Appendix 7-6 - Bat Assessment – Proposed Derryadd Wind farm, Lanesborough, Co. Longford (Bat Eco Services, 2023)

2023

Bat Assessment – Proposed Derryadd Windfarm, Lanesborough, Co. Longford

Dr Tina Aughney

Bat Eco Services

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NPWS licence C17/2023 (Licence to handle bats, expires 23rd January 2026);
NPWS licence 27/2023 (Licence to photograph/film bats, expires 31st December 2024);
NPWS licence DER/BAT 2022-36 (Survey licence, expires 24th March 2025).

Statement of Authority: Dr Aughney has worked as a Bat Specialist since 2000 and has undertaken extensive survey work for all Irish bat species including large scale development projects, road schemes, residential developments, wind farm developments and smaller projects in relation to building renovation or habitat enhancement. She is a monitoring co-ordinator and trainer for Bat Conservation Ireland. She is a co-author of the 2014 publication *Irish Bats in the 21st Century*. This book received the 2015 CIEEM award for Information Sharing. Dr Aughney is a contributing author for the Atlas of Mammals in Ireland 2010-2015.

All analysis and reporting is completed by Dr Tina Aughney. Data collected and surveying is completed with the assistance of a trained field assistant.

Mr. Shaun Boyle (Field Assistant) NPWS licence DER/BAT 2022-37 (Survey licence, expires 24th March 2025).

Client: TOBIN on behalf of Bord na Mona

Project Name & Location: Derryadd, Lanesborough, Co. Longford.

Report Revision History

Date of Issue	Draft Number	Issued To (process of issuing)
1st June 2023	Draft 1	TOBIN (by email)
19th June 2023	Draft 2	TOBIN (by email)
19th October 2023	Final Draft 3	TOBIN (by email)

Purpose

This document has been prepared as a Report for TOBIN. Only the most up to-date report should be consulted. All previous drafts/reports are deemed redundant in relation to the named site.

Bat Eco Service accepts no responsibility or liability for any use that is made of this document other than by the client for the purposes for which it was originally commissioned and prepared.

Carbon Footprint Policy

It is the policy of Bat Eco Services to provide documentation digitally in order to reduce carbon footprint. Printing of reports etc. is avoided, where possible.

Bat Record Submission Policy

It is the policy of Bat Eco Services to submit all bat records to Bat Conservation Ireland database one year post-surveying. This is to ensure that a high level bat database is available for future desktop reviews. This action will be automatically undertaken unless otherwise requested, where there is genuine justification.

Executive Summary

Project Name & Location: Derryadd, Lanesborough, Co. Longford**.**

Proposed work: Wind farm development.

Bat Survey Results - Summary

Bat Species	Roosts	Foraging	Commuting
Common pipistrelle *Pipistrellus pipistrellus*		√	√
Soprano pipistrelle *Pipistrellus pygmaeus*		√	√
Nathusius' pipistrelle *Pipistrellus nathusii*			√
Leisler's bat *Nyctalus leisleri*		√	√
Brown long-eared bat *Plecotus auritus*		√	√
Daubenton's bat *Myotis daubentonii*		√	√
Natterer's bat *Myotis nattereri*		√	√
Whiskered bat *Myotis mystacinus*		√	√
Lesser horseshoe bat *Rhinolophus hipposideros*			

Bat Survey Duties Completed (Indicated by red shading)

Tree PBR Survey	◯	Daytime Building Inspection	◯
Static Detector Survey	◯	Daytime Bridge Inspection	◯
Dusk Bat Survey	◯	Dawn Bat Survey	◯
Walking Transect	◯	Driving Transect	◯
Trapping / Mist Netting	◯	IR Camcorder filming	◯
Endoscope Inspection	◯	Other (Thermal Imagery)	◯

The current bat survey data was collated in 2021 and 2022. A previous bat survey was undertaken in 2016 and 2018 (hereafter known as historical bat survey). The historical bat survey data is referenced but the 2021 and 2022 data is the primary dataset that is used in this report as part of assessment. Please consult separate bat survey report prepared in 2018 for details on 2016 and 2018 bat survey data.

Citation: Bat Eco Services (2023) Bat assessment of the proposed wind farm at Derryadd, Lanesborough, Co. Longford. Unpublished report prepared for TOBIN.

Contents

1. Introduction

Bat Eco Services was commissioned by TOBIN, on behalf of Bord na Mona to undertaken a bat survey of a proposed wind farm at Derryadd, Lanesborough, Co. Longford. Previous surveying was undertaken in 2016 and 2018 and this was presented in a separate report (please consult this report for full details – a brief summary is provided in this report). The current report presents the bat survey results completed in 2021 and 2022.

1.1 Relevant Legislation & Bat Species Status in Ireland

The principal statutory provisions for the protection of animal species are under the Wildlife Act 1976 (as amended) and the European Communities (Birds and Natural Habitats) Regulations 2011, as amended. The Habitats Directive (Council Directive 92/43/EEC) are the legislative instruments which are transposed into Irish law, *inter alia,* by the European Communities (Natural Habitats) Regulations 2011 (S.I. No. 477 of 2011) ('the 2011' Regulations), as amended.

All Irish bat species are protected under the Wildlife Act (1976) and Wildlife Amendment Acts (2000 and 2010). Also, the EC Directive on The Conservation of Natural habitats and of Wild Fauna and Flora (Habitats Directive 1992), seeks to protect rare species, including bats, and their habitats and requires that appropriate monitoring of populations be undertaken. All Irish bats are listed in Annex IV of the Habitats Directive and the lesser horseshoe bat *Rhinolophus hipposideros* is further listed under Annex II. Across Europe, they are further protected under the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention 1982), which, in relation to bats, exists to conserve all species and their habitats. The Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention 1979, enacted 1983) was instigated to protect migrant species across all European boundaries. The Irish government has ratified both these conventions.

There are eleven recorded bat species in Ireland, nine of which are considered resident on the island. Eight resident bat species and one of the vagrant bat species are vesper bats and all vespertilionid bats have a tragus (cartilaginous structure inside the pinna of the ear). Vesper bats are distributed throughout the island. Nathusius' pipistrelle *Pipistrellus nathusii* is a recent addition while the Brandt's bat has only been recorded once to-date (Only record confirmed by DNA testing, all other records has not been genetically confirmed). The ninth resident species is the lesser horseshoe bat *Rhinolophus hipposideros*, which belongs to the Rhinolophidea and has a complex nose leaf structure on the face, distinguishing it from the vesper bats.

Please see Appendix 9.1 for more details.

2. Project Description

2.1 Site Location

The proposed location of the wind turbine farm development is within the study area present on the following map (i.e. Proposed Study Area/Boundary). The proposed development, known as Derryadd Wind Farm is located within the Mountdillon peat production bog group in Co.Longford.

The proposed wind farm site is located within the townlands of Annaghbeg, Annaghmore,Ards, Ballynakill, Barnacor, Cloonbearla, Cloonbony, Cloonbrock, Cloonfiugh, Cloonfore, Cloonkeel, Cloontabeg, Cloontamore, Coolnahinch, Corlea, Corralough, Derraghan Beg, Derraghan More, Derryad, Derryaroge, Derryart, Derrygeel, Derryglogher, Derrynaskea, Derryoghil, Derryshannoge, Grillagh, Kilmakinlan, Mosstown (Rathcline Barony) Mount Davys, Rapparechill. Co.Longford.

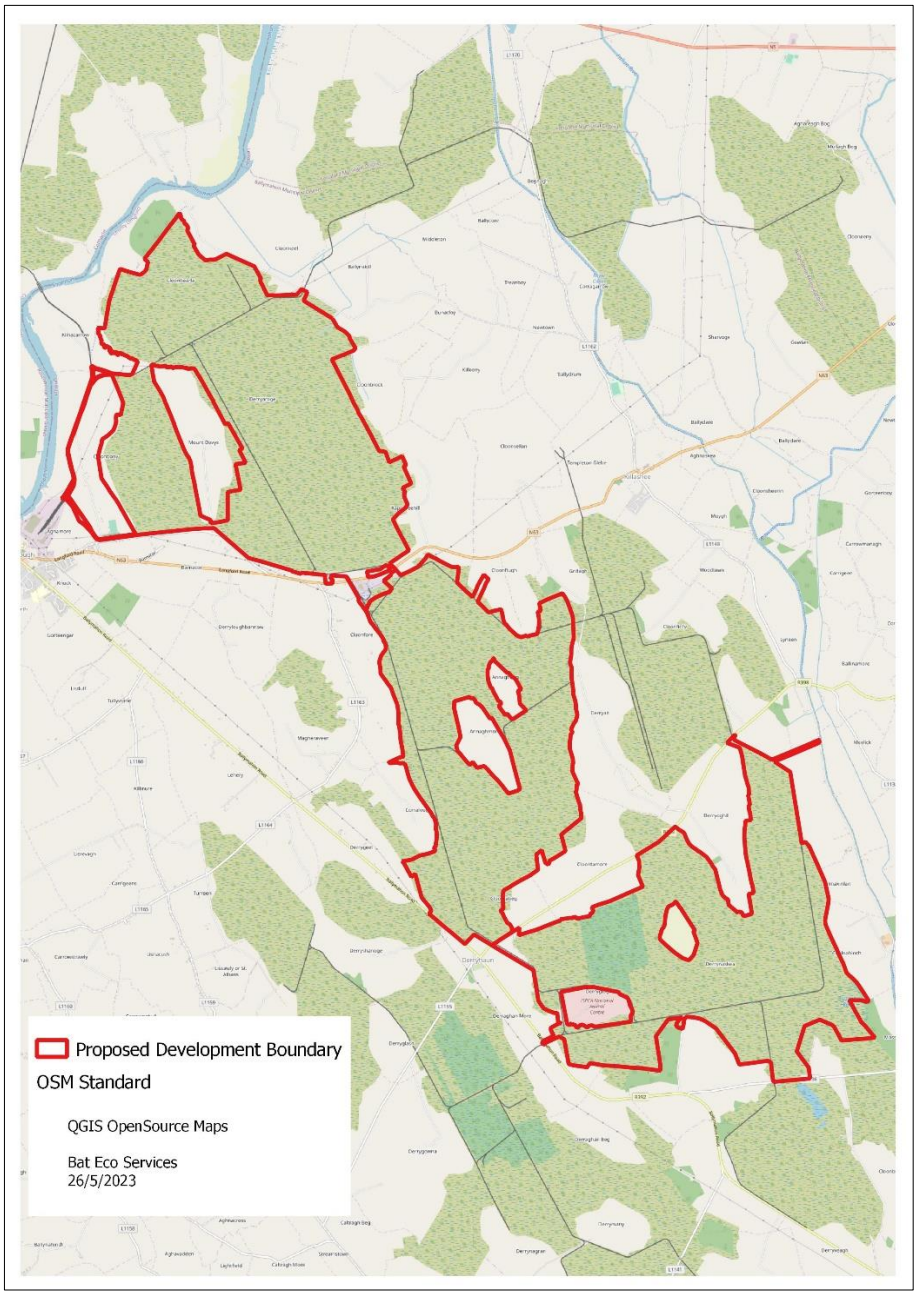

Figure 1a: Study Area/Boundary of the proposed development at Derryadd, Lanesborough, Co. Longford.

2.2 Proposed Project

The proposed development comprises the construction of 22 no. wind turbines and ancillary works. The turbines will have a blade tip height of 190m above the top of the foundation level and will be accessible from internal access routes within the Bord na Móna site.

The Proposed Development will comprise:

- 22 no. wind turbines (including tower sections, nacelle, hub and rotor blades) with a blade tip height of 190m and all associated foundations and hard-standing areas in respect of each turbine;
- New internal site access road, approximately 27,500m in length (permanent and temporary), passing bays, car parking areas and associated drainage;
- Approximately 7,500m of dedicated amenity access tracks to provide linkages between the proposed wind farm site roads, royal canal greenway (to the east), the Corlea visitor centre and amenity areas (to the south), and wider proposed Mid-Shannon Wilderness Park Area;
- 3No. permanent amenity carparks, one of which are situated in Derryarogue Bog (19 car parking spaces in total) and two carparks in Derryadd Bog (38 car parking spaces).
- 2 no. permanent Meteorological Masts, both of which will be 120m in height, and associated hardstanding areas for both masts, as well as the decommissioning and removal of an existing 100m Meteorological Mast on site;
- 4 No. Borrow pits;
- 4 No. temporary construction compounds, including material storage, site welfare facilities, and site offices;
- 4 No. temporary security cabins at the main construction site entrances as well as at a number of access points around the site.
- 1 no. 110kV electrical substation compound (including 2 No. control buildings, a 36m high telecommunications tower, associated electrical plant and equipment, wastewater holding tank, welfare facilities and approximately 16MW battery storage facility) and associated grid connection via a 110 kV loop-in connection to the existing Lanesborough-Richmond 110 kV overhead line which traverses the proposed development site;
- All associated underground electrical and communications cabling connecting the turbines and masts to the proposed electrical substation, including road crossing at N63 and associated grid connection via a 110 kV loop-in connection to the existing Lanesborough-Richmond 110 kV overhead line which traverses the proposed wind farm site;
- 2 no. Peat Deposition Areas, one to the north of the proposed substation compound in Derryaroge Bog and one in Derryadd Bog;
- New site access entrances, temporary improvements and modifications to existing public road infrastructure to facilitate delivery of abnormal loads including locations on N6 Eastbound Slip Road, N6/N61 Roundabout at Athlone, N61/N63 Roundabout at Roscommon, N63 Roscommon Arts Centre Roundabout and N61/N63 Roundabout, Northeast of Roscommon.
- All associated site work and ancillary works including new drainage and updating existing drainage, access road, earthworks, site reinstatement and erosion control, which will be aligned with the existing and future site rehabilitation plans; and,
- A 10-year planning permission is being sought with a 30-year operational life from the date of commissioning of the entire wind farm.

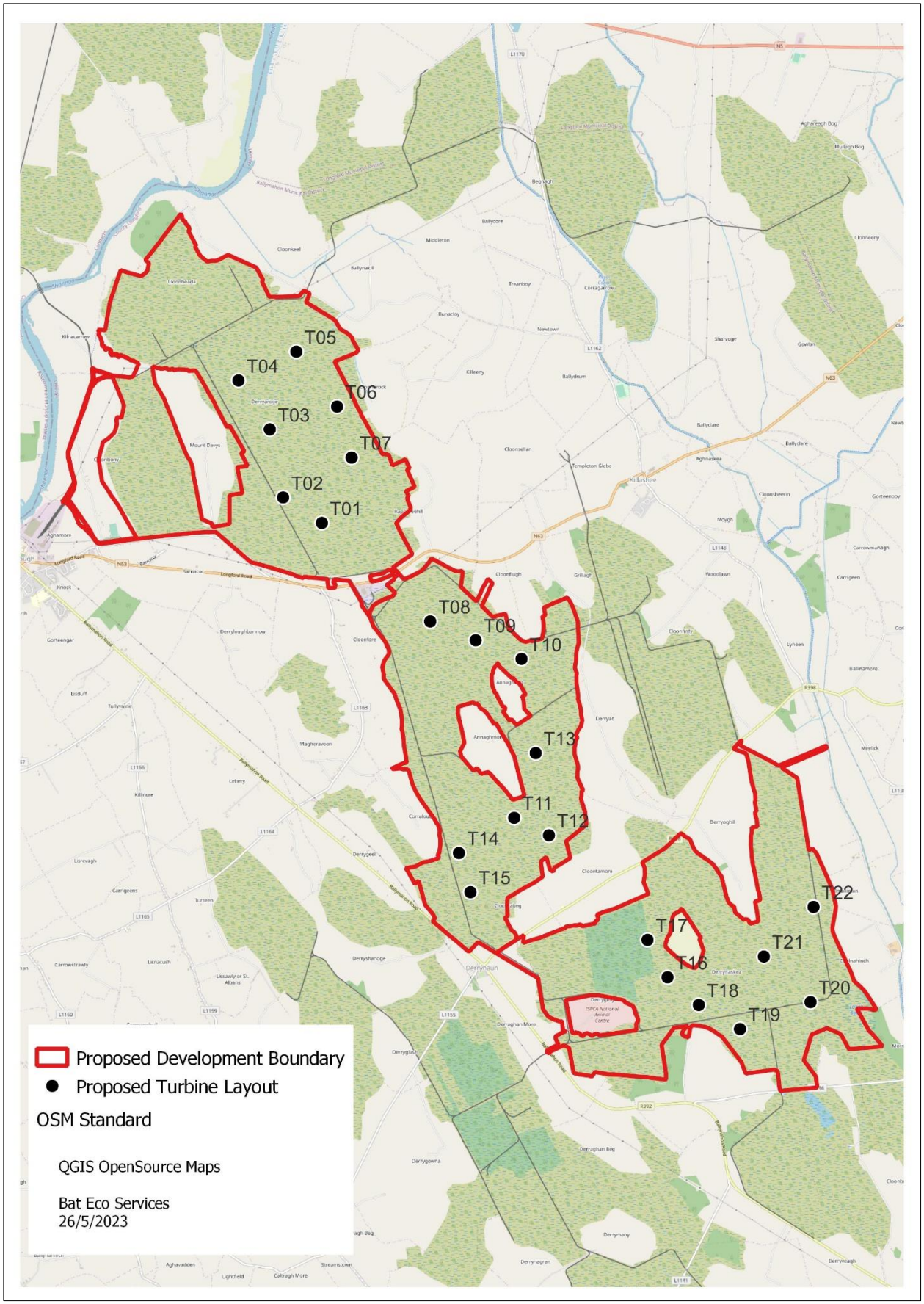

Figure 1b: Turbine layout of the proposed development at Derryadd, Lanesborough, Co. Longford. Red Line = Study Area / Boundary

3. Bat Survey Methodology 2021 & 2022

3.1 Daytime Inspections

One purpose of daytime inspections is to determine the potential of bat roosts within the survey area. Due to the transient nature of bats and their seasonal life cycle, there are a number of different type of bat roosts. Where possible, one of the objectives of the surveys is to be able to identify the types of roosts present, if any. However, the determination of the type of roost present depends on the timing of the survey and the number of bat surveys completed. Consequently, the definition of roost types, in this report, will be based on the following:

Table 1: Bat Roost Types (adapted from Collins 2016).

Roost Type	Definition	Time of Survey
Day Roost	A place where individual bats or small groups of males, rest or shelter in the daytime but are rarely found by night in the summer.	Anytime of the year
Night Roost	A place where bats rest or shelter in the night but are rarely found in the day. May be used by a single bat on occasion or it could be used regularly by the whole colony.	Anytime of the year
Feeding Roost	A place where individual bats or a few bats rest or feed during the night but are rarely present by day.	Anytime of the year
Transitional Roost	A place used by a few individuals or occasionally small groups for generally short periods of time on waking from hibernation or in the period prior to hibernation.	Outside the main maternity and hibernation periods.
Swarming Site	Where large numbers of males and females gather. Appear to be important mating sites.	Late summer and autumn
Mating Site	Where mating takes place.	Late summer and autumn
Maternity Site	Where female bats give birth and raise their young to independence.	Summer months
Hibernation Site	Where bats are found, either individually or in groups in the winter months. They have a constant cool temperature and humidity.	Winter months in cold weather conditions
Satellite Roost	An alternative roost found in close proximity to the main nursery colony and is used by a few individuals throughout the breeding season.	Summer months

3.1.1 Building & Structure Inspection

Structures, buildings and other likely places that may provide a roosting space for bats are inspected during the daytime for evidence of bat usage. Evidence of bat usage is in the form of actual bats (visible or audible), bat droppings, urine staining, grease marks (oily secretions from glands present on stonework) and claw marks. In addition, the presence of bat fly pupae (bat parasite) also indicated that bat usage of a crevice, for example, has occurred in the past. Inspections are undertaken visually

with the aid of a strong torch beam (LED Lenser P14.2) and endoscope (General DC5660A Wet / Dry Scope).

Buildings were assessed to determine their suitability as a bat and described using the parameters Negligible, Low, Medium or High suitability in view of Table 5.1 of Marnell *et al* (2022). Surveying was carried out in the preferred months of May to September (Collins, 2016). The level of suitability informed the level of surveying required (See Appendix 2 for details). The buildings assessed were located within the proposed development site. Building inspections were completed prior to dusk emergence surveys on 27th and 28th July and 9th August 2022.

3.1.2 Bat Habitat & Commuting Routes Mapping

The survey site was assessed during daytime walkabout surveys, in relation to potential bat foraging habitat and potential bat commuting routes. Such habitats were classified according to Fossit, 2000. Bat habitats and commuting routes identified were considered in relation to the wider landscape to determine landscape connectivity for local bat populations through the examination of aerial photographs.

3.2 Night-time Bat Detector Surveys

3.2.1 Dusk & Dawn Bat Surveys

Dusk Emergence Surveys of buildings located within the proposed development area were completed from 10 minutes before sunset to at least 110 minutes post sunset and the surveyors position themselves adjacent to the building / structure to be surveyed to determine if bats are roosting within, location of roost(s), number of bats, bat species etc. These surveys were completed on 27th and 28th July and 9th August 2022.

The following equipment was used during the 2022 bat surveys:

Surveyor 1 (Principal surveyor): Anabat Walkabout Full Spectrum Bat Detector and Petersson D200 Heterodyne Bat Detector.

Surveyor 2: BatLogger M2 Full Spectrum Bat Detector and Petersson D200 Heterodyne Bat Detector.

Surveyor 3: Anabat Scout Full Spectrum Bat Detector and Petersson D200 Heterodyne Bat Detector.

3.2.2 Walking Transects

Walking transects completed in 2022 (27th and 28th July and 9th August 2022) were generally completed post Dusk Emergence Surveys and involved the surveyor(s) walking the survey area. Walking transects were undertaken across the rail tracks of the proposed development area as well as local roads network adjacent to the proposed development area. The GPX. File from the BatLogger M2, Anabat Scout and Anabat Walkabout was used to produce a map detailing the transects undertaken.

Each audio file recorded by the listed full spectrum bat detectors are geo-referenced which aids mapping of bat species distribution. All audio files were analysed using Wildlife Acoustics Kaleidoscope Pro. All of the recordings were analysed using the auto-id function and then recordings identified as Leisler's bat, *Myotis* species (Natterer's bat, Daubenton's bat and whiskered bat), brown long-eared bat, Noise and Unidentified were manual checked. For recordings identified as common pipistrelle and soprano pipistrelle, 10-20% of calls were manually checked to ensure accurate identification. Validation of bat records was completed by the principal bat surveyor prior to mapping.

3.2.3 Driving Transects

A Driving transect was undertaken on 27th July 2022 (post walking transect) on local and regional roads covering larger survey areas around the circumference of the proposed development area. A BatLogger M2 full spectrum bat detector was attached to the window on the passenger side of a vehicle with ultrasonic microphone facing to the rear of the vehicle (to reduce wind interference). The vehicle was driven at 24 km/hr following Bat Conservation Ireland's car-based bat monitoring methodology (Aughney *et al.,* 2018). The GPX. File from the BatLogger M2 was used to produce a map detailing the transects undertaken.

Each audio file recorded by the full spectrum bat detector were treated as per Walking Transect.

3.2.4 Passive Static Bat Detector Survey

A Passive Static Bat Surveys involves leaving a static bat detector unit (with ultrasonic microphone) in a specific location and set to record for a specified period of time (i.e. a bat detector is left in the field, there is no observer present and bats which pass near enough to the monitoring unit are recorded and their calls are stored for analysis post surveying). The bat detector is effectively used as a bat activity data logger. This results in a far greater sampling effort over a shorter period of time. Bat detectors with ultrasonic microphones are used as the ultrasonic calls produced by bats cannot be heard by human hearing.

The microphone of the unit was positioned horizontally to reduce potential damage from rain. Passive bat detectors listed in Table 2 use Real Time recording as a technique to record bat echolocation calls and using specific software, the recorded calls are identified. These sonograms (2-d sound pictures) are digitally stored on the SD card (or micro SD cards depending on the model) and downloaded for analysis. These results are depicted on a graph showing the number of bat passes per species per hour/night. Each bat pass does not correlate to an individual bat but is representative of bat activity levels. Some species such as the pipistrelles will continuously fly around a habitat and therefore it is likely that a series of bat passes within a similar time frame is one individual bat. On the other hand, Leisler's bats tend to travel through an area quickly and therefore an individual sequence or bat pass is more likely to be indicative of individual bats. The recordings were analysed using Wildlife Acoustics Kaleidoscope Pro a per description of methodology for Walking Transects.

Static surveillance was undertaking according to NaturScot (2021) and three static surveillance periods were completed as follows:

- Autumn 2021 (15 static units)
- Spring 2022 (15 static units)
- Summer 2022 (14 static units)

The following static units were deployed during this static bat detector survey:

Table 2: Static Bat Detectors deployed during Static Bat Detector Surveys.

Static Unit Code	Bat Detector Type	Recording Function	Microphone
SM4 Units 1-10	Wildlife Acoustics SongMeter 4 Bat FS	Passive Full Spectrum	SMM-U2, 4m cable
SM Mini Bat Units 1-13	Wildlife Acoustics SongMeter Mini Bat	Passive Full Spectrum	SMM-UM

3.3 Desktop Review

3.3.1 Bat Conservation Ireland Database

A 10km search around the proposed development site was applied for in relation to Bat Conservation Ireland bat record database. The dataset consists of historical records up to 2022.

3.3.2 Bat Conservation Landscape Favourability

Bat Conservation Ireland produced a landscape conservation guide for Irish bat species using their database of species records collated during the 2000-2009 survey seasons. An analysis of the habitat and landscape associations of all bat species deemed resident in Ireland was undertaken and reported in Lundy *et al.*, 2011. The geographical area suitable for individual species was used to identify the core favourable areas of each species. This was produced as a GIS layer for local authorities and planners in order to provide a guide to the consideration of bat conservation. The island is divided into 5km squares and the landscape favourability of each 5km square for each species of bat was modelled. The degree of favourability is colour coded with lighter colours indicating a low favourability progressing towards a dark colour indicating a higher favourability. The value of favourability ranges from 0 – 100 with 0 indicating unsuitable and 100 deemed as suitable. The values of the grid squares represent the range of habitat suitability values the bat species can tolerate within each individual square. This is divided into five categories using "Natural breaks" (Jenks Natural Breaks Classification - is a data clustering method designed to determine the best arrangement of values into different classes. This is done by seeking to minimize each class's average deviation from the class mean, while maximizing each class's deviation from the means of the other groups. The method seeks to reduce the variance within classes and maximize the variance between classes (Jenks, 1967)). As a result of the classification, there are different values (i.e. percentage favourability) for each of the species models shown in the figures below. Each class is represented on a colour ramp to show the difference between 5km squares, where applicable. Therefore, due to the mosaic of land uses in a 5km square, there are no squares where the value a 100. This model is a broad generalisation of the bat species' geographical occurrence.

A caveat is attached to the model and it is that the model is based on records held on the BCIreland database, while core areas have been identified, areas outside the core area should not be discounted as unimportant as bats are a landscape species and can travel many kilometres between roosts and foraging areas nightly and seasonally.

3.3.3 Previous Bat Surveys

3.3.3.1 Derryadd Wind Farm, Co. Mayo (Bat Eco Services, 2018)

Bat surveys were completed in 2016 and 2018 for this proposed development site. The principal component of the 2016 bat surveys was static surveillance. Passive full spectrum bat detectors were erected at 4m and 50m heights on both masts located at Lough Bannoe and Derryaroge Mast and surveillance was completed monthly from June to November (6 months). A detailed summary of the bat survey results is presented in Appendix 9.5. Overall, four bat species were recorded on the 4m static unit on Lough Bannow Mast (soprano pipistrelle, common pipistrelle, Leisler's bat and brown long-eared bat), while five bat species were recorded on the 50m static unit (soprano pipistrelle, common pipistrelle, Leisler's bat, Nathusius' pipistrelle and brown long-eared bat). In relation to the Derryaroge Mast, four bat species were recorded on the 4m static unit (soprano pipistrelle, common pipistrelle, Leisler's bat and *Myotis* species), while three bat species were recorded on the 50m static unit (soprano pipistrelle, common pipistrelle and Leisler's bat).

The following bat species were recorded during additional static recording sessions (static recording units located a 2m height – 20 locations): soprano pipistrelle, common pipistrelle, Leisler's bat, Natterer's bat, brown long-eared bats, *Myotis* species.

Additional bat surveying comprised of walking and driving transects (See Appendix 9.5 for details). The following bat species were recorded during Walking and/or Driving Transects: soprano pipistrelle, common pipistrelle, Leisler's bat, Natterer's bat, Daubenton's bats, *Myotis* species.

Additional survey work was complete in June 2018 to address gaps in the coverage across the entire survey area. This consisted of walkabout surveys in two sections of the survey area and the placement of five static recording units (2m height) for one night surveillance. The following bat species were recorded: soprano pipistrelle, common pipistrelle, Leisler's bat, Nathusius' pipistrelle and *Myotis* species.

