beg, Curraglass and Derreendonee. The primary land use within the study area is commercial forestry with upland peatland habitats occurring in the wider study area.

The main habitat types within the site include conifer plantation, recently felled/replanted forestry, spoil and bare ground, recolonising bare ground, buildings and artificial surfaces and wet heath/upland blanket bog/exposed siliceous rock.

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

With regard to foraging and commuting bats, areas of closed canopy forestry as well as exposed areas of peatland habitats were considered *Negligible* suitability, i.e. negligible habitat features on site likely to be used by commuting or foraging bats (Collins, 2016). Forestry edge and scrub habitats may provide greater foraging and commuting opportunities. These habitats within the study area are connected to the wider landscape by mature hedgerows, treelines and rivers. As such, these habitats were classified as *Moderate* suitability, i.e. habitat connected to the wider landscape that could be used by bats for foraging and commuting (Collins, 2016).

With regard to roosting bats, a targeted roost survey of every tree within the site was considered unnecessary. However, an assessment of the various woodland and forestry habitats was undertaken. Trees present on site comprise a mixture of mature and immature commercial coniferous species. The dominant commercial species planted were Sitka Spruce *(Picea sitchenis),* with smaller areas of Lodgepole Pine *(Pinus contorta)* and Japanese Larch *(Larix kaempferi)* recorded. These were assessed as having *Negligible – Low* roosting potential.

A linear band of Oak-Birch-Holly Woodland is located along the north eastern boundary of the site between the existing local road and conifer plantation. This habitat contained species including Oak *(Quercus petraea*), Ash *(Fraxinus excelsior*), Hazel *(Corylus avellana*), Birch *(Betula pubescens*), and Alder *(Alnus glutinosa*). This area was assessed as having *Low-Moderate* roosting potential for bats.

The substation located within the site was assessed as having *Negligible – Low* roosting potential.

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

4.4 Existing Site Infrastructure

It should be noted that any potential cumulative effects in relation to the previously granted infrastructure on site is also considered. At present the Proposed Development site includes an existing substation that has an associated overhead line connection to the Ballylickey Substation, approximately 12km southwest of the site. The existing substation on site will be subject to decommissioning under the provisions of the previously granted permission and these works have been considered were appropriate in the cumulative assessments.

4.5 Grid Connection

A connection between the proposed substation and the national electricity grid will be necessary to export the electricity generated by the Proposed Development.

The Proposed Development will connect to the existing 38kV overhead line within the site. This overhead line connects into Ballylickey Substation, located approximately 12 kilometres southwest of the site. The connection will comprise of an internal underground cable, approximately 120m in length, which will connect the proposed substation to the existing overhead line infrastructure within the site.

4.6 Roost Surveys

No roost sites or potential roost features were identified during the site walkover inspections in spring, summer and autumn 2019. The surrounding habitats were assessed as largely unsuitable for roosting bats and no evidence of bat use was recorded during the walkover assessments.

The existing substation on site, which will be decommissioned under the provisions of the previously granted permission, was assessed as having *Negligible-Low roosting* potential. No evidence of bats were found during the walkover assessments at the site and no bats were observed emerging from the building.

4.7 Manual Transects

Manual transects were undertaken twice in July and once in October 2019. Bat activity was recorded on all surveys. In general, common pipistrelle (n=240) was recorded most frequently, followed by soprano pipistrelle (n=18), Leisler's bat (n=5) and *Myotis* sp. (n=3). However, species composition and activity levels varied significantly between surveys. Transect survey results were calculated as bat passes per km surveyed (to account for differences in survey effort). Plate 4-1 presents results for individual species per survey period.

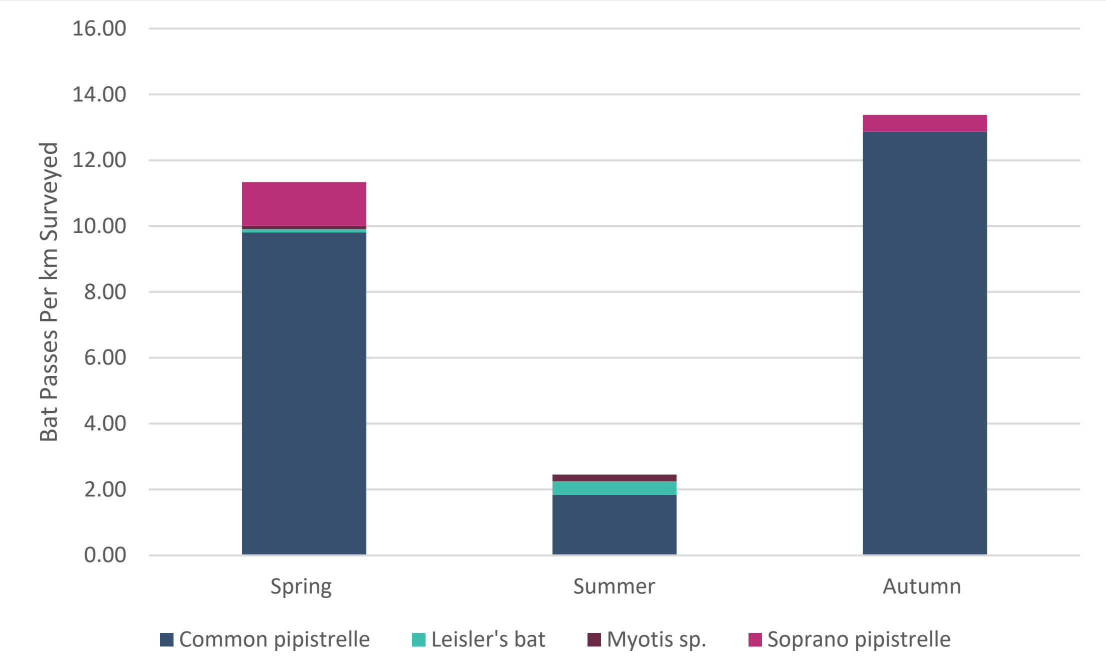

Plate 4-1 2019 Transect Results - Species Composition Per Survey Period

Figures 3-1 – 3-3 presents the spatial distribution of bat activity across surveys. Bat activity was concentrated along mature forestry edge habitats.

