Appendix 6.2 – Bat Survey Report

Proposed Derrinlough Wind Farm

DOCUMENT DETAILS

Client:	**Bord na Móna Powergen Ltd.**
Project Title:	**Proposed Derrinlough Wind Farm**
Project Number:	**171221**
Document Title:	**Bat Survey Report**
Document File Name:	**BR F – 2020.02.18 – 171221**
Prepared By:	**MKO** **Tuam Road** **Galway** **Ireland** **H91 VW84**

Planning and Environmental Consultants

Rev	Status	Date	Author(s)	Approved By
01	Draft	29/10/2019	LD	JH
02	Draft	27/01/2020	AJ	JH
03	Final	18/02/2020	AJ	PR

Table of Contents

TABLE OF TABLES

TABLE OF PLATES

1. INTRODUCTION

MKO was commissioned to complete a comprehensive assessment of the potential effects on bats of a proposed wind farm at Derrinlough and adjacent townlands, Co. Offaly. This report provides details of the bat surveys undertaken, including survey design, methods and results, and the assessment of potential effects of the proposed development on bats. Where necessary, mitigation is prescribed to minimise the potential for likely significant effects.

Bat surveys undertaken in 2019, in accordance with Scottish Natural Heritage Guidance (SNH 2019)[1], form the core dataset for the assessment of effects on bats. It is supplemented by additional data derived from surveys undertaken on the site in 2018 which were designed in accordance with the Bat Conservation Trust's guidelines for wind turbine developments (Hundt, 2012).

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

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

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 2019, Scottish Natural Heritage published B*ats 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 Úna Nealon (BSc, PhD), Laoise Kelly (BSc)and Julie O'Sullivan (BSc, MSc). Each of the surveyors has extensive experience and qualifications in bat surveying and impact assessment. They were assisted by John Hehir, Paddy Manley and Dáire O'Shaughnessy. All staff have relevant academic qualifications to complete the surveys and assessments that they were required to do.

Data analysis was undertaken, and results were compiled by Aoife Joyce (BSc., MSc.) and Luke Dodebier (BSc.). 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 1976-2018). 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

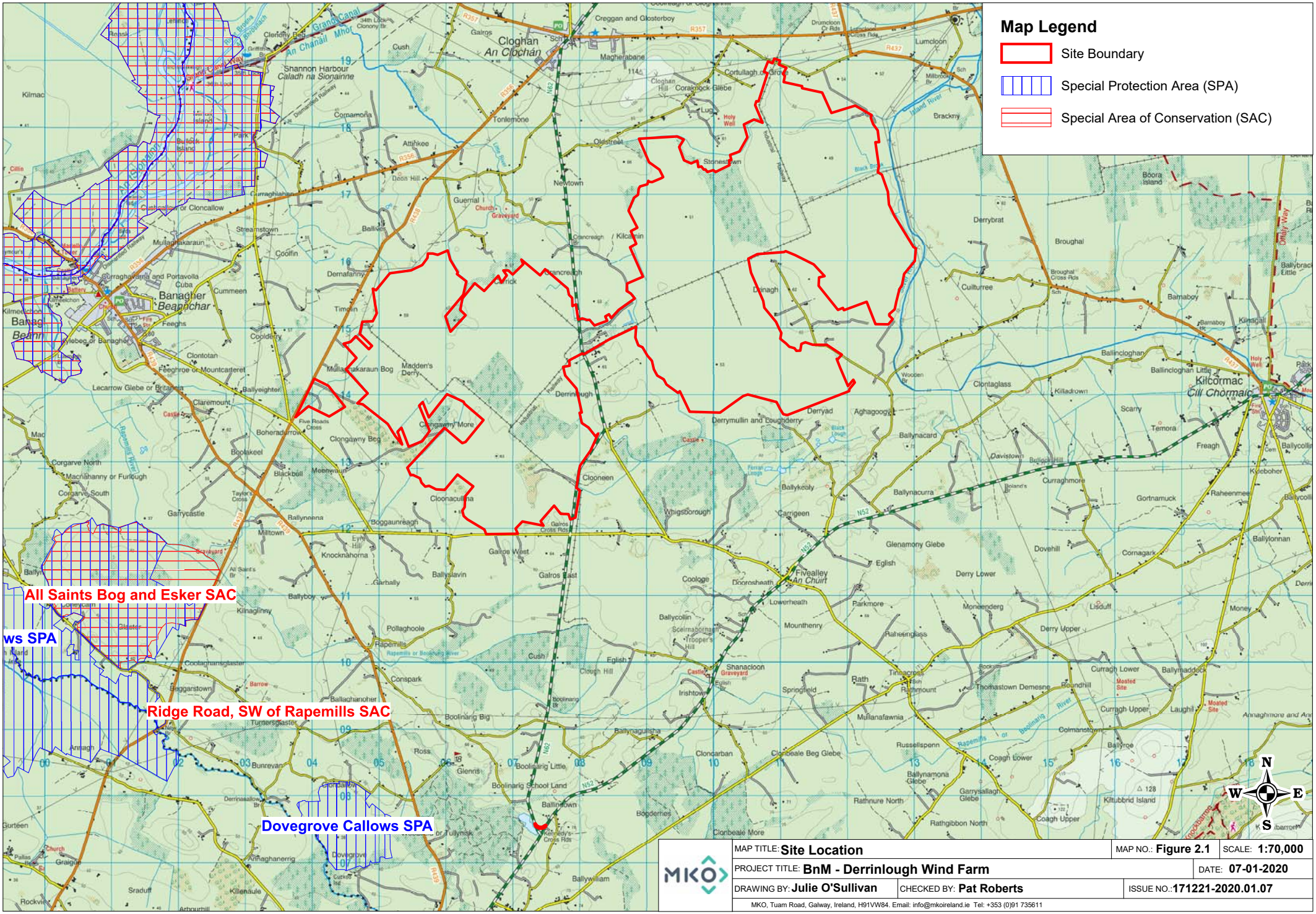
The proposed development will be located on two bogs within the Boora Bog Group in West Co. Offaly, namely Clongawny and Drinagh bogs (E208501, N214984). The site is located approximately 3 kilometres east of Banagher and approximately 7 kilometres northeast of Birr, Co. Offaly (Figure 2.1). The villages of Cloghan and Five Alley are located approximately 2 kilometres north and 2.5 kilometres south of the site, respectively. Other settlements and towns located nearby include Ferbane (c. 6km north) and Shannonbridge (c. 15km north-west). The proposed development site area measures approximately 2,400 hectares.

The site is accessed via the N62 which bisects the site, the R357 which is located approximately 300 metres from the northern site boundary and the L7009 (local Stonestown Road). The site itself is served by a number of existing road and rail access points.

The land-use/activities within the proposed site comprise a mix of bare cutover and cutaway peat, re-vegetation of bare peat, commercial forestry, telecommunications (an existing 30m wind monitoring mast), wind measurement (a single 100m anemometry mast on Clongawny Bog) and the Derrinlough Briquette Factory. There are also a number of Bord na Móna rail lines that pass through the bog facilitating the transportation of milled peat. Land-use in the surrounding landscape comprises a mix of agricultural land, mixed forestry, active peat extraction, cutaway and cutaway peatlands, amenity (e.g. Lough Boora Parklands) and energy production. The operational Meenwaun Wind Farm is located adjacent to the southwestern boundary of the proposed development site.

The Proposed Development comprises:

1. *21 No. wind turbines with an overall blade tip height of up to 185 metres and all associated hard-standing areas.*
2. *2 No. permanent Anemometry Masts up to a height of 120 metres.*
3. *Provision of new and upgraded internal site access roads, passing bays, amenity pathways, amenity carpark and associated drainage.*
4. *2 No. permanent underpasses in the townland of Derrinlough. One underpass will be located beneath the N62 and one will be located beneath an existing Bord na Móna rail line.*
5. *1 No. 110 kV electrical substation, which will be constructed in the townland of Cortullagh or Grove. The electrical substation will have 2 No. control buildings, associated electrical plant and equipment and a wastewater holding tank.*
6. *5 No. temporary construction compounds, in the townlands of Clongawny More, Derrinlough, Derrinlough/Crancreagh, Drinagh and Cortullagh or Grove.*
7. *All associated underground electrical and communications cabling connecting the turbines to the proposed electrical substation.*
8. *2 No. temporary security cabins at the main construction site entrances in the townland of Derrinlough.*
9. *All works associated with the connection of the proposed wind farm to the national electricity grid, which will be to the existing Dallow/Portlaoise/Shannonbridge 110 kV line.*
10. *Removal of existing meteorological mast.*
11. *Upgrade of existing access and temporary improvements and modifications to existing public road infrastructure to facilitate delivery of abnormal loads including locations on the N52 and N62; construction access for delivery of construction materials at locations on the N62 and R357; operational access onto L7009 in the townland of Cortullagh or Grove and amenity access off R357 and L7005.*
12. *All associated site works and ancillary development including signage.*
13. *A 10-year planning permission and 30-year operational life from the date of commissioning of the entire wind farm.*



MAP TITLE: **Site Location**		MAP NO.: **Figure 2.1**	SCALE: **1:70,000**
PROJECT TITLE: **BnM - Derrinlough Wind Farm**			DATE: **07-01-2020**
DRAWING BY: **Julie O'Sullivan**	CHECKED BY: **Pat Roberts**		ISSUE NO.: **171221-2020.01.07**

MKO, Tuam Road, Galway, Ireland, H91VW84. Email: info@mkoireland.ie Tel: +353 (0)91 735611

3. METHODS

3.1 Consultation

A scoping exercise was undertaken as part of the EIAR for the proposed development. A Scoping Document, providing details of the application site and the proposed development, was prepared by MKO and circulated to consultees in June 2018. 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. A search of the National Bat Database of Ireland was last carried out on the 14th February 2020 and examined bat presence and roost records within a 10 km radius of a central point in the Study Area (IG E208260 N214907) (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.

3.2.2 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 (SNH, 2019).

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, SNH 2019). 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 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 14th February 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 14th February 2020).

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 Study Area. It is worth noting that these results are based on a modelling exercise and not confirmed bat species records. Regardless, they may provide a useful indication of potential favourable bat associations within the proposed site.

3.2.4.4 Additional Wind Energy Projects in the Wider Landscape

A search for existing and permitted wind energy developments within 10km of the proposed 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. More details on other infrastructure developments can be found in Chapter 2 of the main EIAR.

3.3 Field Surveys

Bat surveys undertaken in 2019, in accordance with Scottish Natural Heritage Guidance (SNH 2019), form the core dataset for the assessment of effects on bats. It is supplemented by additional data derived from surveys undertaken on the site in 2018 which were designed in accordance with the Bat Conservation Trust's guidelines for wind turbine developments (Hundt, 2012).

3.3.1 2019 Surveys to SNH Guidance

3.3.1.1 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 are divided into *High*, *Moderate*, *Low* and *Negligible*, and are described fully in **Appendix 1**.

3.3.1.2 Roost Surveys (2019)

A search for bat roosts was undertaken within 200m plus the rotor radius (i.e. 150 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 June, 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.

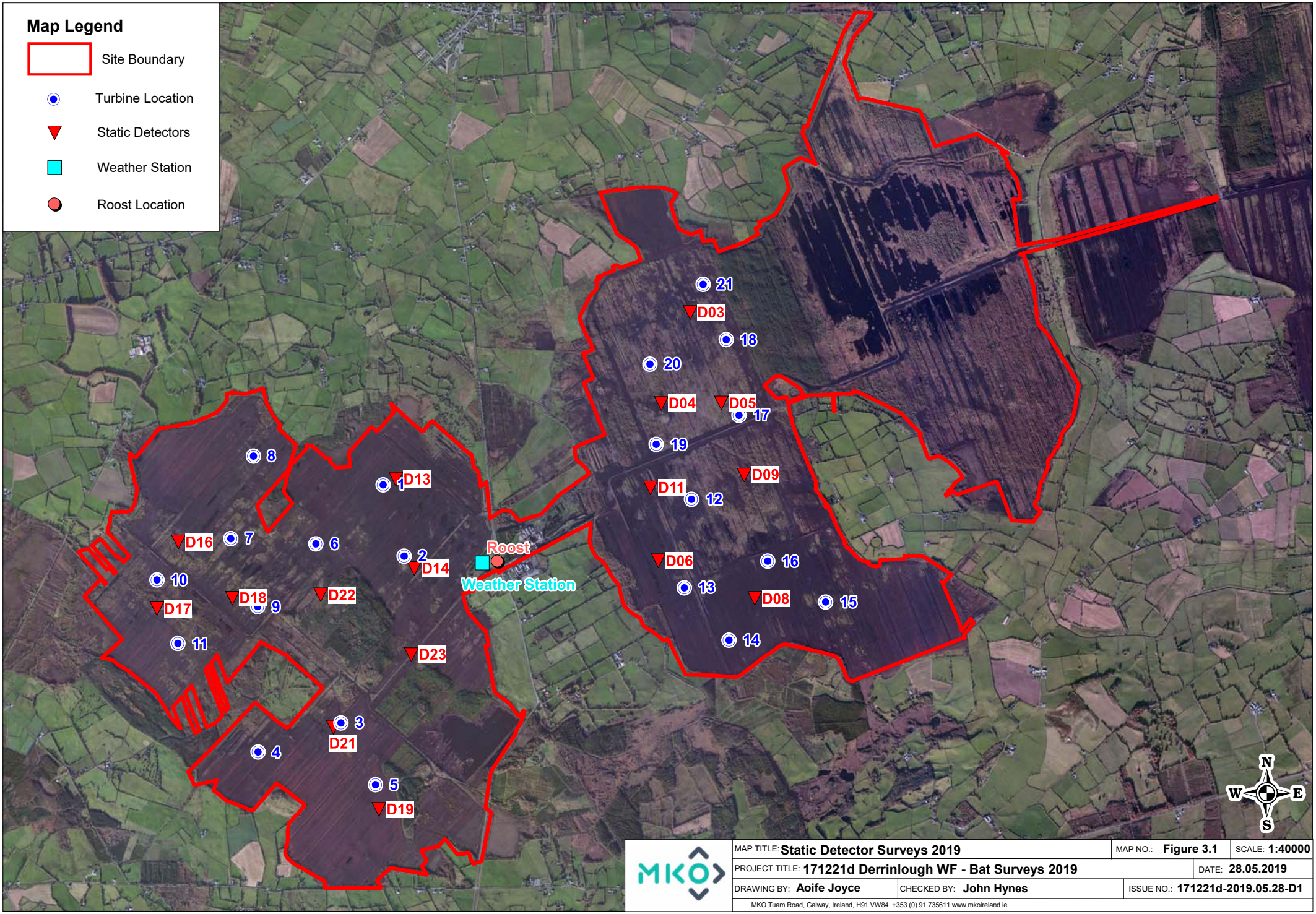
One structure, (IG Ref: N 08042 14688) first identified in 2018, was resurveyed in 2019 and was subject to a roost assessment (Figure 3.1). Emergence surveys were carried out at this abandoned dwelling in June and July 2019 in accordance with Collins (2016). Two surveyors were equipped with Bat Logger M bat detectors (Elekon AG, Lucerne, Switzerland). Conditions were suitable for bat surveys; June - dry, warm (12˚C), calm (Beaufort Force 0), July – dry, warm (20˚C), moderate breeze (Beaufort Force 4). Emergence surveys commenced 30 minutes before sunset and concluded 1.5 hours after sunset. The purpose was to identify bat species, numbers, access points and roosting locations throughout the bat activity season.

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).

3.3.1.3 Manual Transects (2019)

A series of representative transect routes were selected throughout the proposed development site. The aim of these surveys was to identify bat species using the site and gather any information on bat behaviour and important features used by bats. Transect routes were prepared with reference to the proposed layout, desktop and walkover survey results as well as any health and safety considerations and access limitations. As such, transect routes generally followed existing roads and tracks. Transect routes are presented in Figures 3.3- 3.5.

Transects were walked by two surveyors, recording bats in real time. Driven transects followed the methodology described by Roche *et al.* (2012). Surveys commenced 30 minutes before sunset and were completed for3 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 2019. Table 3.1 summarises survey effort in relation to walked transects.



MKO

MAP TITLE: **Static Detector Surveys 2019**		MAP NO.: **Figure 3.1**	SCALE: **1:40000**
PROJECT TITLE: **171221d Derrinlough WF - Bat Surveys 2019**			DATE: **28.05.2019**
DRAWING BY: **Aoife Joyce**	CHECKED BY: **John Hynes**	ISSUE NO.: **171221d-2019.05.28-D1**	

MKO Tuam Road, Galway, Ireland, H91 VW84. +353 (0) 91 735611 www.mkoireland.ie

Table 3-1 2019 Survey Effort - Manual Transects

Date	Surveyor	Type	Sunset	Weather	Transect (km)
6th June 2019	Úna Nealon & Dáire O'Shaughnessy	Dusk	21:55	7-11˚; dry; calm	4.88
22nd July 2019	Úna Nealon & Laoise Kelly	Dusk	21:45	19-20˚; dry; light breeze with strong gusts	18.16
16th October 2019	Laoise Kelly & Julie O'Sullivan	Dusk	18:31	8-9˚; dry; gentle breeze	11.69
Total Survey Effort					**34.73**

3.3.1.4 Ground-level Static Surveys (2019)

Where developments have more than 10 turbines, SNH requires 1 detector per turbine up to 10 turbines plus a third of additional turbines. Given that 21 turbines are proposed 16 detectors were deployed to ensure compliance with SNH guidance.

At the survey scoping stage, the draft turbine layout comprised 28 turbines therefore in accordance with SNH, 2019 automated bat detectors were deployed at 16 no. locations. These were numbered according the 28 turbine layout and left in situ for at least 10 nights in each of spring (April-May), summer (June-mid August) and autumn (mid-August-October) as required by SNH, 2019.

Detectors were numbered utilising an initial indicative layout that included 28 turbines. As outlined in the EIAR, the extent of the proposed development changed through the design process, and the number of turbines reduced to 21. However, the number of static detectors remained the same with some micro siting carried out to account for changes to turbines locations, as required.

Detector locations achieved a good spatial spread in relation to proposed turbines and sampled the range of available habitats. The detectors and associated turbine numbering are included in Table 3.2 below.

Tree/Scrub removal may be required where turbines are proposed in areas of birch scrub within the site. This involves removing an area required to construct the turbine and associated infrastructure thus creating open areas, around proposed turbines. The buffer size is typically 50m from turbine blade tip to forestry/scrub edge, and these areas usually remain open during the wind farm lifetime.

Following the buffer calculation (as seen in section 6.1.3), using a number of hub height vs. blade length scenarios within the 185m tip envelope, the largest buffer width achieved was 85m. This was conservatively rounded up to 100m and applied as a design constraint to all areas of commercial forestry or native woodland.

Where tree/scrub removal is proposed, detectors were located along nearby forestry/scrub 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 3.1.

Table 3-2 Ground-level Static Detector Locations

Corresponding Turbine no.(s)	Detector ID	Location	Habitat	Linear Feature within 50m
T18 and T21	D03	E209702 N216807	Forestry edge	Immature tree stands
T19 and T20	D04	E209455 N216032	Open bog	No
T17	D05	E209968 N216037	Forestry break	Immature tree line
T13	D06	E209430 N214693	Willow scrub, adjacent to railway.	Immature trees & willow scrub
T14, T15 and T16	D08	E210254 N214374	Milled peat	No
T12 and T17	D09	E210164 N215424	Birch scrub/woodland edge & peat track adjacent	Immature trees, birch scrub & peat track
T12	D11	E209363 N215313	Peat bank next to silt pond.	Immature tree stands & scrub
T1	D13	E207187 N215384	Revegetating milled peat, rocky outcrop	No
T2	D14	E207344 N214624	Scattered willow scrub, cutaway bog	Scrub
T7 and T8	D16	E205328 N214847	Treeline/scrub	Peat track, treelines & scrub
T10 and T11	D17	E205145 N214279	Forestry break	Peat track, treelines & scrub
T9	D18	E205789 N214368	Bog drain, scrub, milled peat	Peat track, immature trees & scrub
T5	D19	E207042 N212573	Milled peat, gravel mound	No
T3 and T4	D21	E206653 N213271	Milled peat	No
T6	D22	E206425 N214395	Willow & conifer scrub, very wet ground – Common reed grass abundant adjacent to milled peat track	Immature trees & scrub
Former Potential Turbine Location	D23	E207319 N213890	Heather scrub between railway & conifer (WD4) with birch/willow edge.	Railway track, treelines & scrub

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 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). The location of the weather monitoring station is depicted on Figure 3.1.

Table 3.3 summarises survey effort achieved in 2019 for each of 16 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	24th May – 6th June 2019	13	13
Summer	22nd July – 12th August 2019	21	17
Autumn	26th September – 16th October 2019	21	19
Total Survey Effort		**55**	**49**

3.3.2 2018 Field Surveys to BCT Guidance

Survey design and effort in 2018 was created in accordance with the best practice guidelines available at the time (Hundt, 2012). Minimum survey standards for bat surveys at proposed wind turbine developments are presented in **Appendix 5**. The potential risk level of the development was assessed in relation to site characteristics (Hundt, 2012) using desk study results and initial habitat assessments. The scope of the 2018 surveys are provided below. The results of the 2018 field surveys can be found in **Appendix 6**.

3.3.2.1 Bat Habitat Suitability Appraisal

Bat walkover surveys were carried out throughout 2018. During these surveys, habitats within the Study Area were assessed for their suitability to support roosting, foraging and commuting bats. Connectivity with the wider landscape was also considered. Suitability was assessed according to Collins (2016) which provides a grading protocol for roosting habitats and for commuting and foraging areas. Suitability categories are divided into *High*, *Moderate*, *Low* and *Negligible*, and are described fully in **Appendix 1**. Results of the bat habitat suitability appraisal for 2018 is included in **Appendix 6**.

3.3.2.2 Roost Surveys (2018)

A search for bat roosts was undertaken within the Study Area throughout 2018. The aim was to determine the presence of roosting bats and the need for further survey work or mitigation. The site was visited monthly between April and October 2018. 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. Trees 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 tree roost features identified by Andrews (2013).