In summary, between the numerous different types of bat surveys completed in 2016 and additional surveying in June 2018, bats were encountered at a total of 184 unique grid referenced points (20 static unit points, four microphones locations on the two anemometer masts, 52 driving transect points and 112 walking transect points). Some of these points had multiple bat species recorded (n=49 locations, primarily static unit locations). Where possible, bat encounters were recorded to species level. However for much of the *Myotis* species bat encounters recorded on static units were not identified to species level as it is important to have visual observations to assist with identification to species level. Two species of bats were recorded at twenty-three locations, three species of bat were recorded at 14 locations, four species of bat were recorded at 11 locations and five species of bat were recorded at one location (Static Site No. 5). All other locations had one species of bat recorded at the time of surveying (n=122) while 9 points had no bat species recorded.

The weather data collated by the anemometers was investigated in relation to the potential influence of maximum wind speed (at the 50m and 10m level), average temperature (at the 79m and 5m level) and precipitation (rain gauge collection) on bat activity. The hourly data from Derryaroge 80m mast were analysed (n=262 hrs). Bat data collated by the microphone located on the Derryaroge 80m mast at a height of 4m was correlated with wind speed taken at the 10m level and air temperature recorded a 5m level. Bat data collated by the microphone located at the 50m height was correlated with wind speed taken 50m and air temperature recorded at 79m.

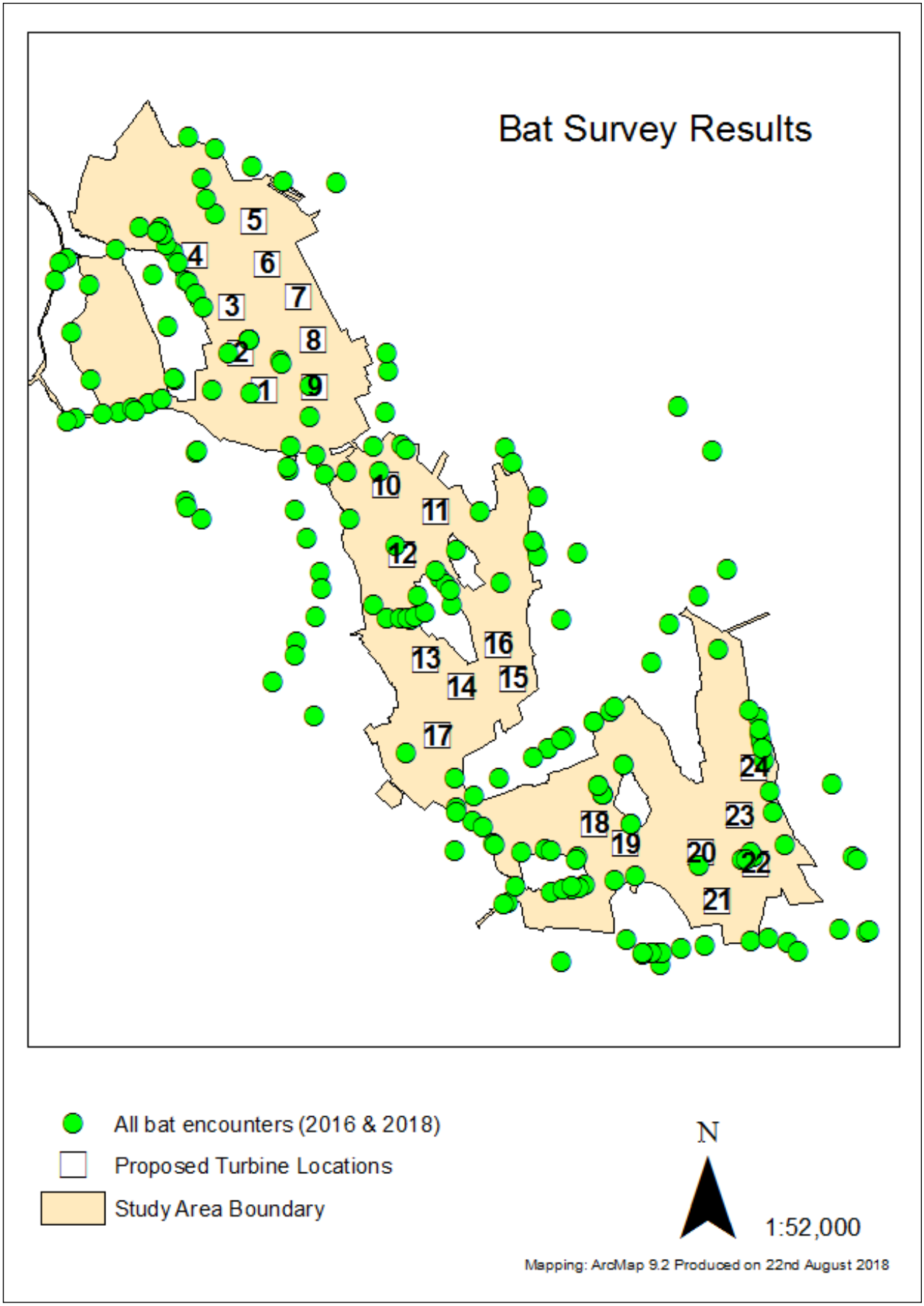

Figure 2: Location of all bat encounters recorded during 2016 bat surveys and additional bat survey work (June 2018). (Source: Bat Eco Services, 2018).

3.4 Analysis

3.4.1 Ecobat Tool

As per NaturScot (2021), it is recommended that the nightly number of bat passes recorded per species on the statics units are analysed using the website based tool Ecobat (http://www.ecobat.org.uk/). This Ecobat tool was designed by the University of Exeter, UK and is hosted by the Mammal Society, UK. The following is taken from the "About " section of the website:

Acoustic surveys using bat detectors are widely used to determine species' presence and to quantify the activity of foraging bats as they are cost-effective, can be automated to run for long time periods, and are non-intrusive. Activity levels are dependent on a number of factors including seasonality, weather conditions and location, with the type of bat detector used during the survey also affecting detection rates.

Using bat passes to assess the relative importance of a site for policymakers therefore requires practitioners to account for how these multiple factors may have influenced the number of bat passes recorded at a site. Although professional opinion is valuable, it can often be based on intuition, is context dependent and can vary considerably between practitioners (Hulme, 2014).

It is therefore likely that an assessment of the ecological value of a site (and the impacts of any proposed action) will vary between practitioners based upon their own level of experience and knowledge of the region and/or species.

Ecobat compares surveys submitted by the user with a national reference dataset and objectively quantifies bat activity levels. It offers a web-based interface for depositing data rapidly and securely, automatically generating a numerical indicator of the relative importance of a night's worth of activity, by contrasting with a comparable reference range. The output can be used by ecologists to accurately quantify what bat activity means for use during ecological impact assessments.

Ecobat uses percentiles to provide a numerical representation of activity levels relative to the surrounding landscape for each night of surveying. Percentiles can then be assigned to activity categories (low, moderate, high) to provide a quantifiable measure of bat activity. Percentiles provide a numerical indicator of the relative importance of a nights' worth of bat activity by comparing it with a national database. For example, activity data in the 80th percentile would indicate that the recorded data were in the top 20% of activity for the reference range.

Table 3: Percentile score and categorised level of bat activity.

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

However, this analysis was not undertaken as the EcoBat Tool facility has not been in operation since November 2022. The author has undertaken analysis using this tool for other wind farm projects and has applied the basic principles of the tool to static unit results in order to facilitate analysis and to complete the steps as per NaturScot (2021) in order to achieve a Bat Activity Value according to Table 3.

3.4.2 EUROBATS 200m Buffer Zone

A second analysis was undertaken in relation the location of wind turbines and the habitats present within the proposed development area. As noted by EUROBATS, wind turbines are recommended to be a minimum distance of 200m from wooded habitats (i.e. potential ***"Bat Habitat"***). Therefore a layer was produced and named ***"200m Buffer"*** to represent the potential area/zone of influence for each individual wind turbine to aid analysis of the potential impact of the proposed wind turbine development on local bat populations.

3.4.3 Bat Habitats

All static recording locations sampled are also classed according to their favourability as a bat habitat within 200m radius of the static unit location. Four classifications are used:

- Open – for example, open peat bog. Typically, there is little tall vegetation in this category which is generally required for bat species to forage and commute along (exception to this is Leisler's bats). This category would be considered to have a low potential for the majority of bat species.
- Edge – for example, hedgerows, treelines and woodland edge. Bat species such as *Pipistrellus* species have a preference to fly along linear habitat features. This category would be considered to have a high potential for the majority of bat species.
- Closed – for example woodland. Bat species such a brown long-eared bats have a preference to foraging within woodland habitats. This category would be considered to have a high potential for the majority of bat species.
- Water – while an open habitat, due to the insect resource associated with water, these habitat types are often favoured by foraging bats, especially Daubenton's bat.

Roche *et al.* (2014) and Lundy *et al.* (2011) reported on the habitats consider favourable for each Irish bat species. Using the habitat maps (QGIS map layers) produced by TOBIN, habitats considered to be ***"Bat Habitat"*** were examined to aid analysis for this report. Habitats deemed by the author, under guidance of Roche *et al.* (2014) and Lundy *et al.* (2011), as ***"Bat Habitat"*** are as follows:

- Mixed broad leaved woodland
- Water bodies
- Linear habitat
- Bog Woodland
- Mosaic
- Scrub
- Conifer plantation

Additional QGIS layers were created to aid analysis for this report. Each bat encounter was mapped. As bats echolocation calls can be detected some distance from where the actual bat is flying, a 50m fly zone was created around each bat encounter to represent the general area that individual bat recorded could be located at that point in time. This was named the ***"50m Buffer"*** and represents the potential distance that bat echolocation calls can be detected by an ultrasonic microphone (i.e. bat detector zone).

3.4.4 Internal Wind Farm Access Tracks

To facilitate the construction of the proposed wind farm, internal wind farm access tracks are required. This may result in the removal of habitats and the potential impact of this is investigated using the ***"Bat Habitat"*** layer, **"50m Buffer"** layer and the **"200m Buffer"** layer produced.

3.4.5 Core Sustenance Areas

Bat Conservation Trust (BCT) defines Core Sustenance Zones (CSZs) for different bat species and this is based on an extensive literature review (www.bats.org.uk). A CSZ refers to the area surrounding a communal bat roost within which habitat availability and quality will have a significant influence on the resilience and conservation status of the colony using the roost. With reference to development, the CSZ could be used to indicate:

- The area surrounding a communal roost within which development work may impact the commuting and foraging habitat of bats using that roost.
- The area within which it may be necessary to ensure no net reduction in the quality and availability of foraging habitat for the colony.

4. Bat Survey Results

4.1 Daytime Inspections

4.1.1 Building & Structure Inspection

The following buildings/structures were inspected as part of the site investigation on 9/8/2022. There are an array of buildings under Bord na Mona ownership located off the N63 regional road. These buildings were inspected during the daytime for their suitability as potential bat roosts and to record any bat roosting evidence. All of the buildings have a Negligible to Low bat roosting potential and no bat evidence was recorded.

Table 4: Buildings / Structures inspection results.

Building Code	Description	Grid Reference (ITM)	Roost Type / Suitability	Bat Species
BnaM buildings	Modern corrugated buildings / storage sheds	604333,768959	Negligible to Low	No evidence
BnaM buildings - cottage	Single storey cottage (tile roof)	604333,768959	Low	No evidence
BnaM buildings 7 offices	Large complex of modern corrugated buildings / storage sheds / offices	604707,768859	Negligible to Low	No evidence

4.1.2 Bat Habitat & Commuting Routes Mapping

The habitat types, with reference to Fossit (2000), were recorded both within the survey area and adjacent to the survey area.

Table 5a: Habitat types present within survey area.

Habitat	Yes	Habitat	Yes	Habitat	Yes	Habitat	Yes
Cultivated land		Salt marshes		Exposed rock		Fens/flushes	
Built land	√	Brackish waters		Caves		Grasslands	√
Coastal structures		Springs		Freshwater marsh	√	Scrub	√
Shingle/gravel		Swamps		Lakes/ponds	√	Hedges/treelines	√
Sea cliffs/islets		Disturbed ground	√	Heath	√	Conifer plantation	√
Sand dunes		Watercourse	√	Bog	√	Woodland	√

Table 5b: Habitat types present adjacent to survey area.

Habitat	Yes	Habitat	Yes	Habitat	Yes	Habitat	Yes
Cultivated land		Salt marshes		Exposed rock		Fens/flushes	
Built land	√	Brackish waters		Caves		Grasslands	√
Coastal structures		Springs		Freshwater marsh	√	Scrub	√
Shingle/gravel		Swamps		Lakes/ponds	√	Hedges/treelines	√
Sea cliffs/islets		Disturbed ground	√	Heath	√	Conifer plantation	√
Sand dunes		Watercourse	√	Bog	√	Woodland	√

In addition, a habitats shapefile was provided by TOBIN (Please consult EIAR for greater details on habitat maps). The principal habitat within the study area / boundary is “cutover peat" large areas of various types of grassland, pioneering vegetation, heath, woodland, water bodies,linear water bodies and scrub. The habitats named in the TOBIN shapefile were examined and categorised into “Bat Habitats” to simplify the maps for analysis. Four principal “Bat Habitat” categories were chosen:

- Woodland
- Scrub
- Conifer Plantation
- Water bodies & aquatic habitats

and these broad categories represent habitats considered to be suitable for foraging and commuting bat species (Roche *et al.,* 2014) and these are presented below with the current turbine layout.

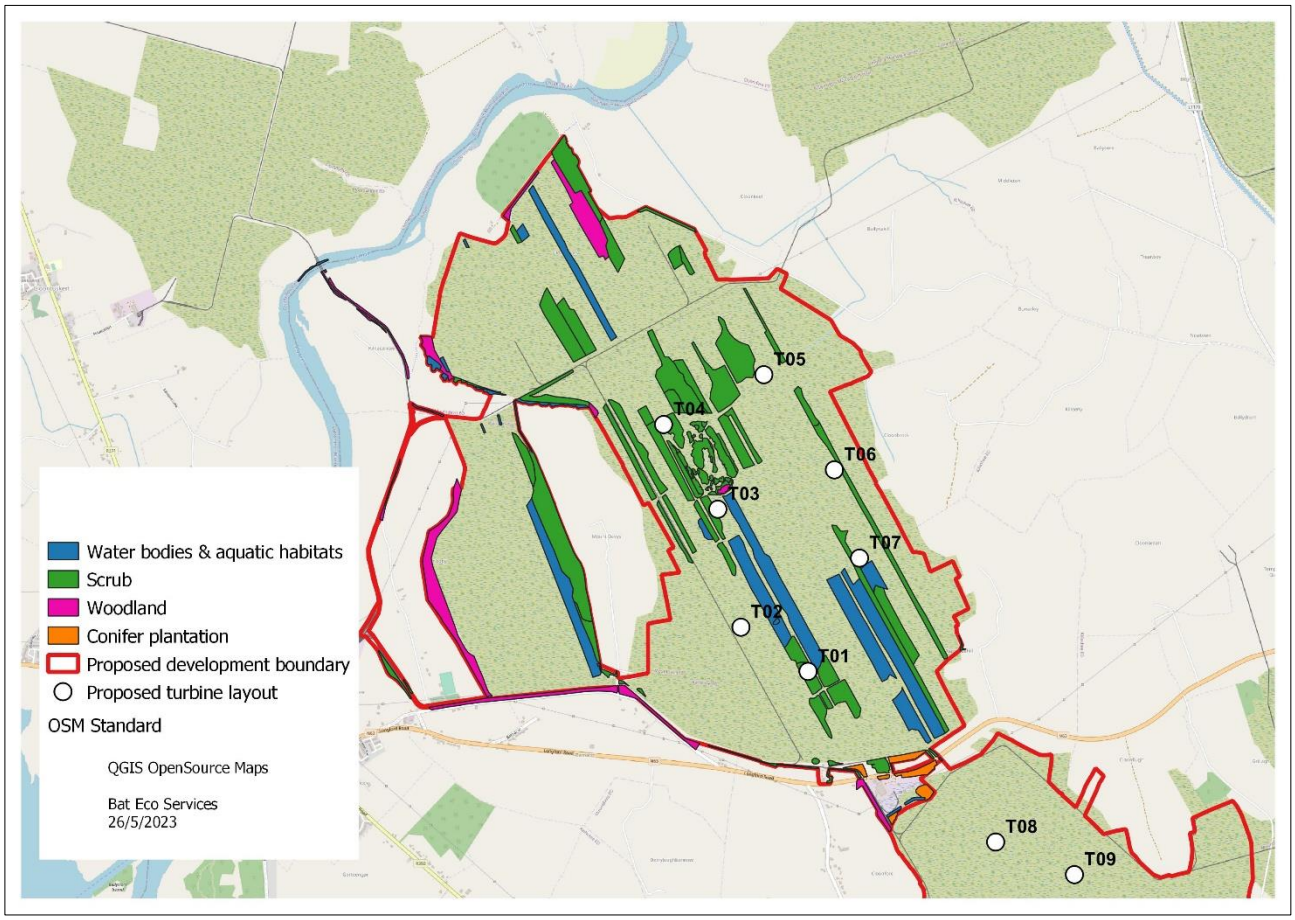

Figure 3a: Bat Habitats recorded within the Study Area/ boundary: Derryaroge

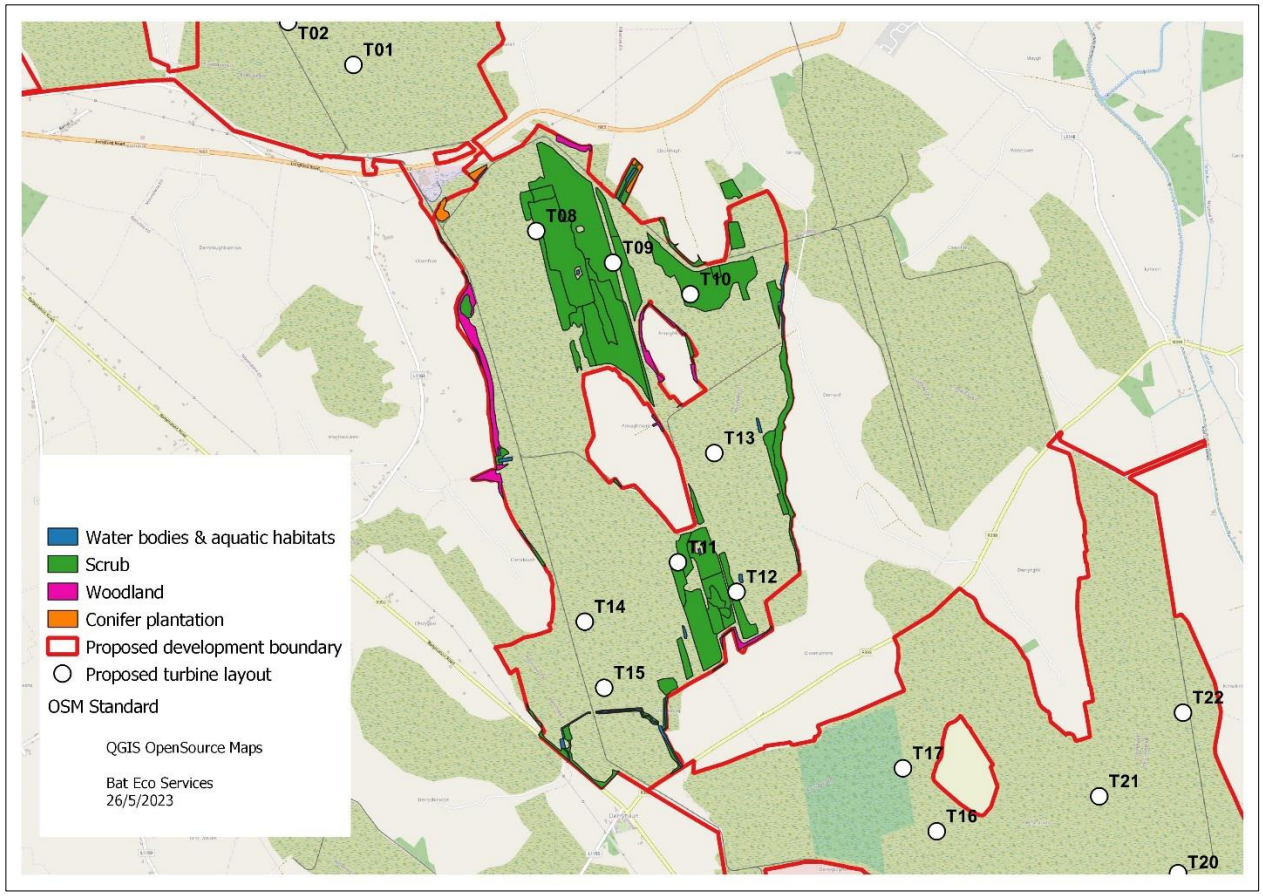

Figure 3b: Bat Habitats recorded within the Study Area / boundary: Derryadd.

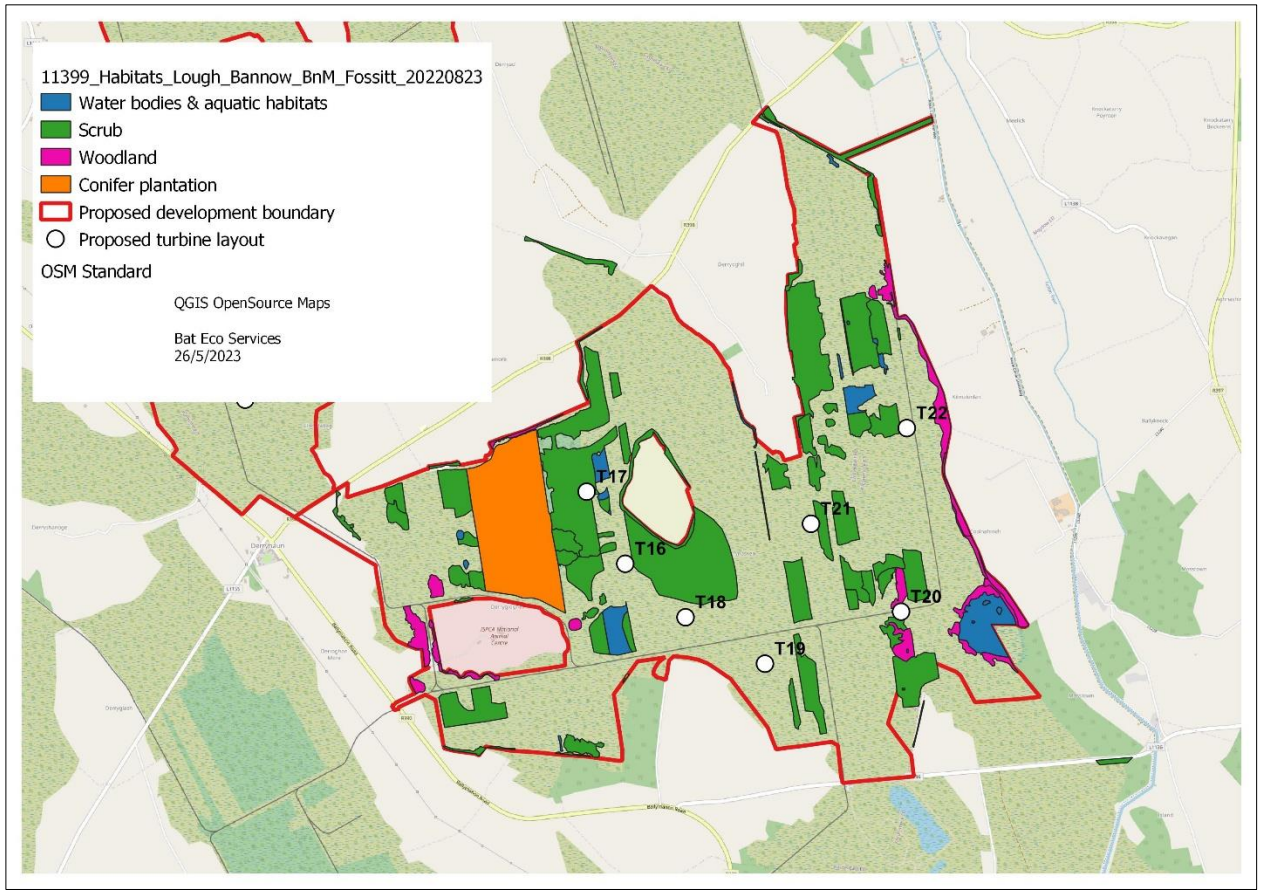

Figure 3c: Bat Habitats recorded within the Study Area / boundary: Lough Bannow.

4.2 2022 Night-time Bat Detector Surveys

4.2.1 Dusk Bat Surveys 2022

The following table summarises the results of the bat detector surveys completed on 9/8/2022 in relation to buildings located within the proposed development area. No bat roosts were recorded.

Table 6: Buildings / Structures survey results.

Building Code	Roost Type & Location	Bat Species (No. of bats)	Access Points	Vegetation / Lighting arrangement
BnaM buildings Dusk Survey 9/8/2022	None	Not applicable	Not applicable	Not applicable
BnaM buildings – cottage Dusk Survey 9/8/2022	None	Not applicable	Not applicable	Not applicable
BnaM buildings & offices Dusk Survey 9/8/2022 support with thermal imagery filming	None	Not applicable	Not applicable	Not applicable

4.2.2 Static Surveillance 2021 & 2022

The 2021 and 2022 passive static bat detector survey comprised of three surveillance periods where 14-15 locations were sampled in each of the surveillance periods. This was based on the proposed turbine locations and the ITM grid reference co-ordinates of all of the static units locations are provided in the Appendices (Appendix 9.6) and presented on the figure below. Static units were deployed to sample the preliminary turbine locations, the locations of which were provided in by TOBIN (initial planning based on turbine locations provided in 2021 and then updated according to new layout provided in June 2022). However the final proposed layout was provided in May 2023 and the following figures present the location of the static units for each surveillance period according to the proposed turbine layout (2023).

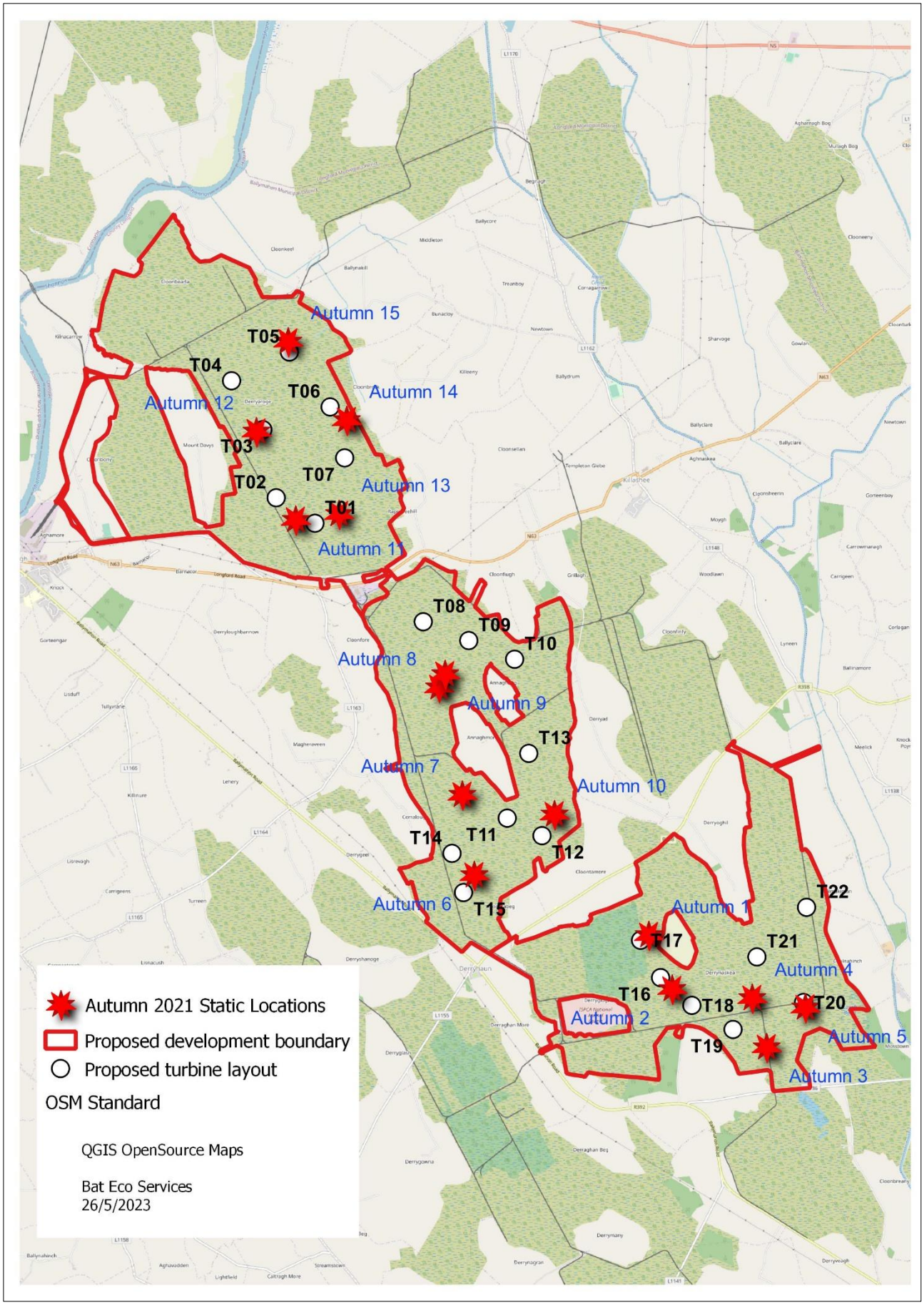

Figure 4a: Location of 2021 Autumn Static surveillance in relation to proposed turbine layout.