4.8 Ground-level Static Surveys

In total, 8,410 bat passes were recorded across all deployments. In general, common pipistrelle (n=6,004) occurred most frequently, followed by *Myotis* sp. (n=1,100), Leisler's bat (n= 768), brown long-eared bat (n=294) and soprano pipistrelle (n=204). Instances of Lesser horseshoe bat (n=34) and Nathusius' pipistrelle (n=6) were significantly less. Plate 4-2 presents relative species composition across all ground-level static detector surveys.

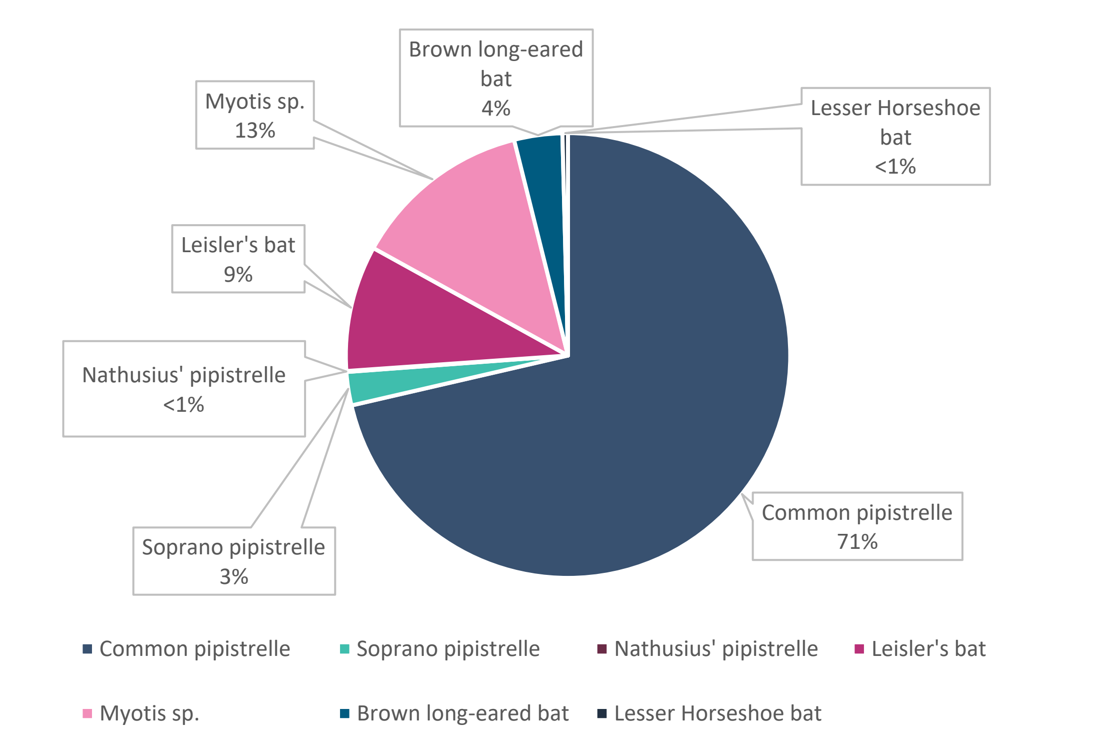

Plate 4-2 Static Detector Surveys: Species Composition Across All Deployments (Total Bat Passes)

Bat activity was calculated as total bat passes per hour (bpph) per season to account for any bias in survey effort, resulting from varying night lengths between seasons. Plate 4-3 and Table 4-4 presents these results for each species. Bat activity was dominated by Common pipistrelle in spring, summer and autumn. In addition, *Myotis* sp. occurred frequently in summer and autumn. Leisler's bat were more frequent in spring, after common pipistrelle. Instances of Lesser horseshoe bat were less frequent and Nathusius' pipistrelle were relatively rare.