One structure was identified (IG Ref: N 08042 14688) and was subject to a roost assessment (Figure 3.1). Emergence and re-entry surveys were carried out at this abandoned dwelling in May and August 2018 in accordance with Collins (2016). Two surveyors were equipped with Bat Logger M bat detectors (Elekon AG, Lucerne, Switzerland). Emergence surveys commenced 30 minutes before sunset and concluded 1.5 hours after sunset. The purpose was to identify bat species, numbers, access points and roosting locations throughout the bat activity season.

3.3.2.3 Manual Transects (2018)

Manual activity surveys comprised walked transects at dusk and at dawn. The aim of these surveys was to identify bat species using the site and gather any information on bat behavior and important features used by bats.

A series of representative transect routes were chosen throughout the proposed development 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 rail tracks.

During each manual survey, transects were walked by two surveyors, recording bats in real time using Batlogger M bat detectors (Elekon AG, Lucerne, Switzerland). Dusk surveys commenced 30 mins before sunset and were completed within three hours after sunset. Dawn surveys commenced 1.5-2 hours before sunrise and finished at sunrise. The order of transects as well as the start and finish points were alternated between survey nights across the season, to allow for varying emergence times of different bat species.

Manual transects were undertaken monthly between April and October 2018. Table 3.4 describes survey effort with regard to manual transects in 2018. Transect routes are presented in Figures 3.6 - 3.12 (**Appendix 6**)

Table 3-4 2018 Survey Effort - Manual Transects

Date	Type	Sunset/rise	Surveyor	Effort (km)	Effort (hr)
19th April 2018	Dusk	20:38	Úna Nealon & Julie O'Sullivan		3.06 + 3.1
20th April 2018	Dawn	06:23	Úna Nealon & Julie O'Sullivan	21.93	1.04
28th May 2018	Dusk	21:40	Úna Nealon & John Hehir		3.10
29th May 2018	Dawn	05:15	Úna Nealon & John Hehir	17.81	0.56
26th June 2018	Dusk	22:02	Julie O'Sullivan & Paddy Manley		3.18 + 2.45
27th June 2018	Dawn	05:07	Julie O'Sullivan & Paddy Manley	19.13	2.00 + 2.00
25th July 2018	Dusk	21:37	Julie O'Sullivan & Paddy Manley		3.33 + 3.27
26th July 2018	Dawn	05:38	Julie O'Sullivan & Paddy Manley	20.85	1.51 + 1.48
23rd August 2018	Dusk	20:42	Úna Nealon & Julie O'Sullivan		2.34 + 3.12
24th August 2018	Dawn	06:30	Úna Nealon & Julie O'Sullivan	19.13	1.20 + 2.00
20th Sept 2018	Dusk	19:35	Julie O'Sullivan & Paddy Manley		3.00 + 3.38
21st Sept 2018	Dawn	07:15	Julie O'Sullivan & Paddy Manley	19.13	1.52 + 1.30
25th October 2018	Dusk	18:18	Julie O'Sullivan & Paddy Manley		2.20 + 2.40
26th October 2018	Dawn	08:18	Julie O'Sullivan & Paddy Manley	20.63	1.02 + 1.42
Total Manual Transect Effort				**138.61**	**58.48**

3.3.2.4 Ground-level Static Surveys (2018)

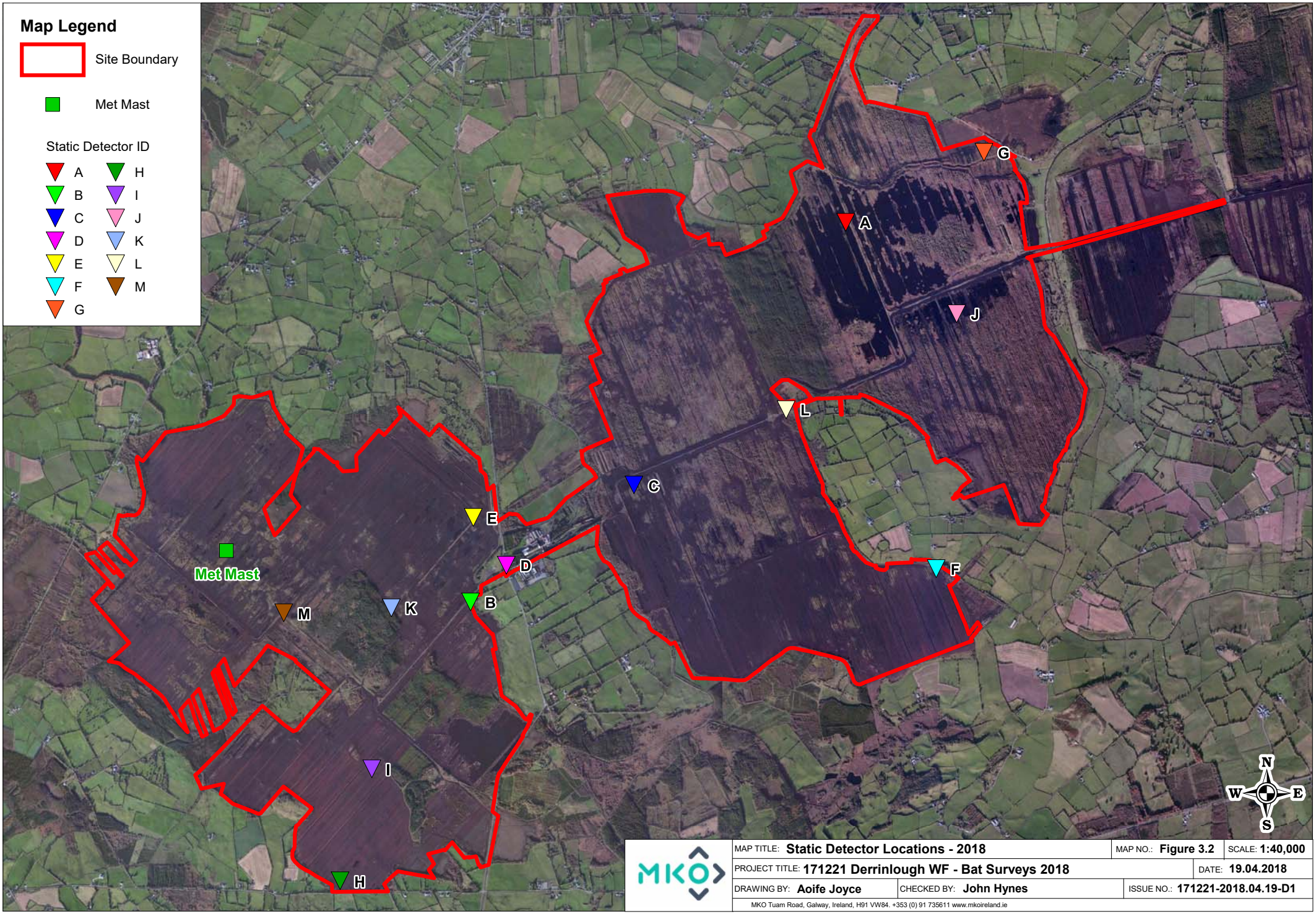
Automated bat detector systems deployed at ground level were used to record activity in fixed locations over prolonged periods of time. Locations of static detectors were selected to represent the range of habitats present within the site, including favourable bat habitats and turbine locations.

Full spectrum bat detectors, Song Meter SM4BAT (Wildlife Acoustics, Maynard, MA, USA), were deployed during static surveys. 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. Detectors were left in place for at least 5 consecutive nights per month between April and October 2018 (Hundt, 2012).

Table 3.5 describes static detector deployments and survey effort. The locations of all 2018 static detectors are displayed in Figure 3.2.

Table 3-5 2018 Survey Effort - Ground-level Static Surveys

ID	Survey Period	Grid Ref	Habitat	No. Nights
A	19th April – 28th May 2018	E210968 N217610	Open habitat along railway. Willow tree on lake edge.	39
B	19th April – 22nd May 2018	E207762 N214375	Birch treeline. Edge of bare peat & improved grassland.	33
C	28th May – 13th July 2018	E209158 N215372	Willow scrub patch in bare peat.	46
D	29th May – 27th June 2018	E208068 N214687	Edge of broadleaf woodland.	29
E	27th June – 26th July 2018	E207785 N215093	Scrub patch in milled peat.	29
F	26th July – 30th July 2018	E211741 N214664	Birch scrub. Edge of bare peat.	4
G	25th July – 29th July 2018	E212149 N218208	Treeline in cutover bog.	4
H	26th July – 14th August 2018	E206648 N211999	Scrub along drainage ditch in milled peat	19
I	23rd August – 20th September 2018	E206918 N212952	Island of disturbed ground/scrub in milled peat.	28
J	24th August – 22nd September 2018	E211916 N216833	Scrub adjacent to wetland.	29
K	21st September – 21st October 2018	E207085 N214322	Edge of conifer plantation, adjacent to bare peat.	30
L	26th October – 21st November 2018	E210459 N216014	Scrub along railway line.	26
M	26th October – 10th November 2018	E206166 N214279	Birch tree in scrub along drainage ditch in area of milled peat.	15
Total Ground Level Survey Effort				**331**



MAP TITLE: **Static Detector Locations - 2018**		MAP NO.: **Figure 3.2**	SCALE: **1:40,000**
PROJECT TITLE: **171221 Derrinlough WF - Bat Surveys 2018**			DATE: **19.04.2018**
DRAWING BY: **Aoife Joyce**	CHECKED BY: **John Hynes**	ISSUE NO.: **171221-2018.04.19-D1**	

MKO Tuam Road, Galway, Ireland, H91 VW84. +353 (0) 91 735611 www.mkoireland.ie

3.3.2.5 Surveys at Height (2018)

Simultaneous surveying at ground level and at height was also undertaken throughout 2018. Monitoring at height can provide useful information on bat activity within the rotor sweep area and is particularly relevant at proposed key-holed sites (SNH, 2019). One Song Meter SM3BAT detector (Wildlife Acoustics, MA, USA) was installed on a meteorological mast within the proposed development site on Clongawny Bog (Grid Ref: E205664 N214813). The detector was equipped with two microphones; one at ground level and one at height (approx. 75 m above ground level). Table 3.6 describes survey effort and the location of the met mast is illustrated in Figure 3.2. Results for 2018 surveys at height can be viewed in **Appendix 6**.

Table 3-6 2018 Survey Effort - Surveys at Height

ID	Survey Period	No. Hours	No. Nights
Mast – 1	3rd May – 15th May 2018	111.77	12
Mast – 2	26th June – 12th July 2018	127.20	16
Mast – 3	25th July – 7th August 2018	112.92	13
Mast – 4	24th August – 4th September 2018	120.12	11
Mast – 5	20th September – 28th September 2018	98.23	8
Mast – 6	25th October – 31st October 2018	95.15	6
Total at Height Survey Effort		**665.39**	**66**

3.4 Bat Call Analysis

All recordings from 2018 and 2019 were later analysed using bat call analysis software Kaleidoscope Pro v.5.1.9 (Wildlife Acoustics, MA, USA). The aim of this was to identify, to a species or genus level, what bats were present at the proposed development site. Bat species were identified using established call parameters, to create site specific custom classifiers 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) 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.

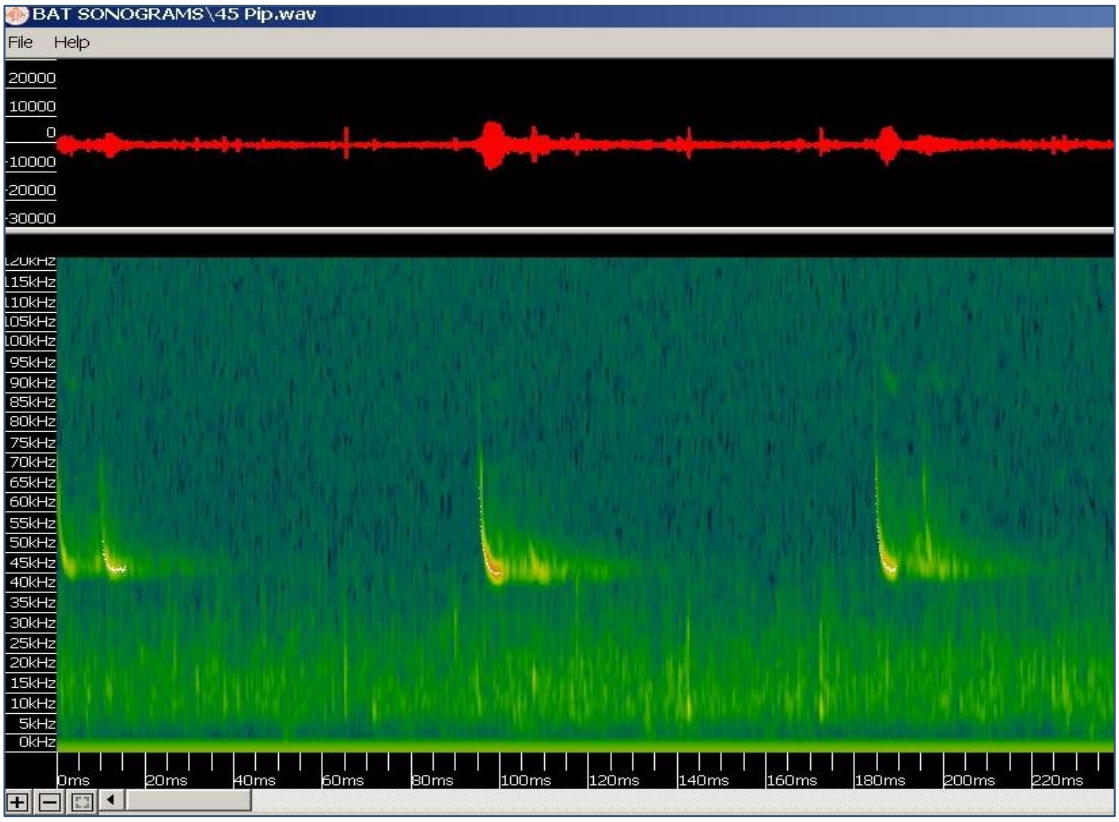


Plate 3-1 Sonogram of Echolocation Pulses of Common Pipistrelle (Peak Frequency 45kHz)

3.5 Assessment of Bat Activity Levels

Static detector monitoring results were uploaded to the online database tool Ecobat (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 Ecobat dataset to provide increasingly robust outputs. Ecobat generates a percentile rank for each night of activity and provides a numerical way of interpreting levels of bat activity in order to provide objective and consistent assessments. Table 3.7 defines bat activity levels as they relate to Ecobat percentile values (SNH, 2019).

2019 static detector at ground level results for the proposed development were uploaded in November 2019 and 2018 static detector at ground level results were uploaded on December 2019. Database records used in analyses were limited to those within a similar time of year (within 30 days of recording) 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 4.7 in the results section below.

Table 3-7 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, an adapted assessment of vulnerability for Irish bat populations is provided. 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 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)

3.6.3 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 were undertaken at the Proposed Development site in 2018 and 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. It is supplemented by additional data derived from surveys undertaken on the site in 2018 which were designed in accordance with the Bat Conservation Trust's guidelines for wind turbine developments (Hundt, 2012).

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. SURVEY RESULTS

4.1 Consultation

A detailed scoping exercise was undertaken for the proposed wind farm. This is described fully in Chapter 2 of the 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 14th February 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 a central point within the proposed site boundary (Grid Ref: E208260 N214907; last search 29/11/2019). At least four of Ireland's nine resident bat species were recorded including common and soprano pipistrelles, Leisler's 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

Grid Square	Species	Record Count	Latest Record	Dataset
N01	Daubenton's bat	36	26/08/2014	National Bat Database of Ireland
N01	Lesser Noctule	2	18/05/2012	Ireland's BioBlitz
N01	*Pipistrelle* sp.	2	18/05/2012	Ireland's BioBlitz
N01	Soprano pipistrelle	2	18/05/2012	Ireland's BioBlitz
N11	Daubenton's bat	4	18/05/2012	Ireland's BioBlitz
N11	*Pipistrelle* sp.	2	18/05/2012	Ireland's BioBlitz
N11	Soprano pipistrelle	2	18/05/2012	Ireland's BioBlitz
N02	Daubenton's bat	9	02/09/2014	National Bat Database of Ireland
N02	Soprano pipistrelle	1	26/05/2009	National Bat Database of Ireland
N12	Daubenton's bat	2	26/05/2009	National Bat Database of Ireland
N12	Lesser Noctule	1	26/05/2009	National Bat Database of Ireland
N12	Soprano pipistrelle	2	26/05/2009	National Bat Database of Ireland

4.2.2 Bat Species Range

The potential for negative impacts is likely to increase where there are high risk species at the edge of their range (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 development site is located outside the current range for Lesser horseshoe bat and Whiskered bat, partially outside and on the edge of the range for Natterers Bat and Nathusius' pipistrelle and within range but not at the edge for all other species.

4.2.3 Designated Sites

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

sites designated for the conservation of bats. Four pNHAs, containing bat roosts, were identified within 10km of the site boundary (Table 4.2).

Table 4-2 pNHAs with Known Bat Roosts

Site Code	Site Name	Results	Year	Distance from site boundary
002058	Bracken's Dwelling, near Whiteford	Nursery roost for Leisler's bat colony - located outside of the required survey distance from the proposed development site.	1992+	8.5km
000569	Birr (Domestic Dwelling No. 1, Occupied)	Nursery roost for Leisler's bat colony - located outside of the required survey distance from the proposed development site.	1987+	7.2km
000568	Birr (Domestic Dwelling No. 2, Occupied)	Nursery roost for Leisler's bat colony - located outside of the required survey distance from the proposed development site.	1989+	7.3km
002059	Cloghanbeg	Nursery roost for Leisler's bat colony - located outside of the required survey distance from the proposed development site.	1992+	6.5km
000567	Banagher (Domestic Dwelling, Occupied)	Brown long-eared roosting bats - located outside of the required survey distance from the proposed development site.	1987+	0.7km

A search for roosts was carried out within 200m plus the rotor radius (i.e. 150m) of the boundary of the proposed development (SNH, 2019).

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 recent land use within the proposed development site is peat extraction.

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 University of Bristol Spelaeological Society (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 27.89 (yellow). This indicates that the proposed development area has 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 Site

Wind Farm Name and Location	No. Turbines	Status
Cloghan Wind Farm, Co. Offaly	9	*Permitted
Meenwaun Wind Farm, Co. Offaly	5	1 permitted, 4 constructed and operational
Leabeg Wind Farm, Co. Offaly	2	Operational

*Modification application underway.

4.3 Overview of Study Area and Bat Habitat Appraisal

The study area is dominated by two large cutover raised bogs with smaller areas of commercial coniferous forestry, birch scrub and re-vegetating bare peat. Peat extraction has currently ceased within the proposed development site since 2019. Peat extraction in some areas within the site has been inactive for longer, therefore, vegetation, dominated primarily by birch scrub, common cottongrass and marsh arrowgrass, has regenerated over much of these areas. There are a number of Bord na Móna rail lines that pass through the bog providing transport for milled peat. The land-use/activities within the proposed site comprise a mix of bare cutover and cutaway peat, re-vegetation of bare peat, commercial forestry, telecommunications (an existing 30m wind monitoring mast), wind measurement (a single 100m anemometry mast on Clongawny Bog) and the Derrinlough Briquette Factory.

The main habitat types on the site include cutover bog habitats with a vegetative composition similar to degraded dry and wet heath type communities (dominated by Ling heather), woodlands and scrub (dominated by birch), poor fen, bare peat communities and small areas of grasslands (occurring alongside railway tracks). A large area of open water and reed swamp occurs to the east of the study area within an area known as the Drinagh wetlands. Another large wetland also occurs within the south-eastern portion of the Clongawny peatland, adjacent to the N62. Small mineral islands/derries also occur within the site and are dominated by native oak woodlands.

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 hedgerows. 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 as well as birch scrub. Overall trees within the site did not provide optimal habitat for roosting bats and were assessed as having *Negligible – Low* roosting potential.

One structure (IG Ref: N 08042 14688) was identified within the Study Area and was subjected to a roost assessment, described in the following Section 4.4.

4.4 Roost Surveys 2018 and 2019

Following the roost surveys in 2018 and 2019, one structure (IG Ref: N 08042 14688) within the site boundary, which is being retained, was identified as a regular roost for bats (Figure 3.1). Emergence and re-entry surveys were carried out at this abandoned dwelling in May and August 2018, and June and July 2019 in accordance with Collins (2016). Tables 4.4 and 4.5 provide survey effort. Two surveyors were equipped with Bat Logger M bat detectors (Elekon AG, Lucerne, Switzerland). The unoccupied cottage had bat access points covered in ivy at the gable apex as well as gaps in the ridge tiles at the front of the building (Plate 4.1 and 4.2).

Plate 4-1 Ivy Cover at Rear of Identified Roost

Plate 4-2 Front Entrance of Identified Bat Roost

Table 4-4 2018 Roost Survey Results

Description	Survey	Date	Results
Unoccupied Cottage	Dawn	29/05/2018	6 Soprano pipistrelles
Unoccupied Cottage	Dusk and Dawn	23/08/2018 - 24/08/2018	Soprano pipistrelle; 5 emerging, 2 re-entering

Table 4-5 2019 Roost Survey Results

Description	Survey	Date	Results
Unoccupied Cottage	Dusk	06/06/2019	7 Common pipistrelle, 1 Soprano pipistrelle
Unoccupied Cottage	Dusk	22/07/2019	4 Soprano pipistrelle

The surrounding habitats were assessed as largely unsuitable for roosting bats and no evidence of bat use was recorded elsewhere during the roost assessment.

4.5 Manual Transects 2019

Manual transects were undertaken in spring, summer and autumn 2019. Bat activity was recorded on all surveys. In general, Soprano pipistrelle (n=240) was recorded most frequently, followed by common pipistrelle (n=126), Leisler's bat (n=103), *Myotis* sp. (n=12) and brown long-eared bat (n=1). However, species composition and activity levels varied significantly between surveys. Transect survey results were calculated as bat passes per km surveyed (to account for differences in survey effort). Plate 4.3 presents results for individual species per survey period.