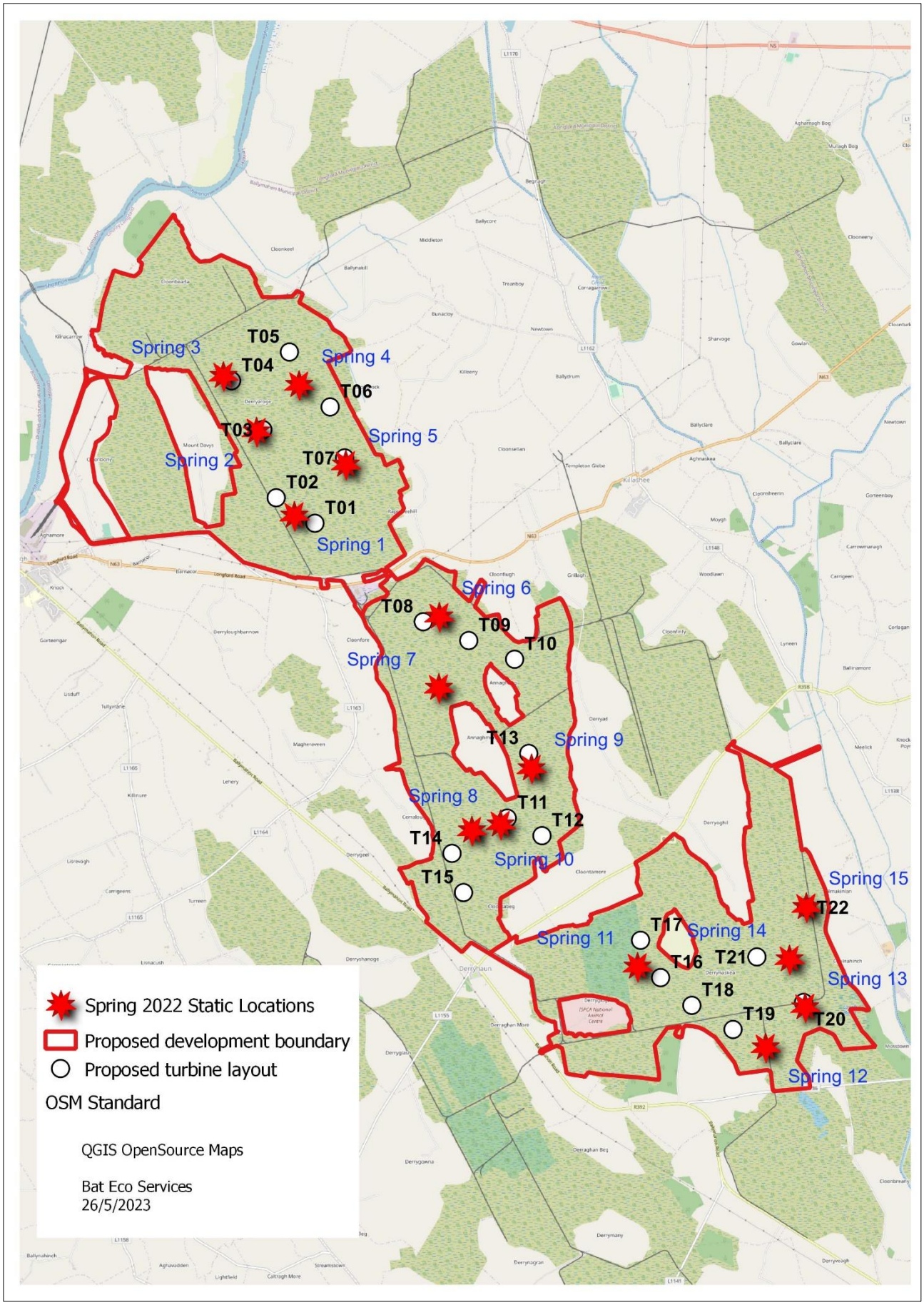

Figure 4b: Location of 2022 Spring Static surveillance in relation to proposed turbine layout.

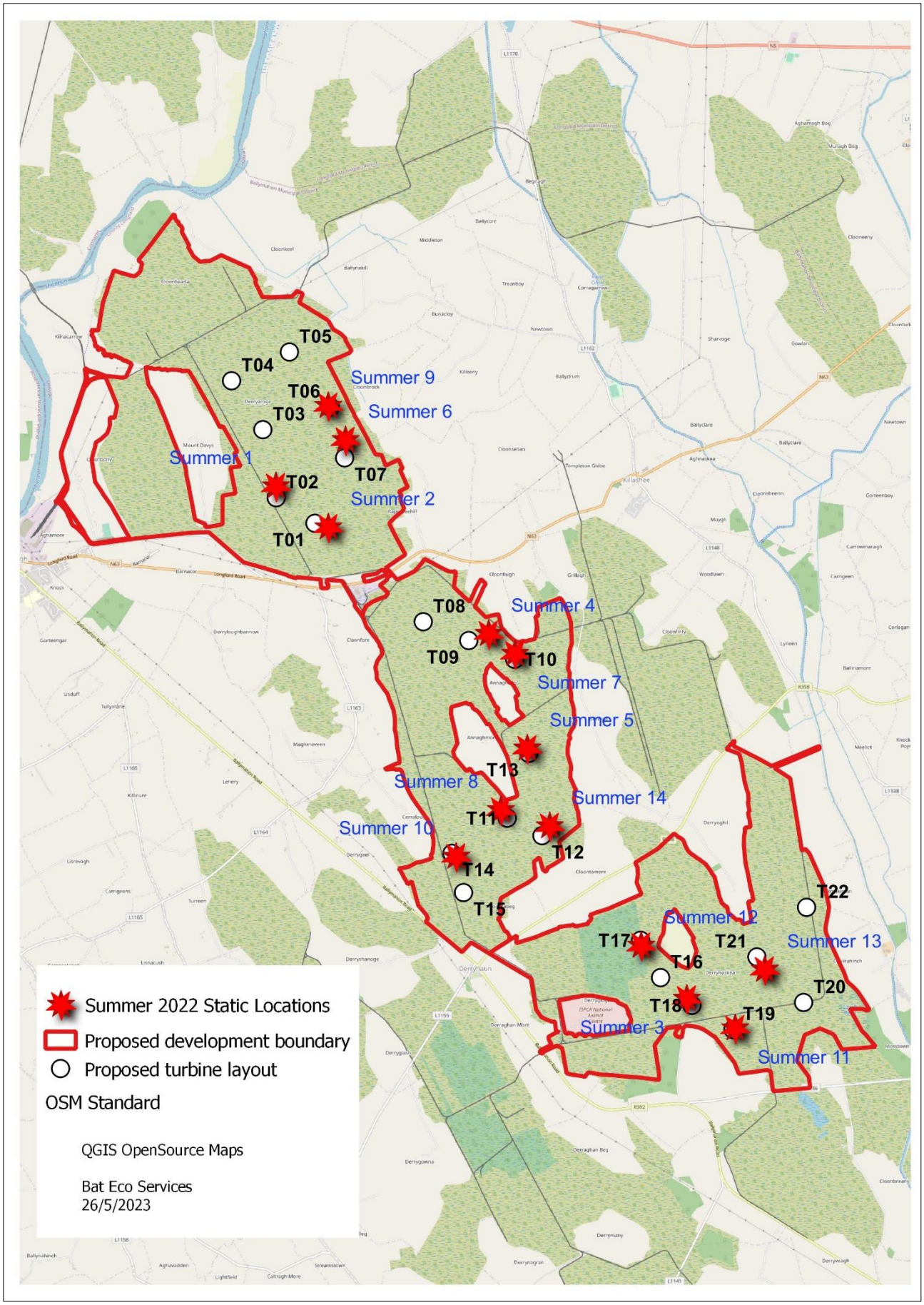

Figure 4c: Location of 2022 Summer Static surveillance in relation to proposed turbine layout.

Due to the changes in proposed turbine number and layouts since static surveillance was started in 2021, the location of static units during surveillance are not all located within 200m of the current proposed turbine layout. However, as a greater number of static units were deployed than recommended by NaturScot (2021) and also due to the fact that static units were located throughout the survey area, the static surveillance completed is representative of the habitats and bat activity within the survey area as at least one static unit was located within the analysis zone for each of the proposed turbine locations. The following table provides details with regards to this. A small number of static unit locations are not located within 500m of a proposed turbine location and these are as follows: Autumn 7, 8, 10, 13 and Spring 7, 14.

Table 7: Static units located within vicinity of proposed turbine locations. (Note: where a static units is located >200m from proposed turbine locations but <500m, the distance is listed).

Turbine No.	ITM Easting	ITM Northing	Autumn 2021	Spring 2022	Summer 2022
T01	604227	769639	Autumn 11	Spring 1 (250m)	Summer 2
T02	603784	769930			Summer 1
T03	603631	770710	Autumn 12	Spring 2	
T04	603273	771269		Spring 3	
T05	603935	771598	Autumn 15	Spring 4 (385m)	
T06	604401	770970	Autumn 14 (245m)		Summer 9
T07	604567	770387		Spring 5	Summer 6
T08	605467	768512		Spring 6	
T09	605988	768296	Autumn 9 (468m)		Summer 4
T10	606513	768082			Summer 7
T11	606428	766264		Spring 8	Summer 8
T12	606826	766064	Autumn 10 (280m)		Summer 14
T13	606675	767005		Spring 9	Summer 5
T14	605796	765861			Summer 10
T15	605928	765413	Autumn 6	Spring 10 (240m)	
T16	608184	764439	Autumn 2	Spring 11 (285m)	
T17	607954	764867	Autumn 1	Spring 11 (300m)	Summer 12
T18	608541	764122			Summer 3
T19	609013	763846	Autumn 3 (445m)	Spring 12 (420m)	Summer 11
T20	609820	764155	Autumn 5	Spring 13	
T21	609286	764676	Autumn 4 (470m)		Summer 13
T22	609854	765244		Spring 15	

The following bat species were recorded during the static surveillance: common pipistrelle, soprano pipistrelle, Leisler's bat, Natterer's bat, Daubenton's bat, brown long-eared bat, whiskered bat, *Myotis* species and Nathusius' pipistrelle (Please see Appendix 9.7, Tables E, F and G for a full breakdown of survey results for each static unit deployed).

The following figure details the total number of bat passes recorded for each bat species during each static surveillance periods (please note the difference in number of static units and number of nights of recording).

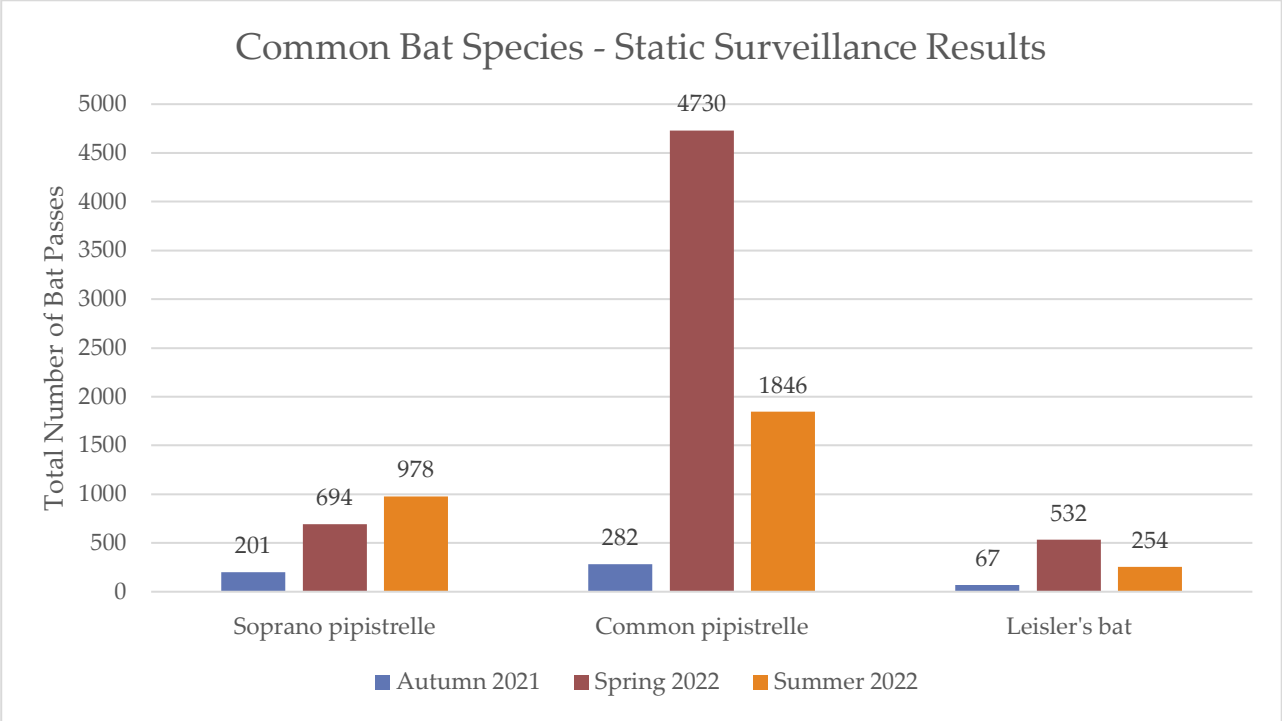

Figure 5a: Total number of bat passes recorded for each "Common" bat species during static surveillance completed in Autumn 2021 and Spring and Summer 2022.

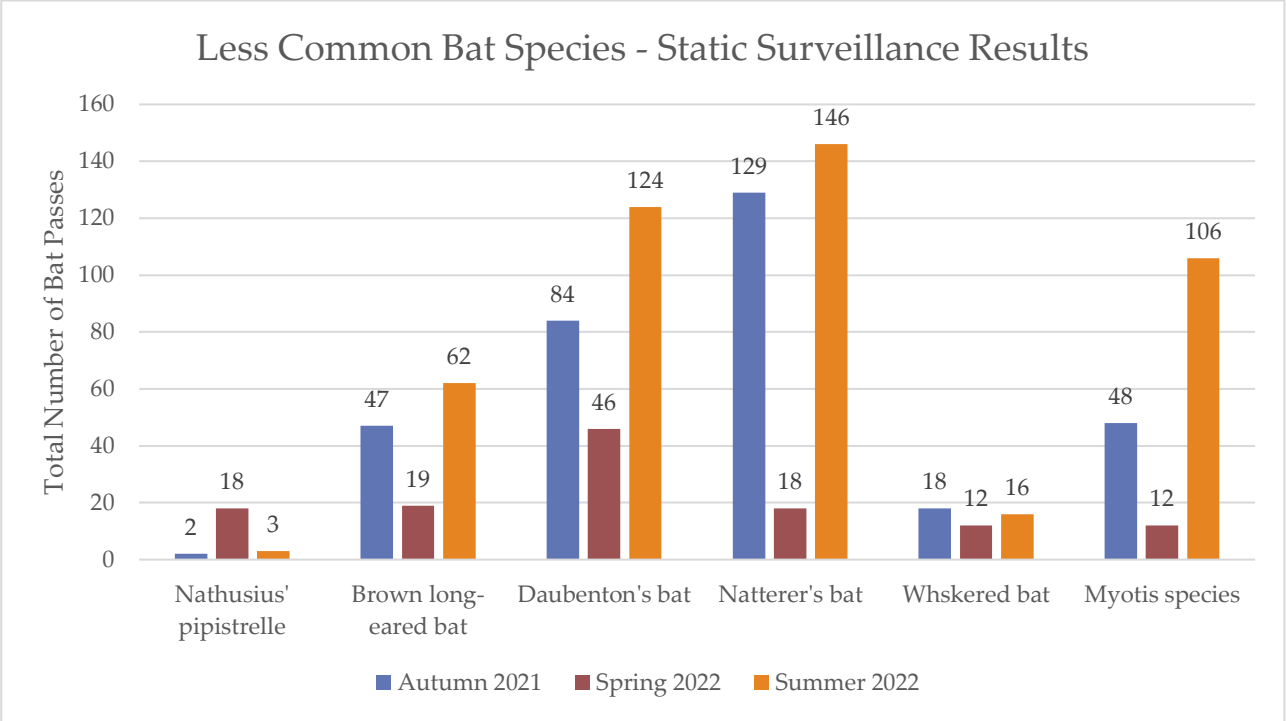

Figure 5b: Total number of bat passes recorded for each "Less Common" bat species during static surveillance completed in Autumn 2021 and Spring and Summer 2022.

The following tables present the average number of bat passes recorded per static surveillance for each bat species during the static surveillance for each period. During the Autumn 2021 surveillance, common pipistrelle and soprano pipistrelle were the most frequently recorded bat species,

respectively while two *Myotis* species (Natterer's bat and Daubenton's bat) were also frequently represented in the data. However, overall the average number of bat passes recorded were lower compared to the other two surveillance periods.

Table 8a: The average number of bat passes per surveillance period for each bat species recorded during the static surveillance. Note: Autumn 2021 – 20 nights surveillance; Spring 2022 – 11 nights surveillance; Summer 2022 – 13 nights surveillance.

Surveillance Period	Soprano pipistrelle	Common pipistrelle	Nathusius' pipistrelle	Leisler's bat	Brown long-eared bat	Daubenton's bat	Natterer's bat	Whiskered bat
Autumn 2021	10.1	14.1	0.1	3.4	2.4	4.2	6.5	0.9
Spring 2022	63.1	430.0	1.6	48.4	1.7	4.2	1.6	1.1
Summer 2022	75.2	142.0	0.2	19.5	4.8	9.5	11.2	1.2

During the 2022 Spring static surveillance period, common pipistrelles was the most frequently recorded bat species followed by soprano pipistrelle and Leisler's bat, respectively. This static surveillance period recorded the highest level of bat activity of the three surveillance periods undertaken.

During the 2022 Summer static surveillance period, common pipistrelle and soprano pipistrelle were the most frequently recorded bat species, respectively while two *Myotis* species (Natterer's bat and Daubenton's bat) were also represented similar to the Autumn 2021 static surveillance period. Leisler's bats were more frequently recorded during this static surveillance period compared to Autumn 2021 and Spring 2022 periods.

Overall, a lower level of bat activity was recorded during the Autumn surveillance period compared to the Spring and Summer surveillance periods. This is not unexpected when compared to Summer months as bat activity is generally greater during the summer months when there are warmer air temperatures and therefore a greater supply of insects to feed on. This would be particularly apparent in the habitats sampled as aquatic insects associated with wet grassland, drains and ponds of the survey area, tend to emerge during warmer weather. The results demonstrate that local bat populations are commuting to the proposed development area to forage, particularly, during the summer months.

However, the bat activity recorded for the Spring Surveillance is greater than the Summer Surveillance and this may be due to an unusually high air temperatures during the static surveillance due to more erratic weather patterns as a result of climate change. The survey guidance recommends completing seasonal static surveillance in order to see this pattern of bat activity, which is clearly demonstrated by the results. High bat activity in Spring and Autumn tends to indicate towards important commuting routes as bats disperse across the landscape. When bats emerge from hibernation, bats will feed in preparation for the summer birthing season and prior to setting up stable summer maternity roosts.

The overall results, indicate that the proposed survey area is a foraging habitat during the summer months. The high Spring bat activity, which is influenced primarily by common pipistrelle bat passes, indicates potential dispersal of this bat species through the survey area and foraging activity within the survey area. Again this activity may be linked to good foraging habitats present within the survey area for local common pipistrelle bat populations. However, it is important to note that bats are

opportunistic landscape foragers and commute to areas where insects are available and therefore this foraging behaviour is influenced by air temperature. So it is with caution that this general statement is made as a warm or cold Spring or Autumn periods will greatly influence local bat population foraging activity.

In order to determine the static units with the higher bat activity levels, a graph was prepared (Figure 6). This illustrates the average number of bat passes recorded for all bat species combined. Overall, the average number of bat passes for all bat species recorded during 2021 and 2022 static surveillance was 19.74 bat passes per night (n=44 static units). The results from 13 static units exceed this average figure: Spring 1, 2, 6, 7, 9, 10, 11,and 14 and Summer 4, 6, 7, 8 and 13. A map is presented below to give an indication of where these static units are located in relation to proposed turbine locations. The majority of these were located in the middle section of the proposed development area: Derryadd.

4.2.3 Static Surveillance Pre 2021 Surveys

Previous survey work undertaken within the survey area also undertook static surveillance (i.e. surveys completed in 2016 and 2018). However, different type of bat detectors were deployed (e.g. Wildlife Acoustics SM3) and a different methodology (i.e. less survey nights) was used and therefore it is not directly comparable to the 2021/2022 surveys. In addition, the static units were located in habitats considered to be suitable for foraging and commuting bats while 2021/2022 static unit locations coincided with proposed turbine locations, which tended to be located in more open habitat.

Twenty-five static locations (excluding the static surveillance on the two anemometer masts) was completed for one or two nights of surveillance either in 2016 or 2018. The dates of these coincided with Summer (13 static locations) and Autumn (12 static locations) surveillance periods. On average, 52.2 passes/night were recorded in the Summer Surveillance and 84.1 bat passes/night were recorded in the Autumn Surveillance.

In comparison to the values presented in Table 8a above, common pipistrelle, Leisler's bat and soprano pipistrelle bat activity was higher in Autumn 2016/2018 static surveillance but less for Summer 2016/2018 static surveillance when compared to 2021/2022 results.

Table 8b: The average number of bat passes per surveillance period for each bat species recorded during the static surveillance completed in 2016 and 2018 (combined).

Surveillance Period	Soprano pipistrelle	Common pipistrelle	Nathusius' pipistrelle	Leisler's bat	Brown long-eared bat
Autumn 2016/2018	23.8	59.6	0	5.6	0.4
Summer 2016/2018	14.1	30	0	4	0.6

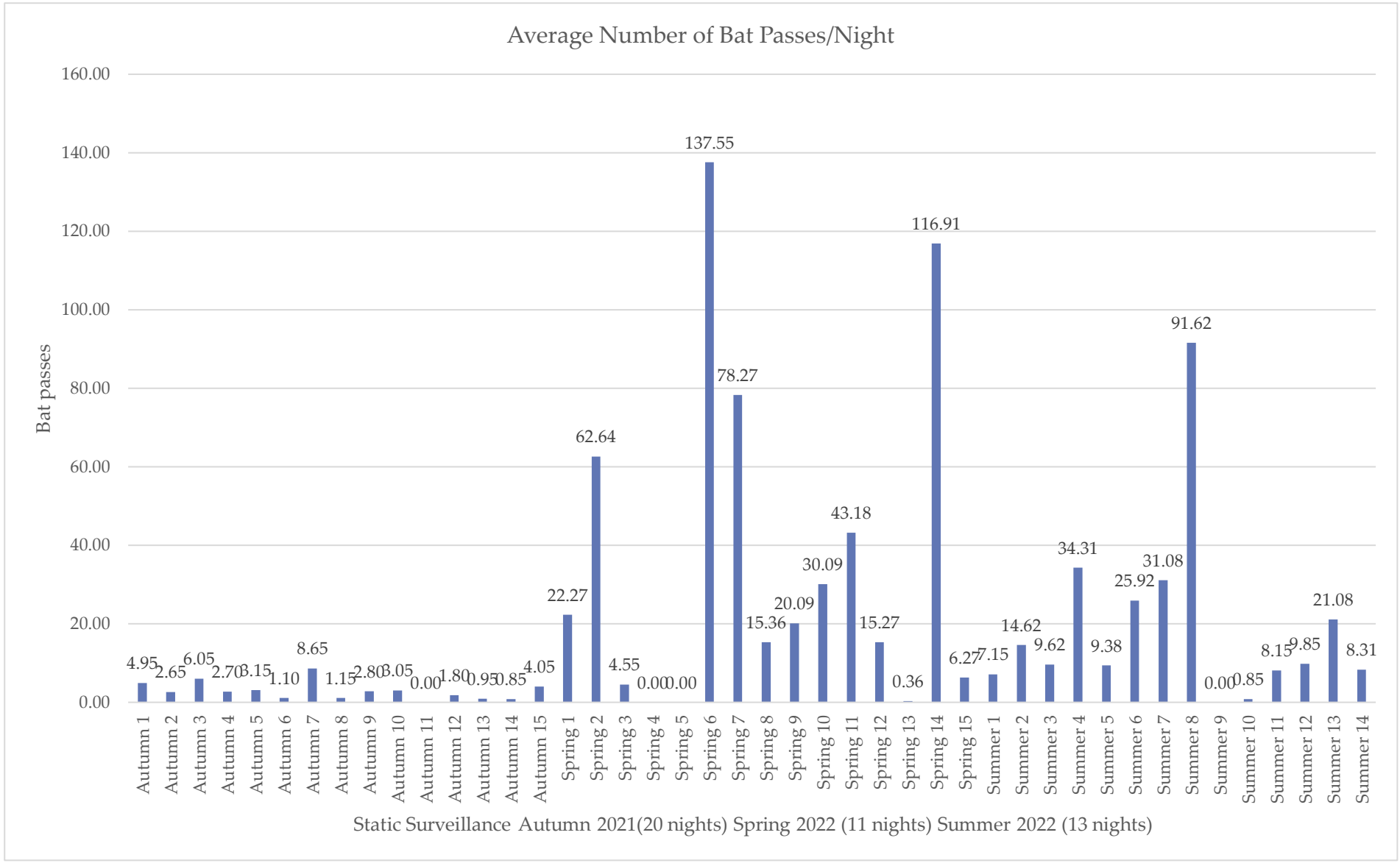

Figure 6a: Average number of bat passes recorded per night at each static unit location during Autumn 2021 and Spring & Summer 2022 Surveillance.

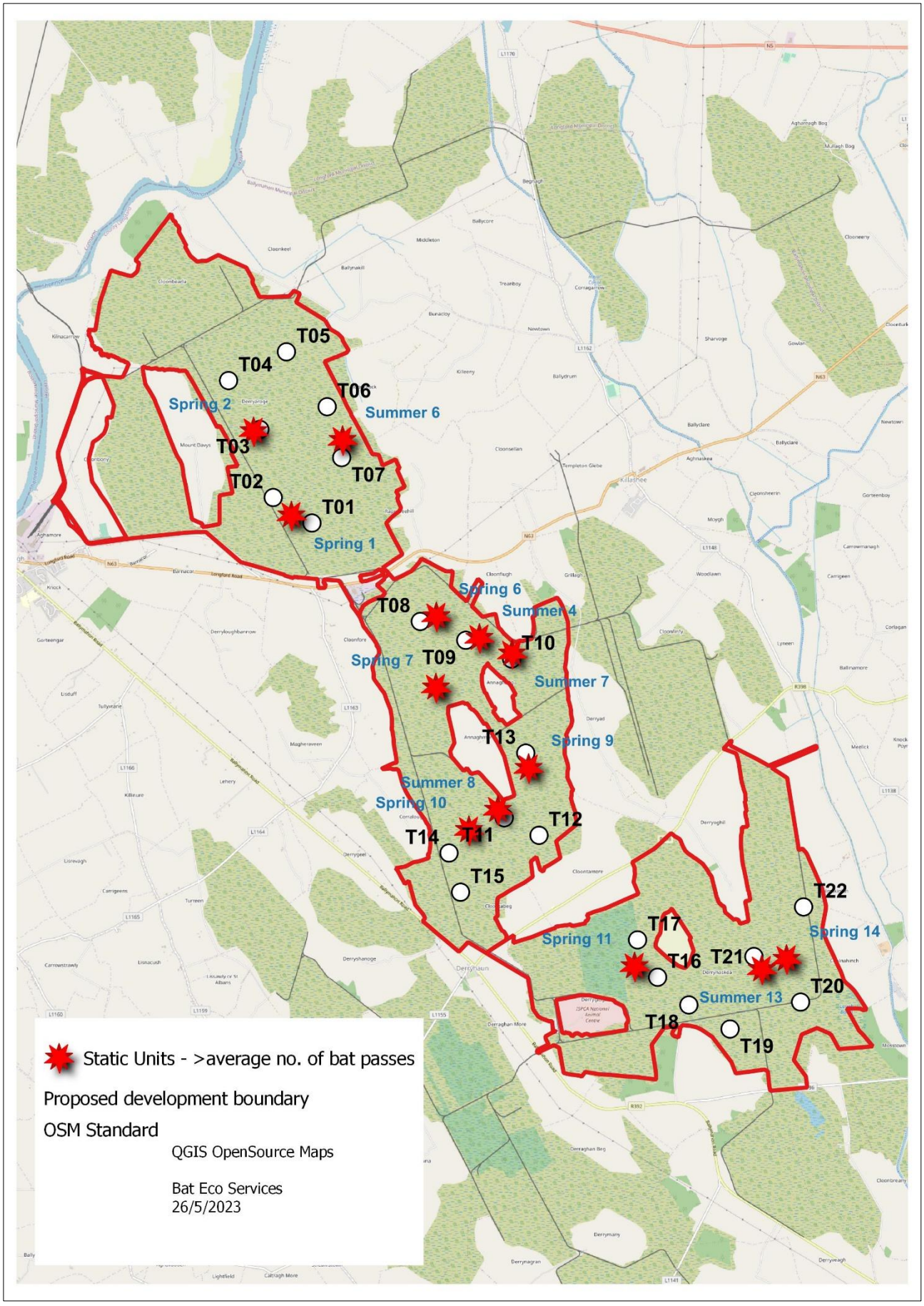

Figure 6b: Location of static units which recorded an average of >19.74 bat passes/night units during the 2021 and 2022 Static Surveillance in relation to proposed turbine locations.