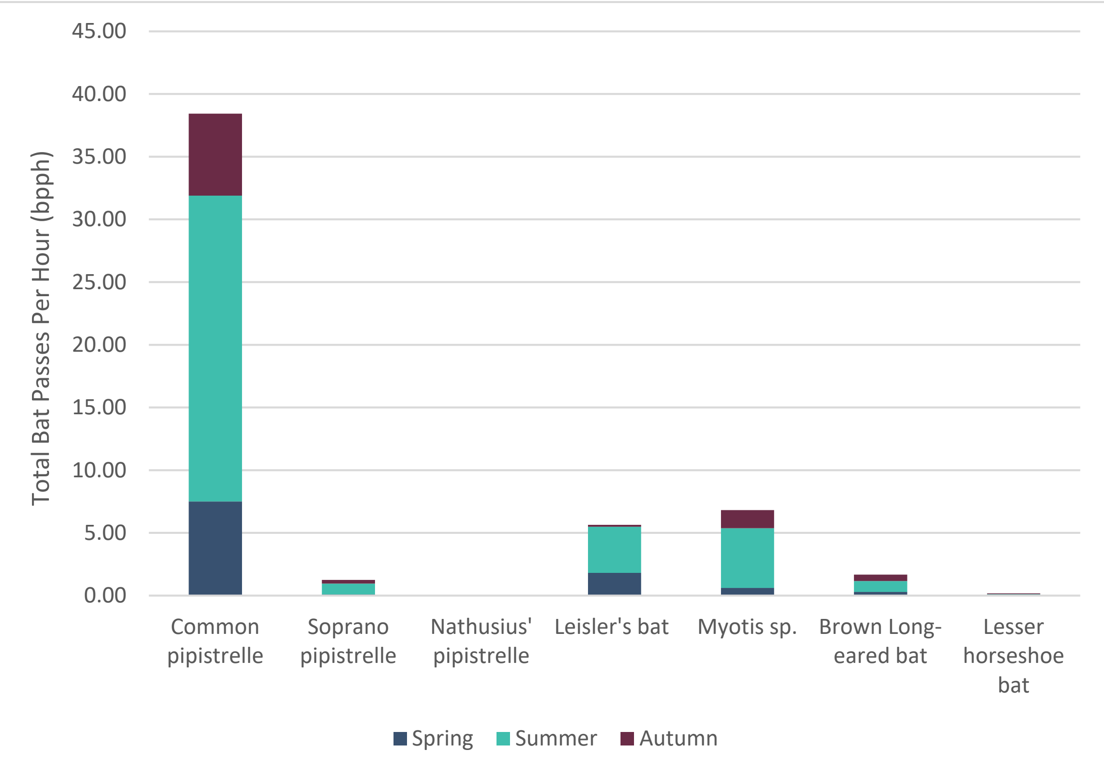

Plate 4-3 Static Detector Surveys: Species Composition Across All Deployments (Total Bat Passes Per Hour, Per Night)

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

	Spring	Summer	Autumn
Total survey hours	139.5	128.9	277.2
Common pipistrelle	7.51	24.38	6.54
Soprano pipistrelle	0.09	0.87	0.28
Nathusius' pipistrelle	0.03	0.00	0.01
Leisler's bat	1.81	3.68	0.15
Myotis sp.	0.62	4.76	1.44
Brown long-eared bat	0.29	0.86	0.51
Lesser horseshoe bat	0.03	0.09	0.07

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

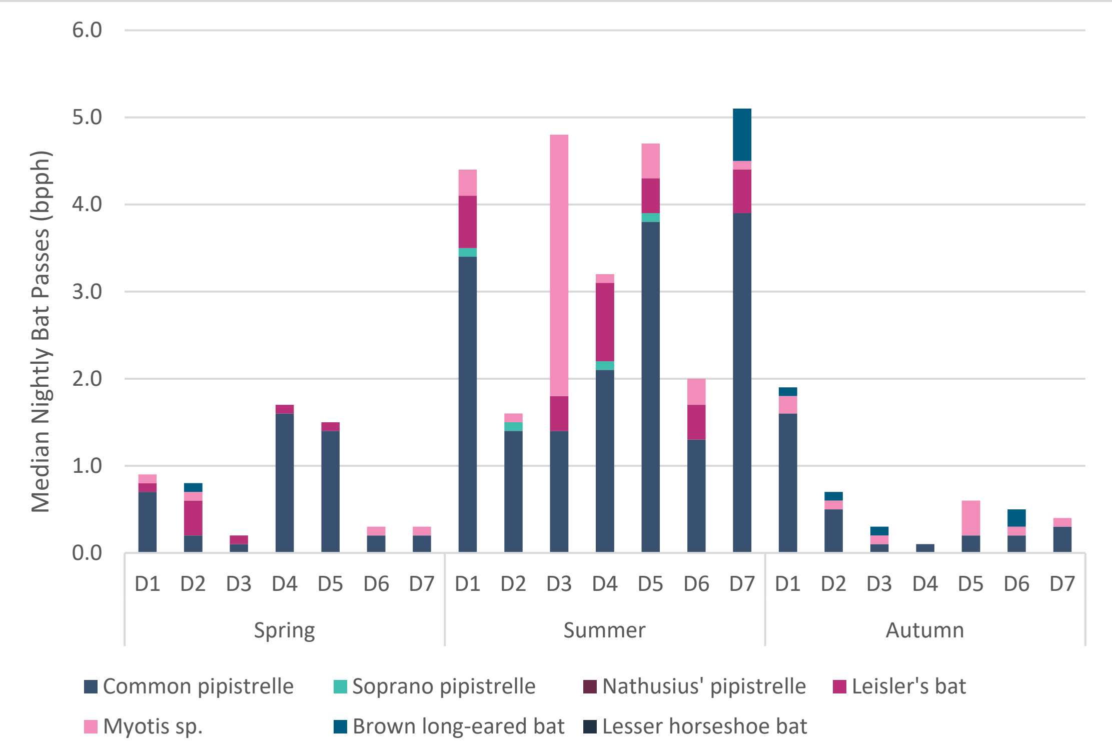

Plate 4-4 Static Detector Surveys: Median Nightly Pass Rate (Bat Passes Per Hour) Including Absences, Per Location Per Survey Period.