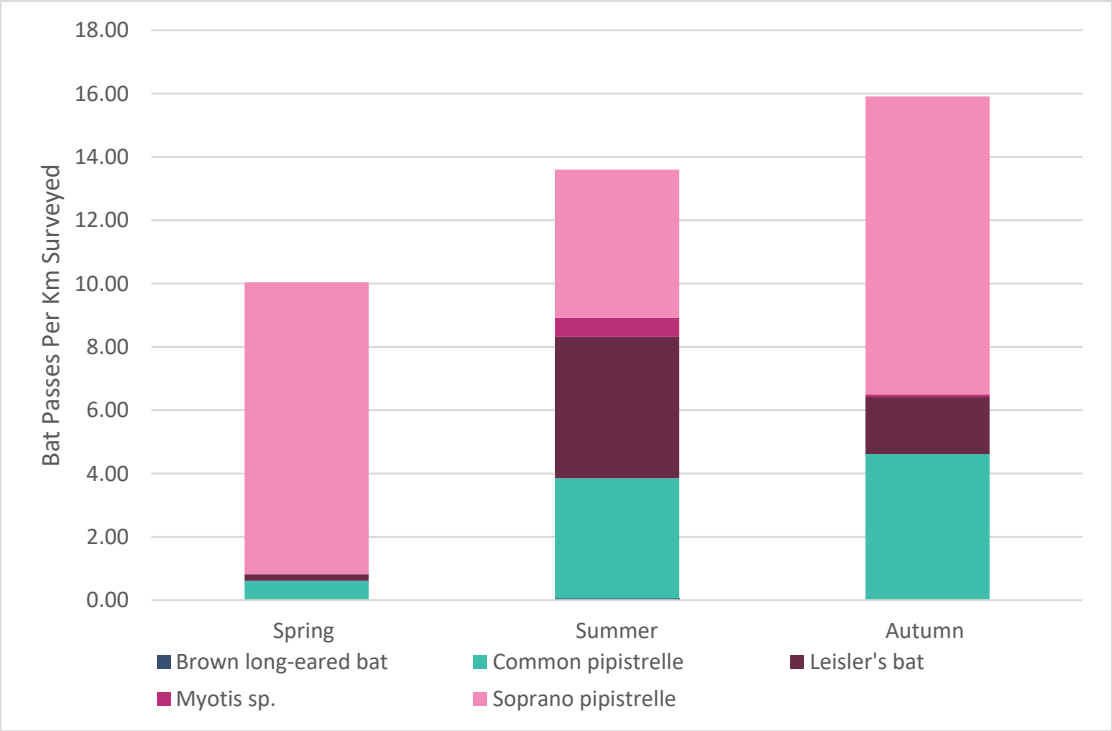


Plate 4-3 Walked Transect Results 2019 - Species Composition Per Survey Period

Figures 3.3-3.5 present the spatial distribution of bat activity across surveys. Bat activity was concentrated along the track beside the briquette factory (mature forestry edge habitats).

4.6 Ground-level Static Surveys 2019

In total, 34,557 bat passes were recorded across all deployments. In general, common pipistrelle (n=15,018), Leisler's bat (n= 9,007) and soprano pipistrelle (n=8,722) occurred most frequently, while instances of *Myotis* sp. (n=1,539) and brown long-eared bat (n=271) were significantly less. Plate 4.4 presents relative species composition across all ground-level static detector surveys.

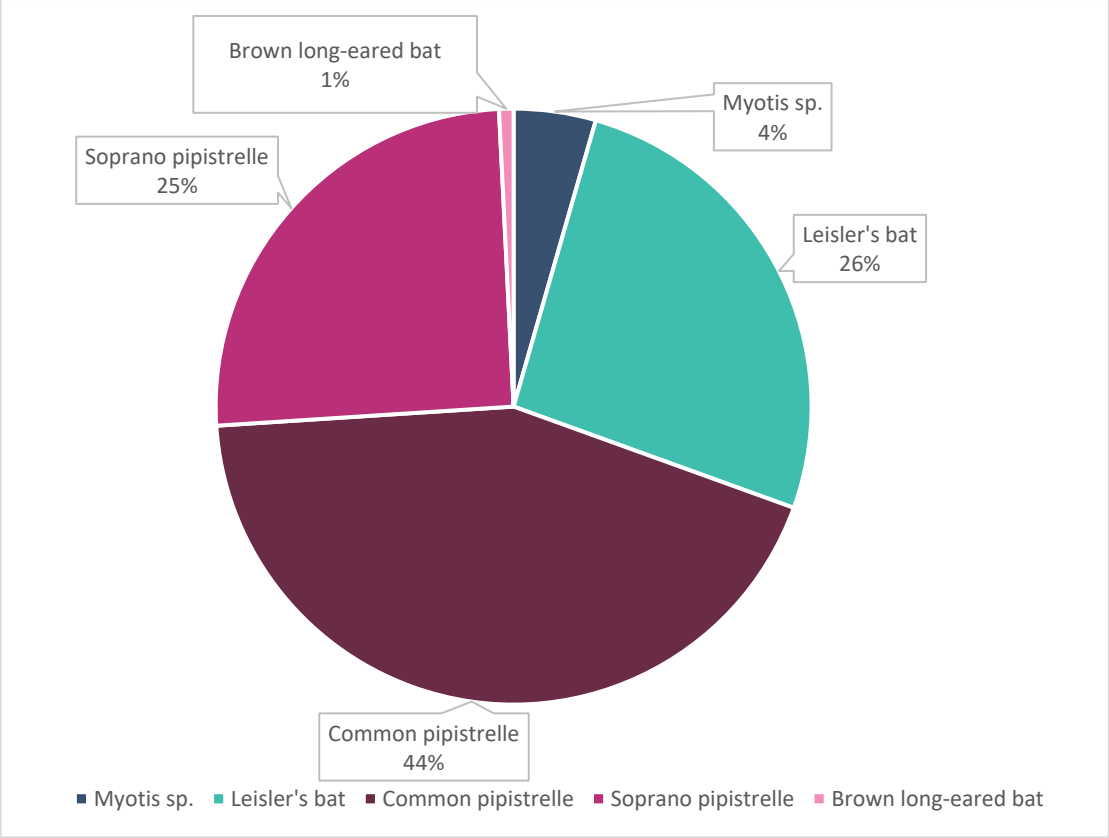


Plate 4-4 Static Detector Surveys: Species Composition Across All Deployments (Total Bat Passes)

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 4.5 and Table 4.6 presents these results for each species. Bat activity was dominated by Common pipistrelle and Leisler's bat in spring. In addition, Leisler's bat, common and soprano pipistrelle occurred frequently in summer. Instances of *Myotis* sp. were less frequent and brown long-eared bat were relatively rare.

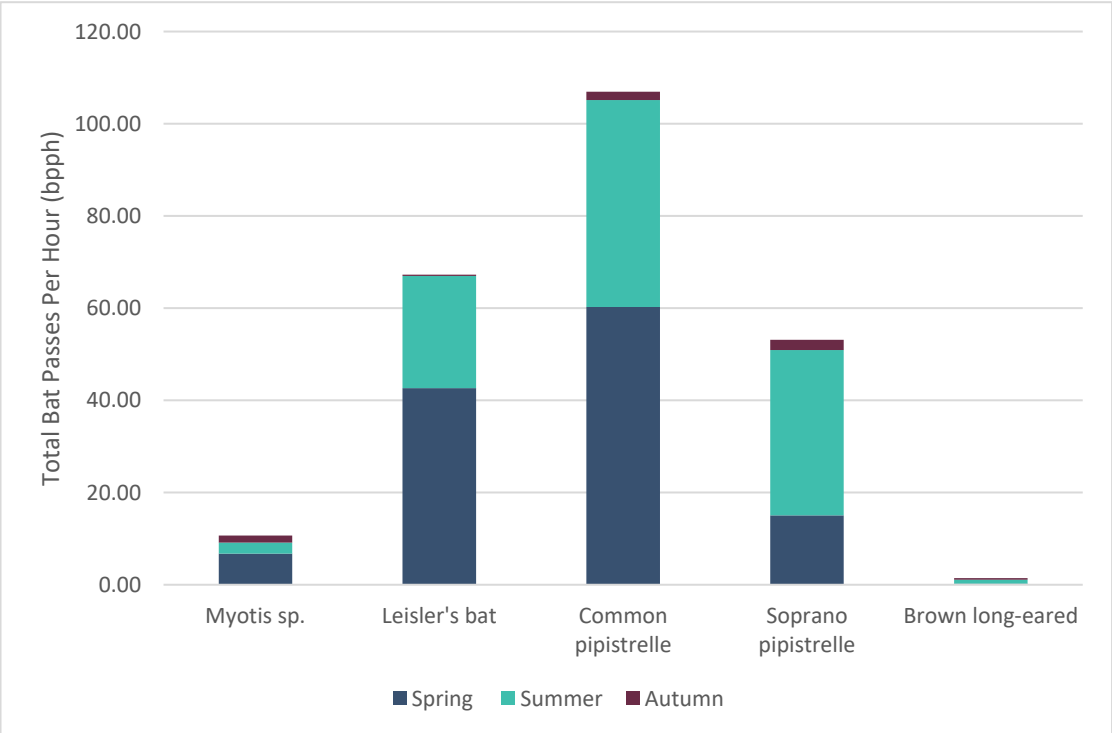


Plate 4-5 Static Detector Surveys: Species Composition Across All Deployments (Total Bat Passes Per Hour, All Nights)

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

	Spring	Summer	Autumn
Total survey hours	***104.9***	***183.4***	***255.5***
Myotis sp.	6.75	2.41	1.52
Leisler's bat	42.66	24.31	0.29
Common pipistrelle	60.24	44.91	1.81
Soprano pipistrelle	15.05	35.87	2.21
Brown long-eared bat	0.22	0.87	0.34

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 was variable between survey nights. Therefore, the median Nightly Pass Rate was used as the most appropriate measure of bat activity (Lintott & Mathews, 2018). Plate 4.6 illustrates the median Nightly Pass Rate per species per deployment. Zero data, when a species was not detected on a night, was also included.

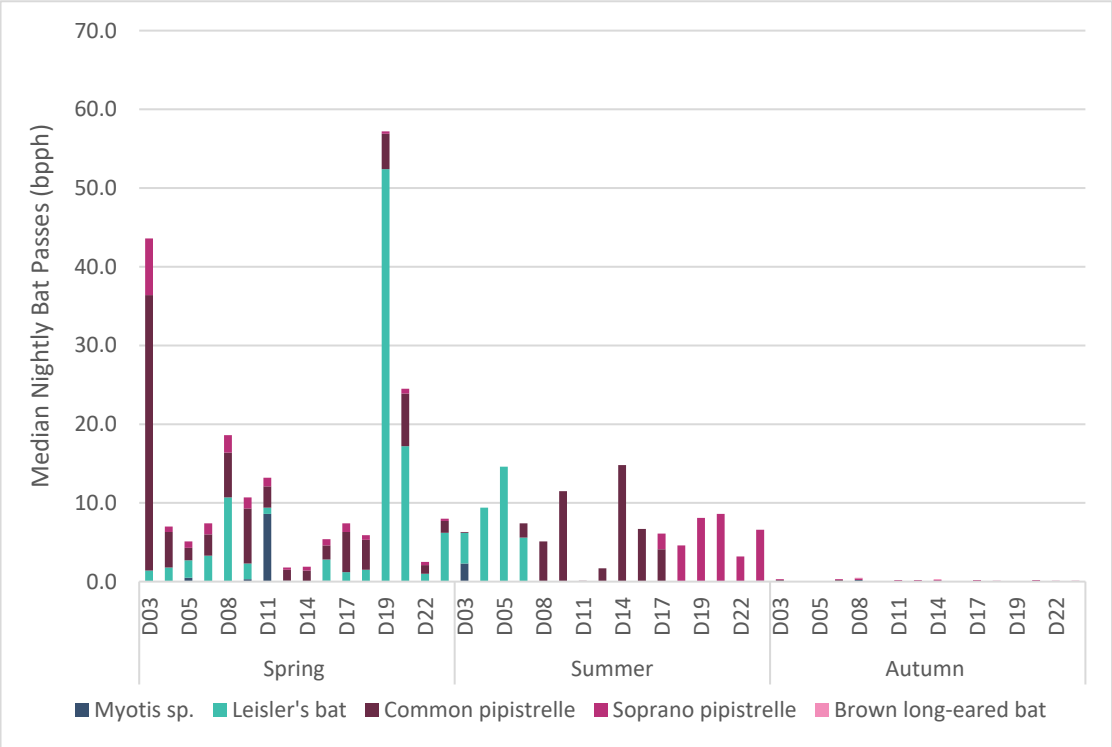


Plate 4-6 Static Detector Surveys: Median Nightly Pass Rate (Bat Passes Per Hour) Including Absences, Per Location Per Survey Period.

Leisler's bat activity at D19 during the spring period was significantly higher than all other deployments. Leisler's bat was also predominant at all other detectors during spring except at D03 which consisted primarily of common pipistrelle. Summer Leisler's activity was higher at D03, D04, D05 and D06 whereas all other detectors were dominated by soprano and common pipistrelle activity. Activity dropped significantly across all bat species for the autumn season.

Bat activity levels were objectively assessed against a reference dataset using Ecobat. Table 4.7 presents the results of Ecobat analysis for each species per season on a site-level. **Appendix 3** provides these results per detector. Median activity levels for common pipistrelle, soprano pipistrelle and Leisler's bat

peaked with ***Moderate to High*** during at least one season. Median activity for *Myotis* sp. peaked at ***Moderate*** activity and ***Low to Moderate*** for brown long-eared bat. Activity peaked with ***Moderate to High*** activity for brown long-eared bat and ***High*** activity for all other species during at least one season.

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

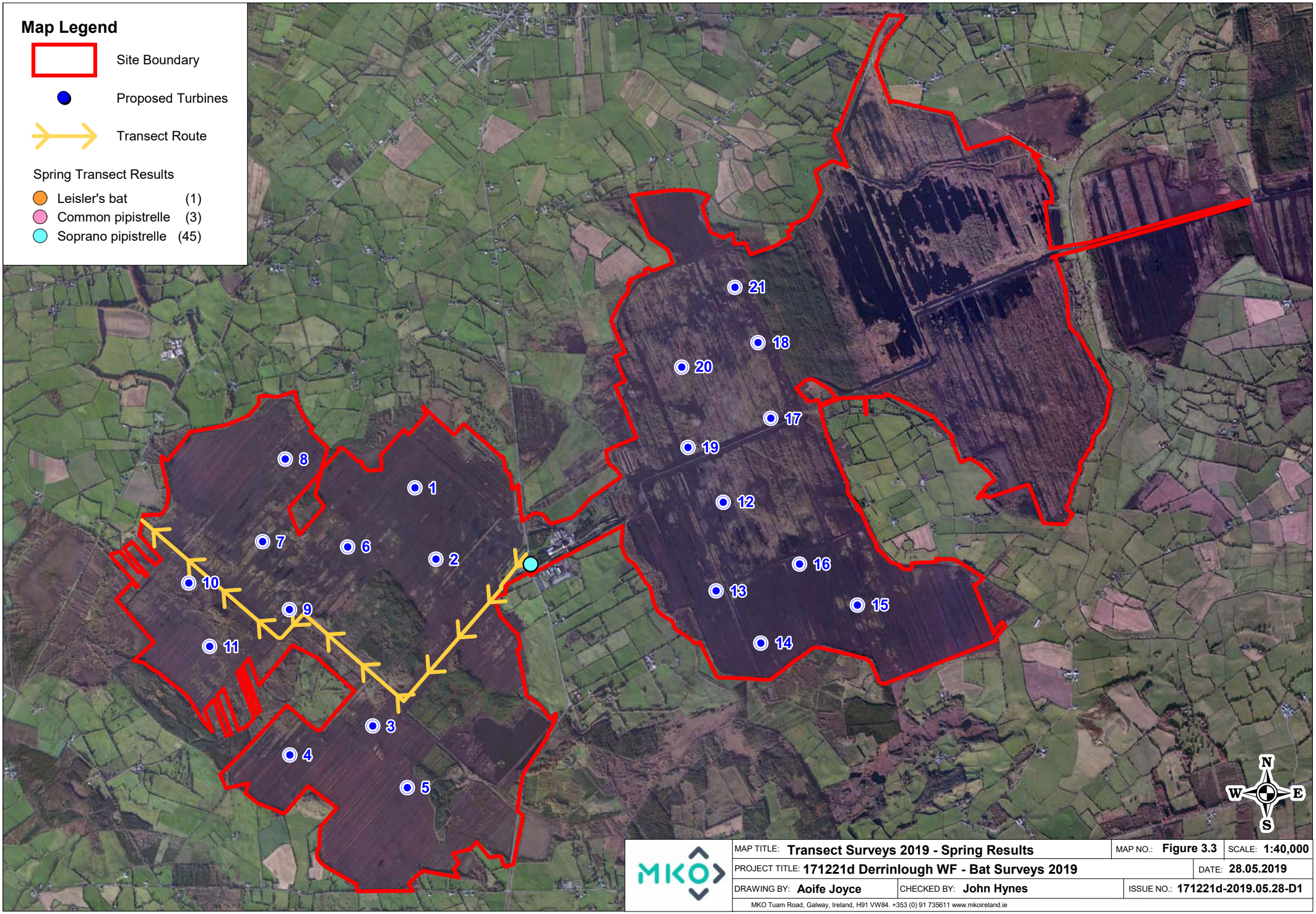
Survey Period	Median Percentile	Median Bat Activity	Max Percentile	Max Bat Activity	Nights Recorded	Ref Range
Common pipistrelle						
Spring	68	Moderate - High	100	High	191	1184
Summer	77	Moderate - High	99	High	160	1509
Autumn	51	Moderate	94	High	93	797
Soprano pipistrelle						
Spring	44	Moderate	95	High	185	1110
Summer	79	Moderate - High	96	High	135	1371
Autumn	51	Moderate	91	High	132	774
Leisler's bat						
Spring	69	Moderate - High	100	High	168	1167
Summer	82	High	98	High	98	1115
Autumn	29	Low - Moderate	74	Moderate - High	47	558
***Myotis* sp.**						
Spring	24	Low - Moderate	98	High	78	625
Summer	60	Moderate	84	High	33	916
Autumn	51	Moderate	95	High	100	667
Brown long-eared bat						
Spring	10	Low	44	Moderate	19	250
Summer	39	Low - Moderate	73	Moderate - High	27	608
Autumn	29	Low - Moderate	60	Moderate	65	452

4.7 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).

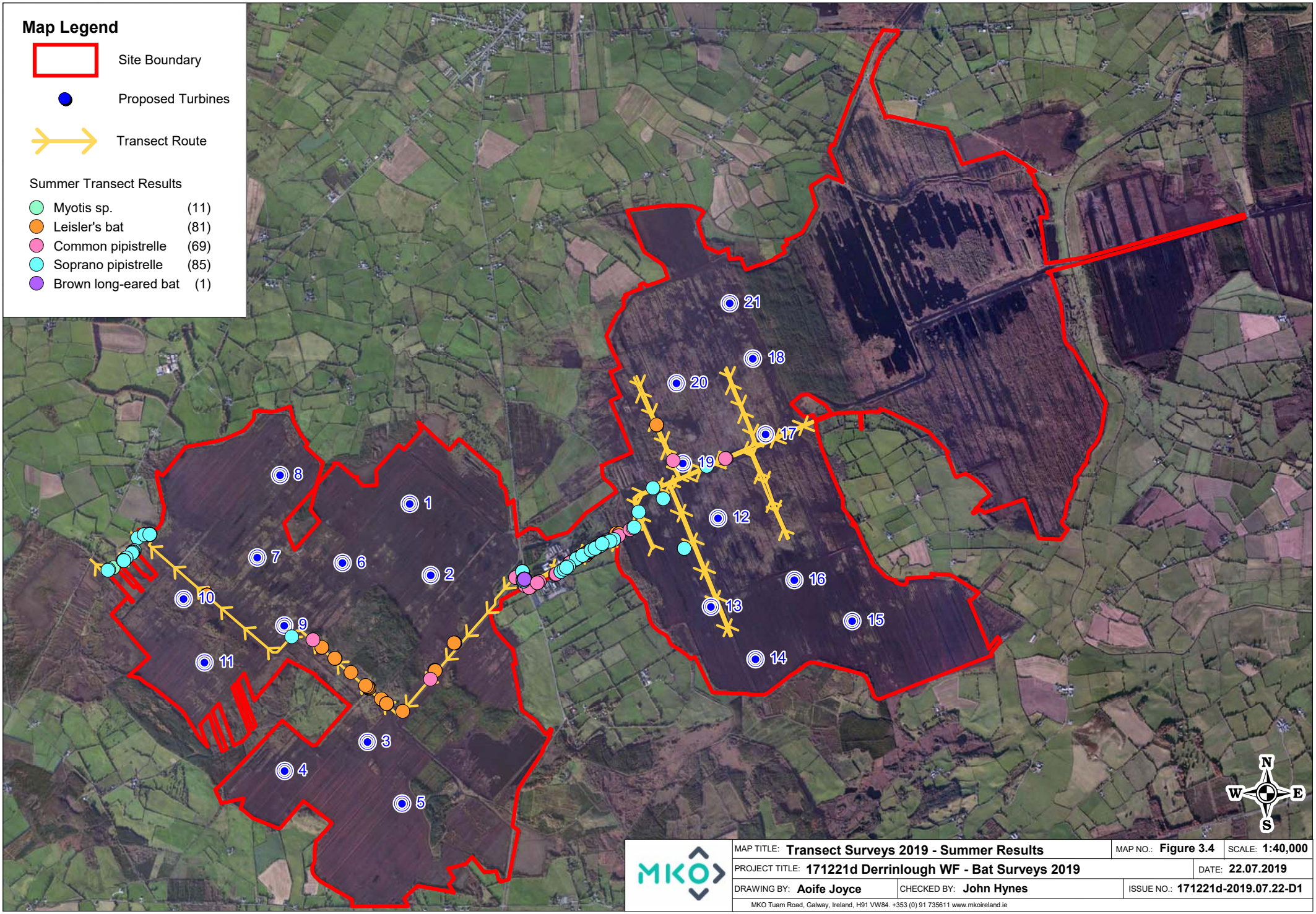
All bat species in Ireland are protected under the Bonn Convention (1992), Bern Convention (1982) and the EU Habitats Directive (92/43/EEC). Additionally, in Ireland bat species are afforded further protection under the Birds and Natural Habitats Regulations (2011) and the Wildlife Acts 1976-2017. No bat roosts were identified within the footprint of the proposed development. Following the surveys undertaken and reported above, 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.