4.2.4 Walking and Driving Transects 2022

Walking and driving transects were generally undertaken post dusk surveys (i.e. 110 minutes post sunset). Walking transects were principally undertaken along the existing tracts within the survey area or along railway tracts within the open bog sections. A driving transect was undertaken on the 27/7/2022 of local and regional roads. The following map depicts the transects completed.

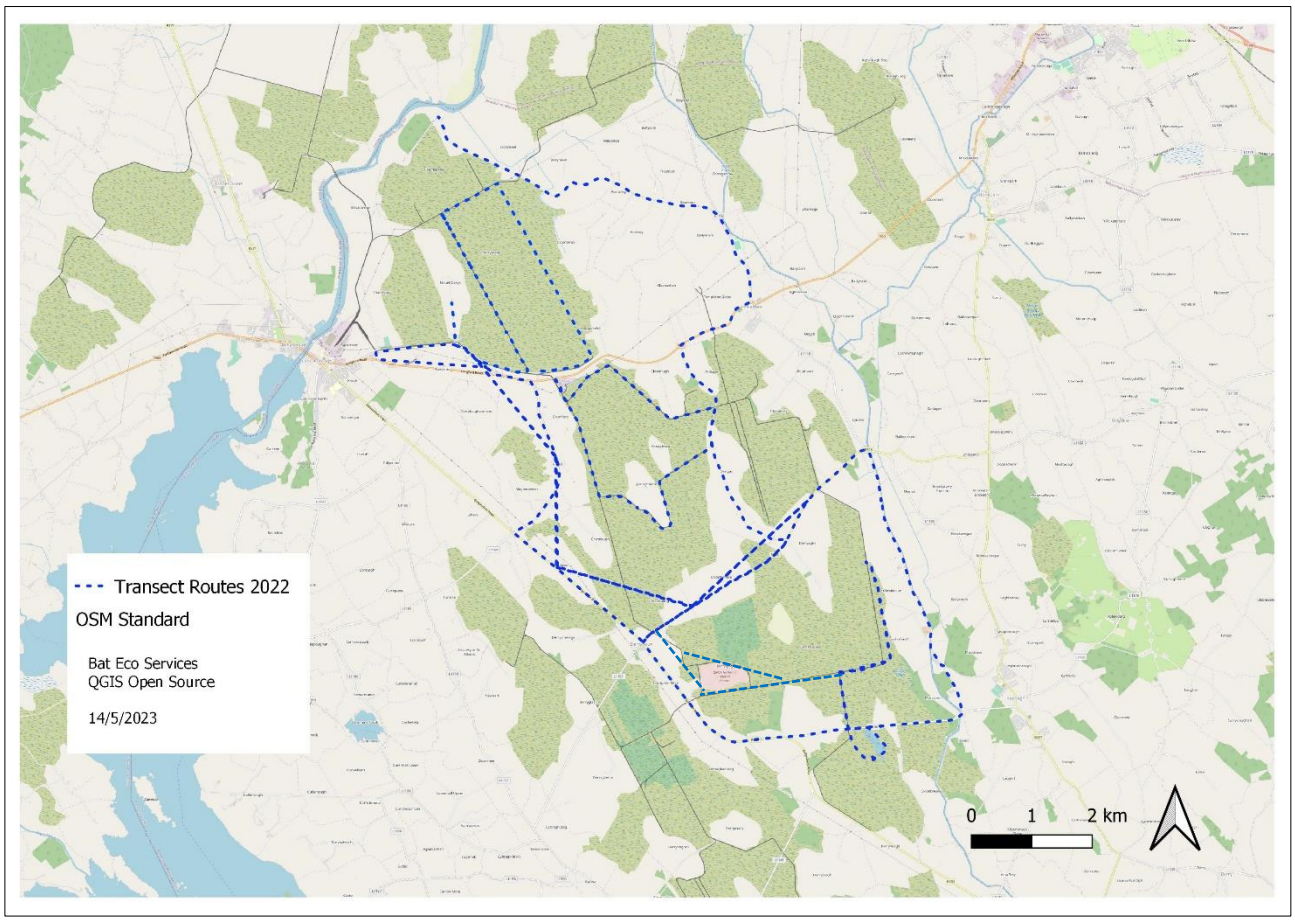

Figure 7a: Walking and Driving Transect routes completed in 2022.

The bat encounters recorded during these surveys were added to the dataset that includes data collated from dusk surveys and the static surveillance periods to provide maps for each of the individual bat species recorded. These results are presented in the next section. In relation to bat encounters recorded during transects, an overall summary of the location of bat encounters (all bat species combined) is present on the map below.

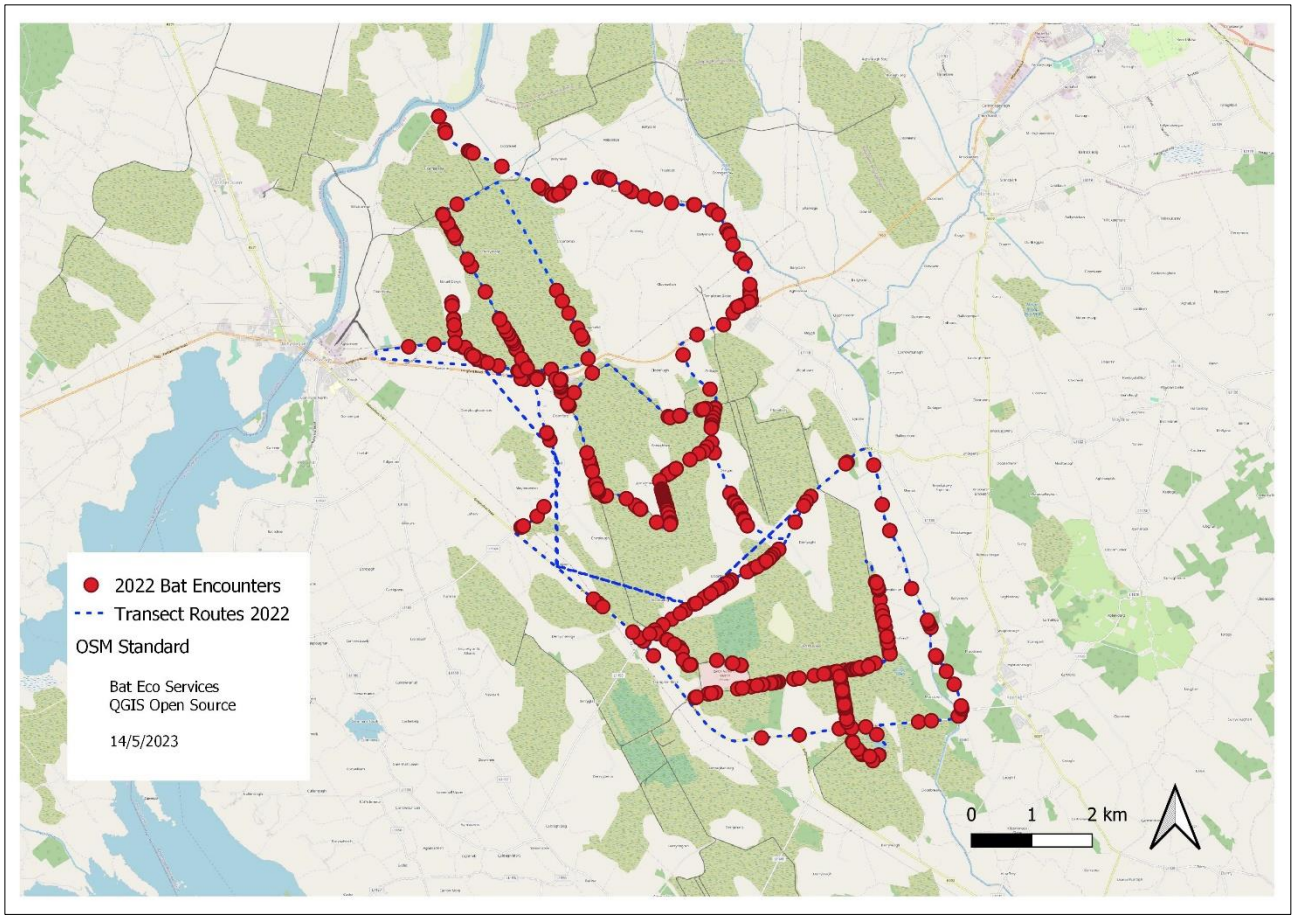

Figure 7b: Summary of bat encounters recorded during Walking and Driving Transect routes completed in 2022.

4.2.5 Bat Survey Results - Summary

The following figures illustrate the location of bat encounters during all of the bat surveys completed. A total of eight bat species were recorded within the proposed development site as a result of the array of bat surveys completed.

4.2.5.1 Soprano pipistrelle

A total of 187 geo-reference bat encounters were recorded for this species of bat during the array of bat surveys completed. As shown on Figure 8a, this bat species was recorded throughout the proposed development area. It was recorded on 39 of the 44 static unit locations. No bat roosts were recorded within the proposed development area for this bat species. Records for this bat species were dispersed throughout the survey area as well as along the local road network.

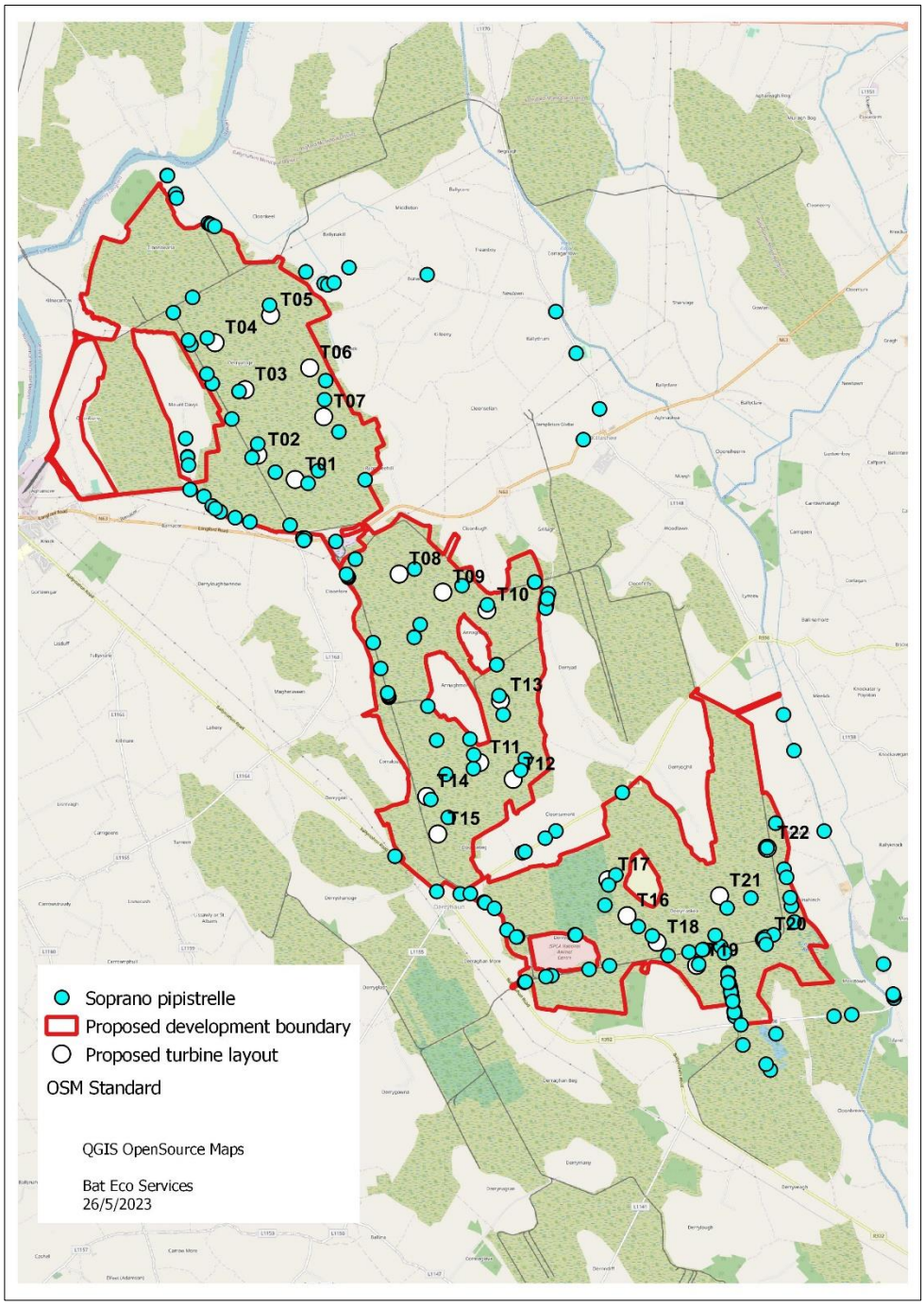

Figure 8a: Soprano pipistrelle bat encounters during 2021 and 2022 bat surveys.

4.2.5.2 Common pipistrelle

A total of 412 geo-reference bat encounters were recorded for this species of bat during the array of bat surveys completed. This was the most frequently encountered bat species during bat surveys completed. As shown on Figure 8b, this bat species was recorded throughout the proposed development area. It was recorded on 40 of the 44 static unit locations. No bat roosts were recorded within the survey area for this bat species. Records for this bat species were dispersed throughout the survey area as well as along the local road network.

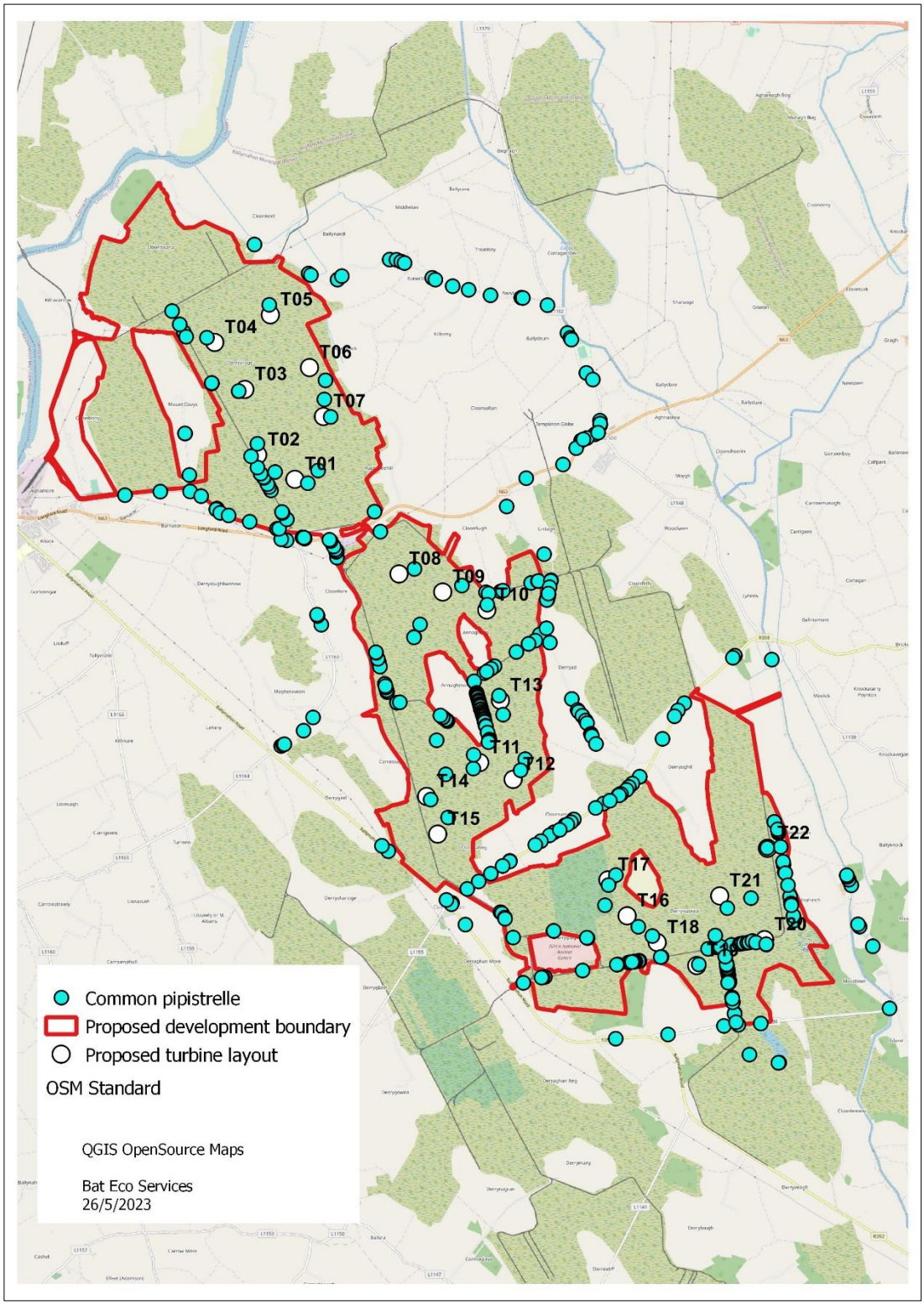

Figure 8b: Common pipistrelle bat encounters during 2021 and 2022 bat surveys.

4.2.5.3 Leisler's bat

A total of 61 geo-reference bat encounters were recorded for this species of bat during the array of bat surveys completed. As shown on Figure 8c, this bat species was recorded throughout the proposed development area. It was recorded on 34 of the 44 static unit locations. No bat roosts were recorded within the proposed development area for this bat species. Records for this bat species were dispersed throughout the survey area including records along the local road network.

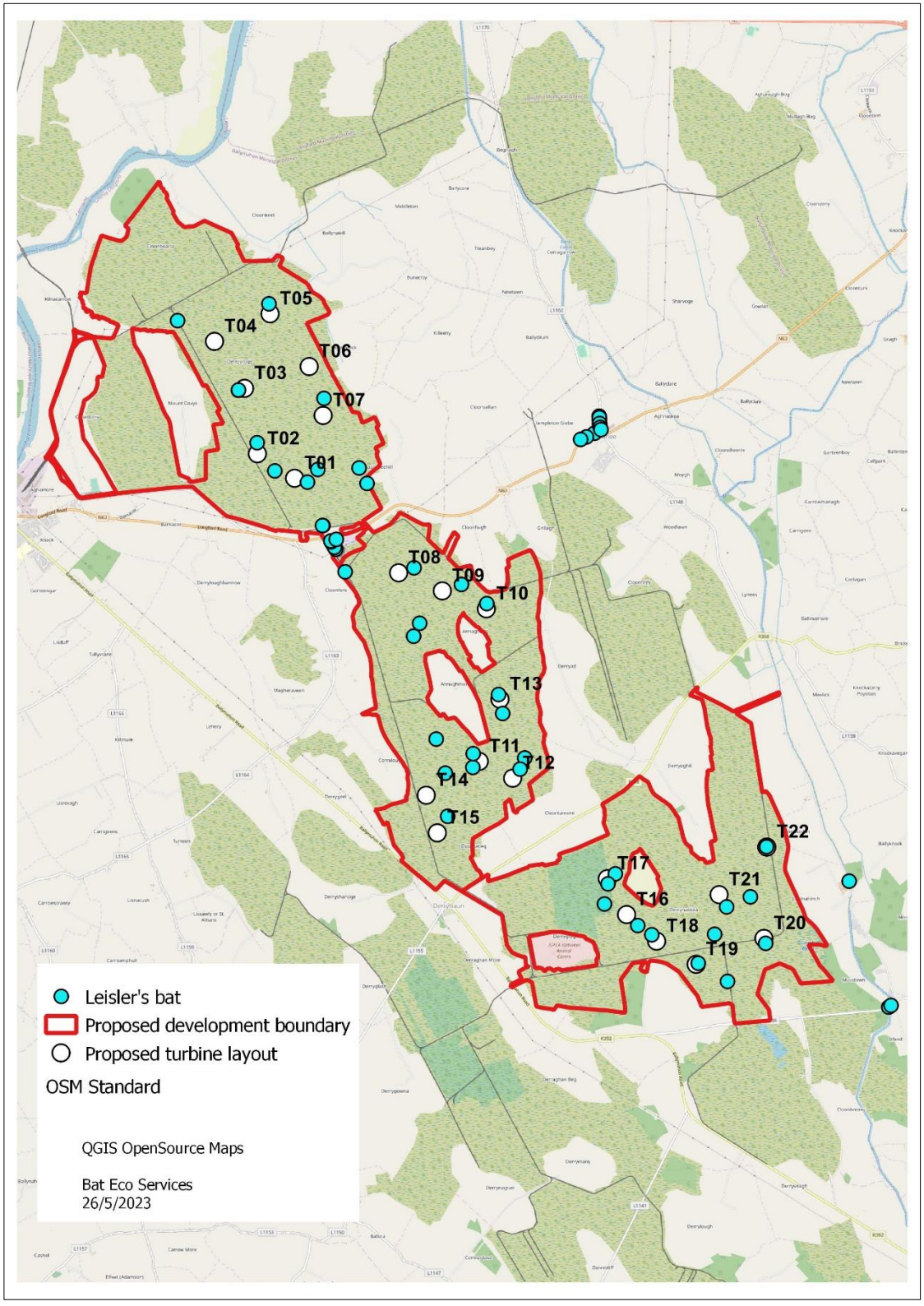

Figure 8c: Leisler's bat encounters during 2021 and 2022 bat surveys.

4.2.5.4 Nathusius' pipistrelle

A total of eight geo-reference bat encounters were recorded for this species of bat during the array of bat surveys completed. As shown on Figure 8d, this bat species was recorded in the three bog zones of proposed development site at a low encounter rate level. It was recorded on 5 of the 44 static unit locations. No bat roosts were recorded within the proposed development area for this bat species.

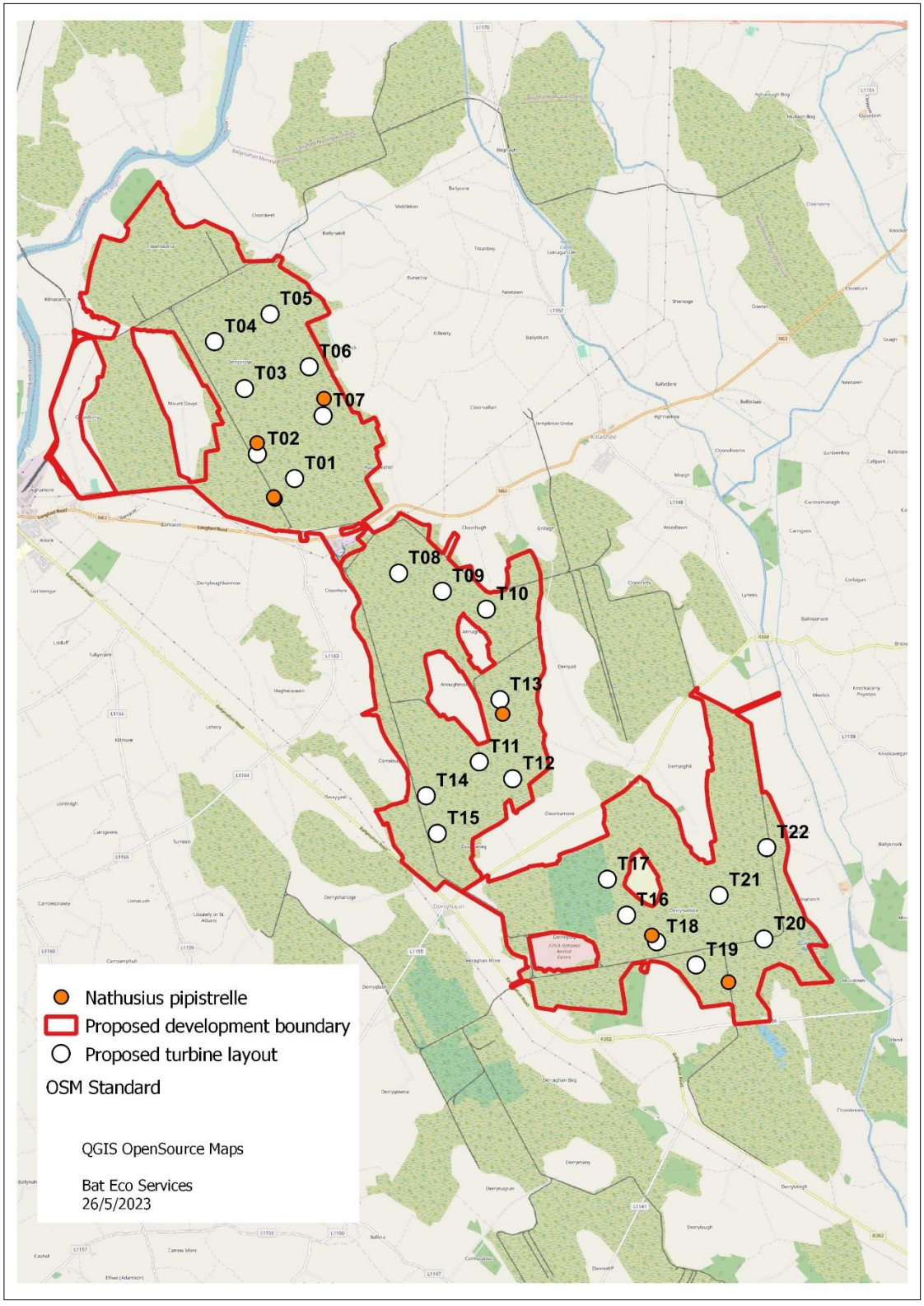

Figure 8d: Nathusius' pipistrelle bat encounters during 2021 and 2022 bat surveys.

4.2.5.5 Natterer's bat

A total of 33 geo-reference bat encounters were recorded for this species of bat during the array of bat surveys completed, the majority of which were recorded during static surveillance (n=28 points). As shown on Figure 8e, this bat species was recorded throughout the survey area. It was recorded on 28 of the 44 static unit locations. An additional 27 records for *Myotis* species was also recorded and these records may be any one of the three *Myotis* bat species recorded (i.e. Natterer's bat, whiskered bat and Daubenton's bat). No bat roosts were recorded within the proposed development area for this bat species. Records for this bat species were dispersed throughout the survey area.

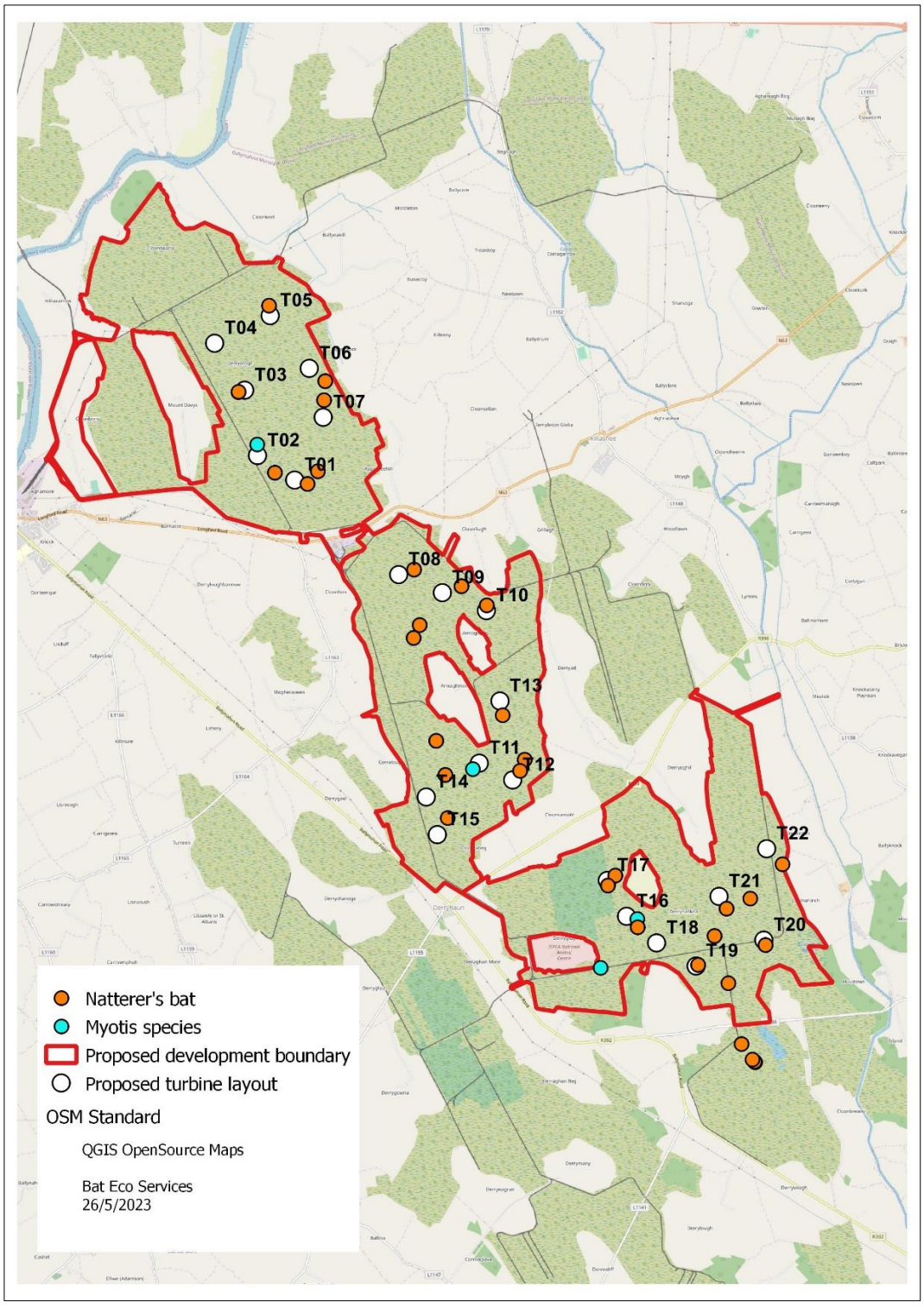

Figure 8e: Natterer's bat encounters during 2021 and 2022 bat surveys.