Bat activity was significantly higher in summer than all other seasons. This coincides with typical bat activity levels across the country. Common pipistrelle activity was dominant throughout the majority of detectors across all seasons. Spring activity at D2 was dominated by Leisler's bat. Summer activity at D3 which was dominated by *Myotis sp.* and autumn activity at D5 was also dominated by *Myotis sp.*

Bat activity levels were objectively assessed against a reference dataset using Ecobat. Table 4-5 presents the results of Ecobat analysis for each species per season on a site-level. **Appendix 3** provides these results per detector. Median bat activity peaked at ***Moderate-High*** for Common pipistrelle and *Myotis sp.* for at least one season. Median activity levels for Leisler's bat and Brown long-eared bat peaked at ***Moderate*** for at least one season while Soprano pipistrelle peaked at ***Low-Moderate***. Peak median activity for Nathusius' pipistrelle and Lesser horseshoe bat remained ***Low***. Maximum bat activity levels for Common pipistrelle and *Myotis sp.* peaked with ***High*** activity for at least one season. All other species had maximum bat activity levels of ***Moderate-High*** for at least one season except Nathusius' pipistrelle which peaked with ***Low*** maximum bat activity for at least one season.

Table 4-5 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	37	Low-Moderate	96	High	70	1001
Summer	64	Moderate-High	96	High	113	1668
Autumn	67	Moderate-High	99	High	87	830
Soprano pipistrelle						
Spring	3	Low	27	Low-Moderate	11	885
Summer	2	Low	68	Moderate-High	50	1569
Autumn	26	Low-Moderate	71	Moderate-High	38	786
Nathusius' pipistrelle						
Spring	3	Low	3	Low	4	111
Summer	-	Nil	-	Nil	-	-
Autumn	10	Low	10	Low	2	55
Leisler's bat						
Spring	18	Low	80	Moderate-High	51	834
Summer	41	Moderate	69	Moderate-High	82	1377
Autumn	10	Low	77	Moderate-High	73	472
***Myotis* sp.**						
Spring	3	Low	50	Moderate	41	630
Summer	32	Low-Moderate	86	High	89	965
Autumn	62	Moderate-High	92	High	73	703
Brown long-eared bat						
Spring	3	Low	32	Low-Moderate	24	261
Summer	12	Low	52	Moderate	46	589
Autumn	41	Moderate	77	Moderate-High	59	445
Lesser horseshoe bat						
Spring	3	Low	18	Low	3	19
Summer	2	Low	21	Low-Moderate	9	36
Autumn	10	Low	67	Moderate-High	23	100

4.9 Significance 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 1976-2019. 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.

The development site does not support a roosting site of ecological significance.

5. RISK AND IMPACT ASSESSMENT

As per SNH 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 study area has been utilized to predict the potential effects of the wind farm on bats.

5.1 Collision Mortality

5.1.1 Assessment of Site-Risk

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

Table 5-1 Site-risk Level Determination for the Proposed Development Site (Adapted from SNH, 2019)

Criteria	Site-specific Evaluation	Individual Risk	Site Assessment
Habitat Risk	No potential roost features identified within the site.	Low	Moderate
	Mix of commercial coniferous forestry and large areas of clear fell located on blanket bog. (Moderate foraging/commuting suitability).	Moderate	
	Connected to wider landscape by mature hedgerows, treelines, rivers and mature forestry stand habitats.	High	
Project Size	Small scale development (7 no. turbines)	Small	Medium
	Other wind energy developments partially within 5km	Medium	
	Comprising turbines >100 m in height	Large	
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 commercial coniferous forestry with large areas of clear fell situated on blanket bog with smaller areas of wet heath and exposed siliceous rock and scrub. As per table 3a of the SNH Guidance (2019), it has a *moderate* habitat risk score. The project scale is *small* and the scale of other wind energy infrastructure is *medium.* The turbine dimensions are typical of the industry standard in Ireland. Overall, the Project Size is classified as *Medium.* The cross tablature of a **Moderate** Risk Site and a **Medium** Size Project results in an overall **Medium Risk Score of 3**.

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; and
- 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 SNH guidance (**Appendix 4**), by a cross-tablature of the site risk level (i.e. Medium) and Ecobat bat activity outputs for each species. The assessment was carried out for both median and maximum Ecobat activity categories in order to provide insight into typical bat activity (i.e. median values) and activity peaks (i.e. maximum values). SNH 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 SNH guidance there is no requirement to complete an Overall Risk Assessment for low risk species. During the extensive suite of surveys undertaken that following low risk species were recorded:

- *Myotis* sp.
- Brown long-eared bat
- Lesser horseshoe 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 site. When assessed in the context of the identified site risk and in line with Table 3b (SNH, 2019) overall activity risk for Leisler's bat was found to be ***Medium*** at typical activity levels in summer and ***Low*** at typical activity levels for spring and autumn. Peak activity levels were ***High*** across all three seasons for Leisler's bat (See Table 5-2 below).

Based on site visit and survey data, including walked transects, it is determined that the Typical Activity (i.e. Median) is reflective of the nature of the site, which is commercial coniferous forestry with large areas of clear fell with low levels of bat activity recorded during the walked transects undertaken.

Thus, there is **Medium** collision risk level assigned to the local population of Leisler's Bat in summer and ***Low*** collision risk level in spring and autumn.

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

Survey Period	Site Risk	Typical Activity (Median)	Typical Risk Assessment (as per Table 3b SNH 2019)	Activity Peaks (Maximum)	Peak Risk Assessment (as per Table 3b SNH 2019)
Spring	Medium (3)	Low (1)	Typical Risk is Low (3)	Moderate-High (4)	Peak Risk is Medium (12)
Summer		Moderate (3)	Typical Risk is Medium (9)	Moderate-High (4)	Peak Risk is Medium (12)
Autumn		Low (1)	Typical Risk is Low (3)	Moderate-High (4)	Peak Risk is Medium (12)

5.1.2.2 Soprano pipistrelle

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

Based on site visit and survey data, including walked transects, it is determined that the Typical Activity (i.e. Median) is reflective of the nature of the site, which is commercial coniferous forestry with large areas of clear fell with low levels of bat activity recorded during the walked transects undertaken.