A bat roost of ***Local Importance*** was identified within the site boundary. A maximum of 6 – 7 pipistrelle bats were identified leaving the roosting site. No roosting site of National Importance (i.e. site greater than 100 individuals) was recorded. The identified roost has been avoided by the proposed development.



MAP TITLE: **Transect Surveys 2019 - Spring Results**		MAP NO.: **Figure 3.3**	SCALE: **1:40,000**
PROJECT TITLE: **171221d Derrinlough WF - Bat Surveys 2019**			DATE: **28.05.2019**
DRAWING BY: **Aoife Joyce**	CHECKED BY: **John Hynes**		ISSUE NO.: **171221d-2019.05.28-D1**

MKO Tuam Road, Galway, Ireland, H91 VW84. +353 (0) 91 735611 www.mkoireland.ie

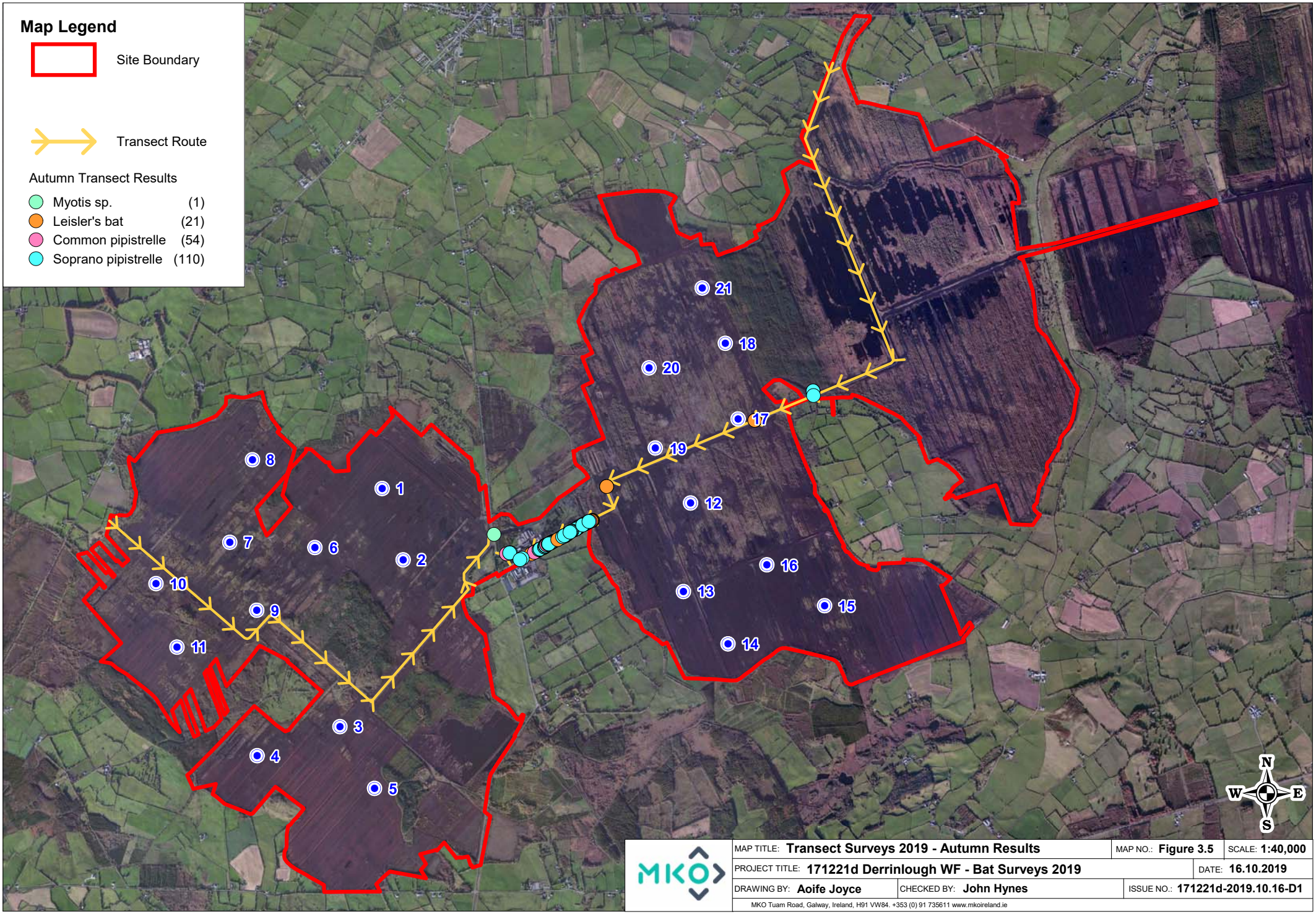


MAP TITLE: **Transect Surveys 2019 - Summer Results** | MAP NO.: **Figure 3.4** | SCALE: **1:40,000**

PROJECT TITLE: **171221d Derrinlough WF - Bat Surveys 2019** | DATE: **22.07.2019**

DRAWING BY: **Aoife Joyce** | CHECKED BY: **John Hynes** | ISSUE NO.: **171221d-2019.07.22-D1**

MKO Tuam Road, Galway, Ireland, H91 VW84. +353 (0) 91 735611 www.mkoireland.ie



MAP TITLE: **Transect Surveys 2019 - Autumn Results**		MAP NO.: **Figure 3.5**	SCALE: **1:40,000**
PROJECT TITLE: **171221d Derrinlough WF - Bat Surveys 2019**			DATE: **16.10.2019**
DRAWING BY: **Aoife Joyce**	CHECKED BY: **John Hynes**		ISSUE NO.: **171221d-2019.10.16-D1**

MKO Tuam Road, Galway, Ireland, H91 VW84. +353 (0) 91 735611 www.mkoireland.ie

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; and
- 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 utilised 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	Small number of potential roost features identified within the site.	Low	Low
	Mix of bare cutaway peat, re-vegetation of bare peat within the site (Low foraging/commuting suitability) with isolated stands of conifer forestry and birch scrub.	Low	
	Connected to wider landscape by hedgerow habitats.	Moderate	
Project Size	Medium scale development (21 no. turbines)	Medium	Large
	Other wind energy developments 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 in an area of cutover bog with smaller areas of commercial coniferous forestry and re-vegetating bare peat. As per table 3a of the SNH Guidance (2019), it has been assigned a low habitat risk score. The proposed development includes 21 turbines of 185m in height. As per Table 3a, it is a medium project (21 turbines) but the turbines are greater than 100m in height and thus for the purposes of the assessment, it is considered to be a large project. It is also noted that there are few other wind farm developments in the wider area.

The cross tabulation of a large project on a low risk site results in an overall risk score of **Medium** (SNH 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; and
- Soprano pipistrelle.

The Overall Risk Assessment for high collision risk species is provided in the sections below. Overall Risk was determined, in accordance with Table 3b of 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 the 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

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 Spring and Autumn and ***High*** in Summer. Peak activity levels were ***High*** in Spring and Summer and ***Medium*** in Autumn (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 a cutover bog with low levels of bat activity recorded during the walked transects undertaken.

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

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

Survey Period	Site Risk	Typical Activity (Median)	Typical Risk Assessment (as per Table 3b SNH 2019)	Activity Peaks (Maximum)	Peak Risk Assessment (as per Table 3b SNH 2019)
Spring	Medium (3)	Moderate to High (4)	Typical Risk is Medium (12)	High (5)	Peak Risk is High (15)
Summer		High (5)	Typical Risk is High (15)	High (5)	Peak Risk is High (15)
Autumn		Low to Moderate (2)	Typical Risk is Medium (6)	Moderate to 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 and ***High*** at peak activity levels across all three seasons (See Table 5.3 below).

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

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

Table 5-3 Soprano pipistrelle - Overall Risk Assessment

Survey Period	Site Risk	Typical Activity (Median)	Typical Risk Assessment (as per Table 3b SNH 2019)	Activity Peaks (Maximum)	Peak Risk Assessment (as per Table 3b SNH 2019)
Spring	Medium (3)	Moderate (3)	Typical Risk is Medium (9)	High (5)	Peak Risk is High (15)
Summer		Moderate to High (4)	Typical Risk is Medium (12)	High (5)	Peak Risk is High (15)
Autumn		Moderate (3)	Typical Risk is Medium (9)	High (5)	Peak Risk is High (15)

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 a cutover bog 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)	Moderate to High (4)	Typical Risk is Medium (12)	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 (3)	Typical Risk is Medium (9)	High (5)	Peak Risk is High (15)

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 cutover bog and there will be no net loss of bat foraging/commuting habitat associated with the proposed wind farm development.

The development, including the creation of new road infrastructure, will have not significantly alter 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 located within a cutover bog with smaller areas of commercial coniferous forestry. The trees in the plantation do not provide potential roosting habitat of significance for bats. One derelict structure was identified within the proposed site boundary and was subjected to dusk and dawn activity surveys. A small number of bats were observed emerging and re-entering the building during the roost surveys, but the structure will be retained thus no loss of roost is anticipated.

Overall no roosting sites suitable for maternity colonies, swarming or hibernation will be impacted by the proposed development.

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

5.4 Displacement of Individuals or Populations

The development is predominantly located within a commercial cutover bog. There will be no net loss of linear landscape features for commuting and foraging bats and there will be no loss of any roosting site of ecological significance. The habitats on the site will remain suitable for bats and no significant displacement of individuals or populations is anticipated.

6. BEST PRACTICE AND MITIGATION MEASURES

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

6.1 Standard Best Practice Measures

6.1.1 Noise Restrictions

During the construction phase, plant and 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)

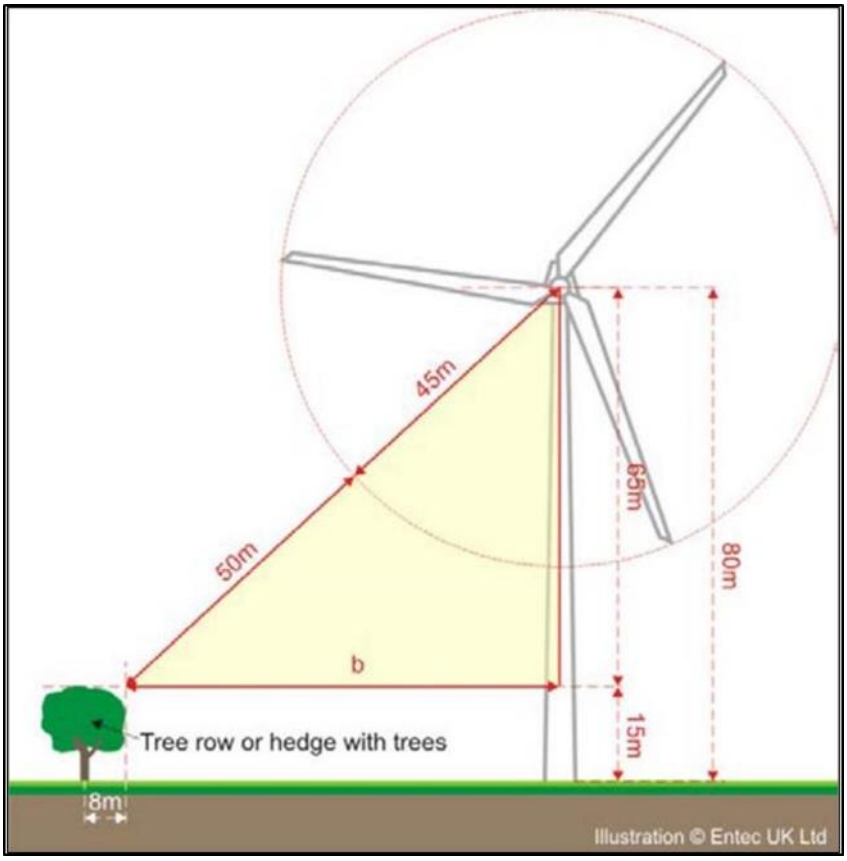


Plate 6-1 Calculate Buffer Distances (Natural England, 2014).

6.2 Site Specific Mitigation and Monitoring Programme

Overall risk levels for high collision risk bat species was typically ***Medium***. This risk level is reflective of the nature of the site, which is a commercial cutover bog 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 and nacelle level 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 and 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 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.

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.

8. BIBLIOGRAPHY

Abbott, I., Aughney, T., Langton, S. and Roche, N. (2015) BATLAS 2020 Pilot Project Report. Bat Conservation Ireland, Virginia, Cavan.

Amorim, F., Rebelo, H., & Rodrigues, L. (2012). Factors influencing bat activity and mortality at a wind farm in the Mediterranean region. Acta Chiropterologica, 14(2), 439-457.

Andrews, H. (2013) Bat Tree Habitat Key. AEcol, Bridgewater.

Arnett, E. B. (2006). A preliminary evaluation on the use of dogs to recover bat fatalities at wind energy facilities. Wildlife Society Bulletin, 34(5), 1440-1445.

Arnett, E. B., Baerwald, E. F., Mathews, F., Rodrigues, L., Rodríguez-Durán, A., Rydell, J., ... & Voigt, C. C. (2016). Impacts of wind energy development on bats: a global perspective. In Bats in the Anthropocene: Conservation of Bats in a Changing World (pp. 295-323). Springer International Publishing.

Aughney, T. (2008) An investigation of the impact of development projects on bat populations: Comparing pre- and post-development bat faunas. Irish Bat Monitoring Programme. Bat Conservation Ireland, Virginia, Cavan.

Aughney, T., Langton, S. and Roche, N. (2011) Brown long-eared bat roost monitoring scheme for the Republic of Ireland: synthesis report 2007-2010. Irish Wildlife Manuals, No.56. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.

Aughney, T., Langton, S. and Roche, N. (2012) All Ireland Daubenton's Bat Waterway Monitoring Scheme 2006-2011. Irish Wildlife Manuals, No. 61. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Ireland.

Barataud, M. and Tupinier, Y. Écologie acoustique des chiroptères d'Europe: identification des espèces, étude de leurs habitats et comportements de chasse. Biotope, 2012.

Baerwald, E. F., D'Amours, G. H., Klug, B. J., & Barclay, R. M. (2008). Barotrauma is a significant cause of bat fatalities at wind turbines. Current biology, 18(16), R695-R696.

Baerwald, E. F., & Barclay, R. M. (2009). Geographic variation in activity and fatality of migratory bats at wind energy facilities. Journal of Mammalogy, 90(6), 1341-1349.

BCI (2012a). Wind Turbine/Wind Farm Development Bat Survey Guidelines, Version 2.8, December 2012. Bat Conservation Ireland, Virginia, Co. Cavan

BCI (2012b) Bats and Appropriate Assessment Guidelines, Version 1, December 2012. Bat Conservation Ireland, Virginia, Co. Cavan Berthinussen, A., Richardson. O.C. and Altringham, J.D. (2014) Bat Conservation: Global evidence for the effects of interventions. Exeter: Pelagic Publishing.

Carden, R., Aughney T., Kelleher C. and Roche, N. (2010) Irish Bat Monitoring Schemes. BATLAS Republic of Ireland Report for 2008-2009.

Collins, J. (ed.) (2016) Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edn). The Bat Conservation Trust, London.

Collins, J., and Jones, G. (2009). Differences in bat activity in relation to bat detector height: implications for bat surveys at proposed windfarm sites. Acta Chiropterologica, 11(2), 343-350.

Cryan, Paul M., *et al.* (2014) Behavior of bats at wind turbines. Proceedings of the National Academy of Sciences 111.42: 15126-15131.

EUROBATS (2016) Report of the Intersessional Working Group on Wind Turbines and Bat Populations at 21st Meeting of the Advisory Committee, Zandvoort, the Netherlands, 18 – 20 April 2016.

Hein, C.D., Gruver, J. and Arnett, E.B. (2013). Relating pre-construction bat activity and post-construction bat fatality to predict risk at wind energy facilities: a synthesis. A report submitted to the National Renewable Energy Laboratory. Bat Conservation International, Austin, TX, USA.

Hill D., Fasham, M., Tucker P., Shewry, M. and Shaw, P (eds) (2005) Handbook of Biodiversity Methods: Survey, Evaluation and Monitoring, 433-449. Cambridge University Press, Cambridge.

Horn, J.W., Arnett, E.B. and Kunz, T.H. (2008). Behavioral responses of bats to operating wind turbines. Journal of wildlife management, 72(1), 123-132.

Hundt L. (2012) Bat Surveys: Good Practice Guidelines, 2nd edition. Bat Conservation Trust ISBN-13: 9781872745985.

Kelleher, C. and Marnell, F. (2006) Bat Mitigation Guidelines for Ireland. Irish Wildlife Manuals, No. 25. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.

Korner-Nievergelt, F., Brinkmann, R., Niermann, I., & Behr, O. (2013). Estimating bat and bird mortality occurring at wind energy turbines from covariates and carcass searches using mixture models. PloS one, 8(7), e67997.

Kunz, Thomas H., Edward B. Arnett, Brian M. Cooper, Wallace P. Erickson, Ronald P. Larkin, Todd Mabee, Michael L. Morrison, M. Dale Strickland, and Joseph M. Szewczak. Assessing impacts of wind-energy development on nocturnally active birds and bats: a guidance document. Journal of Wildlife Management 71, no. 8 (2007): 2449-2486.

Kunz, T.H. and Parsons, S. (2009). Ecological and Behavioral Methods for the Study of Bats, 2nd Edition. The Johns Hopkins University Press, USA.

Mathews, F., Swindells, M., Goodhead, R., August, T. A., Hardman, P., Linton, D. M., and Hosken, D. J. (2013). Effectiveness of search dogs compared with human observers in locating bat carcasses at wind-turbine sites: A blinded randomized trial. Wildlife Society Bulletin, 37(1), 34-40.

Mathews, F., Richardson, S., Lintott, P. and Hosken, D. (2016) Understanding the risk to European protected species (bats) at onshore wind turbine sites to inform risk management. Final Report. University of Exeter.

Mitchell-Jones, A. J. and McLeish, A. P. (2004). The Bat Worker's Manual, 3rd Edition. JNCC, Peterborough.

Mitchell-Jones, A.J. (2004). Bat Mitigation Guidelines. English Nature.
Montgomery, W. I., Provan, J., McCabe, A. M., and Yalden, D. W. (2014). Origin of British and Irish mammals: disparate post-glacial colonisation and species introductions. Quaternary Science Reviews, 98, 144-165.

NRA (2006a) Best practice guidelines for the conservation of bats in the planning of national road schemes. National Roads Authority, Dublin, Ireland.

NRA (2006b) Guidelines for the treatment of bats during the construction of national road schemes. National Roads Authority, Dublin, Ireland.

Natural England (2014). Bats and onshore wind turbines: interim guidance. Third Edition TIN051. English Nature.

Nealon, Ú.C. (2016) Bats and wind farms in Ireland: An assessment of current practices in surveying and monitoring. Oral presentation at the 1st Ecology and Evolution Ireland conference, Sligo.

Northern Ireland Environment Agency (2011) Bat Survey – Specific Requirements for Wind Farm Proposals.

Perrow, M. (Ed.). (2017). Wildlife and Wind Farms-Conflicts and Solutions, Pelagic Publishing Ltd.

Regini, K. (2000) Guidelines for ecological evaluation and impact assessment, In Practice: Bulletin of the Institute of Ecology and Environmental Management, 29, 1-7.

Roche, N., Langton, S. & Aughney T. (2012) Car-based bat monitoring in Ireland 2003-2011. Irish Wildlife Manuals, No. 60. National Parks and Wildlife Service, Department of the Arts, Heritage and the Gaeltacht, Ireland.

Roche, N., T. Aughney, F. Marnell, and M. Lundy (2014). Irish Bats in the 21st Century. Bat Conservation Ireland, Virginia, Co. Cavan, Ireland.

Roche, N., Aughney T. & Langton S. (2015) Lesser Horseshoe bat: population trends and status of its roosting resource. Irish Wildlife Manuals, No 85. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Ireland.

Rodrigues, L., L. Bach, M. J. Dubourg-Savage, B. Karapandža, D. Kovač, T. Kervyn, J. Dekker, A. Kepel, P. Bach, J. Collins, C. Harbusch, K. Park, B. Micevski, and J. Minderman (2015). Guidelines for consideration of bats in wind farm projects - Revision 2014. UNEP/EUROBATS Secretariat Bonn, Germany.

Russ, J. (2012). British bat calls: a guide to species identification. Pelagic publishing.

Rydell, J., Bach, L. Dubourg-Savage, M.-J., Green, M., Rodrigues, L. and Hedenström, A. (2010). Bat mortality at wind turbines in northwestern Europe. Acta Chiropterologica 12. 2: 261 – 274.

Schofield H. (2008). The Lesser Horseshoe Bat: Conservation Handbook. The Vincent Wildlife Trust, Ledbury, UK.

Schuster, E., L. Bulling, and J. Köppel (2015). Consolidating the State of Knowledge: A Synoptical Review of Wind Energy's Wildlife Effects. Environmental Management 56:300-331.

SNH (2019). Bats and onshore wind turbines: survey, Assessment and mitigation.

Wray, S., Wells, D., Long, E. and Mitchell-Jones, T. December (2010). Valuing Bats in Ecological Impact Assessment, CIEEM In-Practice.