4.2.5.6 Daubenton's bat

A total of 34 geo-reference bat encounters were recorded for this species of bat during the array of bat surveys completed, but predominantly during the static surveillance. As shown on Figure 8f, this bat species was recorded throughout the survey area. It was recorded on 34 of the 44 static unit locations. An additional 27 records for *Myotis* species was also recorded and these records may be any one of the three *Myotis* bat species recorded (i.e. Natterer's bat, whiskered bat and Daubenton's bat). No bat roosts were recorded within the proposed development area for this bat species. Records for this bat species were dispersed throughout the survey area.

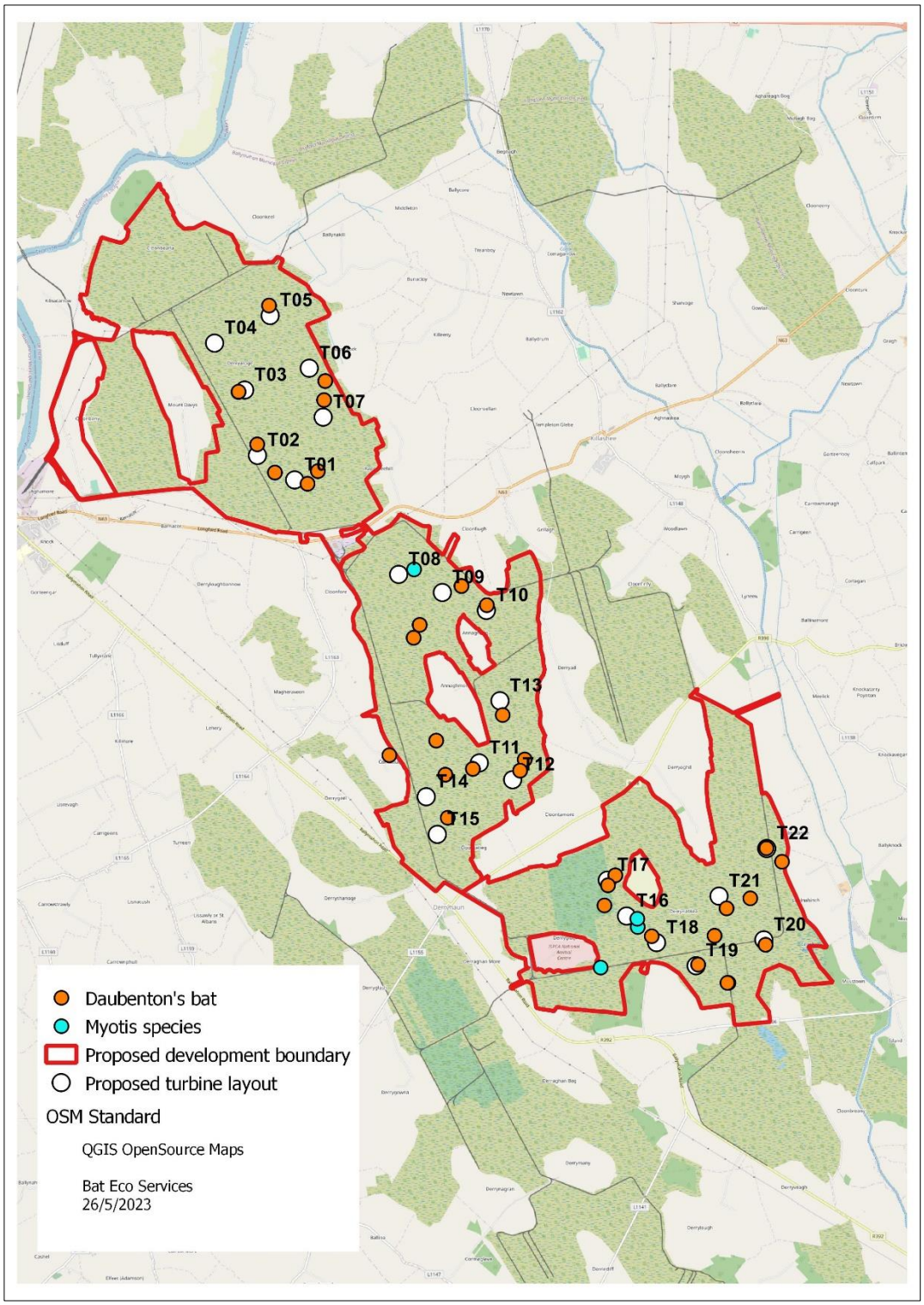

Figure 8f: Daubenton's bat encounters during 2021 and 2022 bat surveys.

4.2.5.7 Whiskered bat

A total of 26 geo-reference bat encounters were recorded for this species which are shown on Figure 8g, the majority of which were recorded during static surveillance (n=23 points). It was recorded on 23 of the 44 static unit locations. An additional 27 records for *Myotis* species was also recorded and these records may be any one of the three *Myotis* bat species recorded (i.e. Natterer's bat, whiskered bat and Daubenton's bat). No bat roosts were recorded within the proposed development area for this bat species. Records for this species were distributed throughout the survey area.

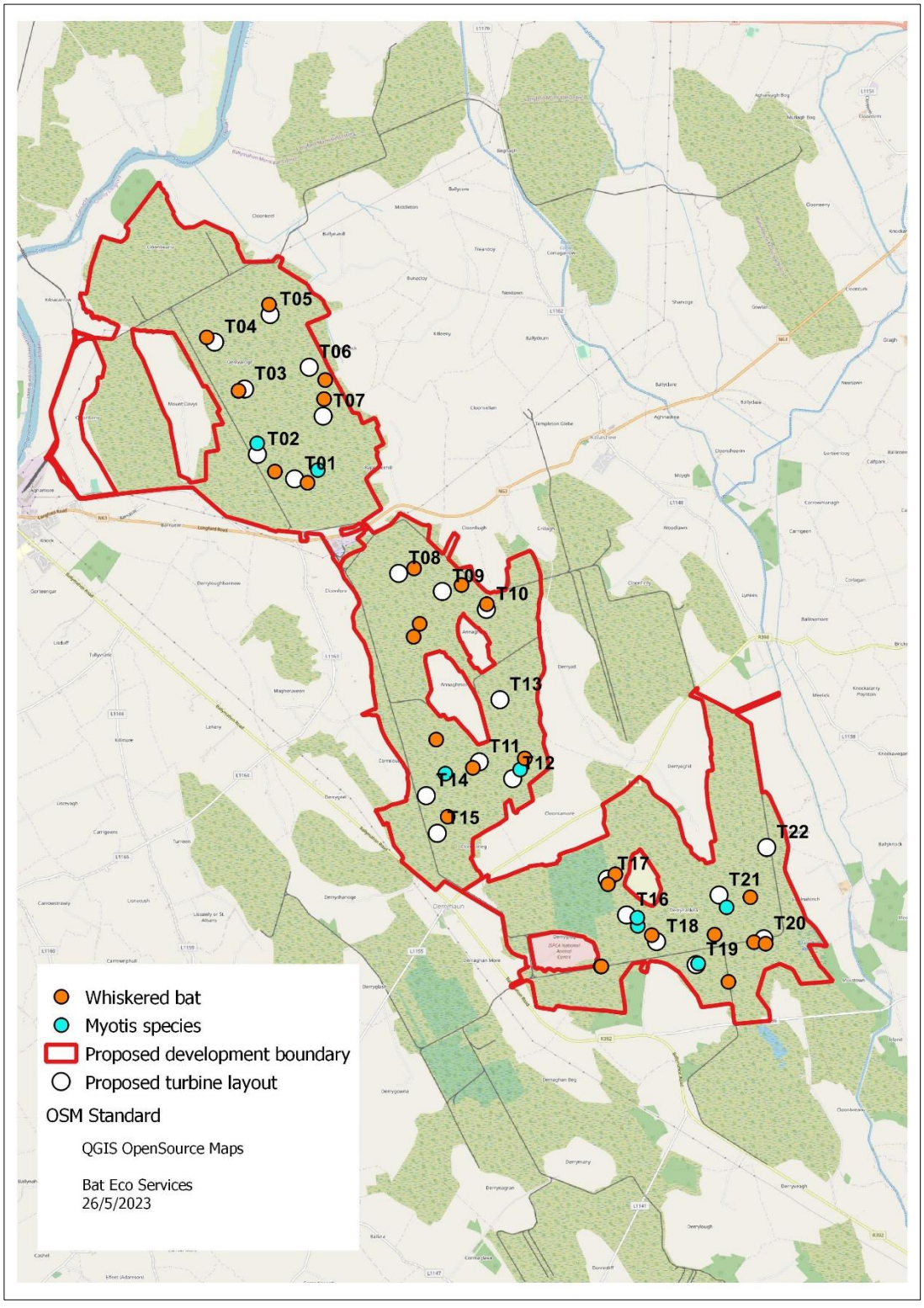

Figure 8g: Whiskered bat encounters during 2021 and 2022 bat surveys.

4.2.5.8 Brown long-eared bat

A total of 34 geo-reference bat encounters were recorded for this species of bat during the array of bat surveys completed. As shown on Figure 8h, this bat species was recorded throughout the proposed development area. It was recorded on 30 of the 44 static unit locations. No bat roosts were recorded within the proposed development area for this bat species. Records for this bat species were dispersed throughout the survey area.

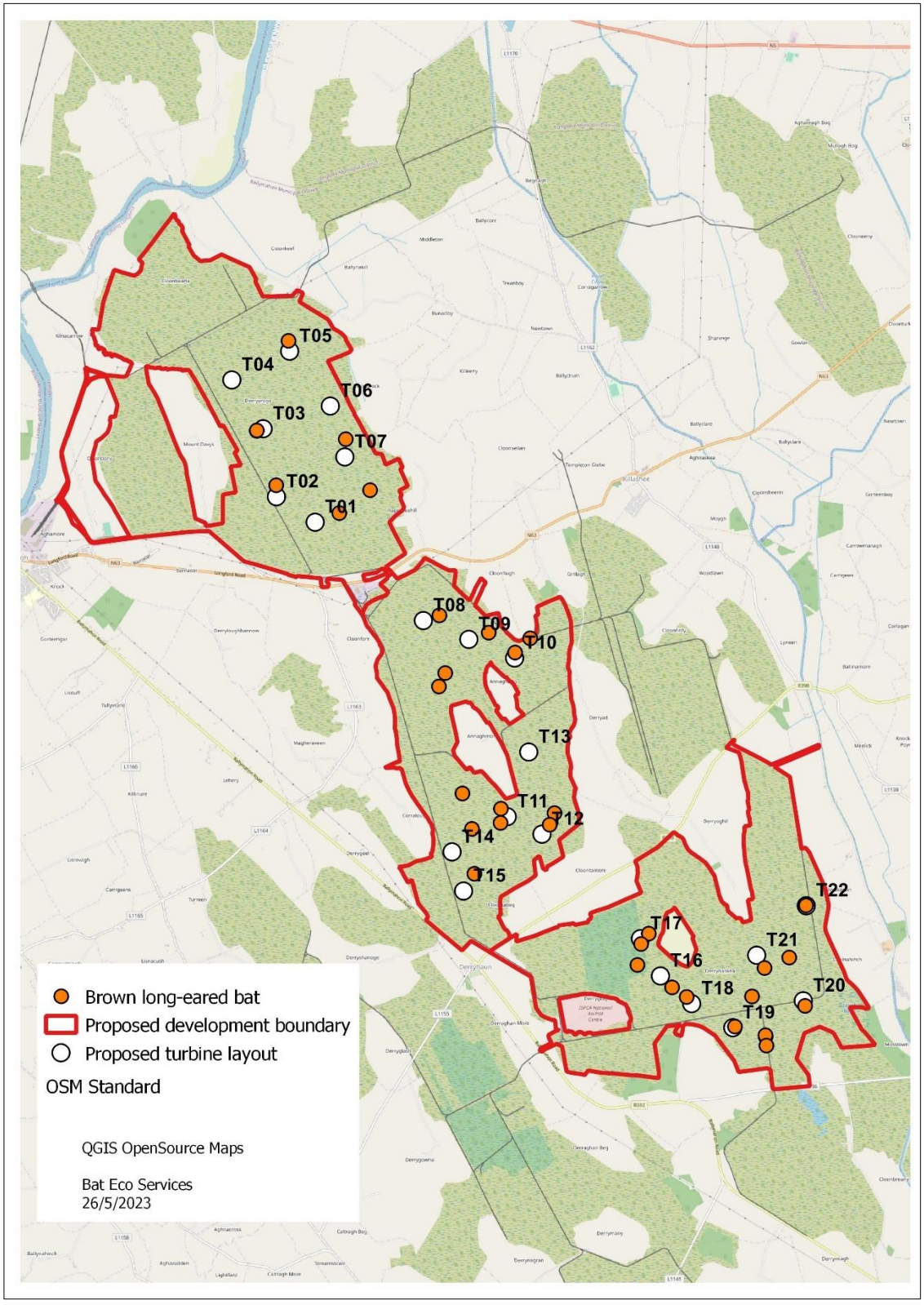

Figure 8h: Brown long-eared bat encounters during 2021 and 2022 bat surveys.

4.3 QGIS Analysis

4.3.1 200m Buffer – Turbine Locations

A 200m buffer was created around each of the proposed turbine locations to determine if “Bat habitat”, as defined in Section 4.1, was located within each turbine zone. There is “Bat Habitat” present in the majority of the 200m buffer zones around the proposed turbine locations. Only two proposed turbine locations did not have “Bat Habitat” present: T13 and T14.

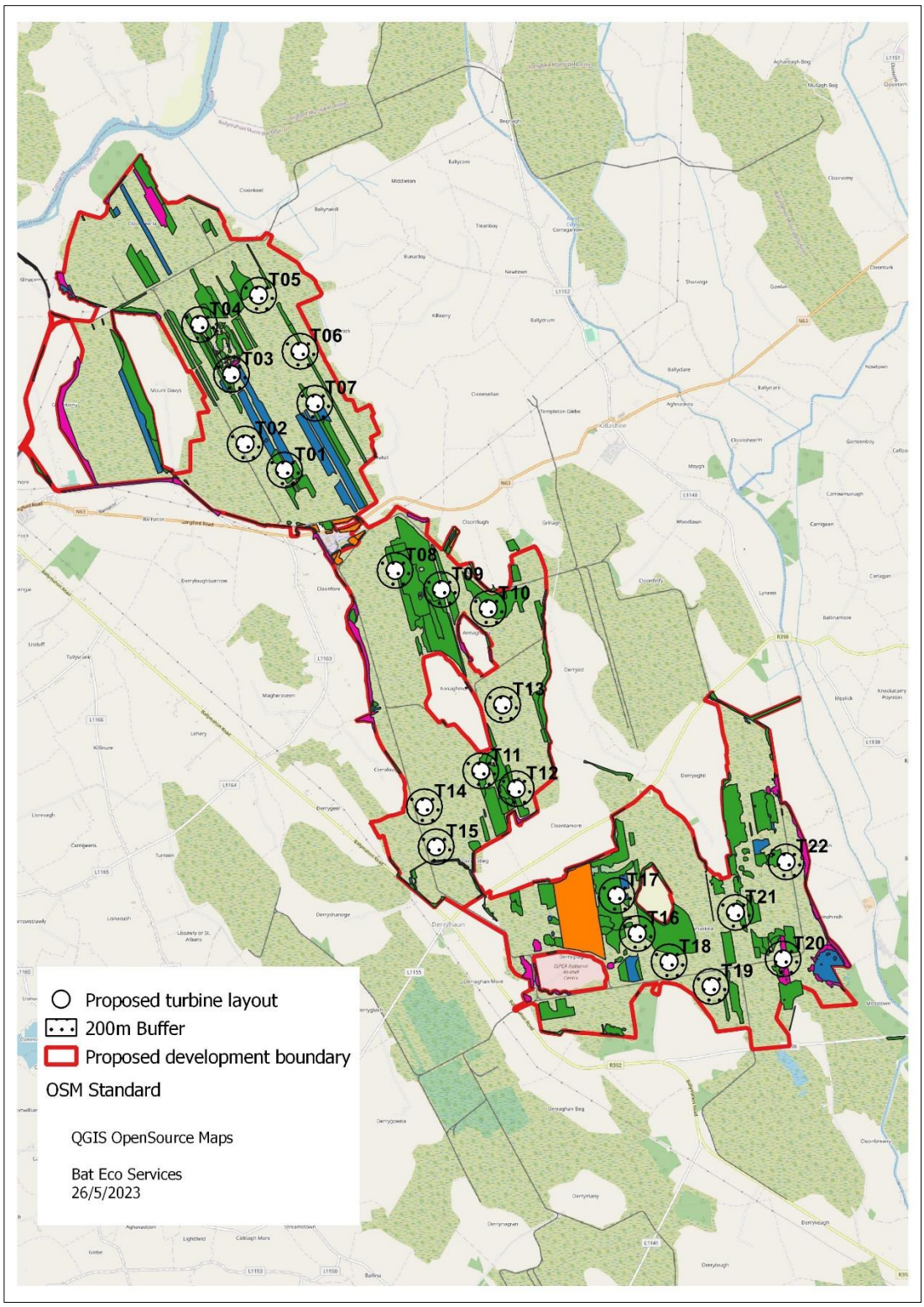

Figure 9: Habitats present within 200m buffer around each turbine location.

4.3.2 50m Buffer – Bat Encounters

A 50m buffer was created around each of the geo-reference bat encounters to determine the habitat within each and to determine their location in respect of the 200m buffer around the proposed turbine locations. Using this buffer, analysis was undertaken for each individual turbine location. This is summarised in a table prepared for Section 5.

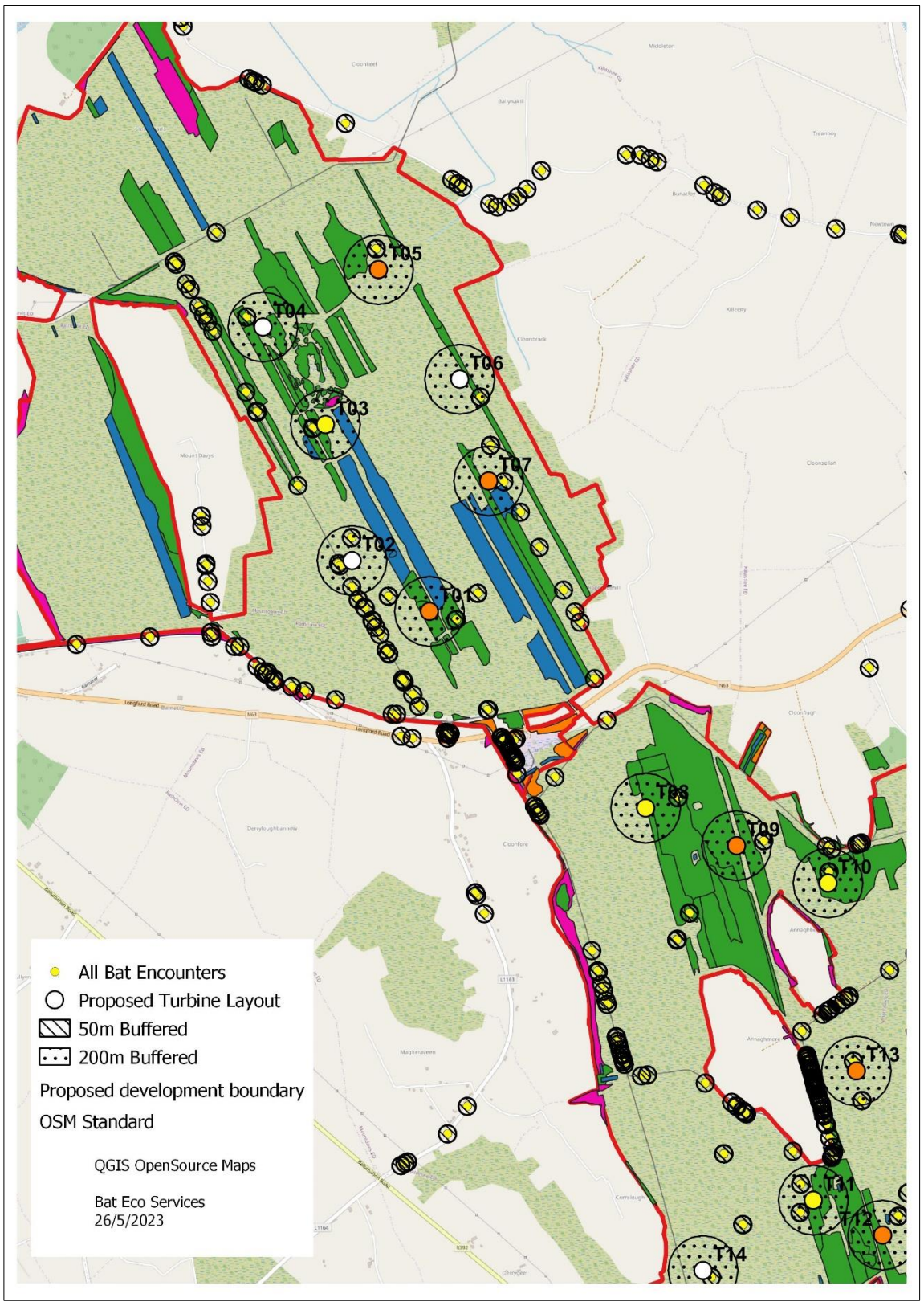

Figure 9a: 50m buffer around All bat encounters and their location with respect to the 200m buffer around each turbine location.

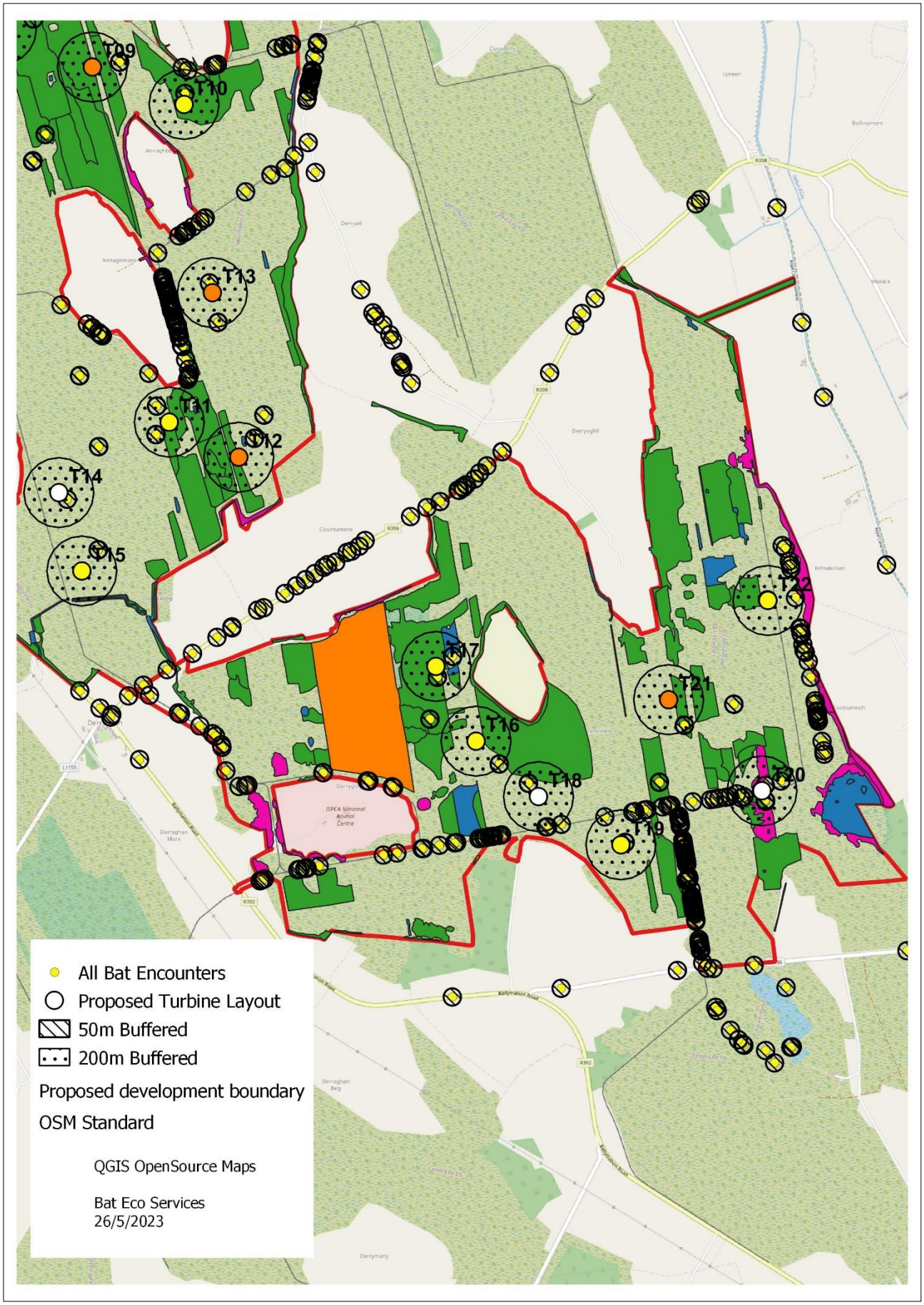

Figure 9b: 50m buffer around All bat encounters and their location with respect to the 200m buffer around each turbine location.

4.3.3 Support Infrastructure

Bat encounters were overlaid on the infrastructure plan for the proposed development site. All recorded bat species were, on occasion, within 50m of the proposed infrastructure for the proposed development.

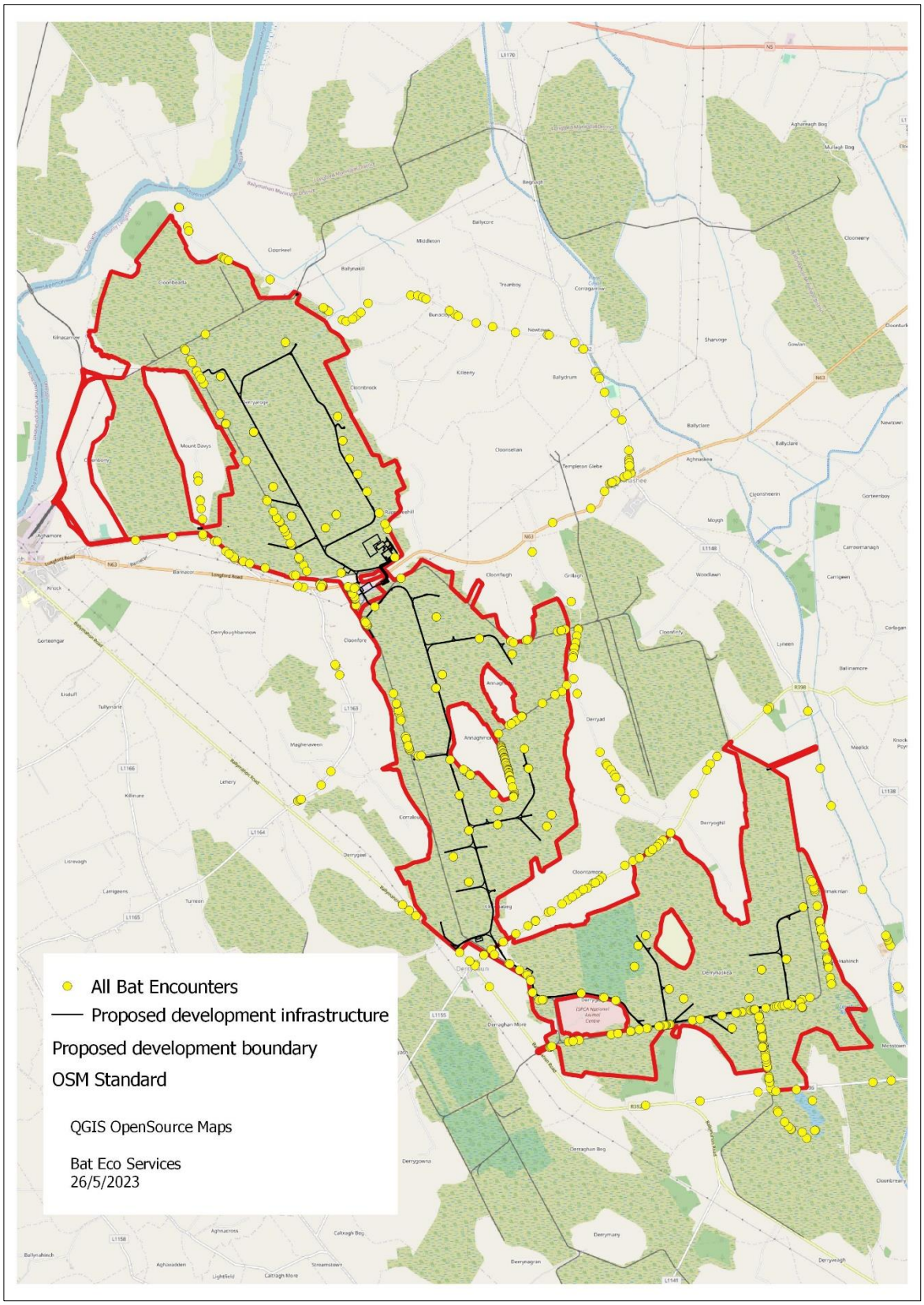

Figure 9c: Location of bat encounters in relation to infrastructure for the proposed development site.