Thus, there is **Medium** collision risk level assigned to the local population of Soprano pipistrelle in autumn and ***Low*** collision risk level for spring and summer.

Table 5-3 Soprano pipistrelle - Overall Risk Assessment

Survey Period	Site Risk	Typical Activity (Median)	Typical Risk Assessment (as per Table 3b SNH 2019)	Activity Peaks (Maximum)	Peak Risk Assessment (as per Table 3b SNH 2019)
Spring	Medium (3)	Low (1)	Typical Risk is Low (3)	Low-Moderate (2)	Peak Risk is Medium (6)
Summer		Low (1)	Typical Risk is Low (3)	Moderate-High (4)	Peak Risk is Medium (12)
Autumn		Low-Moderate (2)	Typical Risk is Medium (6)	Moderate-High (4)	Peak Risk is Medium (12)

5.1.2.3 Common pipistrelle

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

Based on site visit and survey data, including walked transects, it is determined that the Typical Activity (i.e. Median) is reflective of the nature of the site, which is commercial coniferous forestry with large areas of clear fell with low levels of bat activity recorded during the walked transects undertaken.

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

Table 5-4 Common pipistrelle - Overall Risk Assessment

Survey Period	Site Risk	Typical Activity (Median)	Typical Risk Assessment (as per Table 3b SNH 2019)	Activity Peaks (Maximum)	Peak Risk Assessment (as per Table 3b SNH 2019)
Spring	Medium (3)	Low-Moderate (2)	Typical Risk is Medium (6)	High (5)	Peak Risk is High (15)
Summer		Moderate to High (4)	Typical Risk is Medium (12)	High (5)	Peak Risk is High (15)

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

5.1.2.4 Nathusius' pipistrelle

This site is outside the current range of the Nathusius' pipistrelle (NPWS, 2019). Nathusius' pipistrelle are classed as a rarest species of a high population vulnerability which have a high collision risk (Plate 3-4). Nathusius' pipistrelle were recorded during activity surveys across the proposed site in spring and summer. When assessed in the context of the identified site risk and in line with Table 3b (SNH 2019); overall activity risk for Nathusius' pipistrelle at typical activity levels was found to be ***Low*** across all seasons. Peak risk levels for Nathusius' pipistrelle were found to be ***Low*** across all seasons (See Table 5-5 below).

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

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

Table 5-5 Nathusius' pipistrelle - Overall Risk Assessment

Survey Period	Site Risk	Typical Activity (Median)	Typical Risk Assessment (as per Table 3b SNH 2019)	Activity Peaks (Maximum)	Peak Risk Assessment (as per Table 3b SNH 2019)
Spring	Medium (3)	Low (1)	Typical Risk is Low (3)	Low (1)	Peak Risk is Low (3)
Summer		Nil (0)	Typical Risk is Low (0)	Nil (0)	Peak Risk is Low (0)
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. However, the proposed development is predominantly located within an existing commercial forestry plantation with existing road infrastructure and there will be no net loss of bat foraging/commuting habitat associated with the proposed wind farm development.

The proposed development, including the creation of new road infrastructure, has the potential to open up the commercial forestry and thereby increase the amount and availability of linear landscape features that may be utilised by bats for commuting or foraging.

No significant effects with regard to loss of commuting and foraging habitat are anticipated.

5.3 Loss of, or Damage to, Roosts

The development is predominantly a commercial forestry plantation with large areas of clear fell. The trees in the plantation do not provide potential roosting habitat of significance for bats. It is not anticipated that any bats will be impacted by the proposed development.

No significant effects with regard to loss of, or damage to, roosts is anticipated.

5.4 Displacement of Individuals or Populations

The development is predominantly located within a commercial forestry plantation. There will be no net loss of linear landscape features for commuting and foraging bats and there will be no loss of any roosting site of ecological significance. The habitats on the site will remain suitable for foraging and commuting 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 (SI 359/1996).

6.1.2 Lighting Restrictions

Where lighting is required, directional lighting will be used to prevent overspill on to woodland/forestry edges. This will be achieved using lighting accessories, such as hoods, cowls, louvers and shields, to direct the light to the intended area only.

6.1.3 Buffering

A 50m buffer from the blade tip to the nearest woodland, as recommended by the Natural England (2014) and SNH (2019) guidelines, shall be implemented. These vegetation-free areas will be maintained during the operational life of the development.

The correct buffer distance must be measured from the blade tip sweep to the canopy of the nearest habitat feature. Measuring 50m for the base of the turbine to the habitat feature is inadequate as tall tree canopies may put bat populations at risk. It is necessary to calculate the distance between the edge of the habitat feature and the centre of the tower (b). Using the formula:

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

Where, **bl** =Blade length, **hh** = hub height, **fh** = feature height all in metres.