Planning and Environmental Consultants

Bat Survey Report

Appendix 1 – Habitat Suitability Assessment

HABITAT SUITABILITY ASSESSMENT

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

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

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

Planning and Environmental Consultants

Bat Survey Report

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

SITE RISK ASSESSMENT

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

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

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

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

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

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

Planning and Environmental Consultants

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	Median Bat Activity	Max Bat Activity	Max Bat Activity Level
Spring	9	1167	D03	59	Moderate	79	Moderate/High
Spring	11	1167	D04	63	Moderate/High	84	High
Spring	10	1167	D05	71	Moderate/High	79	Moderate/High
Spring	13	1167	D06	71	Moderate/High	88	High
Spring	12	1167	D08	90	High	96	High
Spring	10	1167	D09	66	Moderate/High	84	High
Spring	79	1167	D11	52	Moderate	79	Moderate/High
Spring	5	1167	D13	31	Low/Moderate	52	Moderate
Spring	5	1167	D14	10	Low	40	Low - Moderate
Spring	12	1167	D16	69	Moderate/High	79	Moderate/High
Spring	11	1167	D17	59	Moderate	90	High
Spring	10	1167	D18	62	Moderate/High	78	Moderate/High
Spring	13	1167	D19	98	High	100	High
Spring	12	1167	D21	93	High	99	High
Spring	10	1167	D22	54	Moderate	82	High
Spring	13	1167	D23	81	High	87	High
Summer	22	1115	D03	79	Moderate/High	95	High
Summer	21	1115	D04	88	High	97	High
Summer	22	1115	D05	91	High	98	High
Summer	22	1115	D06	83	High	93	High
Summer	-	1115	D08	-	Nil	-	Nil
Summer	-	1115	D09	-	Nil	-	Nil
Summer	-	1115	D11	-	Nil	-	Nil
Summer	-	1115	D13	-	Nil	-	Nil
Summer	-	1115	D14	-	Nil	-	Nil
Summer	-	1115	D16	-	Nil	-	Nil
Summer	-	1115	D17	-	Nil	-	Nil
Summer	-	1115	D18	-	Nil	-	Nil
Summer	-	1115	D19	-	Nil	-	Nil
Summer	-	1115	D21	-	Nil	-	Nil
Summer	-	1115	D22	-	Nil	-	Nil
Summer	11	1115	D23	13	Low	39	Low - Moderate
Autumn	3	558	D03	51	Moderate	60	Moderate
Autumn	1	558	D04	29	Low/Moderate	29	Low - Moderate

Autumn	6	558	D05	56	Moderate	70	Moderate/High
Autumn	5	558	D06	29	Low/Moderate	70	Moderate/High
Autumn	5	558	D08	51	Moderate	66	Moderate/High
Autumn	-	558	D09	-	Nil	-	Nil
Autumn	2	558	D11	29	Low/Moderate	29	Low - Moderate
Autumn	1	558	D13	51	Moderate	51	Moderate
Autumn	8	558	D14	29	Low/Moderate	74	Moderate/High
Autumn	-	558	D16	-	Nil	-	Nil
Autumn	2	558	D17	40	Low/Moderate	51	Moderate
Autumn	3	558	D18	51	Moderate	60	Moderate
Autumn	8	558	D19	29	Low/Moderate	70	Moderate/High
Autumn	3	558	D21	29	Low/Moderate	60	Moderate
Autumn	-	558	D22	-	Nil	-	Nil
Autumn	-	558	D23	-	Nil	-	Nil

MYOTIS SP.

Survey Period	Nights Recorded	Ref Range	Detector ID	Median Bat Activity	Median Bat Activity	Max Bat Activity	Max Bat Activity Level
Spring	4	625	D03	28	Low/Moderate	36	Low/Moderate
Spring	4	625	D04	10	Low	31	Low/Moderate
Spring	12	625	D05	38	Low/Moderate	67	Moderate/High
Spring	4	625	D06	17	Low	24	Low/Moderate
Spring	4	625	D08	10	Low	10	Low
Spring	8	625	D09	38	Low/Moderate	72	Moderate/High
Spring	12	625	D11	86	High	98	High
Spring	1	625	D13	10	Low	10	Low
Spring	5	625	D14	24	Low/Moderate	59	Moderate
Spring	9	625	D16	24	Low/Moderate	40	Low/Moderate
Spring	4	625	D17	17	Low	31	Low/Moderate
Spring	2	625	D18	17	Low	24	Low/Moderate
Spring	-	625	D19	-	Nil	-	Nil
Spring	1	625	D21	10	Low	10	Low
Spring	4	625	D22	17	Low	36	Low/Moderate
Spring	4	625	D23	10	Low	24	Low/Moderate
Summer	22	916	D03	69	Moderate/High	84	High
Summer	-		D04	-	Nil	-	Nil
Summer	-		D05	-	Nil	-	Nil
Summer	-		D06	-	Nil	-	Nil
Summer	-		D08	-	Nil	-	Nil
Summer	-		D09	-	Nil	-	Nil
Summer	-		D11	-	Nil	-	Nil
Summer	-		D13	-	Nil	-	Nil
Summer	-		D14	-	Nil	-	Nil
Summer	-		D16	-	Nil	-	Nil
Summer	3	916	D17	13	Low	13	Low
Summer	-		D18	-	Nil	-	Nil
Summer	-		D19	-	Nil	-	Nil
Summer	-		D21	-	Nil	-	Nil
Summer	-		D22	-	Nil	-	Nil
Summer	8	916	D23	26	Low/Moderate	33	Low/Moderate
Autumn	8	667	D03	29	Low/Moderate	74	Moderate/High
Autumn	4	667	D04	29	Low/Moderate	66	Moderate/High
Autumn	8	667	D05	29	Low/Moderate	78	Moderate/High

Autumn	10	667	D06	63	Moderate/High	95	High
Autumn	12	667	D08	60	Moderate	86	High
Autumn	-		D09	-	Nil	-	Nil
Autumn	6	667	D11	29	Low/Moderate	66	Moderate/High
Autumn	8	667	D13	40	Low/Moderate	70	Moderate/High
Autumn	10	667	D14	66	Moderate/High	80	High
Autumn	-		D16	-	Nil	-	Nil
Autumn	7	667	D17	51	Moderate	76	Moderate/High
Autumn	5	667	D18	29	Low/Moderate	74	Moderate/High
Autumn	7	667	D19	29	Low/Moderate	70	Moderate/High
Autumn	11	667	D21	51	Moderate	70	Moderate/High
Autumn	4	667	D22	48	Moderate	76	Moderate/High
Autumn	-		D23	-	Nil	-	Nil

SOPRANO PIPISTRELLE

Survey Period	Nights Recorded	Ref Range	Detector ID	Median Bat Activity	Median Bat Activity	Max Bat Activity	Max Bat Activity Level
Spring	11	1110	D03	83	High	95	High
Spring	11	1110	D04	47	Moderate	57	Moderate
Spring	13	1110	D05	44	Moderate	67	Moderate/High
Spring	13	1110	D06	55	Moderate	66	Moderate/High
Spring	14	1110	D08	63	Moderate/High	78	Moderate/High
Spring	10	1110	D09	55	Moderate	67	Moderate/High
Spring	13	1110	D11	53	Moderate	80	High
Spring	9	1110	D13	24	Low/Moderate	52	Moderate
Spring	11	1110	D14	36	Low/Moderate	75	Moderate/High
Spring	11	1110	D16	47	Moderate	61	Moderate/High
Spring	12	1110	D17	52	Moderate	89	High
Spring	12	1110	D18	38	Low/Moderate	78	Moderate/High
Spring	10	1110	D19	38	Low/Moderate	63	Moderate/High
Spring	12	1110	D21	42	Moderate	59	Moderate
Spring	11	1110	D22	31	Low/Moderate	50	Moderate
Spring	12	1110	D23	36	Low/Moderate	55	Moderate
Summer	5	1371	D03	26	Low/Moderate	39	Low/Moderate
Summer	-		D04	-	Nil	-	Nil
Summer	-		D05	-	Nil	-	Nil
Summer	4	1371	D06	13	Low	13	Low
Summer	-		D08	-	Nil	-	Nil
Summer	-		D09	-	Nil	-	Nil
Summer	-		D11	-	Nil	-	Nil
Summer	-		D13	-	Nil	-	Nil
Summer	-		D14	-	Nil	-	Nil
Summer	-		D16	-	Nil	-	Nil
Summer	19	1371	D17	68	Moderate/High	85	High
Summer	20	1371	D18	80	High	91	High
Summer	22	1371	D19	87	High	95	High
Summer	22	1371	D21	88	High	96	High
Summer	21	1371	D22	75	Moderate/High	90	High
Summer	22	1371	D23	84	High	95	High
Autumn	9	774	D03	51	Moderate	83	High
Autumn	5	774	D04	29	Low/Moderate	51	Moderate
Autumn	9	774	D05	29	Low/Moderate	60	Moderate

Autumn	16	774	D06	51	Moderate	88	High
Autumn	17	774	D08	51	Moderate	91	High
Autumn	-		D09	-	Nil	-	Nil
Autumn	-		D11	-	Nil	-	Nil
Autumn	7	774	D13	60	Moderate	70	Moderate/High
Autumn	13	774	D14	60	Moderate	91	High
Autumn	-		D16	-	Nil	-	Nil
Autumn	11	774	D17	60	Moderate	76	Moderate/High
Autumn	8	774	D18	45	Moderate	66	Moderate/High
Autumn	7	774	D19	66	Moderate/High	74	Moderate/High
Autumn	9	774	D21	66	Moderate/High	83	High
Autumn	7	774	D22	51	Moderate	60	Moderate
Autumn	6	774	D23	29	Low/Moderate	60	Moderate

COMMON PIPISTRELLE

Survey Period	Nights Recorded	Ref Range	Detector ID	Median Bat Activity	Median Bat Activity	Max Bat Activity	Max Bat Activity Level
Spring	11	1184	D03	96	High	100	High
Spring	14	1184	D04	76	Moderate/High	99	High
Spring	13	1184	D05	59	Moderate	78	Moderate/High
Spring	13	1184	D06	68	Moderate/High	82	High
Spring	13	1184	D08	81	High	93	High
Spring	12	1184	D09	85	High	93	High
Spring	13	1184	D11	69	Moderate/High	86	High
Spring	9	1184	D13	55	Moderate	71	Moderate/High
Spring	10	1184	D14	60	Moderate	69	Moderate/High
Spring	13	1184	D16	59	Moderate	85	High
Spring	12	1184	D17	79	Moderate/High	93	High
Spring	10	1184	D18	76	Moderate/High	91	High
Spring	13	1184	D19	76	Moderate/High	91	High
Spring	13	1184	D21	82	High	91	High
Spring	10	1184	D22	54	Moderate	71	Moderate/High
Spring	12	1184	D23	58	Moderate	68	Low/Moderate
Summer	11	1509	D03	26	Low/Moderate	33	Low/Moderate
Summer	-		D04	-	Nil	-	Nil
Summer	-		D05	-	Nil	-	Nil
Summer	19	1509	D06	68	Moderate/High	87	High
Summer	19	1509	D08	82	High	93	High
Summer	22	1509	D09	90	High	98	High
Summer	1	1509	D11	13	Low	13	Low
Summer	20	1509	D13	64	Moderate/High	85	High
Summer	22	1509	D14	91	High	99	High
Summer	21	1509	D16	85	High	94	High
Summer	22	1509	D17	79	Moderate/High	89	High
Summer	-		D18	-	Nil	-	Nil
Summer	-		D19	-	Nil	-	Nil
Summer	-		D21	-	Nil	-	Nil
Summer	-		D22	-	Nil	-	Nil
Summer	3	1509	D23	13	Low	26	Low/Moderate
Autumn	8	797	D03	56	Moderate	82	High
Autumn	5	797	D04	29	Low/Moderate	51	Moderate

Autumn	6	797	D05	51	Moderate	81	High
Autumn	12	797	D06	51	Moderate	87	High
Autumn	9	797	D08	51	Moderate	92	High
Autumn	-		D09	-	Nil	-	Nil
Autumn	8	797	D11	29	Low/Moderate	83	High
Autumn	5	797	D13	51	Moderate	66	Moderate/High
Autumn	8	797	D14	51	Moderate	94	High
Autumn	-		D16	-	Nil	-	Nil
Autumn	8	797	D17	40	Low/Moderate	86	High
Autumn	5	797	D18	76	Moderate/High	81	High
Autumn	7	797	D19	60	Moderate	86	High
Autumn	4	797	D21	80	High	87	High
Autumn	5	797	D22	66	Moderate/High	70	Moderate/High
Autumn	3	797	D23	29	Low/Moderate	29	Low/Moderate

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	-		D03	-	Nil	-	Nil
Spring	-		D04	-	Nil	-	Nil
Spring	-		D05	-	Nil	-	Nil
Spring	1	250	D06	10	Low	10	Low
Spring	2	250	D08	10	Low	10	Low
Spring	1	250	D09	24	Low/Moderate	24	Low/Moderate
Spring	4	250	D11	24	Low/Moderate	44	Moderate
Spring	-		D13	-	Nil	-	Nil
Spring	3	250	D14	10	Low	24	Low/Moderate
Spring	1	250	D16	10	Low	10	Low
Spring	2	250	D17	10	Low	10	Low
Spring	-		D18	-	Nil	-	Nil
Spring	-		D19	-	Nil	-	Nil
Spring	1	250	D21	24	Low/Moderate	24	Low/Moderate
Spring	1	250	D22	10	Low	10	Low
Spring	3	250	D23	10	Low	24	Low/Moderate
Summer	3	608	D03	13	Low	13	Low
Summer	–		D04	-	Nil	-	Nil
Summer	-		D05	-	Nil	-	Nil
Summer	3	608	D06	13	Low	26	Low/Moderate
Summer	-		D08	-	Nil	-	Nil
Summer	-		D09	-	Nil	-	Nil
Summer	-		D11	-	Nil	-	Nil
Summer	-		D13	-	Nil	-	Nil
Summer	-		D14	-	Nil	-	Nil
Summer	-		D16	-	Nil	-	Nil
Summer	–		D17	-	Nil	-	Nil
Summer	-		D18	-	Nil	-	Nil
Summer	-		D19	-	Nil	-	Nil
Summer	-		D21	-	Nil	-	Nil
Summer	-		D22	-	Nil	-	Nil
Summer	21	608	D23	52	Moderate	73	High
Autumn	6	452	D03	29	Low/Moderate	29	Low/Moderate
Autumn	-		D04	-	Nil	-	Nil

Autumn	7	452	D05	51	Moderate	60	Moderate
Autumn	6	452	D06	40	Low/Moderate	60	Moderate
Autumn	11	452	D08	29	Low/Moderate	60	Moderate
Autumn	-		D09	-	Nil	-	Nil
Autumn	2	452	D11	29	Low/Moderate	29	Low/Moderate
Autumn	1	452	D13	29	Low/Moderate	29	Low/Moderate
Autumn	12	452	D14	51	Moderate	60	
Autumn	-	-	D16	-	Nil	-	Nil
Autumn	1	452	D17	29	Low/Moderate	29	Low/Moderate
Autumn	4	452	D18	29	Low/Moderate	51	Moderate
Autumn	8	452	D19	29	Low/Moderate	60	Moderate
Autumn	4	452	D21	40	Low/Moderate	51	Moderate
Autumn	3	452	D22	29	Low/Moderate	29	Low/Moderate
Autumn	-		D23	-	Nil	-	Nil

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).

Planning and Environmental Consultants

Bat Survey Report

Appendix 5 – Minimum Survey Effort 2018

MINIMUM SURVEY STANDARDS 2018

Minimum standards for bat surveys at proposed onshore wind turbine developments (taken from Hundt, 2012)

Survey Criteria	Site Risk Level		
	Low	Medium	High
Roost Surveys			
Selection of roosts requiring further survey	If evidence of roosting by medium or high-risk species and or roosts of district importance and above is found, further survey should follow SNCO guidance & guidelines available in Chapter 8 (Hundt, 2012)		
Activity Surveys			
Survey Period	Surveys should provide data for one survey as a minimum		
Survey Area[1]	Up to 200 m + rotor radius from turbine locations or potential turbine locations		
Ground Level Transects	One visit per transect each season (spring, summer & autumn)	One visit per transect each month (April - October)	Up to two visits per transect each month (April - October)
Automated surveys at ground level	5 consecutive nights for each single[2] or pair of locations within the survey area, per season	5 consecutive nights for each single or pair of locations within the survey area, per month	Up to 2 sets of 5 consecutive nights for each single or pair of locations within the survey area, per month
Automated surveys at height	Situations where at-height survey may be appropriate are outlined in Chapter 10 (Hundt, 2012) For surveys undertaken from masts, survey effort is as outlined above for surveys at ground level.		

[1] Should include potential turbine locations plus the nearest habitat features likely to be used by bats.
[2] Single locations will be at potential turbine locations. It may not be necessary to survey potential turbine locations without suitable habitat for bats located within 100 m plus the rotor radius. See Chapter 10 in Hundt (2012) for further details.

Planning and Environmental Consultants

Bat Survey Report

Appendix 6 - Derrinlough Bat Survey Results 2018 (BCT Standards)

Table of Contents

TABLE OF TABLES

TABLE OF PLATES

1. DERRINLOUGH ANALYSIS AND RESULTS 2018

1.1 Introduction

Bat surveys undertaken in 2019, in accordance with Scottish Natural Heritage Guidance (SNH 2019)[1], form the core dataset for the assessment of effects on bats provided in the EIAR.

This appendix provides supplementary data that was derived from surveys undertaken on the site in 2018 which were designed in accordance with the Bat Conservation Trust's guidelines for wind turbine developments (Hundt, 2012).

The following surveys were undertaken in 2018:

- Potential Roost Survey
- Manual transects
- Static detector Surveys

The results are provided in the sections below.

1.2 Roost Surveys 2018

A search for bat roosts was undertaken within the Study Area throughout 2018. The aim was to determine the presence of roosting bats and the need for further survey work or mitigation. The site was visited monthly between April and October 2018. 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. Trees 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 tree roost features identified by Andrews (2013).

One structure was identified (IG Ref: N 08042 14688) and was subject to a roost assessment. The results are provided in Appendix 6.2 of the EIAR.

1.3 Manual Transects 2018

Manual transects were undertaken over several consecutive nights each month between April and October 2018, totaling 58.48 hours of survey time (Table 3.4, Appendix 6.2, EIAR).

Surveys were undertaken during favourable conditions with dusk temperatures above 7°C and no strong winds (BCI, 2012). Where rain was encountered, surveys were paused and resumed once the rain had stopped.

In total, 1,842 bat passes were recorded during manual transect surveys between April and August 2018. No bat passes were recorded during the September and October 2018 manual transects. Soprano pipistrelle and common pipistrelle were encountered most frequently, followed by Leisler's bat, *Myotis* sp., *Pipistrelle* sp., Brown long-eared bat and Nathusius' pipistrelle (Plate 1.1).

Table 1.1 presents manual transect results for individual bat species per survey period (i.e. per month).

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

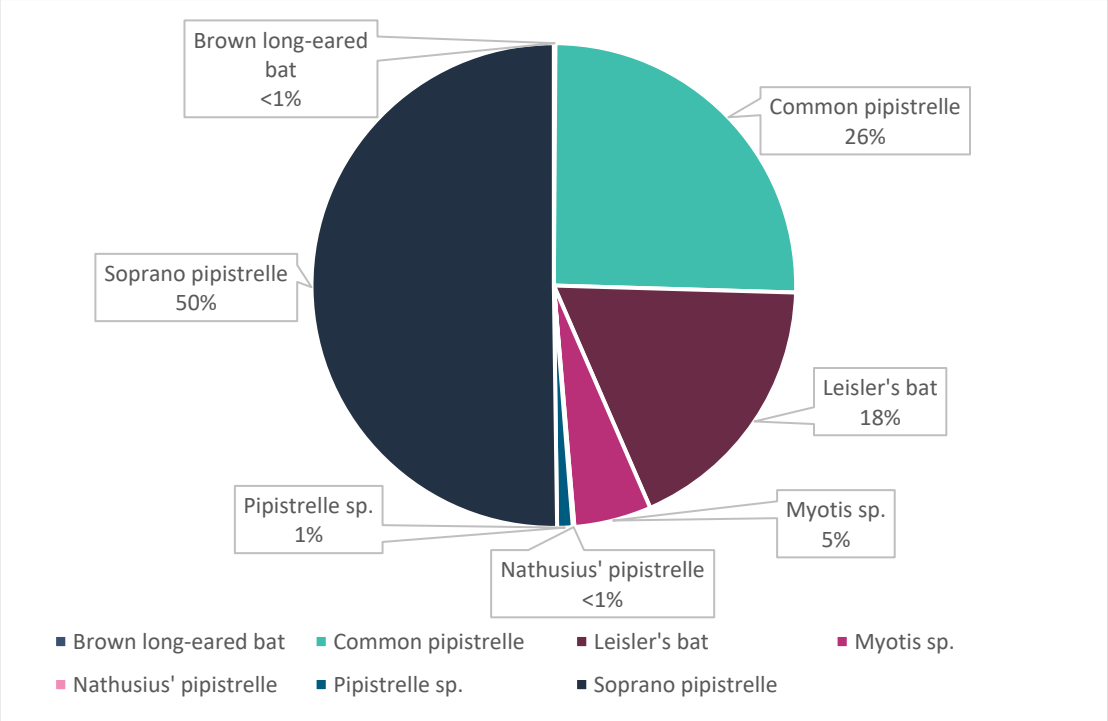


Plate 1-1 Manual Transect Results: Species Composition (Total Bat Passes)

Table 1-1 Summary of Manual Transect Results 2018 (Total Bat Passes)

	Apr 2018	May 2018	June 2018	July 2018	Aug 2018	Sep 2018	Oct 2018	Total
Brown long-eared bat	-	-	1	-	1	-	-	2
Common pipistrelle	74	44	209	117	23	-	-	467
Leisler's bat	80	58	80	92	22	-	-	332
Myotis sp.	2	1	62	8	22	-	-	95
Nathusius' pipistrelle	-	-	2	-	-	-	-	2
Pipistrelle sp.	2	3	6	6	2	-	-	19
Soprano pipistrelle	118	120	171	233	283	-	-	925
Grand Total	**276**	**226**	**531**	**456**	**353**	**-**	**-**	**1842**

In addition, transect survey results were calculated as bat passes per km surveyed. Plate 1.2 and Table 1.2 present these results for individual species per survey period. Soprano pipistrelle and common pipistrelle showed the greatest activity levels followed by Leisler's bat and *Myotis* sp. Small numbers of brown long-eared bat and Nathusius' pipistrelle were observed. Bat activity was significantly greater in the period June to August, peaking in June.