4.4 EcoBat Tool - Offline

The 2021 and 2022 surveillance data was not analysed by the EcoBat Tool as the website has been offline for essential maintenance since November 2022 and there is no date reported for when it will be available. However, as the author has undertaken a number of wind farm projects and therefore past EcoBat Analysis results were examined to produce a set of rules for analysis of the 2021 and 2022 static surveillance data for this project.

As part of the EcoBat Tool, data from a specific project are compared to other data according to the paraemeters listed below.

The reference range datasets under EcoBat Tool are generally stratified to include:

- Only records from within 30 days of the survey date.
- Only records from within 100km^2 of the survey location.
- Records using any make of bat detector.

The Ecobat tool then produces a series of summary tables to enable analysis of the bat activity level at each static location. The author examined EcoBat Tool reports for a similar project and similar surveillance periods to determine the range of nightly bat passes to be assigned to different bat activity categories. These have been determined as follows:

Low = 1 bat pass per species per night
Low to Moderate = 2-3 bat passes per species per night
Moderate = 4-7 bat passes per species per night
Moderate to High = 8-17 bat passes per species per night
High - >18 bat passes per species per night

The overall Bat Activity Category is then calculated as the median value. This process has been undertaken for the High Risk bat species: Leisler's bat, common pipistrelle, soprano pipistrelle and Nathusius' pipistrelle.

4.4.1 Autumn Surveillance 2021

From the table below, none of the static units recorded a High "Bat Activity Category". One static unit (Autumn 7) recorded a Moderate to High "Bat Activity Category for soprano pipistrelle. This static is located along a railway / track and is likely to be a commuting path for this species of bat. There is no proposed turbine within 500m of this static unit location. Autumn 2, Autumn 3, Autumn 4, Autumn 7 and Autumn 15 have a Moderate "Bat Activity Category" for common pipistrelle, soprano pipistrelle and Leisler's bats.

Table 9a: Results of analysis for 2021 Autumn Surveillance.

Yellow = High, Orange = Moderate to High, Green = Moderate

EcoBat Tool	Species/Species Group	Nights of High Activity	Nights of Moderate/ High Activity	Nights of Moderate Activity	Nights of Low/ Moderate Activity	Nights of Low Activity	Bat Activity Category
Autumn 1	*Common pipistrelle*	0	0	2	7	7	Low to Mod
Autumn 1	*Soprano pipistrelle*	0	0	1	3	2	Low to Mod
Autumn 1	*Leisler's bat*	0	0	0	1	2	Low
Autumn 1	*Nathusius' pipistrelle*	0	0	0	0	0	No activity
Autumn 2	*Common pipistrelle*	0	0	0	1	1	Low to Mod
Autumn 2	*Soprano pipistrelle*	0	0	1	1	2	Moderate
Autumn 2	*Leisler's bat*	1	0	0	1	2	Moderate
Autumn 2	*Nathusius' pipistrelle*	0	0	0	0	0	No activity
Autumn 3	*Common pipistrelle*	1	1	4	0	1	Mod to High
Autumn 3	*Soprano pipistrelle*	1	0	1	0	2	Moderate
Autumn 3	*Leisler's bat*	0	0	0	0	1	Low
Autumn 3	*Nathusius' pipistrelle*	0	0	0	0	0	No activity
Autumn 4	*Common pipistrelle*	0	1	1	1	3	Moderate
Autumn 4	*Soprano pipistrelle*	0	0	0	3	1	Low to Mod
Autumn 4	*Leisler's bat*	0	0	1	0	2	Low to Mod
Autumn 4	*Nathusius' pipistrelle*	0	0	0	0	0	No activity
Autumn 5	*Common pipistrelle*	0	0	0	3	6	Low to Mod
Autumn 5	*Soprano pipistrelle*	0	0	1	3	5	Low to Mod
Autumn 5	*Leisler's bat*	0	0	1	0	2	Low to Mod
Autumn 5	*Nathusius' pipistrelle*	0	0	0	0	0	No activity
Autumn 6	*Common pipistrelle*	0	0	0	0	2	Low
Autumn 6	*Soprano pipistrelle*	0	0	0	0	2	Low
Autumn 6	*Leisler's bat*	0	0	0	0	1	Low
Autumn 6	*Nathusius' pipistrelle*	0	0	0	0	0	No activity
Autumn 7	*Common pipistrelle*	0	4	1	3	2	Moderate
Autumn 7	*Soprano pipistrelle*	0	2	3	3	1	Mod to High
Autumn 7	*Leisler's bat*	0	0	0	1	1	Low to Mod
Autumn 7	*Nathusius' pipistrelle*	0	0	0	0	0	No activity
Autumn 8	*Common pipistrelle*	0	0	1	1	4	Low to Mod
Autumn 8	*Soprano pipistrelle*	0	0	0	0	6	Low
Autumn 8	*Leisler's bat*	0	0	0	0	0	No activity
Autumn 8	*Nathusius' pipistrelle*	0	0	0	0	0	No activity
Autumn 9	*Common pipistrelle*	0	0	0	4	4	Low to Mod
Autumn 9	*Soprano pipistrelle*	0	0	0	0	1	Low
Autumn 9	*Leisler's bat*	0	0	0	0	4	Low
Autumn 9	*Nathusius' pipistrelle*	0	0	0	0	0	No activity
Autumn 10	*Common pipistrelle*	0	0	2	1	7	Low to Mod
Autumn 10	*Soprano pipistrelle*	0	0	0	2	2	Low to Mod
Autumn 10	*Leisler's bat*	0	0	0	0	0	No activity
Autumn 10	*Nathusius' pipistrelle*	0	0	0	0	0	No activity

Autumn 11	*Common pipistrelle*	0	0	0	0	0	No activity
Autumn 11	*Soprano pipistrelle*	0	0	0	0	0	No activity
Autumn 11	*Leisler's bat*	0	0	0	0	0	No activity
Autumn 11	*Nathusius' pipistrelle*	0	0	0	0	0	No activity
Autumn 12	*Common pipistrelle*	0	0	0	0	1	Low
Autumn 12	*Soprano pipistrelle*	0	0	1	4	3	Low to Mod
Autumn 12	*Leisler's bat*	0	0	0	0	1	Low
Autumn 12	*Nathusius' pipistrelle*	0	0	0	0	0	No activity
Autumn 13	*Common pipistrelle*	0	0	0	1	1	Low to Mod
Autumn 13	*Soprano pipistrelle*	0	0	0	0	1	Low
Autumn 13	*Leisler's bat*	0	0	0	0	2	Low
Autumn 13	*Nathusius' pipistrelle*	0	0	0	0	0	No activity
Autumn 14	*Common pipistrelle*	0	0	0	1	2	Low to Mod
Autumn 14	*Soprano pipistrelle*	0	0	0	0	2	Low
Autumn 14	*Leisler's bat*	0	0	0	0	0	No activity
Autumn 14	*Nathusius' pipistrelle*	0	0	0	0	0	No activity
Autumn 15	*Common pipistrelle*	0	0	1	3	3	Moderate
Autumn 15	*Soprano pipistrelle*	0	0	1	3	3	Moderate
Autumn 15	*Leisler's bat*	0	0	0	0	1	Low
Autumn 15	*Nathusius' pipistrelle*	0	0	0	0	0	No activity

4.4.2 Spring Surveillance 2022

From the table below, Spring 2, Spring 6, Spring 7, Spring 10, Spring 11, Spring 12 and Spring 15 recorded a High "Bat Activity Category". Spring 1, Spring 2, Spring 7, Spring 8, Spring 9 and Spring 10 recorded a Moderate to High "Bat Activity Category. Spring 1, Spring 3, Spring 8, Spring 11, Spring 13, Spring 14 and Spring 15 have a Moderate "Bat Activity Category".

Table 9b: Results of analysis for 2022 Spring Surveillance.

Yellow = High, Orange = Moderate to High, Green = Moderate

EcoBat Tool	Species/Species Group	Nights of High Activity	Nights of Moderate/ High Activity	Nights of Moderate Activity	Nights of Low/ Moderate Activity	Nights of Low Activity	Bat Activity Category
Spring 1	*Common pipistrelle*	1	3	5	3	0	Mod to High
Spring 1	*Soprano pipistrelle*	0	2	3	5	1	Moderate
Spring 1	*Leisler's bat*	1	1	3	4	1	Mod to High
Spring 1	*Nathusius' pipistrelle*	0	0	0	0	0	No activity
Spring 2	*Common pipistrelle*	6	5	0	1	0	High
Spring 2	*Soprano pipistrelle*	1	3	6	1	1	Mod to High
Spring 2	*Leisler's bat*	2	1	3	5	0	Mod to High
Spring 2	*Nathusius' pipistrelle*	0	0	0	0	0	No activity
Spring 3	*Common pipistrelle*	0	0	4	1	3	Moderate
Spring 3	*Soprano pipistrelle*	0	1	2	0	3	Moderate
Spring 3	*Leisler's bat*	0	0	0	0	0	No activity
Spring 3	*Nathusius' pipistrelle*	0	0	0	0	0	No activity
Spring 4	*Common pipistrelle*	0	0	0	0	0	No activity

Spring 4	*Soprano pipistrelle*	0	0	0	0	0	No activity
Spring 4	*Leisler's bat*	0	0	0	0	0	No activity
Spring 4	*Nathusius' pipistrelle*	0	0	0	0	0	No activity
Spring 5	*Common pipistrelle*	0	0	0	0	0	No activity
Spring 5	*Soprano pipistrelle*	0	0	0	0	0	No activity
Spring 5	*Leisler's bat*	0	0	0	0	0	No activity
Spring 5	*Nathusius' pipistrelle*	0	0	0	0	0	No activity
Spring 6	*Common pipistrelle*	9	0	0	0	0	High
Spring 6	*Soprano pipistrelle*	6	2	0	1	0	High
Spring 6	*Leisler's bat*	0	0	0	4	1	Low to Mod
Spring 6	*Nathusius' pipistrelle*	0	0	0	0	0	No activity
Spring 7	*Common pipistrelle*	10	1	1	0	0	High
Spring 7	*Soprano pipistrelle*	0	5	1	2	2	Mod to High
Spring 7	*Leisler's bat*	2	2	1	5	1	Mod to High
Spring 7	*Nathusius' pipistrelle*	0	0	0	0	0	No activity
Spring 8	*Common pipistrelle*	1	6	1	3	0	Mod to High
Spring 8	*Soprano pipistrelle*	0	0	1	3	2	Moderate
Spring 8	*Leisler's bat*	0	2	2	3	1	Moderate
Spring 8	*Nathusius' pipistrelle*	0	0	0	0	0	No activity
Spring 9	*Common pipistrelle*	2	1	5	3	0	Mod to High
Spring 9	*Soprano pipistrelle*	0	0	0	3	1	Low to Mod
Spring 9	*Leisler's bat*	0	1	1	4	3	Low to Mod
Spring 9	*Nathusius' pipistrelle*	0	0	0	1	1	Low to Mod
Spring 10	*Common pipistrelle*	3	5	2	0	2	High
Spring 10	*Soprano pipistrelle*	0	0	1	5	1	Low to Mod
Spring 10	*Leisler's bat*	2	2	2	3	1	Mod to High
Spring 10	*Nathusius' pipistrelle*	0	0	0	0	0	No activity
Spring 11	*Common pipistrelle*	5	0	5	1	0	High
Spring 11	*Soprano pipistrelle*	0	0	1	3	4	Low to Mod
Spring 11	*Leisler's bat*	0	0	6	2	2	Moderate
Spring 11	*Nathusius' pipistrelle*	0	0	0	0	0	No activity
Spring 12	*Common pipistrelle*	2	0	1	0	0	High
Spring 12	*Soprano pipistrelle*	0	0	0	1	1	Low to Mod
Spring 12	*Leisler's bat*	0	0	1	2	2	Low to Mod
Spring 12	*Nathusius' pipistrelle*	0	0	0	0	0	No activity
Spring 13	*Common pipistrelle*	0	0	1	0	0	Moderate
Spring 13	*Soprano pipistrelle*	0	0	0	0	0	No activity
Spring 13	*Leisler's bat*	0	0	0	0	0	No activity
Spring 13	*Nathusius' pipistrelle*	0	0	0	0	0	No activity
Spring 14	*Common pipistrelle*	1	0	2	5	1	Moderate
Spring 14	*Soprano pipistrelle*	0	0	0	1	2	Low to Mod
Spring 14	*Leisler's bat*	0	0	1	1	0	Low to Mod
Spring 14	*Nathusius' pipistrelle*	0	0	0	0	0	No activity
Spring 15	*Common pipistrelle*	8	2	0	0	0	High
Spring 15	*Soprano pipistrelle*	0	4	3	2	0	Moderate
Spring 15	*Leisler's bat*	0	0	2	4	2	Low to Mod

Spring 15	*Nathusius' pipistrelle*	0	0	0	0	0	No activity

4.4.3 Summer Surveillance 2022

From the table below, Summer 7 and Summer 8 recorded a High "Bat Activity Category". Summer 2, Summer 4, Summer 5, Summer 6, Summer 7 and Summer 13 recorded a Moderate to High "Bat Activity Category. Summer 1, Summer 2, Summer 3, Summer 6, Summer 7, Summer 8, Summer 11, Summer 12, Summer 14 recorded a Moderate "Bat Activity Category".

Table 9c: Results of analysis for 2022 Summer Surveillance.

Yellow = High, Orange = Moderate to High, Green = Moderate

EcoBat Tool	Species/Species Group	Nights of High Activity	Nights of Moderate/ High Activity	Nights of Moderate Activity	Nights of Low/ Moderate Activity	Nights of Low Activity	Bat Activity Category
Summer 1	*Common pipistrelle*	0	2	3	2	0	Moderate
Summer 1	*Soprano pipistrelle*	0	2	2	1	1	Moderate
Summer 1	*Leisler's bat*	0	0	2	0	2	Low to Mod
Summer 1	*Nathusius' pipistrelle*	0	0	0	0	1	Low
Summer 2	*Common pipistrelle*	0	4	3	2	1	Moderate
Summer 2	*Soprano pipistrelle*	0	4	4	1	1	Mod to High
Summer 2	*Leisler's bat*	0	1	3	3	3	Moderate
Summer 2	*Nathusius' pipistrelle*	0	0	0	0	0	No activity
Summer 3	*Common pipistrelle*	0	2	2	3	0	Moderate
Summer 3	*Soprano pipistrelle*	0	2	3	2	0	Moderate
Summer 3	*Leisler's bat*	0	1	2	2	1	Moderate
Summer 3	*Nathusius' pipistrelle*	0	0	0	0	1	Low
Summer 4	*Common pipistrelle*	5	3	2	0	1	Mod to High
Summer 4	*Soprano pipistrelle*	2	5	3	0	0	Mod to High
Summer 4	*Leisler's bat*	0	0	2	4	2	Low to Mod
Summer 4	*Nathusius' pipistrelle*	0	0	0	0	0	No activity
Summer 5	*Common pipistrelle*	1	1	1	1	2	Mod to High
Summer 5	*Soprano pipistrelle*	1	0	1	2	1	Mod to High
Summer 5	*Leisler's bat*	0	0	1	1	2	Low to Mod
Summer 5	*Nathusius' pipistrelle*	0	0	0	0	0	No activity
Summer 6	*Common pipistrelle*	1	4	3	0	2	Mod to High
Summer 6	*Soprano pipistrelle*	4	4	0	0	1	Mod to High
Summer 6	*Leisler's bat*	0	1	3	4	2	Moderate
Summer 6	*Nathusius' pipistrelle*	0	0	0	0	1	Low
Summer 7	*Common pipistrelle*	3	7	0	0	1	High
Summer 7	*Soprano pipistrelle*	1	4	4	1	1	Mod to High
Summer 7	*Leisler's bat*	0	1	2	6	2	Moderate
Summer 7	*Nathusius' pipistrelle*	0	0	0	0	0	No activity
Summer 8	*Common pipistrelle*	7	1	0	1	0	High
Summer 8	*Soprano pipistrelle*	3	4	1	0	1	High
Summer 8	*Leisler's bat*	0	0	2	2	1	Moderate
Summer 8	*Nathusius' pipistrelle*	0	0	0	0	0	No activity
Summer 9	*Common pipistrelle*	0	0	0	0	0	No activity

Summer 9	*Soprano pipistrelle*	0	0	0	0	0	No activity
Summer 9	*Leisler's bat*	0	0	0	0	0	No activity
Summer 9	*Nathusius' pipistrelle*	0	0	0	0	0	No activity
Summer 10	*Common pipistrelle*	0	0	1	1	0	Low to Mod
Summer 10	*Soprano pipistrelle*	0	0	0	1	1	Low to Mod
Summer 10	*Leisler's bat*	0	0	0	0	0	No activity
Summer 10	*Nathusius' pipistrelle*	0	0	0	0	0	No activity
Summer 11	*Common pipistrelle*	0	2	4	1	1	Moderate
Summer 11	*Soprano pipistrelle*	0	1	2	4	2	Moderate
Summer 11	*Leisler's bat*	0	0	0	2	3	Low to Mod
Summer 11	*Nathusius' pipistrelle*	0	0	0	0	0	No activity
Summer 12	*Common pipistrelle*	0	1	3	1	1	Moderate
Summer 12	*Soprano pipistrelle*	0	2	2	2	2	Moderate
Summer 12	*Leisler's bat*	0	0	0	2	5	Low to Mod
Summer 12	*Nathusius' pipistrelle*	0	0	0	0	0	No activity
Summer 13	*Common pipistrelle*	2	2	2	0	3	Mod to High
Summer 13	*Soprano pipistrelle*	1	4	3	0	0	Mod to High
Summer 13	*Leisler's bat*	0	0	2	5	2	Low to Mod
Summer 13	*Nathusius' pipistrelle*	0	0	0	0	0	No activity
Summer 14	*Common pipistrelle*	0	3	0	5	1	Moderate
Summer 14	*Soprano pipistrelle*	0	1	0	2	3	Low to Mod
Summer 14	*Leisler's bat*	0	1	2	3	1	Moderate
Summer 14	*Nathusius' pipistrelle*	0	0	0	0	0	No activity

4.4.4 Summary of Analysis

The analysis has highlighted a number of static locations with High or Moderate to High "Bat Activity Category" (i.e. Yellow and Orange highlighted cells in previous tables) for a number of bat species. In order to allow a clear visualisation of this in relation to locations, the following figure is repeated with these results marked on it.

ORANGE SQUARES - Autumn Surveillance: Autumn 7.

BLUE SQUARES - Spring Surveillance: Spring 1, 2, 6, 7, 8, 9, 10, 11, 12 and 15.

YELLOW SQUARES - Summer Surveillance: Summer 2, 4, 5, 6, 7, 8, 13.

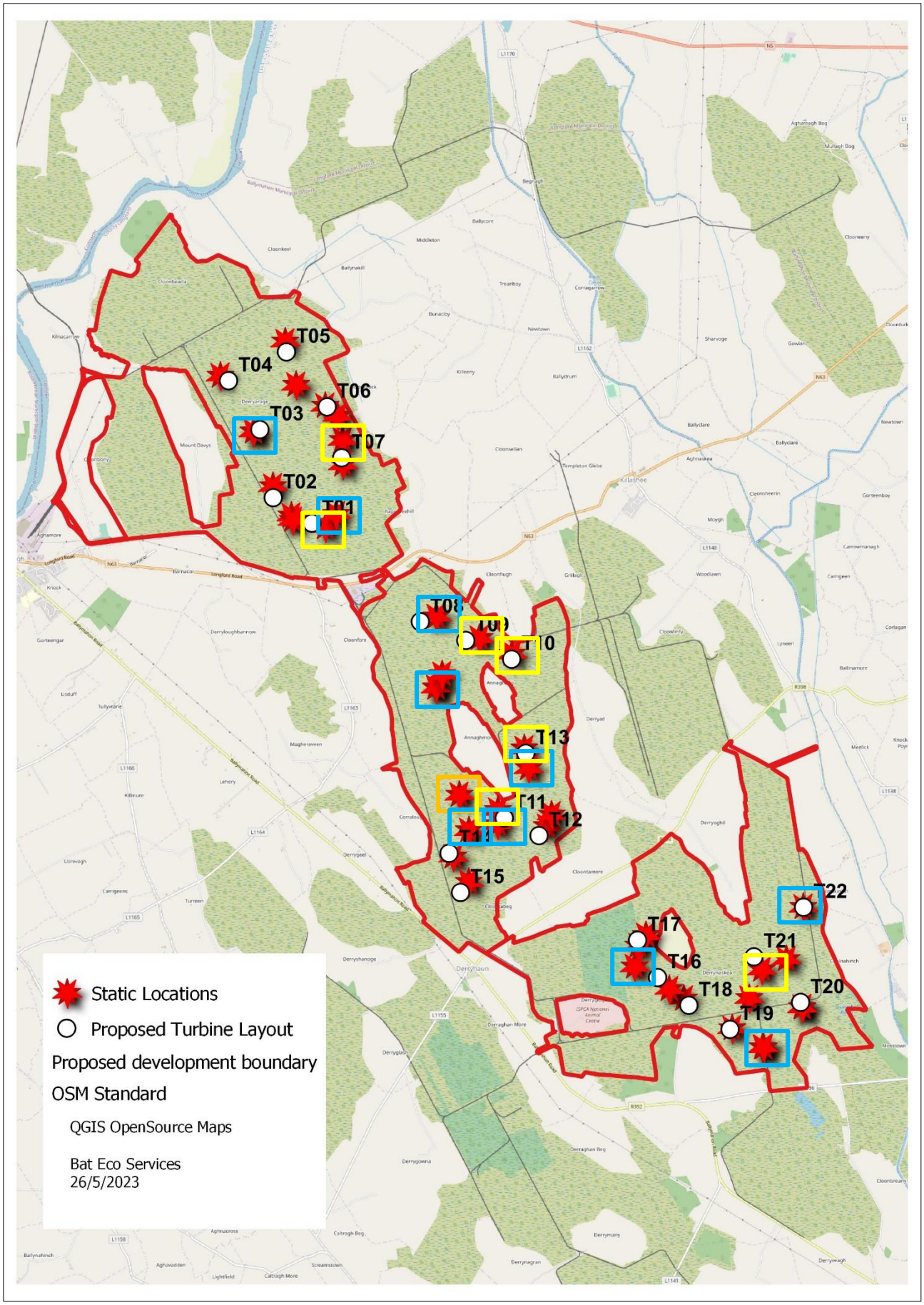

Figure 10: Location of High and Moderate to High activity static units in relation to proposed turbine layout.

The analysis compares nightly bat activity for each bat species. An EcoBat Tool Value was calculated for each of the proposed turbine locations and is presented in Table 9d below. From this table, the proposed turbine locations are categorised according to the highest bat activity value.

Due to the Moderate to High level of bat activity recorded in vicinity of many of the proposed turbine locations, nine turbines have been deemed to have High bat activity, five have been deemed to have Moderate to High bat activity and two have been deemed to have Moderate bat activity. Two static units were recorded Moderate to High (Autumn 7) and High (Spring 7) bat activity. Both of these are located in the Lough Bannow section of the proposed development site.

Table 9d: Static units located within vicinity of proposed turbine locations and colour coded according to Bat Activity Value. (Note: where a static unit is located >200m from proposed turbine locations but <500m, the distance is listed).

Yellow = High, Orange = Moderate to High, Green = Moderate

Turbine No.	Autumn 2021	Spring 2022	Summer 2022	Bat Activity Value
T01	Autumn 11	Spring 1 (250m)	Summer 2	Moderate to High
T02			Summer 1	
T03	Autumn 12	Spring 2		High
T04		Spring 3		
T05	Autumn 15	Spring 4 (385m)		Moderate
T06	Autumn 14 (245m)		Summer 9	
T07		Spring 5	Summer 6	Moderate to High
T08		Spring 6		High
T09	Autumn 9 (468m)		Summer 4	Moderate to High
T10			Summer 7	High
T11		Spring 8	Summer 8	High
T12	Autumn 10 (280m)		Summer 14	Moderate
T13		Spring 9	Summer 5	Moderate to High
T14			Summer 10	
T15	Autumn 6	Spring 10 (240m)		High
T16	Autumn 2	Spring 11 (285m)		High
T17	Autumn 1	Spring 11 (300m)	Summer 12	High
T18			Summer 3	
T19	Autumn 3 (445m)	Spring 12 (420m)	Summer 11	High
T20	Autumn 5	Spring 13		
T21	Autumn 4 (470m)		Summer 13	Moderate to High
T22		Spring 15		High
Static Locations >500m from proposed turbine layout				
	Autumn 7	Spring 7		Both of these are located in Derryadd section

4.5 Desktop Review

4.5.1 Bat Conservation Ireland Database

There are bat records for the following bat species within a 10km radius of the proposed development site (3 sections of the proposed development area = 3 buffers): soprano pipistrelle, common pipistrelle, Leisler's bat, brown long-eared bat, Natterer's bat, Daubenton's bat, *Pipistrelle* spp. and *Myotis* spp.

Figure 11a: Bat Conservation Ireland bat records within a 10km radius of proposed development area (Source Bat Conservation Ireland Database).

4.5.2 International & National Site Designations

There are a number of SAC and pNHA designation within and adjacent to the proposed development site but bats are not a qualifying species for any of these sites.

4.5.3 Bat Conservation Landscape Favourability

Figure 11b depicts the BCIreland Bat Landscape Favourability Model (Lundy *et al.,* 2011) for all batspecies (individual species values are presented in the table below). The county is divided into 5km squares and the darker the shading of the square, the higher favourability of the 5km square for bats.This GIS layer is hosted on the NBDC website www.biodiversityireland.ie. The proposed development site is approximately located in the Red boundary.

The survey area of the proposed wind farm development is located, primarily, in 5 x 5km squares. The five 5km squares where the majority of the proposed development area is located are considered, in general, to have low-medium landscape favourability for bat species (Map 2.1, bright green – 14.1-22% favourability). It was reported by Lundy *et al.*, 2011 that large expanse of openbog tended to be avoided by bats. Linear landscape features such as treelines and hedgerows are an essential component to many bat species to guide them through the landscape and these habitatsare often not present in open peat habitats. The exception to this is Leisler's bats and Nathusius'pipistrelles as these two species are high flying bats and therefore not confined to linear landscape features for guidance.

Table 10: Percentage suitability of 5km squares, encompassing the survey area, for each of the bat species.