E.g. (below) **b** = 69.3m (Plate 6-1)

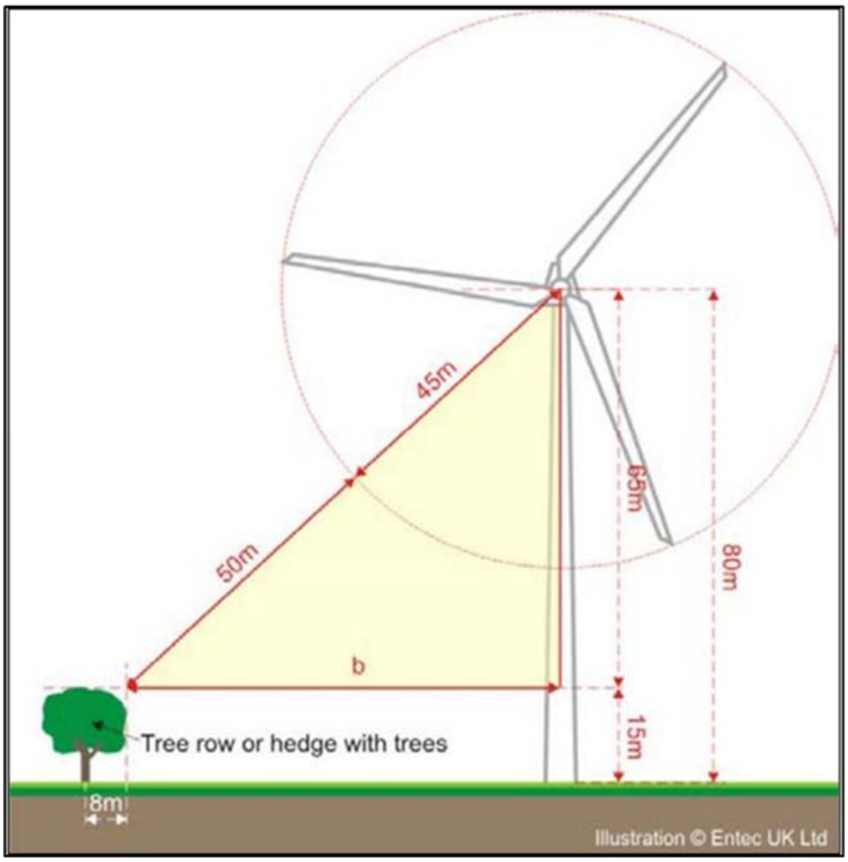

Plate 6-1 Calculate Buffer Distances (Natural England, 2014).

6.2 Site Specific Mitigation and Monitoring Programme

Overall risk levels for high collision risk bat species was typically ***Low-Medium***. This risk level is reflective of the nature of the site, which is an upland commercial conifer plantation with low levels of bat activity recorded during the walked transects undertaken.

However, taking a precautionary approach and given that high collision risk was recorded at peak activity levels, an adaptive monitoring and mitigation strategy has been devised for the proposed development in line with the case study example provided in Appendix 5 of the SNH Guidance.

6.2.1 Post Construction Monitoring and Assessment of Adaptive Mitigation Requirement

As per SNH Guidance at least 3 years of post-construction monitoring is required to assess the effects of construction related habitat modification on bat activity. For example, it may be that the construction of wind turbines significantly reduces bat activity at the site relative to that recorded pre-construction and to a level at which there is no longer potential for significant effects on bats (SNH 2019). Therefore, the results of post construction monitoring shall be utilised to assess changes in bat activity patterns and to inform the design of any advanced site specified mitigation requirements, including curtailment, to ensure that there are no significant residual effects on bat species.

6.2.1.1 Operational Year 1

Static monitoring at turbine bases shall take place at each turbine during the bat activity season (between April and October). Full spectrum recording detectors shall be utilised for the same duration as during pre-application surveys and at the same density (SNH, 2019).

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)

Carcass searches, to monitor and record bat fatalities, shall be conducted at each turbine in accordance with SNH Guidance. 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. Calculating casualty rates across the site shall be done in accordance with the methods and formulas provided in Appendix 4 of the SNH Guidance.

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.

Curtailment involves raising the cut-in speed with associated loss of power generation in combination with reducing the blade rotation (blade feathering) below the cut-in speed. The most basic and least sophisticated form of curtailment "blanket" curtailment -involves feathering the blades between dusk and dawn over the entire bat active period (April to October). A more sophisticated and efficient solution is to focus on certain times and dates, corresponding with those periods when the highest level of bat activity is expected to occur. Further savings can be achieved by programming the SCADA operating system to only pause/feather the blades below a specified wind speed and above a specified temperature within specified time periods.

In order to minimise down time, the threshold values at which turbines are feathered should be site specific and informed by bat activity peaks at that location, but as an indication, they are likely to be in the range of wind speeds between 5.0 and 6.5m/s and at temperatures above approximately 10 or 11ºC measured at the nacelle. Significant savings can be achieved by so-called "smart "curtailment over the other less sophisticated alternatives.

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

6.2.1.2 Operational Years 2 & 3

Where a curtailment requirement is identified, monitoring surveys shall continue in Year 2 and 3, and the success of the curtailment strategy shall be assessed in line with the baseline data collected in the 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.

6.3 Residual Impacts

Taking into consideration 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.

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 SNH guidance. Following consideration of the residual effects (post mitigation) it is noted that the proposed development will not result in any significant effects on bats

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

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APPENDIX 1

HABITAT SUITABILITY ASSESSMENT

MKO Planning and Environmental Consultants

Bat Survey Report

Appendix 1 – Habitat Suitability Assessment

MKO Planning and Environmental Consultants

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

Bat Survey Report

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

MKO Planning and Environmental Consultants

SITE RISK ASSESSMENT

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

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

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

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

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

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

APPENDIX 3

ECOBAT PER DETECTOR RESULTS

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Bat Survey Report

Appendix 3 – Ecobat Per Detector Results 2019

Table of Contents

Summary tables are provided for each species recorded showing key metrics per detector per survey period.