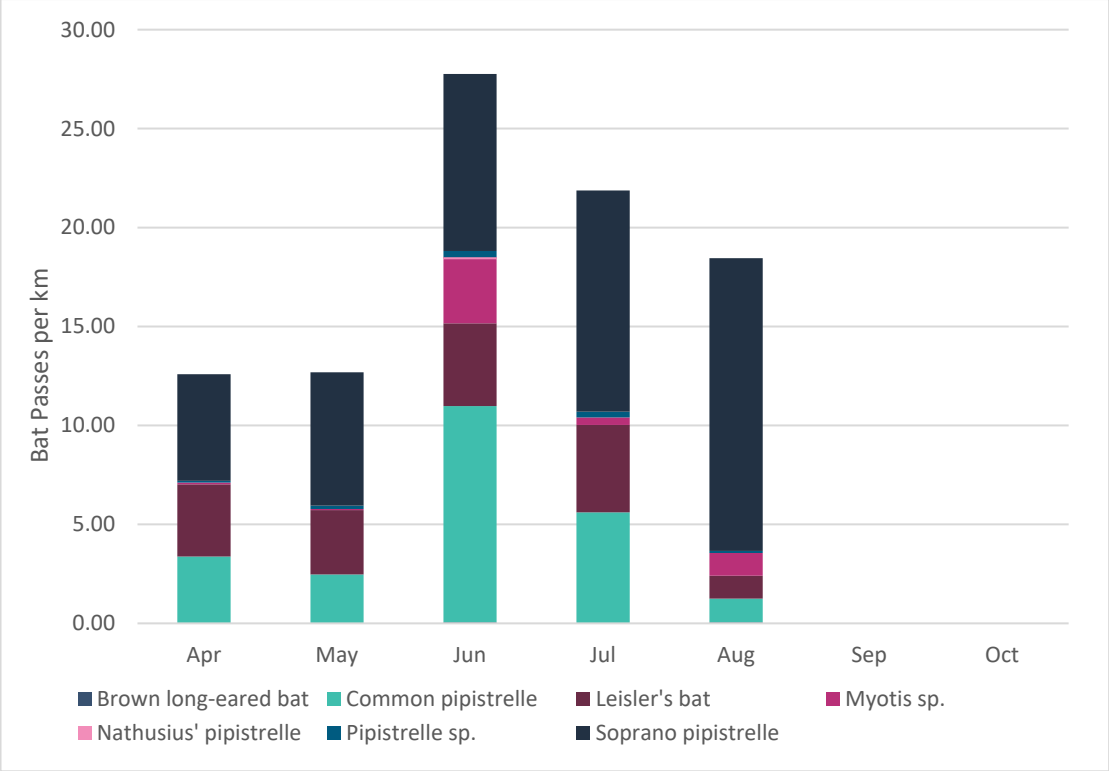
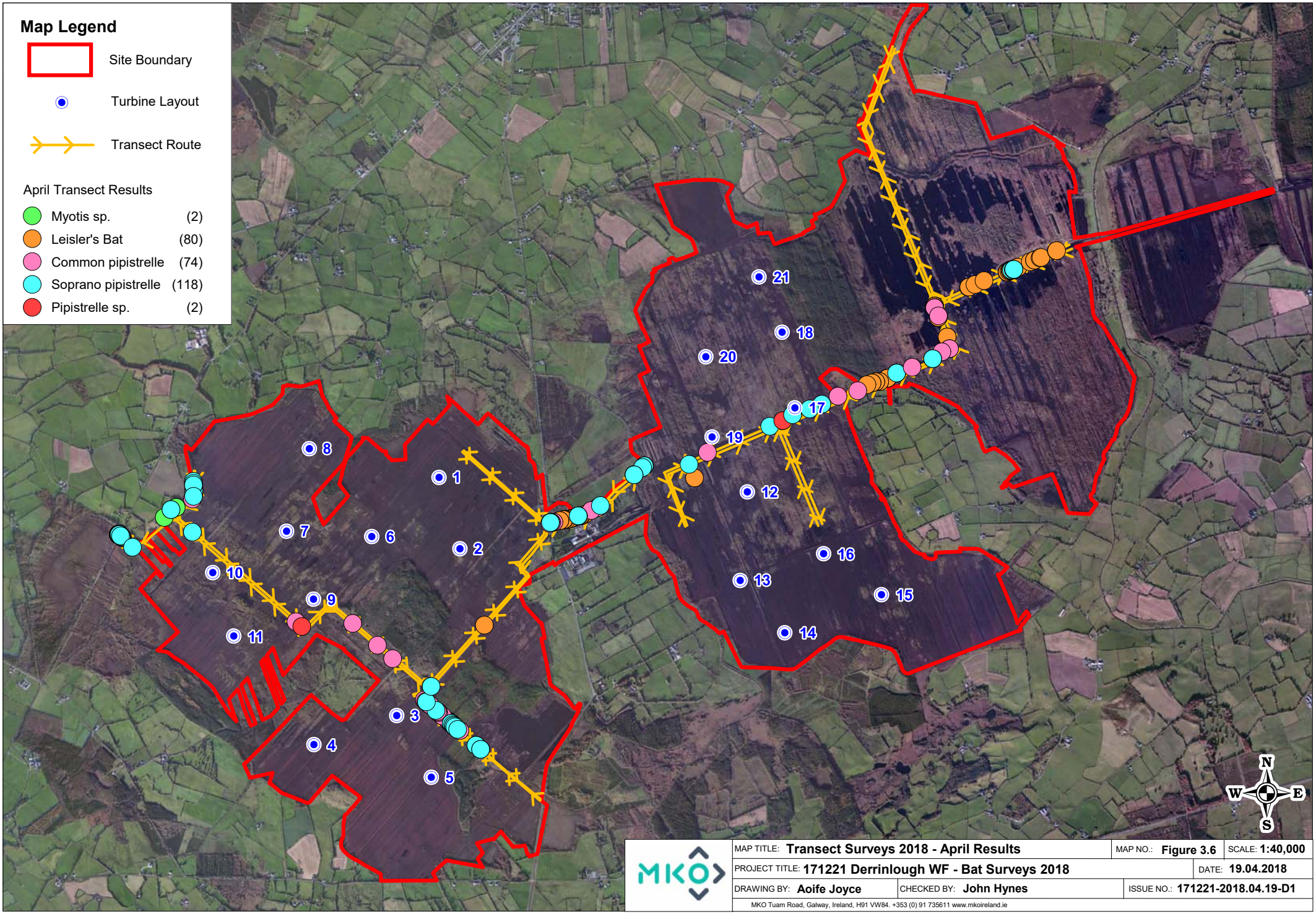


Plate 1-2 Manual Transect Results: Bat Passes Per Km in 2018

Table 1-2 Manual Transect Results 2018 (Bat Passes Per Survey Km)

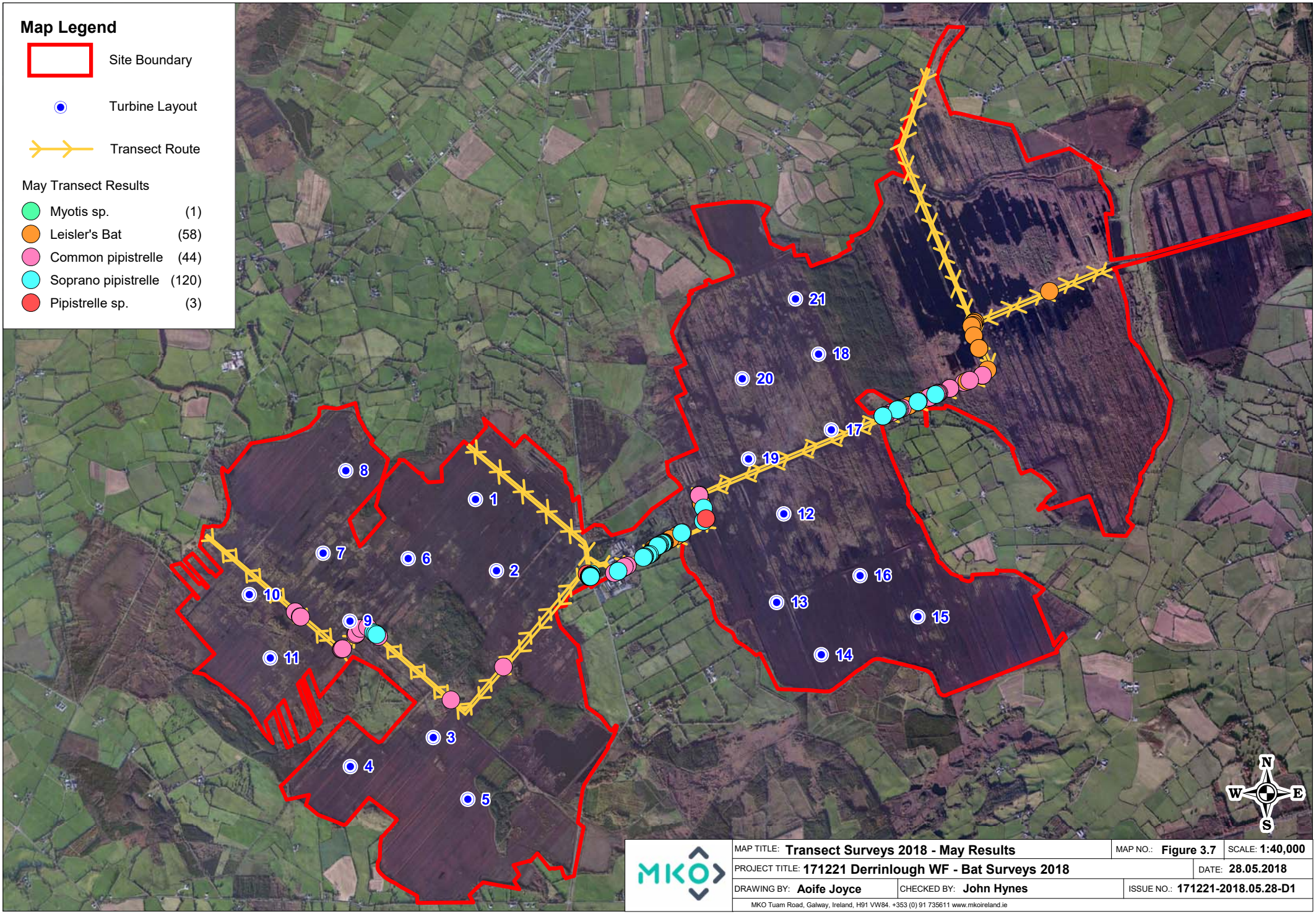
	Apr 2018	May 2018	Jun 2018	Jul 2018	Aug 2018	Sep 2018	Oct 2018	Total
Survey length (km)	**21.93**	**17.81**	**19.13**	**20.85**	**19.13**	**19.13**	**20.63**	**138.61**
Brown long-eared bat	0.00	0.00	0.05	0.00	0.05	0.00	0.00	0.10
Common pipistrelle	3.37	2.47	10.93	5.61	1.20	0.00	0.00	23.58
Leisler's bat	3.65	3.26	4.18	4.41	1.15	0.00	0.00	16.65
Myotis sp.	0.09	0.06	3.24	0.38	1.15	0.00	0.00	4.92
Nathusius' pipistrelle	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.10
Pipistrelle sp.	0.09	0.17	0.31	0.29	0.10	0.00	0.00	0.97
Soprano pipistrelle	5.38	6.74	8.94	11.18	14.79	0.00	0.00	47.03
Total	**12.59**	**12.69**	**27.76**	**21.87**	**18.45**	**0.00**	**0.00**	**93.36**

Figures 3.6 – 3.12 presents the distribution of bat activity across all survey months. Bat activity was recorded on transects between April and August 2018. In general, bat activity was concentrated along the track beside the briquette factory as well as treeline edge habitats and along tracks. Bats tended to avoid open habitat areas over bog habitats.



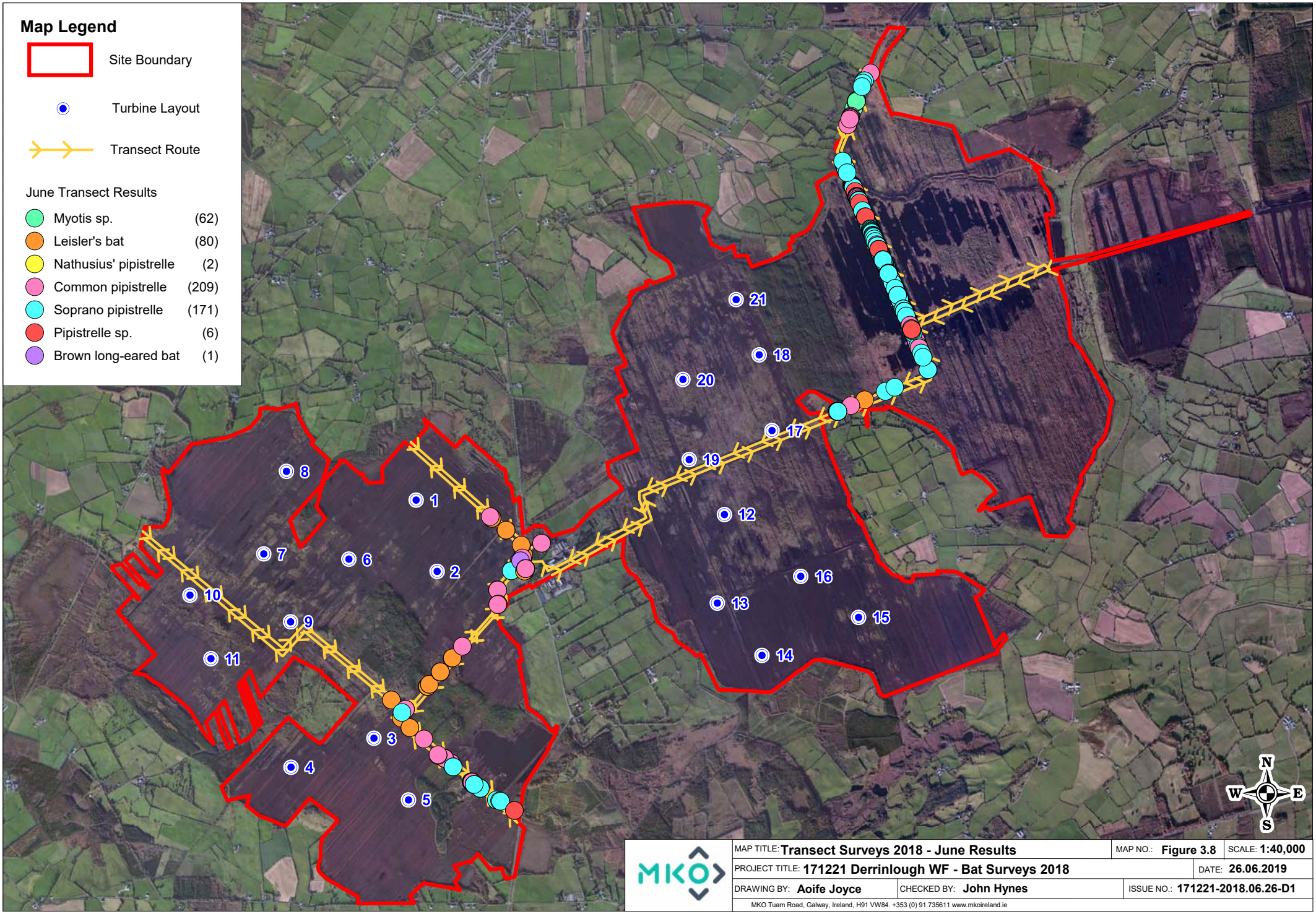
MAP TITLE: **Transect Surveys 2018 - April Results**		MAP NO.: **Figure 3.6**	SCALE: **1:40,000**
PROJECT TITLE: **171221 Derrinlough WF - Bat Surveys 2018**			DATE: **19.04.2018**
DRAWING BY: **Aoife Joyce**	CHECKED BY: **John Hynes**	ISSUE NO.: **171221-2018.04.19-D1**	

MKO Tuam Road, Galway, Ireland, H91 VW84. +353 (0) 91 735611 www.mkoireland.ie



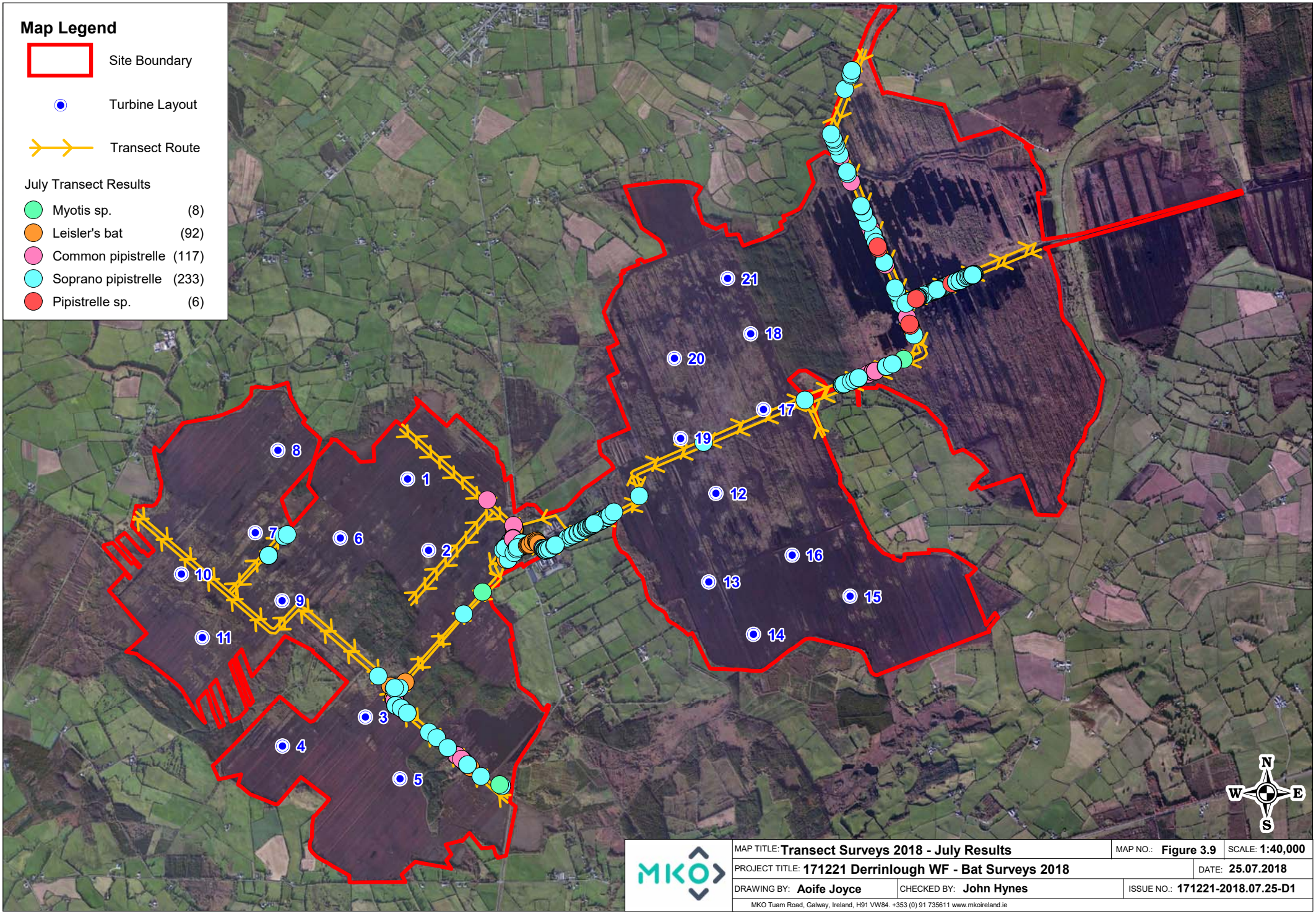
MAP TITLE: **Transect Surveys 2018 - May Results**		MAP NO.: **Figure 3.7**	SCALE: **1:40,000**
PROJECT TITLE: **171221 Derrinlough WF - Bat Surveys 2018**			DATE: **28.05.2018**
DRAWING BY: **Aoife Joyce**	CHECKED BY: **John Hynes**		ISSUE NO.: **171221-2018.05.28-D1**