Bat species	5km Square No. 1	5km Square No. 2	5km Square No. 3	5km Square no. 4	5km Square no. 5
Common pipistrelle	21% (Med)	17% (Low to Med)	16% (Low to Med)	25% (Med to High)	22% (Med)
Soprano pipistrelle	31% (High)	29% (High)	27% (Med to High)	39% (High)	36% (High)
Nathusius' pipistrelle	0%	0%	0%	0%	0%
Leisler's bat	15% (Low to Med)	14% (Low)	15% (Low to Med)	21% (Med)	20% (Med)
Brown long-eared bat	11% (Low)	12% (Low)	11% (Low)	10% (Low)	12% (Low)
Daubenton's bat	11% (Low)	11% (Low)	12% (Low)	16% (Low to Med)	20% (Med)
Natterer's bat	4% (Low)	2% (Low)	1% (Low)	2% (Low)	3% (Low)
Whiskered bat	0%	0%	0%	0%	0%
Lesser horseshoe bat	0%	0%	0%	0%	1%

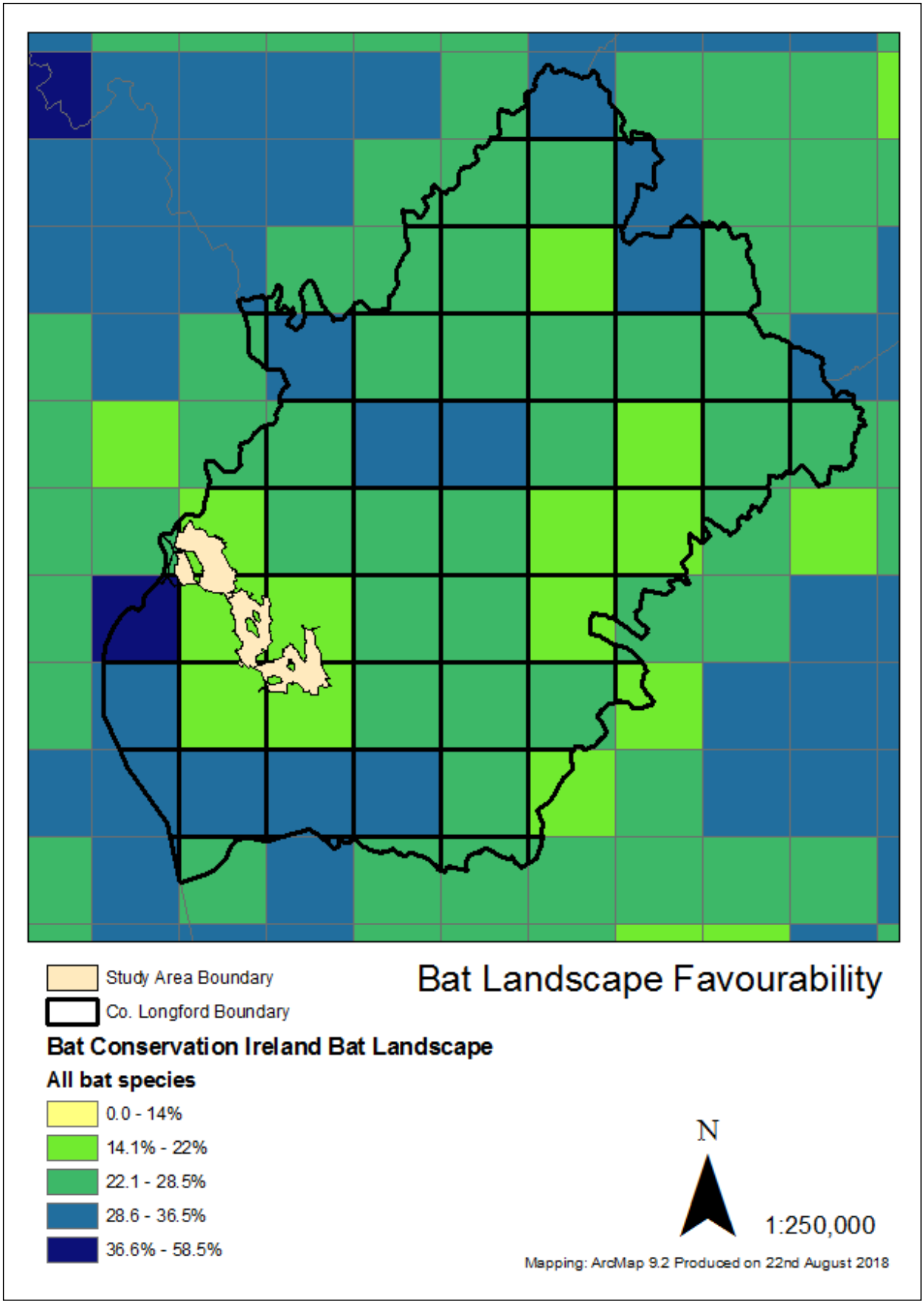

Figure 11b: Bat Conservation Ireland Landscape Favourability Map for all bat species for Co. Longford. (All bat species (i.e. the entire model generalised to represent all Irish bat species): 0-14% favourable; 14.1-22% favourable; 22.1-28.5% favourable; 28.6-36.5% favourable and 26.6-58.6% favourable). (Source: Bat Conservation Ireland) – Red Line = Planning study area boundary.

4.6 Survey Effort, Constraints & Survey Assessment

The following table details any Survey Constraints encountered and a summary of Scientific Assessment completed.

Table 11: Survey Effort, Constraints & Survey Assessment Results.

Category	Discussion
Timing of surveys	As per bat survey guidelines – NaturScot, 2021, Collins, 2016
Survey Type **As per Collins (2016) & NaturScot (2021)**	Bat Survey Duties Completed (Indicated by red shading) Tree PBR Survey ○ — Daytime Building Inspection ● Static Detector Survey ● — Daytime Bridge Inspection ○ Dusk Bat Survey ● — Dawn Bat Survey ○ Walking Transect ● — Driving Transect ● Trapping/Mist Netting ○ — IR Camcorder filming ○ Endoscope Inspection ● — Other (Thermal Imagery) ●
Weather conditions	Variable weather conditions but suitable for bat surveys.
Survey Constraints	There were limitations in relation to night-time work on Health & Safety grounds (i.e. safe traversing through the survey area during hours of darkness). This limited walking transects across open sections of bog within the survey area. Transects were limited to tracts and trailway lines. However, static surveillance provided bat survey information for this area.
Survey effort – relating to 2021/2022 only **TOTAL = 7,511 hrs**	2021 Surveillance – 1 survey periods, 15 static locations (20 nights per static) = 3,300 hours 2022 Surveillance – 2 survey periods, 29 static locations (minimum 10 nights per static) = 4,186 hours Dusk Surveys – 3 surveys (6 hours) Thermal Filming – 2 surveys (4 hours) Walking Transects – 6 surveys (13 hours) Driving Transects – 1 surveys (2 hours)
Extent of survey area	Principally undertaken within the study area with driving transects undertaken of the local road network.
Equipment	All in good working order

The extent of the surveys undertaken has achieved to determine:

- Presence / absence of bats within the survey area;
- A bat species list for the survey area;
- Extent and pattern of usage by bats within the survey area.

It is therefore deemed that the Scientific Assessment completed is Appropriate in order to completed the aims of the bat survey.

5. Bat Ecological Evaluation

5.1 Bat Species Recorded & Sensitivity

Eight species of bat and additional records for *Myotis* species group were recorded during the 2021 and 2022 bat surveys. The table below provides an ecological valuation of each bat species and the collision risk factor in relation to wind farms. Four of the bat species recorded are considered to be High risk.

Table 12: Evaluation of the bat species recorded during the bat survey.

Using CIEM (2016) Guidelines for ecological value, "Bat Risk" in relation to Wind Turbines (NaturScot, 2021) and with reference to Wray et al., 2010 (Table 2 in NaturScot, 2021) in relation to level of potential vulnerability of populations extrapolated for Irish bat species, Irish status according to Marnell et al., 2019 and population numbers and core area from Roche et al., 2014.

Yellow = low population vulnerability
Orange = medium population vulnerability
Red = high population vulnerability

Bat Species	Ecological Value / Geographical Scale of Importance	Irish Status	Bat Risk	Population Numbers / Core Area
Leisler's bat	International	Least Concern	High	Common
Natterer's bat	County	Least Concern	Low	Widespread
Whiskered bat	Regional	Least Concern	Low	Rare
Nathusius' pipistrelle	Regional	Least Concern	High	Rare
Daubenton's bat	County	Least Concern	Low	Common
Brown long-eared bat	County	Least Concern	Low	Widespread
Common pipistrelle	Local	Least Concern	High	Common
Soprano pipistrelle	Local	Least Concern	High	Common

5.2 Site Risk Assessment & Impact Assessment

According to NaturScot (2021) wind farms can affect bats in the following ways:

1. Collision mortality, barotrauma and other injuries (although it is important to consider these in the context of other forms of anthropogenic mortality)
2. Loss or damage to commuting and foraging habitat, (wind farms may form barriers to commuting or seasonal movements, and can result in severance of foraging habitat);
3. Loss of, or damage to, roosts;
4. Displacement of individuals or populations (due to wind farm construction or because bats avoid the wind farm area).

According to the NaturScot (2021) to ensure that bats are protected by minimising the risk of collision, an assessment of impact at a site requires an appraisal of:

- The level of activity of all bat species recorded at the site assessed both spatially and temporally.
- The risk of turbine-related mortality for all bat species recorded at the site during bat activity surveys.
- The effect on the species' population status if predicted impacts are not mitigated.

In addition, it is recommended to consider the relevant factors in the assessment process:

- Is the bat species at the edge of its range
- Cumulative effects
- Presence of protected sites
- Proximity of maternity roosts
- Key foraging areas
- Key flight lines
- Possible migration routes.

Using Table 3 (See Appendices for additional details) in the NaturScot (2021) guidelines the following risk assessment for the individual turbines in relation to each bat species recorded was completed using the following values:

- Project Size = Medium (18 turbines);
- Habitat Risk = Low;
- Presence of other wind farms within 5km radius;
- Proposed tall wind turbines.

Therefore a value of 3a is applied to this proposed development site and this is multiplied by the EcoBat value for the three most common bat species recorded which are also High Risk species (i.e. Leisler's bat, common pipistrelle and soprano pipistrelle) for two separate value categories. The overall value of the site is based on a summary of tables presented in Appendices (Section 9.3).

- Highest Ecobat activity category recorded (or equivalent);
- Most frequent activity category (i.e. median value, or equivalent).

But as the EcoBat Tool was not available for the 2022 static surveillance analysis, Table 10b figures were used to calculate the Risk Assessment.

Therefore the following scores are assigned to the different proposed turbine locations:

Low = 1 point – T2, T4, T6, T14, T18, T20
Moderate = 3 points – T5, T12
Moderate to High = 4 points – T1, T7, T9, T13, T21
High = 5 points – T3, T8, T10, T11, T15, T16, T17, T19, T22

Overall assessment value (i.e. Turbine Risk value) is then compared to the ranges below:

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

The risk assessment of the three High Risk bat species (Leisler's bat, common pipistrelle and soprano pipistrelle) was calculated for each proposed turbine location in the next table.

Table 13: Risk assessment for each proposed turbine location for Leisler's bat & *Pipistrellus* species.

Turbine No.	Site Risk Value	Ecobat Activity Category	Turbine Risk
			Site Risk x Ecobat
1	3	4	12
2	3	1	3
3	3	5	15
4	3	1	3
5	3	3	9
6	3	1	3
7	3	4	12
8	3	5	15
9	3	4	12
10	3	5	15
11	3	5	15
12	3	3	9
13	3	4	12
14	3	1	3
15	3	5	15
16	3	5	15
17	3	5	15
18	3	1	3
19	3	5	15
20	3	1	3
21	3	4	12
22	3	5	15

Due to the moderate to high levels of nightly bat activity at many of the static locations, the majority of the proposed wind turbines have a potential Medium (7 turbines) to High Risk (9 turbines) factor. The High Risk turbines are located throughout the proposed development site. The peak of bat activity was predominantly in the Spring and Summer months. The location of the proposed turbines, according to their "Turbine Risk" is present on the figure below.

The proposed development area is divided into three locations: Derryogue (northern section), Derryadd (middle section) and Lough Bannow (southern section). These three separate area will be taken into account as part of the analysis to determine bat mitigation measures required.

Derryogue: 7 proposed turbines

- 1 High risk, 3 Medium risk, 3 Low risk.

Derryadd: 8 proposed turbines

- 4 high risk, 3 Medium risk, 1 Low risk along with two addition static locations with Moderate to High bat activity (Autumn 7) and High bat activity (Spring 7).

Lough Bannow: 7 proposed turbines

- 4 High risk, 1 Medium risk, 2 Low risk.

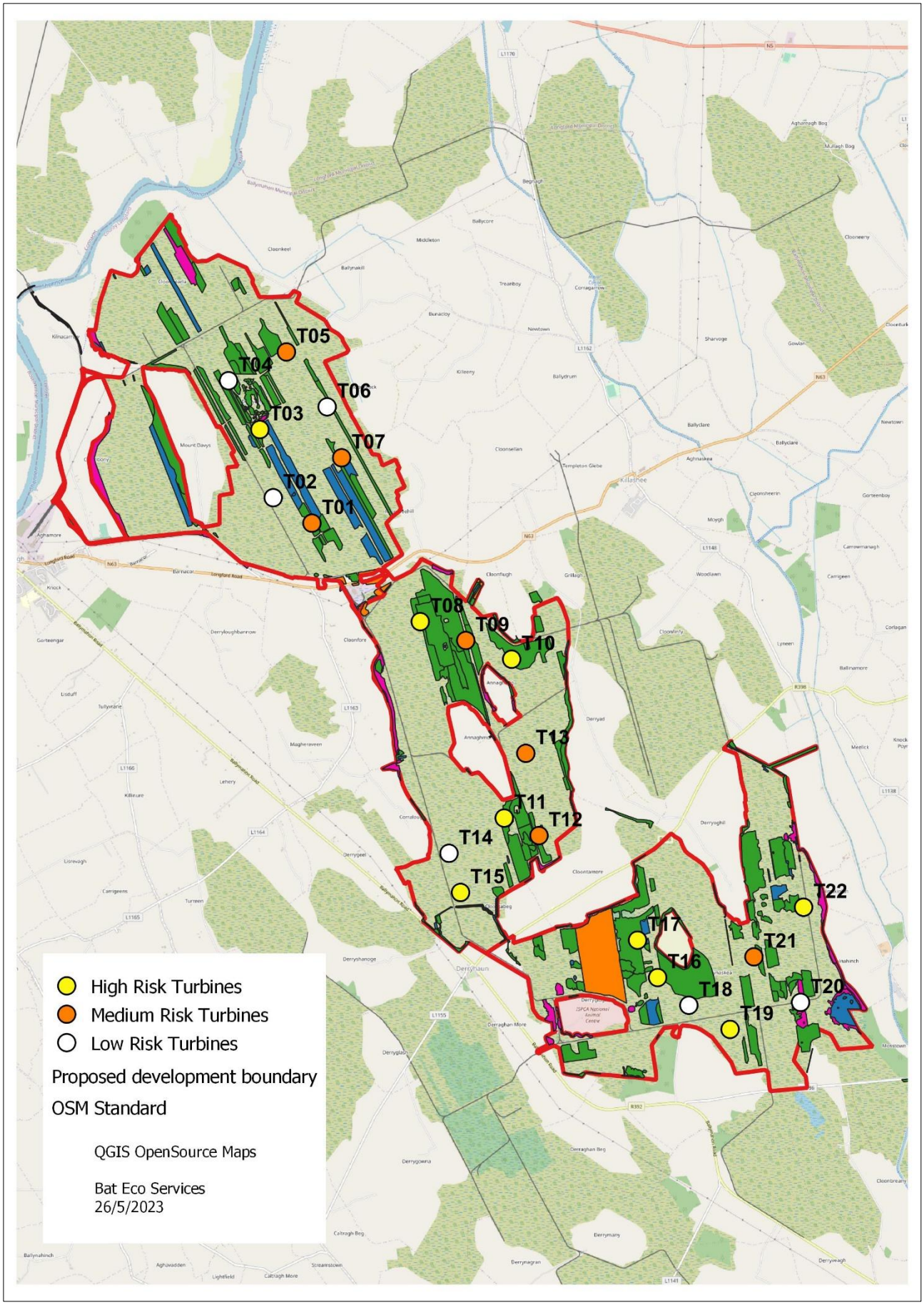

Figure 12: Bat Risk Value for each of the proposed turbine locations.

6. Impact Assessment & Mitigation

6.1 Impact Assessment

The impact assessment takes into consideration the following:

- Eight bat species were recorded during the 2021 and 2022 bat surveys of the proposed development site.
- Four of these species are considered to be High Risk bat species in relation to wind turbines: Leisler's bat, common pipistrelle, soprano pipistrelle and Nathusius' pipistrelle.
- The remaining four species are Low Risk: Natterer's bat, Daubenton's bat, whiskered bat and brown long-eared bat.
- Analysis of static surveillance results and additional analysis highlighted turbine locations with High Risk and Medium Risk for Leisler's bat, common pipistrelle and soprano pipistrelle. Nine turbine locations are deemed High Risk and this is primarily due to spring and summer activity. These High Risk turbines are located throughout the proposed development site but there is a greater concentration of such in the Derryadd and Lough Bannow sections.
- An additional eight turbine locations have a Medium Risk value for local bat populations. These Medium Risk turbines are located throughout the proposed development site but there is a greater concentration of such in Derryogue and Derryadd sections.
- Greater dispersal and higher activity levels were recorded in Spring compared to Autumn and Summer surveillance periods.
- There is a wide spread of bat encounter records within the proposed development site, and this is particularly important in relation to infrastructure.
- There are bat habitats present within 200m of turbine locations and along infrastructure routes.

6.1.1 Potential Impact on Local Bat Populations

If no mitigation measures are implemented, there are nine High Risk turbines and seven additional turbine locations considered to be a Medium risk to local bat populations. The remaining five proposed turbine locations are considered to have a Low Risk. However, the High Risk and Medium Risk turbines are spread throughout the proposed development area.

6.1.2 Core Sustenance Zones

No bat roosts were recorded within the proposed development zone during bat surveys undertaken. Therefore Core Sustenance Zone analysis was not undertaken.

6.1.3 Potential Impact on Roosts

No bat roosts were recorded within the proposed development area and therefore there are no impacts on roosting sites.

6.1.4 Cumulative Impacts of Existing Wind Farm Operations

The following information was provided by TOBIN in relation to other proposed, permitted and/or constructed wind farms.

Information on the relevant projects within the vicinity of the proposed development is described in Chapter 4 of this EIAR (Policy, Planning & Development Context). The information was sourced by TOBINS from a search of the local authorities planning registers, EPA website, planning applications, EIAR documents and planning drawings which facilitated the identification of past and future projects, their activities and their potential environmental impacts.

Table 14: Other Wind Farm Operations (Source: TOBIN).

Registered Reference (Roscommon Co. Co.)	Description of Development	Location	Year of Decision
03/341	A grant of planning permission issued to Provento Ireland PLC for a development comprising 2 no. wind turbines along with a meteorological tower, and a control building. An extension of duration permission was granted (Reg. Ref. 11/3055) to Gaelectric Development Ltd. on this planning permission, extending it until 25/06/2013.	Rooskey Townland, Ballaghaderreen,, Co. Roscommon.	27/06/2003
04/103 (Appeal Ref. 20.208733)	A grant of planning permission issued to Provento Ireland PLC for a development comprising 3 no. 1.5MW wind turbines with a maximum output of 4.5MW. The turbines have a stated 78m hub height and 72m blade diameter. This site is nearly 20km to the SW of the subject site. This wind farm has been constructed.	Skrine/Knockmeane Townland, Athleague, Co. Roscommon.	19/01/2005
07/2255	Amendments to 2 no. wind turbines and associated substation and met mast as granted under Reg. Ref. 03/341 (original permission). Amendments related to a change in the height of the turbine and sound pressure levels to revise condition 1 and 13 of the original permission. An extension of duration permission was granted (Reg. Ref. 13/3005) to Gaelectric Development Ltd. on this planning permission, extending it until 10/03/2014.	Ballaghaderreen, County Roscommon (Roosky Wind Farm)	28/03/2008
10/507 (Appeal Ref. 20.239743)	A grant of planning permission issued to Coillte Teo. for a development comprising 20 no. wind turbines with a total output capacity of 58MW along with a 110kV sub-station. An extension of time was granted (Reg. Ref. 10/3002) to Gaelectric Development Ltd. on this planning permission, extending it until 18/1/2012. 85m hub height and 93m rotor diameter. The planning permission was permitted for 10 years	Aghadangan, Bunnageddy, Corhawny, Kilmacananneny, Cloonycarran More,Carroward, Trila (Martin), Trila (Dillon), Ballyduffy,Curraghduffy, Tullyvarran, Killavackan,	27/03/2012

	with an operational period of 25 years from the date of commissioning of the wind farm. The site is located about 8km to the NW of the subject site. This wind farm has been constructed and is operational since March 2017.	Telton, Lackan (ED Kilgefin), Reagh, Doughil, Trilacroghan, Kilnasillagh and Aghaclogher, approximately 5 km southeast of Strokestown, Co. Roscommon (Sliabh Bawn Wind Farm)	
11/126	A grant of planning permission issued to erect 2 no. 2.3MW wind turbines along with a sub-station. The turbines have a stated hub height of 85m and up to 82m rotor diameter.	Derrane and Roxborough Townlands, Co. Roscommon	03/01/2012
18/313	Minor technical amendments to development permitted under Reg. Ref. 11/126.	Derrane and Roxborough, Co. Roscommon	28/09/2018
18/447 (ABP Ref. 303677)	Relocation of the permitted wind turbines and associated infrastructure	Derrane and Roxborough, Co. Roscommon (Derrane Wind Farm)	12/07/2019

Using the Core Sustenance Zone radius of 4km (this is the CSZ for Natterer's bat, the widest zone value for the eight bat species recorded during the surveys), a buffer of 4km was created from the proposed wind farm site boundary of the proposed development site. This was mapped in relation to the list of developments permitted and proposed supplied by TOBIN, in preparation of the Policy, Planning and Development chapter for the Environmental Impact Assessment Report (EIAR) of the proposed development (Chapter 4). None of these developments are Therefore, there are no cumulative impacts of additional planning applications in relation to local bat populations.

6.2 Mitigation Measures

In order to reduce the potential impact of the proposed development on local bat populations the following mitigation is recommended.

6.2.1 Construction Phase

Mitigation is best achieved through avoidance especially in relation to bat fauna. It is proposed that the following measures be put in place to avoid or lessen the degree of impacts on local bat populations.

6.2.1.1 Minimum Buffer Zone

To minimize risk to bat populations, a buffer zone is recommended around any forestry, treeline, hedgerow, woodland feature, into which no part of the turbine should intrude. Using the formula quoted below, the minimum distances of wind turbines for bat mitigation are calculated for each of the potential turbine models (information supplied by TOBIN):

Blade length = 81m
Hub Height = 107.5m
Tip height = 190m
Rotor Diameter = 165m
22 no. Turbines proposed.

formula: $Buffer\ distance = \sqrt{(50 + b1)^2 – (hh – fh)^2}$
where bl = blade length, hh = hub height, fh = feature height (all in meters)

The dimensions of the potential wind turbine models proposed to be used are provided in the table below. Feature height is 15m (typical tall scrub vegetation). Dimensions of Blade length and Hub height were provided and the calculation is as follows:

$Buffer\ distance = \sqrt{(50 + 81)^2 – (107.5 – 15)^2}$

Buffer distance is calculated as 92.76m.

Table 17a: Bat Mitigation Measures recommended during the Construction Phase.

High Level Bat Mitigation This applies to T3, T8, T10, T11, T15, T16, T17, T19, T22	**Moderate Level Bat Mitigation** This applies to T1, T5, T7, T9, T12, T13, T21.This also applies to remaining Internal Road Network	**Low Level Bat Mitigation** This applies to T2, T4, T5, T14, T18, T20
Ensure that wind turbine is >92.76m away from bat habitat according to English Nature calculation.	Ensure that wind turbine is >92.76m away from bat habitat according to English Nature calculation.	Ensure that wind turbine is >92.76m away from bat habitat according to English Nature calculation.
A zone of >92.76m m around the wind turbines (from the tip of the blade) should be cleared of tall vegetation (shrubs, trees, scrub etc.) to reduce favourability of this zone for foraging and commuting bats. The clearance of deciduous vegetation should be assessed to ensure that such clearance is necessary and will not increase the potential impact of the proposed development on local bat populations. A low level of vegetation should be maintained for the entire operational phase. This should be monitored to ensure that scrub vegetation does not develop within the zone around the turbines.	A zone of 50m around the wind turbines (from the tip of the blade) should be cleared of tall vegetation (shrubs, trees, scrub etc.) to reduce favourability of this zone for foraging and commuting bats. The clearance of deciduous vegetation should be assessed to ensure that such clearance is necessary and will not increase the potential impact of the proposed development on local bat populations. A low level of vegetation should be maintained for the entire operational phase. This should be monitored to ensure that scrub vegetation does not develop within the zone around the turbines.	A zone of 50m around the wind turbines (from the tip of the blade) should be cleared of tall vegetation (shrubs, trees, scrub etc.) to reduce favourability of this zone for foraging and commuting bats. The clearance of deciduous vegetation should be assessed to ensure that such clearance is necessary and will not increase the potential impact of the proposed development on local bat populations. A low level of vegetation should be maintained for the entire operational phase. This should be monitored to ensure that scrub vegetation does not develop within the zone around the turbines.
Complete clearance work at least 6 months prior to installation of wind turbines. Studies have shown that bats are attracted to clear felled forestry areas due to increase insect loading. This has been shown to occur for a period of 3-6 months before the insect loading reduces to pre-cleared felled levels (Kirkpatrick *et al.* 2017*)*.	Complete clearance work at least 6 months prior to installation of wind turbines. Studies have shown that bats are attracted to clear felled forestry areas due to increase insect loading. This has been shown to occur for a period of 3-6 months before the insect loading reduces to pre-cleared felled levels (Kirkpatrick *et al.* 2017*)*.	Complete clearance work at least 6 months prior to installation of wind turbines. Studies have shown that bats are attracted to clear felled forestry areas due to increase insect loading. This has been shown to occur for a period of 3-6 months before the insect loading reduces to pre-cleared felled levels (Kirkpatrick *et al.* 2017*)*.
Investigate the possibility of providing “bat habitat” of 2 hectares/wind turbine. If feasible.	Investigate the possibility of providing “bat habitat” of 0.5 hectares/wind turbine (e.g. replant lands).	Investigate the possibility of providing “bat habitat” of 0.25 hectares/wind turbine (e.g. replant lands).

This land should be located at least 1km away from the nearest wind turbine (e.g. replant lands).		
Undertaken a Potential Bat Roost (PBR) survey of trees proposed to be felled and fell according to PBR value.		
Investigate the potential of providing alternative bat roosting sites in operation buildings (e.g. potential substation location outside the buffer zones of the individual turbines) required for the operation of the proposed wind farm. Measures can be implemented to provide roosting spaces and this is required to mitigation for potential PBR trees proposed to be felled.		
Any biodiversity conservation measures proposed within the proposed development area should be assessed using the following question – Are such measures going to increase or encourage the likelihood of bats commuting and foraging in close proximity of proposed turbine locations and therefore increasing the likely impact of the proposed development on local bat populations?		

6.2.2 Operational Phase

6.2.2.1 Feathering of blades

The operation of the turbines should be in a manner that will restrict the rotation of turbine blades as much as possible below the manufacturer's cut-in speed (e.g. by feathering the blades during low wind levels - changes in blade feathering by altering the angle of the blade and therefore preventing the blades from rotating during low wind situations). This would prevent freewheeling or idling of the blades.

Therefore ensure that blades of turbines are prevented from freewheeling (idling/spinning). Feathering of the blades during low wind conditions are recommended for all turbines.

6.2.2.2 Turbine Cut-in Speeds

There are few bat mitigation measures available in relation to wind farms to reduce bat fatalities. One successful measure applied to wind farms in Europe is to increase the cut-in speeds of the individual turbines. This is important in order to protect High Risk species (Leisler's bat, soprano and common pipistrelle) foraging/commuting in vicinity of turbine locations.

Increasing the cut-in speed to 5.5 m/s from 30 minutes prior to sunset and to 30 minutes after sunrise to reduce bat collisions with turbines should be employed where required (i.e. at turbine locations where surveillance recorded high bat activity levels for High Risk and Medium Risk bat species and/or bat carcasses were recorded). The standard duration required is during the principal activity season of Spring to Autumn months but can depends on the level of bat mitigation required for individual turbine sites (i.e. curtailment regime tailored according to post construction monitoring coupled with carcass searches). For such post-construction monitoring a risk assessment should be undertaken using the surveillance data and analysed using best practice e.g. assessment of static data should be completed using the online tool *EcoBat* (http://www.mammal.org.uk/science-research/ecostat/) as recommended by NaturScot (2021) or other equivalent tool depending on most up to-date recommendations at the time of monitoring.

Where cut-in speeds are required, they should be operated according to specific weather conditions. In a previous bat survey undertaken by the author, static units were erected on an anemometer at

4m and 50m level. The number of bat passes recorded on the static units was analysed according to temperature and wind speed recorded at similar height levels. During this survey, it was determined that:

1. The vast majority of bat passes were recorded at the temperatures of 8^{o}C and greater. Therefore, when the air temperature was less than 7^{o}C there was no bat activity recorded during the surveys completed.
2. In general, bat activity was highest at low wind speeds (<5.5m/s). It has been shown that curtailing the operations of wind turbines at low wind speeds can reduce bat mortality dramatically, especially during the late summer and early autumn months.
3. NaturScot (2021) recommend that curtailment is implement for 10^{o}C and above.

Reducing fatalities can be reduced by changing the speed trigger or cut-in speeds of the turbines (i.e. meaning that the turbine is not operational during low wind speeds) or by changing the turbine blades angles which will mean that higher wind speeds are needed to start the wind turbine blades moving. Modern remotely operated wind turbines allow such cut-in speeds to be controlled centrally and automatically.