LEISLER'S BAT							
Survey Period	Nights Recorded	Ref Range	Detector ID	Median Bat Activity Level	Median Bat Activity	Max Bat Activity Level	Max Bat Activity Level
Spring	8	834	D01	3	Low	69	Moderate-High
Spring	11	834	D02	32	Low-Moderate	80	Moderate-High
Spring	8	834	D03	27	Low-Moderate	69	Moderate-High
Spring	8	834	D04	18	Low	58	Moderate
Spring	8	834	D05	18	Low	37	Low-Moderate
Spring	2	834	D06	15	Low	27	Low-Moderate
Spring	6	834	D07	3	Low	60	Moderate
Summer	13	1377	D01	52	Moderate	68	Moderate-High
Summer	2	1377	D02	2	Low	2	Low
Summer	14	1377	D03	35	Low-Moderate	69	Moderate-High
Summer	15	1377	D04	50	Moderate	64	Moderate-High
Summer	11	1377	D05	38	Low-Moderate	52	Moderate
Summer	14	1377	D06	35	Low-Moderate	58	Moderate
Summer	13	1377	D07	50	Moderate	61	Moderate-High
Autumn	2	472	D01	32	Low-Moderate	54	Moderate
Autumn	6	472	D02	10	Low	41	Moderate
Autumn	2	472	D03	32	Low-Moderate	54	Moderate
Autumn	-	472	D04	-	Nil	-	Nil
Autumn	5	472	D05	10	Low	77	Moderate-High
Autumn	2	472	D06	26	Low-Moderate	41	Moderate
Autumn	4	472	D07	26	Low-Moderate	54	Moderate

MYOTIS SP.							
Survey Period	Nights Recorded	Ref Range	Detector ID	Median Bat Activity Level	Median Bat Activity	Max Bat Activity Level	Max Bat Activity Level
Spring	9	630	D01	18	Low	27	Low-Moderate
Spring	8	630	D02	30	Low-Moderate	50	Moderate
Spring	5	630	D03	3	Low	18	Low
Spring	2	630	D04	3	Low	3	Low
Spring	6	630	D05	11	Low	32	Low-Moderate
Spring	3	630	D06	27	Low-Moderate	37	Low-Moderate
Spring	8	630	D07	3	Low	18	Low
Summer	13	965	D01	21	Low-Moderate	56	Moderate
Summer	8	965	D02	2	Low	38	Low-Moderate
Summer	16	965	D03	72	Moderate-High	86	High
Summer	10	965	D04	21	Low-Moderate	43	Moderate
Summer	16	965	D05	32	Low-Moderate	60	Moderate
Summer	16	965	D06	27	Low-Moderate	47	Moderate
Summer	10	965	D07	21	Low-Moderate	58	Moderate
Autumn	15	703	D01	62	Moderate-High	89	High
Autumn	12	703	D02	48	Moderate	86	High
Autumn	8	703	D03	62	Moderate-High	79	Moderate-High
Autumn	-	703	D04	-	Nil	-	Nil
Autumn	18	703	D05	71	Moderate-High	92	High
Autumn	10	703	D06	48	Moderate	71	Moderate-High
Autumn	10	703	D07	26	Low-Moderate	77	Moderate-High

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SOPRANO PIPISTRELLE							
Survey Period	Nights Recorded	Ref Range	Detector ID	Median Bat Activity Level	Median Bat Activity	Max Bat Activity Level	Max Bat Activity Level
Spring	0	885	D01	-	Nil	-	Nil
Spring	3	885	D02	3	Low	3	Low
Spring	1	885	D03	3	Low	3	Low
Spring	2	885	D04	3	Low	3	Low
Spring	3	885	D05	3	Low	3	Low
Spring	1	885	D06	3	Low	3	Low
Spring	1	885	D07	3	Low	3	Low
Summer	8	1569	D01	2	Low	68	Moderate-High
Summer	8	1569	D02	2	Low	21	Low-Moderate
Summer	6	1569	D03	2	Low	21	Low-Moderate
Summer	8	1569	D04	2	Low	63	Moderate-High
Summer	9	1569	D05	21	Low-Moderate	47	Moderate
Summer	6	1569	D06	21	Low-Moderate	21	Low-Moderate
Summer	5	1569	D07	21	Low-Moderate	32	Low-Moderate
Autumn	6	786	D01	48	Moderate	67	Moderate-High
Autumn	8	786	D02	41	Moderate	71	Moderate-High
Autumn	5	786	D03	41	Moderate	67	Moderate-High
Autumn	-	786	D04	-	Nil	-	Nil
Autumn	9	786	D05	10	Low	54	Moderate
Autumn	6	786	D06	10	Low	54	Moderate
Autumn	4	786	D07	26	Low-Moderate	41	Moderate