MKO Tuam Road, Galway, Ireland, H91 VW84. +353 (0) 91 735611 www.mkoireland.ie



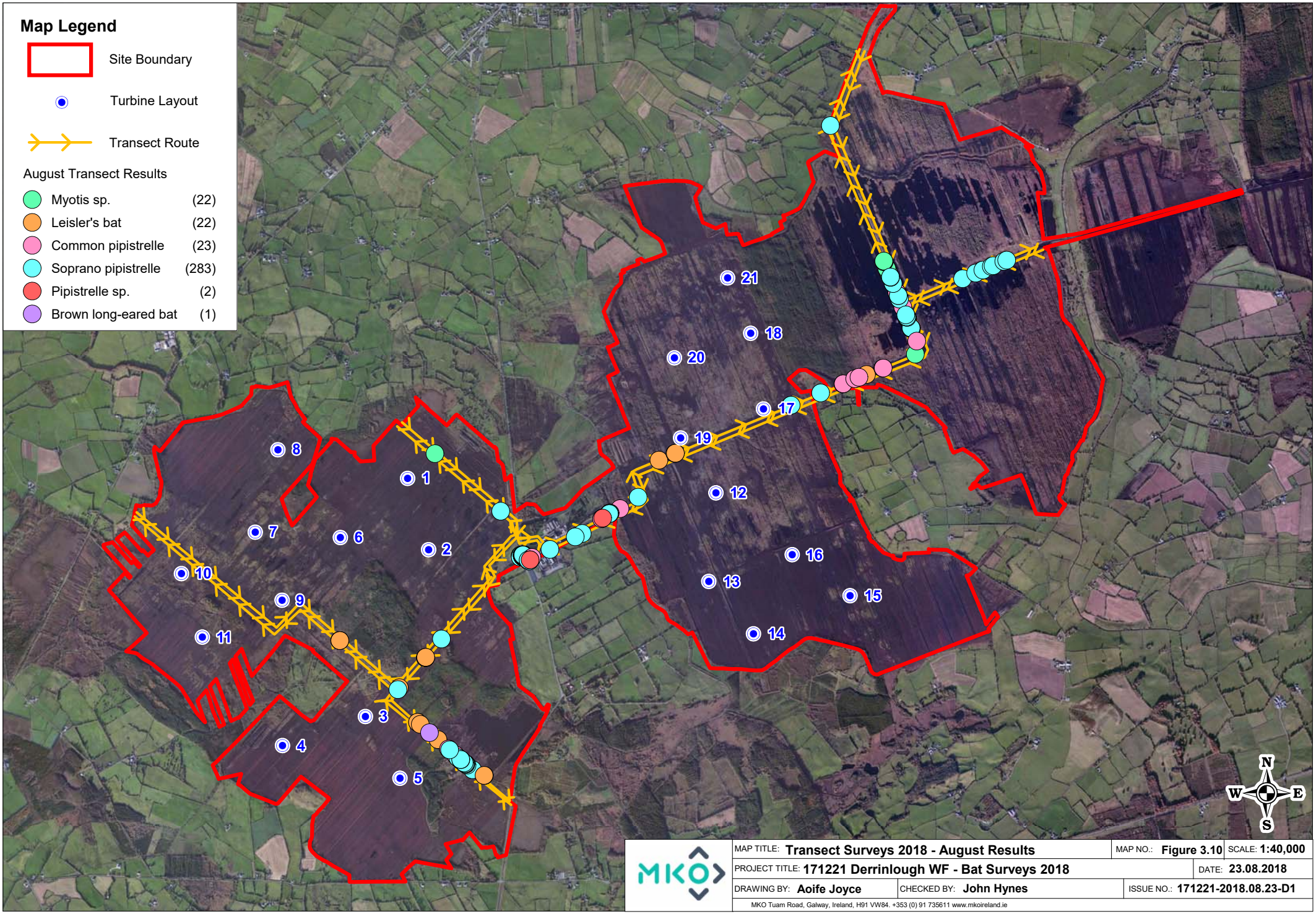
MAP TITLE: **Transect Surveys 2018 - June Results**		MAP NO.: **Figure 3.8**	SCALE: **1:40,000**
PROJECT TITLE: **171221 Derrinlough WF - Bat Surveys 2018**			DATE: **26.06.2019**
DRAWING BY: **Aoife Joyce**	CHECKED BY: **John Hynes**		ISSUE NO.: **171221-2018.06.26-D1**

MKO Tuam Road, Galway, Ireland, H91 VW84. +353 (0) 91 735611 www.mkoireland.ie



MAP TITLE: **Transect Surveys 2018 - July Results**		MAP NO.: **Figure 3.9**	SCALE: **1:40,000**
PROJECT TITLE: **171221 Derrinlough WF - Bat Surveys 2018**			DATE: **25.07.2018**
DRAWING BY: **Aoife Joyce**	CHECKED BY: **John Hynes**	ISSUE NO.: **171221-2018.07.25-D1**	

MKO Tuam Road, Galway, Ireland, H91 VW84. +353 (0) 91 735611 www.mkoireland.ie

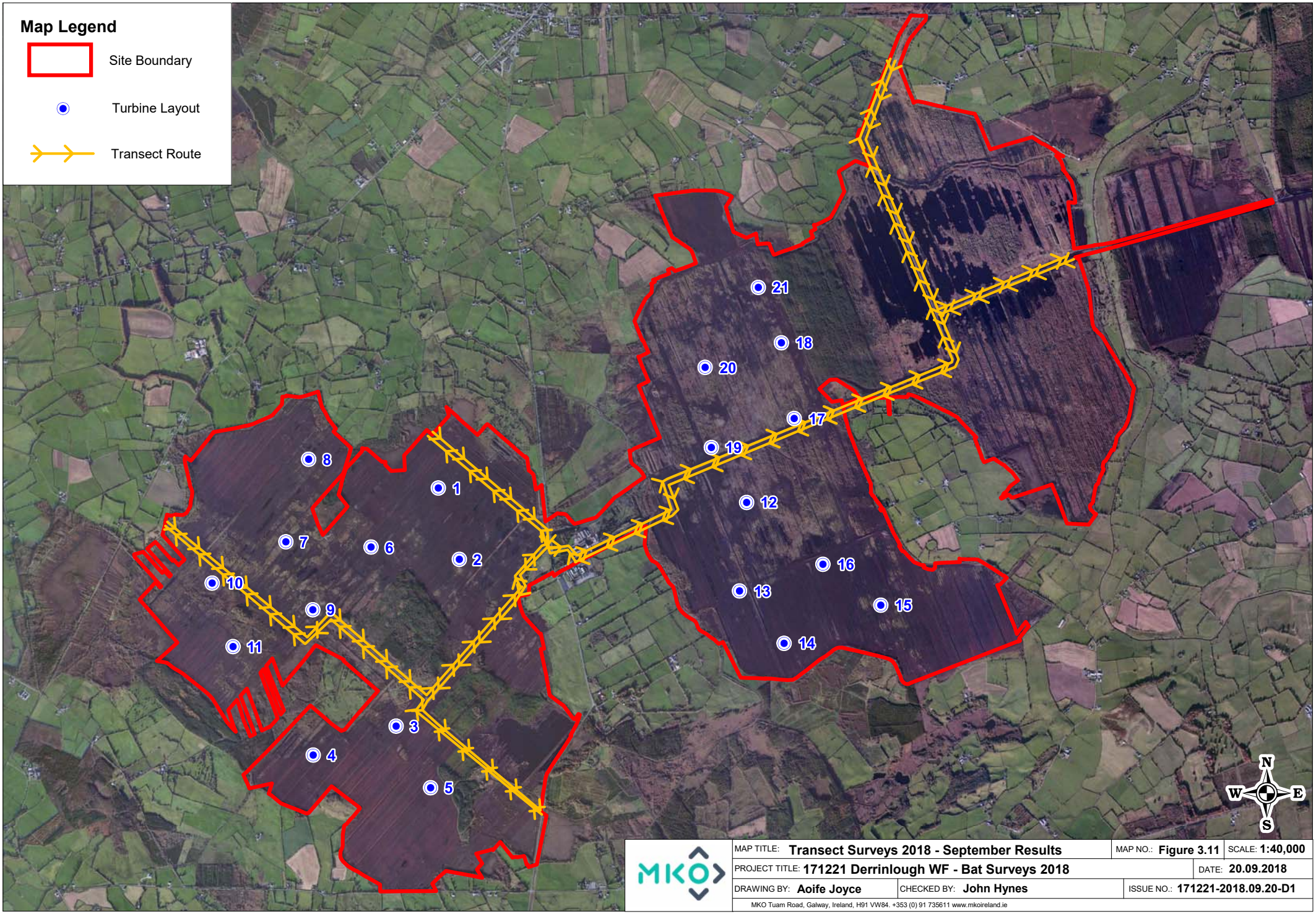


MAP TITLE: **Transect Surveys 2018 - August Results** | MAP NO.: **Figure 3.10** | SCALE: **1:40,000**

PROJECT TITLE: **171221 Derrinlough WF - Bat Surveys 2018** | DATE: **23.08.2018**

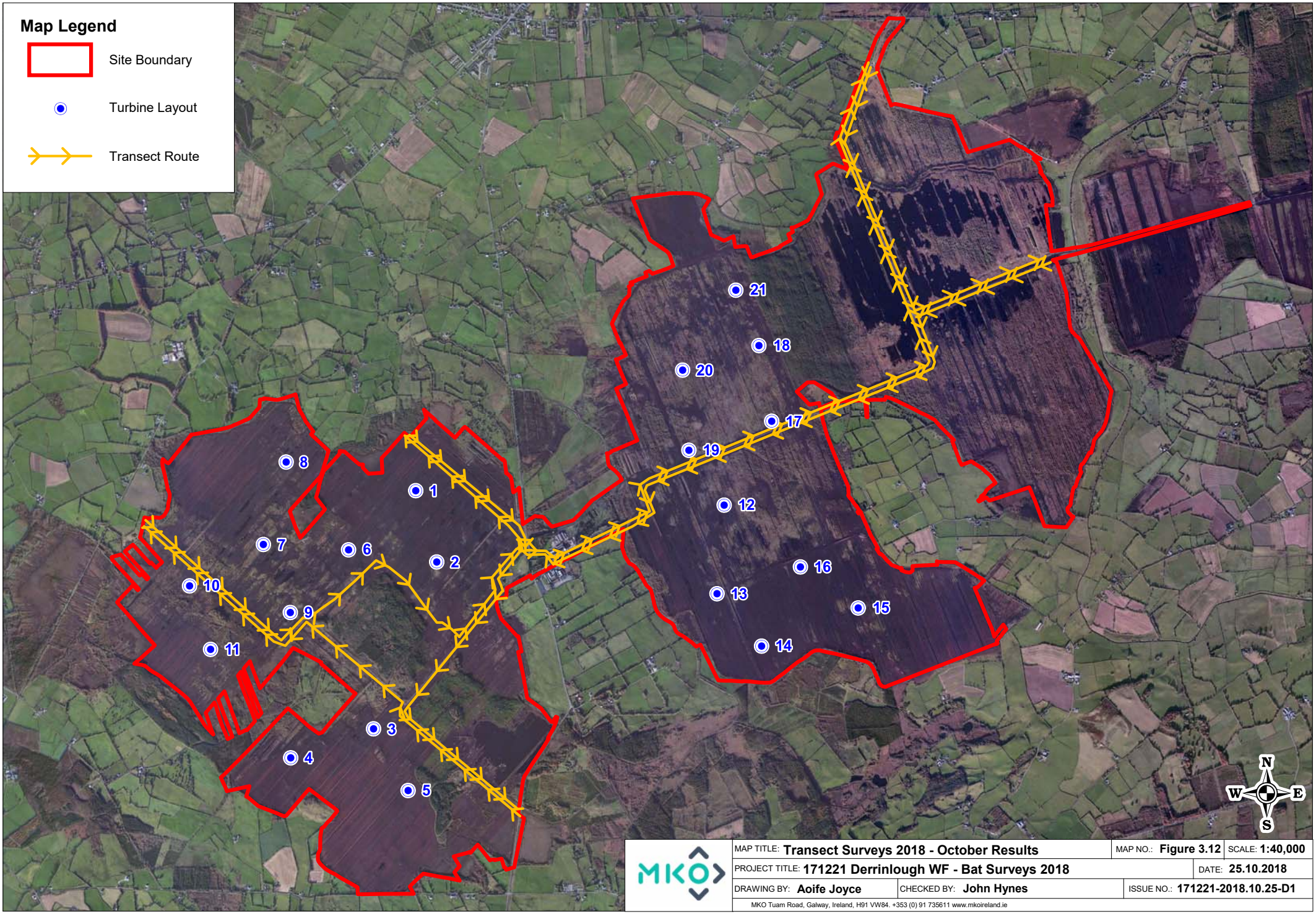
DRAWING BY: **Aoife Joyce** | CHECKED BY: **John Hynes** | ISSUE NO.: **171221-2018.08.23-D1**

MKO Tuam Road, Galway, Ireland, H91 VW84. +353 (0) 91 735611 www.mkoireland.ie



MAP TITLE: **Transect Surveys 2018 - September Results**		MAP NO.: **Figure 3.11**	SCALE: **1:40,000**
PROJECT TITLE: **171221 Derrinlough WF - Bat Surveys 2018**			DATE: **20.09.2018**
DRAWING BY: **Aoife Joyce**	CHECKED BY: **John Hynes**		ISSUE NO.: **171221-2018.09.20-D1**

MKO Tuam Road, Galway, Ireland, H91 VW84. +353 (0) 91 735611 www.mkoireland.ie



MAP TITLE: **Transect Surveys 2018 - October Results**		MAP NO.: **Figure 3.12**	SCALE: **1:40,000**
PROJECT TITLE: **171221 Derrinlough WF - Bat Surveys 2018**			DATE: **25.10.2018**
DRAWING BY: **Aoife Joyce**	CHECKED BY: **John Hynes**	ISSUE NO.: **171221-2018.10.25-D1**	

MKO Tuam Road, Galway, Ireland, H91 VW84. +353 (0) 91 735611 www.mkoireland.ie

1.4 Static Detector Surveys at Ground Level 2018

The time at which bats are recorded can provide some indication of roosting behavior. Bats recorded around sunset may indicate they have just left a roost, whereas bats recorded much later, are more likely to have travelled farther.

Emergence times, i.e. the time at which a bat will leave a roost to begin feeding, vary between species. In general, Leisler's bat and the pipistrelle species emerge earlier (approx. 0-20 min after sunset) while *Myotis* species emerge later (approx. 20-40 min after sunset) (Russ 2012, Collins, 2016). However, it should be noted that emergence and re-entry times may be influenced by a host of other factors including the availability of protective cover around the roost, the bats' reproductive status, ambient weather conditions on the night in question and on previous nights, etc.

Table 3.4 (Appendix 6.2, EIAR) represents ground level static survey efforts for 2018. Plates 1.4 – 1.9 display median bat passes recorded starting from 30-minutes before sunset and 30-minutes after sunrise. As no bat passes were recorded during the detector survey in June, a graph has not been generated.

Following Ecobat analysis, bat activity was generally greatest within the between 30-90 minutes after sunset and the last 30 minutes before sunrise, this indicates that bats may have to commute some distance from their roosting sites to reach the survey area. There were instances of *Myotis* sp., Leisler's bat, common pipistrelle and soprano pipistrelle activity recorded within the first 30 minutes after sunset. This indicates that there may be some small roosting features located outside the study area. Features may include trees, houses and other buildings located near the survey area.

Table 1-3 Total Bat Passes Per Detector

Month	**April**		**May**		**June**	**July**			**Aug**		**Sept**	**Oct**		
Detector	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**	**M**	**N**	**Total**
Common pipistrelle	3835	2677	1088	2218	0	1111	725	48	1344	498	175	1	0	**13720**
Soprano pipistrelle	5947	1798	430	7020	0	997	1145	479	114	878	994	1	1	**19804**
Leisler's bat	6116	930	763	20354	0	419	391	15	184	170	38	0	0	**29380**
Myotis sp.	953	47	58	46	0	14	22	3	13	81	36	2	2	**1277**
Brown long-eared	0	8	7	36	0	10	8	0	14	11	42	3	0	**139**
Total	**16851**	**5460**	**2346**	**29674**	**0**	**2551**	**2291**	**545**	**1669**	**1638**	**1285**	**7**	**3**	**64,320**

Table 1-4 Median Bat Passes Per Hour

Month	April		May		June	July			Aug		Sept	Oct		
Detector	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**	**L**	**M**	**Total**
Common pipistrelle	7.1	6.6	2.8	10.3	0	4.4	0.9	4	0.3	1.1	0.2	0	0	**37.7**
Soprano pipistrelle	5.1	2.9	0.9	29.5	0	4.5	3.8	6.1	0.3	2.2	0.6	0	0	**55.9**
Leisler's bat	8.4	2.2	1.5	86.2	0	2	0.5	0.9	0.3	0.1	0	0	0	**102.1**
Myotis sp.	2.3	0.1	0.1	0.1	0	0	0.1	0.1	0	0.2	0.1	0	0.1	**3.2**
Brown long-eared bat	0	0	0	0.1	0	0	0	0	0	0	0	0	0	**0.1**
Total	**22.9**	**11.8**	**5.3**	**126.2**	**0**	**10.9**	**5.3**	**11.1**	**0.9**	**3.6**	**0.9**	**0**	**0.1**	199

1.4.1 Static Detector Results

In total, 64,320 bat passes were recorded over 180 nights of static detector monitoring, comprising 1676.8 survey hours. Most of this activity was attributed to Leisler's bat (n=29,380), followed by soprano pipistrelle (n=19,804) and common pipistrelle (n=13,720). *Myotis* sp. (n=1,277) and Brown long-eared bat (n=139) were recorded less frequently (Plate 1.3). Table 1.3 provides a summary of these results.

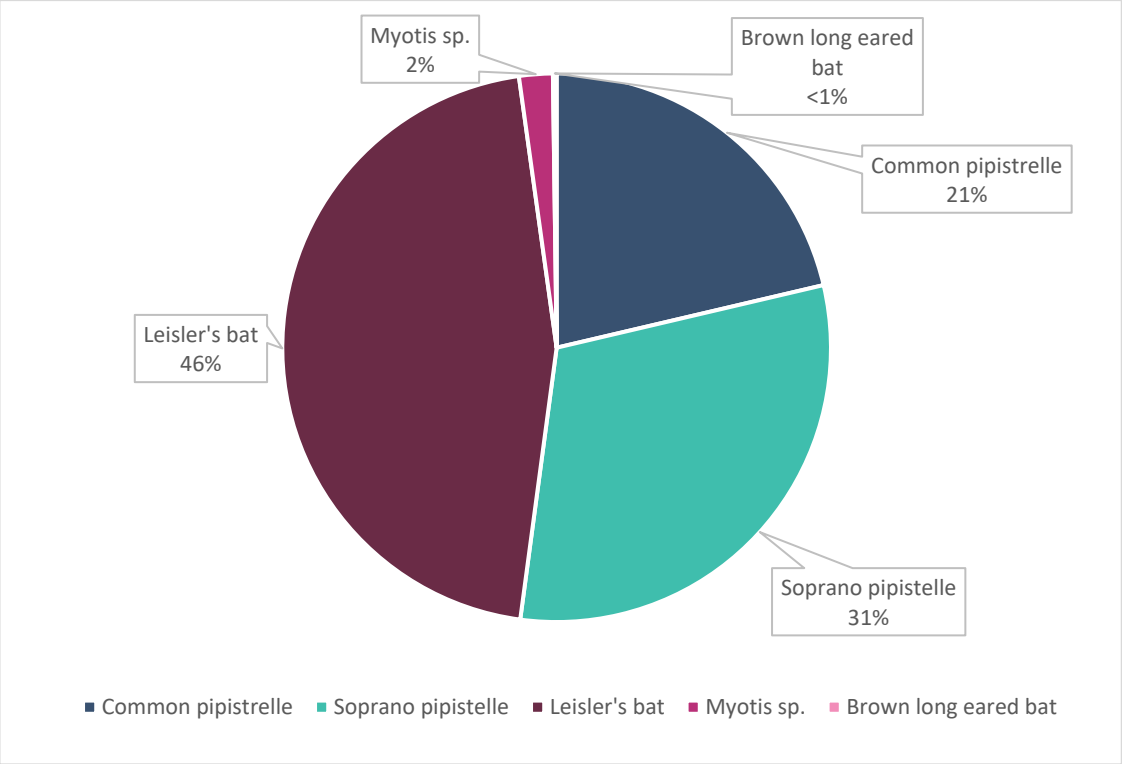


Plate 1-3 Static Detector Survey Results: Species Composition (Total Bat Passes)

Bat activity was calculated as median bat passes per hour (bpph) to account for any bias in survey effort, resulting from varying night lengths throughout the survey season. Table 1.4 presents these results for each static detector location. Bat activity totalled 199 bat passes per survey hour. However, significant differences were observed between different species and survey locations (Plate 1.4 – 1.9).

The highest bat activity was recorded at static location D which is woodland edge habitat favourable to bats. In comparison, the least active static location was E where no bats were recorded, the habitat that this static was located in was open bare peat which is less suitable for bats.

Other detector results where linear woodland or scrub was present recorded bats with some variability across the site. The results provided an indication of activity levels across the site and not numbers of individuals present.

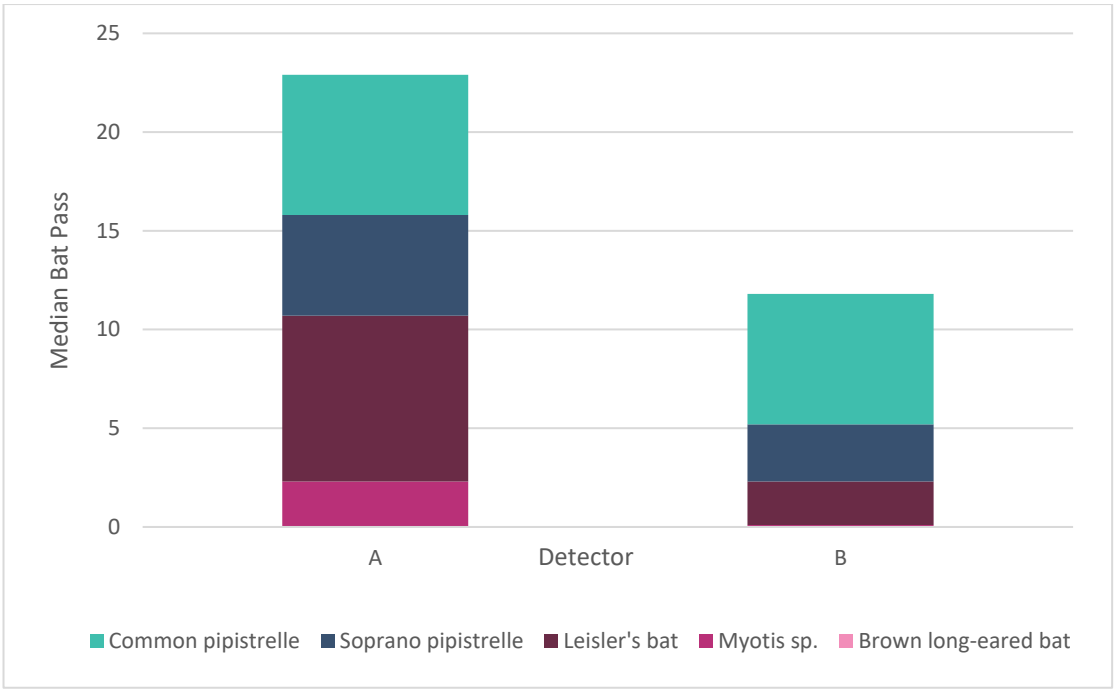


Plate 1-4 Static Detector Survey Results for April 2018: Bat Species Composition and Median Bat Pass Per Hour.

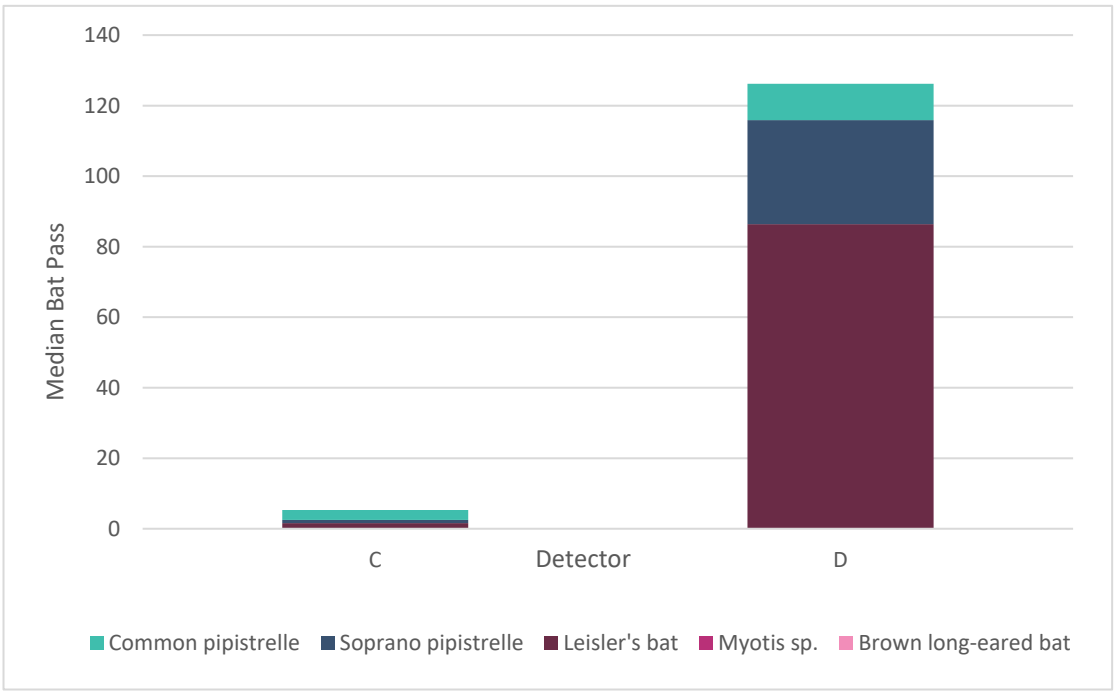


Plate 1-5 Static Detector Survey Results for May 2018: Bat Species Composition and Median Bat Pass Per Hour.

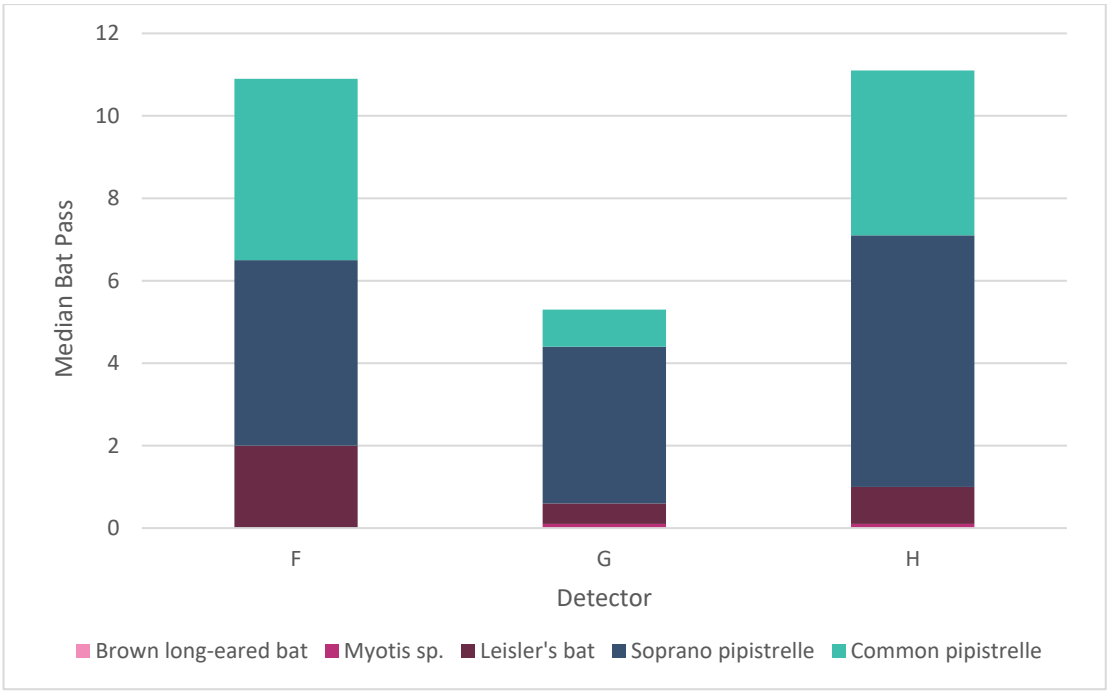


Plate 1-6 Static Detector Survey Results for July 2018: Bat Species Composition and Median Bat Pass Per Hour.

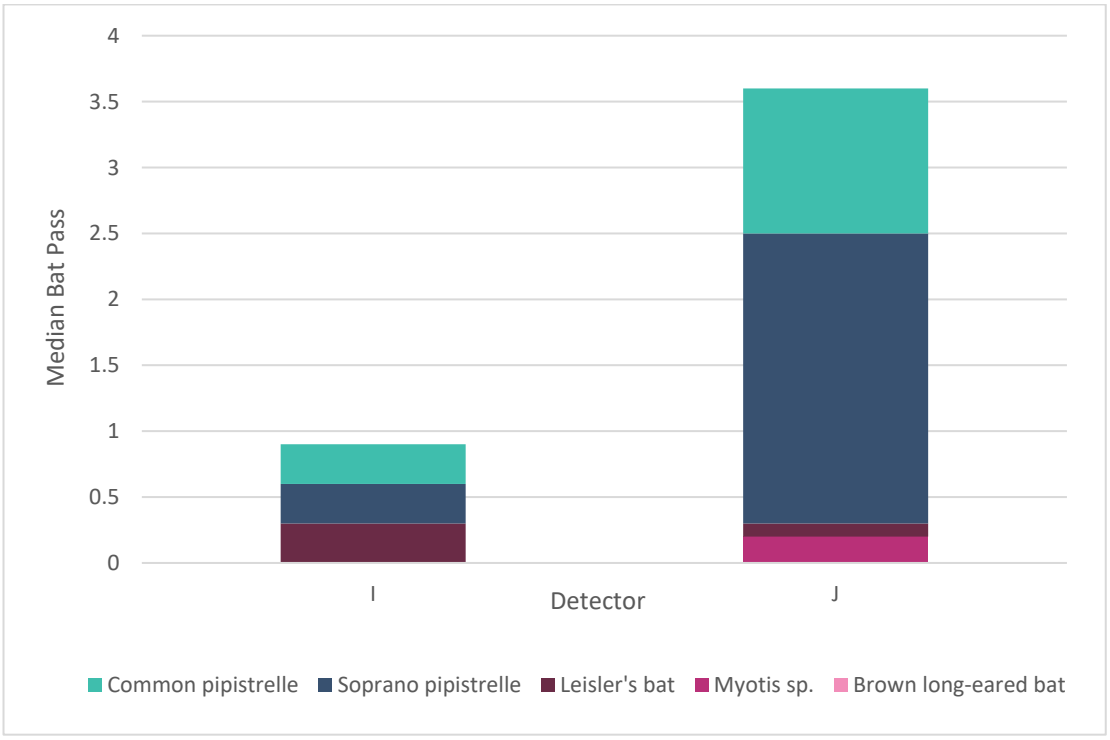


Plate 1-7 Static Detector Survey Results for August 2018: Bat Species Composition and Median Bat Pass Per Hour.

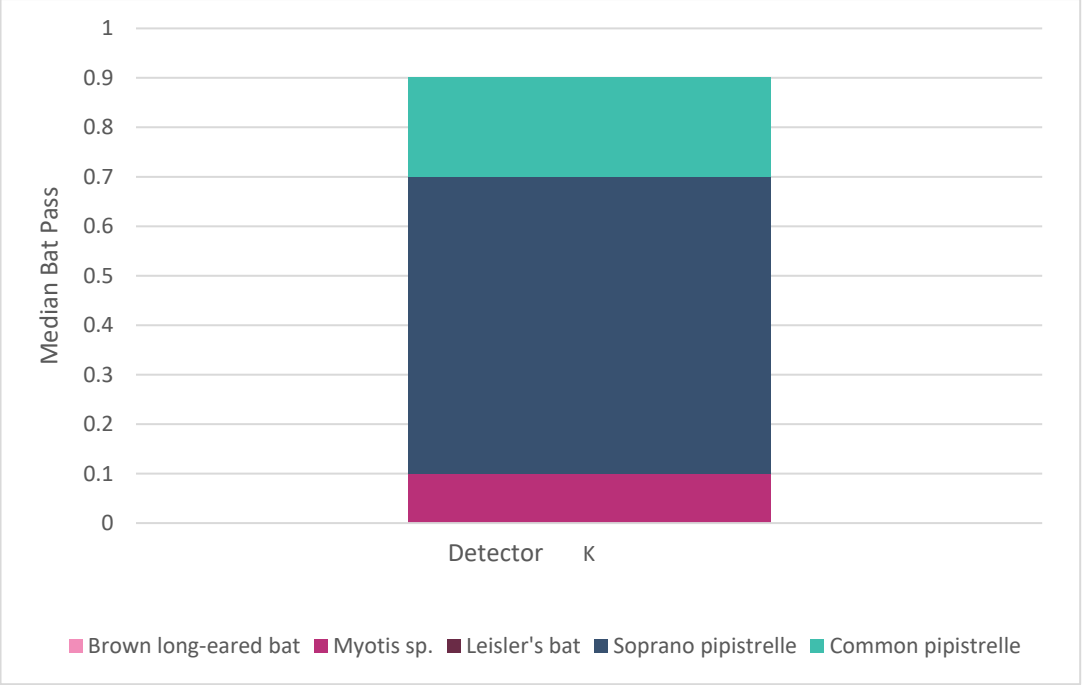


Plate 1-8 Static Detector Survey Results for September 2018: Bat Species Composition and Median Bat Pass Per Hour.

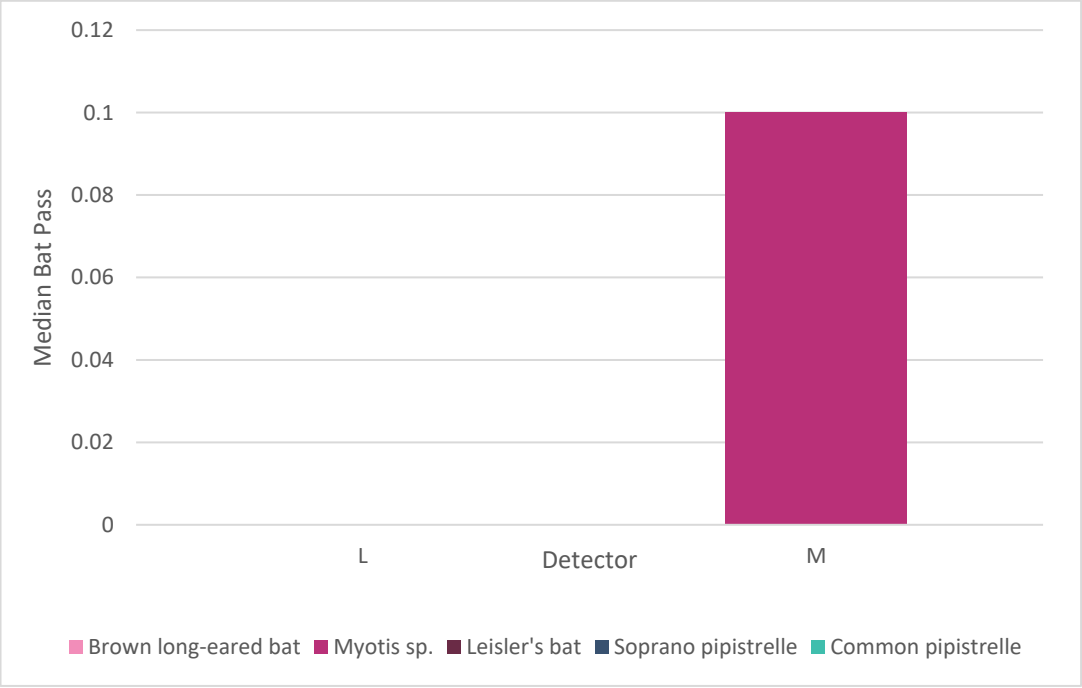


Plate 1-9 Static Detector Survey Results for October 2018: Bat Species Composition and Median Bat Pass Per Hour.

1.5 Surveys at Height, 2018

Simultaneous surveying at ground level and at height was undertaken using static detectors.

In 2018, 66 nights of simultaneous bat monitoring at ground level and at height was achieved and comprised a total of 665.39 survey hours (Table 1.5). In total, 1,666 bat passes were recorded with bat activity significantly higher at ground level (86%) compared to at height (14%). Leisler's bat (n=224), soprano pipistrelle (n=4) and brown long-eared bat (n=1) were recorded at height.

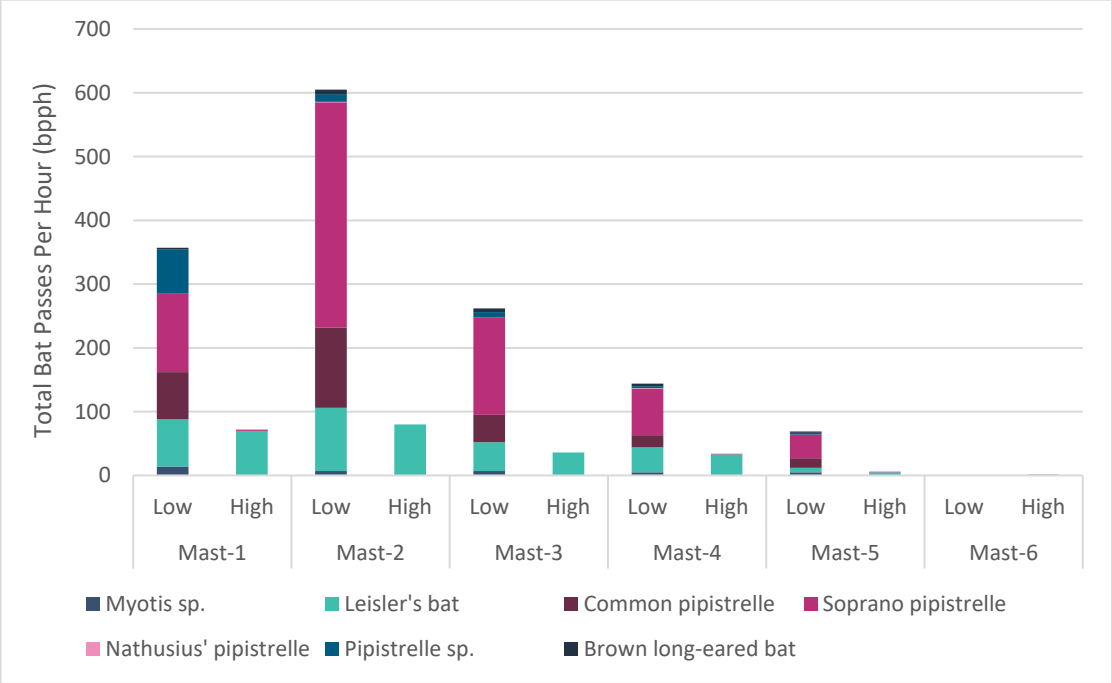


Plate 1-10 Surveys at Height - Species Composition Per Microphone Per Deployment.

Table 1.5 presents met mast monitoring as total bat passes per hour. Plate 1.10 provides a summary of these results. Mast-1 to Mast-6 refers to deployment occasions of the static detector (see Table 3.6, Appendix 6.2, EIAR).

Table 1-5 Static Detector Surveys at Height: 2018 Total Bat Passes

	Mast-1		Mast-2		Mast-3		Mast-4		Mast-5		Mast-6		Total
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	
Myotis sp.	14	-	7	-	7	-	5	-	5	-	-	-	38
Leisler's bat	74	70	99	80	45	36	39	33	7	5	-	-	488
Common pipistrelle	74	-	126	-	43	-	19	-	15	-	-	-	277
Soprano pipistrelle	123	2	353	-	153	-	73	1	37	1	-	-	743
Nathusius' pipistrelle	-	-	1	-	-	-	1	-		-	-	-	2
Pipistrelle sp.	69	-	12	-	8	-	3	-	3	-	-	-	95
Brown long-eared bat	3	-	7	-	6	-	4	-	2	-	-	1	23
Total	**357**	**72**	**605**	**80**	**262**	**36**	**144**	**34**	**69**	**6**	**0**	**1**	**1666**

1.6 Assessment of Bat Activity Levels

Static monitoring results for 2018 were uploaded to Ecobat. This online tool allows the comparison of bat activity data to a reference dataset allowing the objective interpretation of activity levels.

Ecobat assesses activity levels using percentiles. Percentiles provide a numerical indicator of the relative importance of a night's worth of activity. Ecobat provide the following cut-off levels between activity categories.

- Low activity <20th percentile
- Low to Moderate activity 20-30th percentiles
- Moderate activity 30-70th percentiles
- Moderate to High activity 70-80th percentiles
- High activity >80th percentile

Table 1.6 presents the results of Ecobat analyses. All recorded bat species displayed ***High*** or ***Moderate to High*** activity at activity peaks. Bat activity was ***Moderate to High*** and ***High*** for Leisler's bat, common and soprano pipistrelles, however activity was ***Low to Moderate*** and ***Low*** for *Myotis* sp. and Brown long-eared bat respectively.

Table 1-6 Assessment of Bat Activity Levels: Ecobat Results

Species	Total Survey Nights	Median Percentile	Median Bat activity level	Max Percentile	Max Bat activity level	No. Database Records Compared
Common pipistrelle	266	81	High	98	High	1934
Soprano pipistrelle	279	77	Moderate - High	100	High	1760
Leisler's bat	240	71	Moderate - High	100	High	1415
Myotis sp.	198	30	Low - Moderate	92	High	1374
Brown long-eared bat	80	11	Low	61	Moderate - High	866

1.7 Summary of Results

Bat surveys were designed in accordance with survey standards for medium risk sites, in accordance with the Bat Conservation Trust's guidelines for wind turbine developments (Hundt, 2012). Surveys took place between April and October 2018, this work included a desktop study, habitat and landscape assessments, roost inspections, manual activity surveys and static detector surveys at ground level and at height.

The landscape surrounding the proposed site contains a range of habitats suitable for most bat species occurring in Ireland. In particular, tree lines and scrub are present throughout the proposed development site and present good foraging and commuting opportunities for bats.

Habitats within the proposed development site are dominated by commercial peat extraction, with smaller areas of commercial coniferous forestry, birch scrub and re-vegetating bare peat. Areas of woodland and forestry edge habitats created by roadways/watercourses and commercial forestry show potential for foraging and commuting bats. However, some of these habitats are isolated from the wider landscape, particularly by wide expanses of open peatland habitats. Forestry edge and scrub habitats were thus assigned a ***Moderate*** suitability value for foraging and commuting bats. All other habitats present were assigned a ***Negligible*** value. The results of the manual transect and static detector monitoring in 2018 confirmed a preference for woodland edge and edge habitats along smaller forestry tracks as well as a tendency to avoid open areas and edge habitats along wider access roads.

Overall, activity levels for Leisler's bat, soprano and common pipistrelle were considered ***High*** using Ecobat analyses. Activity levels for *Myotis* sp. and brown long-eared bat were assessed as ***Low to Moderate*** and ***Low*** respectively. Manual transect results showed bat activity gradually increased from April, peaked in June and gradually tapered off into October. Static detector results did not reflect this trend, with significantly higher activity recorded in May than other months and no bats recorded in June. However, this may be due to the location of the static detectors in favorable/unfavorable habitats.

Static detector surveys at the site's met mast, simultaneously monitoring at ground level and at height in 2018, found low levels of bat activity at height, compared to activity at ground level over the same time period. Almost all the bat passes recorded at height were Leisler's bat, with a small quantity of soprano pipistrelle bats (Plate 1.10).

A search for roosts was undertaken within 200m of the site boundary, using a four-season approach. Trees within the proposed development site were assessed as not being of sufficient size or age to contain potential roost features thus a ***Low*** suitability value was assigned. A derelict house showed ***Moderate*** roosting potential. Additional structures identified within the proposed development site were assigned ***Negligible*** or ***Low*** potential values. Habitat assessments did not find any suitable sites for maternity colonies, swarming activity or hibernation within the proposed development site.

A roost survey conducted on the small derelict house revealed a number of soprano pipistrelle bats roosting within the house. It is likely only used by a small number of individuals as a day, feeding or night roost. Due to its structure, design and surrounding habitat, it was not found to support important roosts, e.g. maternity colonies or large roosts of lesser horseshoe bat, whiskered bat or Natterer's bat (NRA, 2006). The structure is being retained as part of the proposed development.