COMMON PIPISTRELLE							
Survey Period	Nights Recorded	Ref Range	Detector ID	Median Bat Activity Level	Median Bat Activity	Max Bat Activity Level	Max Bat Activity Level
Spring	12	1001	D01	51	Moderate	79	Moderate-High
Spring	12	1001	D02	18	Low	83	High
Spring	7	1001	D03	18	Low	32	Low-Moderate
Spring	11	1001	D04	59	Moderate	87	High
Spring	14	1001	D05	58	Moderate	96	High
Spring	5	1001	D06	18	Low	32	Low-Moderate
Spring	9	1001	D07	32	Low-Moderate	50	Moderate
Summer	16	1668	D01	74	Moderate-High	94	High
Summer	16	1668	D02	57	Moderate	88	High
Summer	16	1668	D03	58	Moderate	82	High
Summer	16	1668	D04	65	Moderate-High	93	High
Summer	16	1668	D05	76	Moderate-High	86	High
Summer	17	1668	D06	56	Moderate	75	Moderate-High
Summer	16	1668	D07	77	Moderate-High	96	High
Autumn	17	830	D01	89	High	99	High
Autumn	18	830	D02	71	Moderate-High	96	High
Autumn	9	830	D03	10	Low	97	High
Autumn	1	830	D04	10	Low	10	Low
Autumn	17	830	D05	67	Moderate-High	98	High
Autumn	13	830	D06	67	Moderate-High	95	High
Autumn	12	830	D07	65	Moderate-High	96	High

NATHUSIUS' PIPISTRELLE

Survey Period	Nights Recorded	Ref Range	Detector ID	Median Bat Activity Level	Median Bat Activity	Max Bat Activity Level	Max Bat Activity Level
Spring	-	-	D01	-	Nil	-	Nil
Spring	1	111	D02	3	Low	3	Low
Spring	-	-	D03	-	Nil	-	Nil
Spring	-	-	D04	-	Nil	-	Nil
Spring	2	111	D05	3	Low	3	Low
Spring	-	-	D06	-	Nil	-	Nil
Spring	1	111	D07	3	Low	3	Low
Summer	-	-	D01	-	Nil	-	Nil
Summer	-	-	D02	-	Nil	-	Nil
Summer	-	-	D03	-	Nil	-	Nil
Summer	-	-	D04	-	Nil	-	Nil
Summer	-	-	D05	-	Nil	-	Nil
Summer	-	-	D06	-	Nil	-	Nil
Summer	-	-	D07	-	Nil	-	Nil
Autumn	1	55	D01	10	Low	10	Low
Autumn	-	-	D02	-	Nil	-	Nil
Autumn	-	-	D03	-	Nil	-	Nil
Autumn	-	-	D04	-	Nil	-	Nil
Autumn	1	55	D05	10	Low	10	Low
Autumn	-	-	D06	-	Nil	-	Nil
Autumn	-	-	D07	-	Nil	-	Nil

BROWN LONG-EARED BAT

Survey Period	Nights Recorded	Ref Range	Detector ID	Median Bat Activity level	Median Bat Activity	Max Bat Activity Level	Max Bat Activity Level
Spring	3	261	D01	3	Low	18	Low
Spring	10	261	D02	3	Low	32	Low-Moderate
Spring	1	261	D03	3	Low	3	Low
Spring	0	261	D04	-	Nil	-	Nil
Spring	7	261	D05	18	Low	32	Low-Moderate
Spring	1	261	D06	3	Low	3	Low
Spring	2	261	D07	3	Low	3	Low
Summer	7	589	D01	2	Low	68	Moderate-High
Summer	1	589	D02	2	Low	2	Low
Summer	6	589	D03	12	Low	21	Low-Moderate
Summer	6	589	D04	2	Low	32	Low-Moderate
Summer	6	589	D05	2	Low	38	Low-Moderate
Summer	6	589	D06	21	Low-Moderate	38	Low-Moderate
Summer	14	589	D07	43	Moderate	52	Moderate
Autumn	13	445	D01	10	Low	67	Moderate-High
Autumn	11	445	D02	41	Moderate	74	Moderate-High
Autumn	7	445	D03	41	Moderate	74	Moderate-High
Autumn	-	445	D04	-	Nil	-	Nil
Autumn	9	445	D05	41	Moderate	62	Moderate-High
Autumn	12	445	D06	41	Moderate	77	Moderate-High
Autumn	7	445	D07	41	Moderate	77	Moderate-High

LESSER HORSESHOE BAT							
Survey Period	Nights Recorded	Ref Range	Detector ID	Median Bat Activity level	Median Bat Activity	Max Bat Activity Level	Max Bat Activity Level
Spring	2	19	D01	11	Low	18	Low
Spring	1	19	D02	3	Low	3	Low
Spring	-	19	D03	-	Nil	-	Nil
Spring	-	19	D04	-	Nil	-	Nil
Spring	-	19	D05	-	Nil	-	Nil
Spring	-	19	D06	-	Nil	-	Nil
Spring	-	19	D07	-	Nil	-	Nil
Summer	2	36	D01	2	Low	2	Low
Summer	-	36	D02	-	Nil	-	Nil
Summer	2	36	D03	2	Low	2	Low
Summer	-	36	D04	-	Nil	-	Nil
Summer	1	36	D05	2	Low	2	Low
Summer	2	36	D06	21	Low-Moderate	21	Low-Moderate
Summer	2	36	D07	2	Low	2	Low
Autumn	2	100	D01	10	Low	10	Low
Autumn	2	100	D02	10	Low	10	Low
Autumn	6	100	D03	10	Low	41	Moderate
Autumn	-	100	D04	-	Nil	-	Nil
Autumn	7	100	D05	10	Low	67	Moderate-High
Autumn	3	100	D06	10	Low	10	Low
Autumn	3	100	D07	41	Moderate	41	Moderate

APPENDIX 4

OVERALL RISK ASSESSMENT

Planning and Environmental Consultants

Bat Survey Report

Appendix 4 – Overall Risk Assessment (Table 3b, SNH)

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

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

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

Overall assessment:

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

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