Due to the high levels of bat activity, cut-in speeds is required at seven proposed turbine locations. As recommended by SNH, 2019 if curtailment is put into operation, *"then 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 considered to be 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".*

"Where the need for curtailment has been identified, a curtailment regime should be developed and presented as a part of the supporting Environmental Statement for the project. The proposed operating regime should specify, and be designed around the values for the key weather parameters and other factors that are known to influence collision risk which may include any or all of the following:

- *Wind speed in m/s (measured at nacelle height)*
- *Time after sunset*
- *Month of the year*
- *Temperature (^{o}C)*
- *Precipitation (mm/hr) "*

Post construction acoustic surveys provide additional information which, when used in conjunction with appropriate carcass search data, can support any proposed changes to pre-application predictions concerning the need for curtailment or adjustments to an agreed curtailment regime.

This surveillance and annual review should be carried out by an independent experienced bat ecologist and all reports should be issued to the Local Authority and NPWS for review.

Due to the large number of High Risk turbines, it is recommended that the mitigation is grouped according to where turbines are located within each of the three separate bog locations (i.e. Lough Bannow, Derryadd and Deryogue). As both Derryadd and Lough Bannow sections have a greater concentration of High Risk turbines, it is recommended that the highest level of bat mitigation is applied to proposed turbines located within these areas, regardless of bat risk value, as a precautionary measure.

Table 17b: Bat Mitigation Measures recommended during the Operational Phase.

High Level Bat Mitigation This applies to all proposed turbines located in Derryadd (T8, T9, T10, T11, T12, T13, T14, T15), Lough Bannow (T16, T17, T18, T19, T20, T21, T22) and T3 (Derryogue)	**Moderate Level Bat Mitigation** This applies to T5, T7, T1 (Derryogue) This also applies to remaining Internal Road Network	**Low Level Bat Mitigation** This applies to T2, T4, T6 (Derryogue)
Operate the wind turbines in a manner that reduces the movement of the blades below the cut-in speed (e.g. by feathering the blades).	Operate the wind turbines in a manner that reduces the movement of the blades below the cut-in speed (e.g. by feathering the blades).	Operate the wind turbines in a manner that reduces the movement of the blades below the cut-in speed (e.g. by feathering the blades).
Operate the wind turbine from 30 minutes prior sunset to 30 minutes after sunrise at a cut-in speed of 5.5 m/s during specified weather conditions and during the active bat season (April to October) when air temperatures are 10^{o}C or more at the nacelle height. Undertake monitoring the first three years of operation to determine bat activity levels post construction. Review the results of monitoring at individual High Risk turbines after Year 1. Use such monitoring coupled with carcass search to determine if a more tailored curtailment regime is required.	Put in a monitoring programme for the first year of operation to ensure that bat activity is at a low level in vicinity of these turbines. Review monitoring results to determine if further bat mitigation measures are required (e.g. cut-in speeds to be applied to listed proposed turbine locations).	
Undertake a carcass search for 3 years post operation of the wind farm to determine whether a higher cut-in speed of the blades is required. Review after Year 1 along with bat activity monitoring.	Undertake a carcass search for 3 years post operation of the wind farm. If fatalities are recorded, curtailment (as per the High Risk turbines) will need to be examined to determine what additional mitigation is required.	Undertake a carcass search for 3 years post operation of the wind farm. If fatalities are recorded, curtailment (as per High Risk turbines) will need to be examined to determine what additional mitigation is required
Annual inspection of each buffer zone around each turbine will be undertaken and any regenerating trees or tall shrubs will be cut back.	Annual inspection of each buffer zone around each turbine will be annually inspected and any regenerating trees or tall shrubs will be cut back.	Annual inspection of each buffer zone around each turbine will be annually inspected and any regenerating trees or tall shrubs will be cut back.

Bat mitigation measures during the Operational Phase can be reviewed by implementing a strict surveillance programme for the first three years of operation of the wind farm in order to identify if there exists a substantial risk at a particular turbine location or during a particular time-period (3 yrs - as per recommendation of NaturScot, 2021 guidelines). This surveillance should then be repeated at Year 10 and Year 20 of the operation of the wind farm to ensure that sufficient mitigation is being implemented. This surveillance required is as follows:

a) Bat activity surveillance
   The level of bat activity should be monitoring for a minimum of 10 nights at each turbine location (ground level). The surveillance periods should be divided into three survey periods to represent the three main periods where bat collisions have been documented: Spring (April/May); Summer (June/July) and Autumn (August/September).
b) Carcass search
   During the surveillance periods of specific wind turbines, carcass search is required for a minimum of 1 morning per turbine (i.e. 3/4 mornings in total over the 1 year surveillance i.e. one per surveillance period). For each turbine, the search area should be 100m radius after ideal bat foraging weather conditions (mild, calm and dry weather and greater than 10^{o}C). A scavenger trial is required to facilitate analysis (as per NaturScot, 2021 guidelines).
c) For exact protocols consult most up-date best practice guidelines from current research publications / guidelines (e.g. NaturScot, 2021).
d) Assessment of static data should be completed using the online tool *EcoBat Tool* (http://www.mammal.org.uk/science-research/ecostat/) as recommended by NaturScot, 2021 or other equivalent tool depending on most up to-date recommendations at the time of monitoring.

6.2.3 Bat Surveys – Age of Data

It is recommended that if three years lapse from between pre-construction surveys and the construction of the wind turbines, it may be necessary to repeat the pre-construction surveys (Rodrigues *et al.*, 2015). Surveys completed for this report were concluded in 2022. Therefore, a review should be undertaken no later than Spring 2025. Future survey work should be completed according to best practice guidelines available.

6.2.4 *Monitoring: Operational phase*

Acoustic surveys can be used to continue to assess bat activity and behaviour following construction of turbines to assess the ongoing need for curtailment mitigation. 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 a need for curtailment.

The mitigation measures should be monitored by experience bat specialist at intervals during the initial years of operation of the development to ensure successful implementation. Good practice also requires that impacts on adjoining areas are also monitored.

As described above, Years 1-3 Surveillance, Year 10 Surveillance and Year 20 Surveillance is required.

a) Static Surveys
- Minimum of 10 nights surveillance per turbine
- 3 periods within the months of March/April to October/November
- 3 periods should be Spring, Summer and Autumn to investigate bat activity during the 3 periods where bat collisions have been documented and when bat movement is at its highest.

b) Carcass Searches
- Minimum of 1 morning per turbine during the static survey per surveillance period.
- After ideal bat foraging weather conditions (mild, calm and dry weather and greater than 10^{o}C). Searches should be completed at dawn in order to find bats before predation of corpses occurs.
- Follow best practice carcass search protocols as new guidelines are published/updated.
- Include scavenger trials as per NaturScot (2021) guidelines.

c) Curtailment Monitoring
- As per NaturScot (2021) guidelines at the turbines where curtailment will be applied.

It should aim to assess changes in bat activity patterns and the efficacy of mitigation to inform any changes to curtailment. Monitoring should take place for at least 3 years post-construction, but the effects of habitat modification and off-site enhancements on bat activity may require monitoring over a longer period.

7. Survey Conclusions

The survey area is deemed to have a Low to Medium landscape favourability for Irish bat species. However there is medium connectivity between the linear habitats and woodland habitats and this increases the favourability for the proposed development site for foraging and commuting bats. During bat surveys eight species of bat were recorded within the survey area and this is a high level of bat biodiversity.

- Four of these bat species are considered to be High Risk bat species in relation to wind turbines: Leisler's bat, common pipistrelle, soprano pipistrelle and Nathusius' pipistrelle.
- The remaining four species are Low Risk: Natterer's bat, Daubenton's bat, whiskered bat and brown long-eared bat.
- Analysis of static surveillance results and additional analysis highlighted turbine locations with High Risk and Medium Risk for Leisler's bat, common pipistrelle and soprano pipistrelle. Nine turbine locations are deemed High Risk and this is primarily due to spring and summer activity. These High Risk turbines are located throughout the proposed development site but there is a greater concentration of such in the Derryadd and Lough Bannow sections.
- An additional eight turbine locations have a Medium Risk value for local bat populations. These Medium Risk turbines are located throughout the proposed development site but there is a greater concentration of such in Derryogue and Derryadd sections.
- Greater dispersal and higher activity levels were recorded in Spring compared to Autumn and Summer surveillance periods.
- There is a wide spread of bat encounter records within the proposed development site, and this is particularly important in relation to infrastructure.
- There are bat habitats present within 200m of turbine locations and along infrastructure routes.

Twenty-two turbines are proposed as part of this wind farm development. Bat activity was recorded at or in vicinity of the proposed turbine locations. Additional bat activity was recorded along much of the walking and driven transect routes. No bat roosts were recorded within the proposed development site.

The location of wind turbines is important in relation to their potential impact on local bat populations. To reduce impact on High Risk species such as Leisler's bat, common pipistrelle and soprano pipistrelle, it is important to ensure that turbines are not located adjacent to the linear habitat features and habitat considered important for foraging bats. To reduce the impact on High Risk species such as Leisler's bats that fly high and over tree canopies, it is important to ensure that turbine are located away from mature trees (treelines, woodland etc.). The proposed development will impact on local bat populations and this is primarily due to the moderate to high levels of bat activity of three common bat species (Leisler's bat, common pipistrelle and soprano pipistrelle). All three of these bat species are considered to be High Risk species in relation to wind farms. As a consequence bat mitigation measures are required.

The mitigation measures recommended in this report require strict implementation to reduce the long-term impact of the proposed wind farm on local bat populations. The proposed wind farm is likely to have an overall Moderate impact on local bat populations. The implementation of mitigation measures will likely reduce this to a Low Impact on local bat populations.

Monitoring (including acoustic surveillance and carcass surveys) is essential to determine that mitigation measures recommended are effective in reducing the potential impacts on local bat

populations. The operation of the wind farm should be flexible to implement changes, if recommended, by the monitoring results.

8. Bibliography

Abbott, I. M., Butler, F. And Harrison, S. (2012) When flyways meet highways – the relative permeability of different motorway corssing sites to functionality diverse bat species. Landscape and Urban Planning 106 (4): 293-302.

Abbott, I. M., Berthinessen, A., Stone, E., Booman, M., Melber, M. and Altringham, J. (2015) Bats and Roads, Chapter 5, pp/ 290-299. In: Handbook of Road Ecology. Editors: R. Van der Ree., D. J. Smidt and C. Grilo. Wiley Blackwell.

Altringham, J. D. (2013) Biritah Bats. Collins New Naturalist Library, Volume 93. Haper Collins, London.

Altringham, J. And Kerth, G. (2016) Bats and Roads, Chapter 3. In: Bats in the Anthropocence: Conservation of Bats in a Changing World. Editors: C. C. Voigt and T. Kingston. Springer Open.

Arnett, E. B., M. M. Huso, M. R. Schirmacher, and J. P. Hayes. (2011) Altering turbine speed reduces bat mortality at windenergy facilities. Frontiers in Ecology and the Environment 9:209–214

Arnett EB, Brown WK, Erickson WP, Fiedler JK, Hamilton BL,Henry TH, Jain A, Johnson GD, Kerns J, Koford RR, Nicholson, CP, O'Connell TJ, Piorkowski MD, Tankersley RD (2008) Patterns of bat fatalities at wind energy facilities in North America. Journal of Wildlife Management 72:61–78.

Aughney, T., Stephens, R. and Roche, N. (2021) Monthly roost counts of Lesser Horseshoe Bats (*Rhinolophus hipposideros* (Bechstein)) in a purpose-renovated building in Co. Galway. *Irish Naturalists' Journal* **37** (2): 137-141.

Aughney, T., Roche, N., & Langton, S (2018) The Irish Bat Monitoring Programme 2015-2017. *Irish Wildlife Manuals*, No. 103. National Parks and Wildlife Service, Department of Cultural heritage and the Gaeltacht, Ireland.

Aughney, T., Roche, N. and Langton, S. (2022) Irish Bat Monitoring Programme 2018-2021. *Irish Wildlife Manuals*, No. 137. National Parks and Wildlife Service, Department of Housing, Local Government and Heritage, Ireland.

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

Baerwald, E. F., J. Edworthy, M. Holder, and R. M. Barclay. (2009). A large-scale mitigation experiment to reduce bat fatalities at wind energy facilities. Journal of Wildlife Management 73:1077–1081.

Barataud, M. (2016) Acoustic Ecology of European bats:species identification, study of their habitats and foraging behaviour. University of Chicago Press, Chicago, Illinois, 352pp.

Barratt, E. M., Deauville, R., Burland, T. M., Bruford, M. W., Jones, G., Racey, P. A., & Wayne, R. K. (1997). DNA answers the call of pipistrelle bat species. *Nature* 387: 138 - 139.

Bat Conservation Ireland (2015) BATLAS 2020 Pilot Project 2015: Volunteer Survey Manual. Version 01. www.batconservationireland.org.

Bat Conservation Trust (2018) Bats and artificial lighting in the UK: bats and the built environment series. Guidance Note 08/2019. BCT, London.

Bat Conservation Trust (2020) Core Sustenance Zones and habitats of importance for designing Biodiversity Net Gain for bats. BCT, London.

Bharddwaj, M., Soaner, K., Straka, T., Lahoz-Monfort, J., Lumsden, L. F. and van der Ree, R. (2017) Differential use of highway underpasses by bats. Biological Conservation 212: 22-28.

Billington, G. E. & Norman, G. M. (1997). A report on the survey and conservation of bat roosts in bridges in Cumbria, Kendal. English Nature.

BTHK (2018) Bat Roosts in Trees – A Guide to Identification and Assessment for Tree-Care and Ecology Professionals. Exeter: Pelagic Publishing.

CIEEM (2016) Guidelines for Ecological impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal (2nd Edition). CIEEM, Winchester.

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

Collins, J.H., Ross, A.J., Ferguson, J.A., Williams, C.D. & Langton, S.D. (2022) The implementation and effectiveness of bat roost mitigation and compensation measures for *Pipistrellus* and *Myotis* spp. and brown long-eared bat (*Plecotus auritus*) included in building development projects completed between 2006 and 2014 in England and Wales. Conservation Evidence: 17, 19-26.

Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention) 1982.

Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention) 1979.

Dietz, C., Helversen, O. and Dietmar, N. (2011) Bats of Britain, Europe & Northweat Africa. A&C Black, London.

Downs, N.C., Beaton, V., Guest, J., Polanski, J., Robinson, S.L. and Racey, P.A. (2003) The effects of illuminating the roost entrance on the emergence behaviour of *Pipistrellus pygmaeus*. Biological Conservation 111, p. 247-252.

EC Directive on The Conservation of Natural habitats and of Wild Fauna and Flora (HabitatsDirective) 1992.

Eisenbeis G and Hassel F. (2000). Zur Anziehung nachtaktiver Insekten durch Straßenlaternen – eine Studie kommunaler Beleuchtungseinrichtungen in der Agrarlandschaft Reinhessens Attraction of nocturnal insects to street lights – a study of municipal lighting systems in a rural area of Rheinhessen (Germany)]. *Natur und Landschaft* **75**: 145–56.

Finch, D. & McAney, K. (2020) Using Circuitscape to identify potential landscape corridors for the lesser horseshoe bat in Ireland. Unpublished report for Vincent Wildlife Trust, Ledbury, UK.

Frank K.D. (1988). Impact of outdoor lighting on moths: an assessment. *J Lepidop Soc* 42: 63–93.

Gunnell, K., Grant, G. and Williams, C (2012) Landscape and urban design for bats and biodiversity. The Bat Conservation Trust, London.

Hanski, I. (1998) Metapopulation Dynamics. Nature, 396, 41-49.

Holker, F., Wolter, C., Perkin, E.K. & Tockner, K. (2010). Light pollution as a biodiversity threat. Trends Ecol. Evol. 25, 681–682. https://doi.org/10.1016/j.tree.2010.09.007.

Hulme 2014: Bridging the knowing–doing gap: know-who, know-what, know-why, know-how and know-when. Journal of Applied Ecology, 51, 1131-1136.

Hundt, L. (2012) Bat Surveys: Good Practice Guidelines (2nd Edition). The Bat Conservation Trust, London.

Kelleher, C. & 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.

Kirkpatrick, L., Oldfield, I.F. & Park, K. (2017) Responses of bats to clear fell harvesting in Sitka Spruce plantations, and implications for wind turbine installation. Forest Ecology and Management 395: 1-8.

Kolligs D. 2000. Ökologische Auswirkungen künstlicher Lichtquellen auf nachtaktive Insekten, insbesondere Schmetterlinge (Lepidoptera) [Ecological effects of artificial light sources on nocturnally active insects, in particular on moths (Lepidoptera)]. *Faunistisch-Ökologische Mitteilungen Suppl* **28**: 1–136.

Lintott P. & Mathews F. (2018) *Reviewing the evidence on mitigation strategies for bats in buildings: informing best-practice for policy makers and practitioners*. CIEEM Commissioned Report

Longcore T. and Rich C. (2004). Ecological light pollution. *Frontiers in Ecology and Environment.* **2**: 191-198.

Lundy, M.G., Montgomery, I.W., Roche, N. & Aughney, T. (2011). *Landscape Conservation for Irish Bats & Species Specific Roosting Characteristics* (Unpublished). Bat Conservation Ireland, Cavan, Ireland.

Lysaght, L. and Marnell, F. (eds) (2016) Atlas of Mammals in Ireland 2010-2015, National Biodiversity Data Centre, Waterford.

Lyons, F. (2014) GIS desktop project: Mapping a future of the Lesser horseshoe bat – a study of its population fragmentation in Limerick and north Kerry. Unpublished report for the Vincent Wildlife Trust, Ledbury, UK.

Marnell, F., Kingston, N. & Looney, D. (2009) *Ireland Red List No. 3: Terrestrial Mammals*, National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin, Ireland.

Marnell, F., Looney, D. & Lawton, C. (2019) Ireland Red List No. 12: Terrestrial Mammals. National Parks and Wildlife Service, Department of the Culture, Heritage and the Gaeltacht, Dublin, Ireland.

Marnell, F., Kelleher, C. & Mullen, E. (2022) Bat mitigation guidelines for Ireland v2. Irish Wildlife Manuals, No. 134. National Parks and Wildlife Service, Department of Housing, Local Government and Heritage, Ireland.

Martín, B.; Pérez, H.; Ferrer, M. Light-Emitting Diodes (LED): A Promising Street Light System to Reduce the Attraction to Light of Insects. *Diversity* **2021**, *13*, 89. https://doi.org/10.3390/d13020089.

Mathews, F., Roche, N., Aughney, T., Jones, N,M. Day, J., Baker, J. and Langton, S. (2015) Barriers and benefits: implications of artificial night-lighting for the distribution of common bats in Britain and Ireland. *Philosphical Transactions of the Royal Society of London B* 370 (1667), doi: 10.1098/rstb.2014.0124.

McAney, K. (2006) A conservation plan for Irish vesper bats, Irish Wildlife Manual No. 20 National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland. McAney, K. (2014). An overview of Rhinolophus hipposideros in Ireland (1994-2014). *Vespertilio* **17**, 115–125.

McAney, K., O'Mahony, C., Kelleher, C., Taylor, A. & Biggane, S. (2013). *The Lesser Horseshoe Bat in Ireland: Surveys by The Vincent Wildlife Trust*. Belfast, Northern Ireland: Irish Naturalists' Journal.

Mullen, E. (2007). Brandt's Bat *Myotis brandtii* in Co. Wicklow. Irish Naturalists' Journal 28: 343.

NaturScot et al (2021) *Bats and onshore wind turbines – survey, assessment and mitigation*. https://www.nature.scot/bats-and-onshore-wind-turbines-survey-assessment-andmitigation. (August 2021 - version updated).

Norberg U.M. and Rayner J.M.V. (1987). Ecological morphology and flight in bats (Mammalia; Chiroptera): wing adaptations, flight performance, foraging strategy and echolocation. *Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences.* **316**: 335-427.

NPWS & VWT (2022) Lesser Horseshoe Bat Species Action Plan 2022- 2026. National Parks and Wildlife Service, Department of Housing, Local Government and Heritage, Ireland.

NPWS (2018) Conservation objectives supporting document – lesser horseshoe bat (Rhinolophus hipposideros) Version 1. Conservation Objectives Supporting Document Series. National Parks and Wildlife Service, Department of Culture, Heritage and the Gaeltacht, Dublin, Ireland

O'Sullivan, P. (1994). *Bats in Ireland.* Special supplement to the Irish Naturalists' Journal.

Rich, C. & Longcore, T. (eds). 2006 Ecological consequences of artificial night lighting. Washington, DC: Island Press

Richardson, P. (2000). *Distribution atlas of bats in Britain and Ireland 1980 - 1999*. The Bat Conservation Trust, London, UK.

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

Roche, N., Langton, S. & Aughney, T. (2012). *Lesser Horseshoe Bat: Population, Trends and Threats 1986 to 2012* (Unpublished). Bat Conservation Ireland, Cavan, Ireland.

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

Rodrigues, L., Bach, L., Duborg-Savage, M.J., Karapandza, B., Kovak, D., Kervyn, T., Dekker, J., Kepel, A., Back, P., Collins, J., Harbusch, C., Park, K., Micevski, B., Minderman, J. (2015) Guidelines for consideration of bats in wind farm projects – Revision 2014. EUROBATS Publication Series No. 6 (English Version). UNEP/EUROBATS Secretariat, Bonn, Germany, 133 pp.

Rowse EG, Harris S, Jones G. 2018Effects of dimming light-emitting diode street lights on light-opportunistic and light-averse bats in suburban habitats. *R.Soc. open sci.* **5**: 180205.http://dx.doi.org/10.1098/rsos.180205

Russ, J. (2012) British Bat Calls: A guide to species identification. Pelagic Publishing, Exeter.

Russo, D., Cistrone, L., Libralato, N., Korine, C., Jones, G. & Ancillotto, L. (2017). Adverse effects of artificial illumination on bat drinking activity. Anim. Conserv. 20, 492–501. https://doi.org/10.1111/acv.12340.

Rydell J. (1992). Exploitation of insects around streetlamps by bats in Sweden. *Functional Ecology* **6**: 744-750.

Rydell J. (2006). Bats and their insect prey at streetlights. In C. Rich and T. Longcore (eds.) Ecological Consequences of Artificial Night Lighting. 43-60.

Rydell J. and Racey P.A. (1995). Street lamps and the feeding ecology of insectivorous bats. In P.A. Racey and S.M. Swift (eds.) Ecology, evolution and behaviour of bats. *Symposia of the Zoological Society of London*. **67** pp 291-307. Clarendon Press, Oxford.

Schofield, H. (2008). *The Lesser Horseshoe Bat Conservation Handbook*. Herefordshire, England: The Vincent Wildlife Trust.

Scottish Natural Heritage et al (2019) *Bats and onshore wind turbines – survey, assessment and mitigation*. https://www.nature.scot/bats-and-onshore-wind-turbines-survey-assessment-andmitigation.

Speakman, J.R. (1991) Why do insectivorous bats in Britain not fly in daylight more frequently? Funct. Ecol. 5, 518–524.

Stebbings, R. E. & Walsh, S. T. (1991) *Bat Boxes: A guide to the history, function, construction and use in the conservation of bats.* The Bat Conservation Trust, 1991.

Stone, E., Jones, G. and Harris, S. (2009). Street lighting disturbs commuting bats. *Current Biology*, **19**: 1123-1127.

Stone, E. L., Jones, G., and Harris, S. (2012). Conserving energy at a cost to biodiversity? Impacts of LED lighting on bats. *Global Change Biology* **18**, 2458–2465. doi:10.1111/j.1365-2486.2012.02705.x

Stone EL, Harris S, Jones G. 2015 Impacts of artificial lighting on bats: a review of challenges and solutions. *Mammal. Biol.* **80**, 213–219. (doi:10.1016/j.mambio.2015.02.004)

Svensson A.M. and Rydell J. (1998). Mercury vapour lamps interfere with bat defence of tympanate moths (*Operophtera* spp.; Geometridae). *Animal Behaviour* **55**: 223-226.

Voigt C.C., Azam, C., Dekker, J., Feguson, J., Fritze, M., Gazaryan, S., Holker, F., Jones, G., Leader, N., Limpens, H.J.G.A., Mathews, F., Rydell, J., Schofield, H., Spoelstra, K., Zagmajster, M. (2018) Guidelines for consideration of bats in lighting projects. EUORBATS Publication Series No. 8. UNEP/EUROBATS Secretatiat, Bonn.

Wakefield, A., Broyles, M., Stone, E.L., Jones, G. & Harris, S. (2016). Experimentally comparing the attractiveness of domestic lights to insects: Do LEDs attract fewer insects than conventional light types? Ecol. Evol. 6, 8028–8036. https://doi.org/10.1002/ece3.2527.

Whilde, A. (1993). *Threatened mammals, birds, amphibians and fish in Ireland. Irish Red Data Book 2: Vertebrates.* Belfast: HMSO.

Wildlife Act 1976 and Wildlife [Amendment] Act 2000. Government of Ireland.

Wilson, R., Wakefield, A., Roberts, N. and Jones, G. (2021) Artificial light and biting flies: the parallel development of attractive light traps and unattractive domestic lights. Parasite & Vectors. https://doi.org/10.1186/s13071-020-04530-3.

Wray, S., Wells, D., Long, E. & Mitchell-Jones, T. (2010) *Valuing Bats in Ecological Impact Assessment*. IEEM In-Practice p. 23-25.

Zeale, M.R.K., Stone, E.L., Zeale, E., Browne, W.J., Harris, S. & Jones, G. (2018). Experimentally manipulating light spectra reveals the importance of dark corridors for commuting bats. Glob. Chang. Biol. 24, 5909–5918. https://doi.org/10.1111/gcb.14462.

9. Appendices

9.1 Appendix 1 Relevant Legislation & Bat Species Status in Ireland

9.1.1 Irish Statutory Provisions

A small number of animals and plants are protected under Irish legislation (Nelson, *et al.,* 2019). The principal statutory provisions for the protection of animal and plant species are under the Wildlife Act 1976 (as amended) and the European Communities (Birds and Natural Habitats) Regulations 2011, as amended. The Flora (Protection) Order 2015 (S.I. no. 356 of 2015) lists the plant species protected by Section 21 of the Wildlife Acts. See www.npws.ie/ legislation for further information.

The codes used for national legislation are as follows:

- WA = Wildlife Act, 1976, Wildlife (Amendment) Act, 2000 and other relevant amendments
- FPO = Flora (Protection) Order, 2015 (S.I. No. 356 of 2015)

9.1.2 EU Legislation

The Birds Directive (Directive 2009/147/EC) and Habitats Directive (Council Directive 92/43/EEC) are the legislative instruments which are transposed into Irish law, *inter alia,* by the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477 of 2011) ('the 2011' Regulations), as amended.

The codes used for the Habitats Directive (Council Directive 92/43/EEC) are:

- Annex II Animal and plant species listed in Annex II
- Annex IV Animal and plant species listed in Annex IV
- Annex V Animal and plant species listed in Annex V

The main aim of the Habitats Directive is the conservation of biodiversity by requiring Member States to take measures to maintain or restore natural habitats and wild species listed on the Annexes to the Directive at a favourable conservation status. These annexes list habitats (Annex I) and species (Annexes II, IV and V) which are considered threatened in the EU territory. The listed habitats and species represent a considerable proportion of biodiversity in Ireland and the Directive itself is one of the most important pieces of legislation governing the conservation of biodiversity in Europe.

Under Article 11 of the Directive, each member state is obliged to undertake surveillance of the conservation status of the natural habitats and species in the Annexes and under Article 17, to report to the European Commission every six years on their status and on the implementation of the measures taken under the Directive. In April 2019, Ireland submitted the third assessment of conservation status for 59 habitats and 60 species. There are three volumes with the third listing details of the species assessed.

Article 12 of the Habitats Directive requires Member States to take measures for the establishment of a strict protection regime for animal species listed in Annex IV(a) of the Habitats Directive within the whole territory of Member States. Article 16 provides for derogation from these provisions under defined conditions. These provisions are implemented under Regulations 51 and 54 of the 2011 Regulations.

9.1.3 IUCN Red Lists

The International Union for the Conservation of Nature (IUCN) coordinates the Red Listing process at the global level, defining the categories so that they are standardised across all taxa. Red Lists are also produced at regional, national and subnational levels using the same IUCN categories (IUCN 2012, 2019). Since 2009, Red Lists have been produced for the island of Ireland by the National Parks and Wildlife Service (NPWS) and the Northern Ireland Environment Agency (NIEA) using these IUCN categories. To date, 13 Red Lists have been completed. The Red Lists are an assessment of the risk of extinction of each species and not just an assessment of their rarity. Threatened species are those species categorised as Critically Endangered, Endangered or Vulnerable (IUCN, 2019) – also commonly referred to as 'Red Listed'.

9.1.4 Irish Red List - Mammals

Red Lists in Ireland refer to the whole island, i.e. including Northern Ireland, and so follow the guidelines for regional assessments (IUCN, 2012, 2019). The abbreviations used are as follows:.

- RE Regionally Extinct
- CR Critically Endangered
- EN Endangered
- VU Vulnerable
- NT Near Threatened
- DD Data Deficient
- LC Least Concern
- NA Not Assessed
- NE Not Evaluated

There are 27 terrestrial mammals species in Ireland, which includes the nine resident bat species listed. The terrestrial mammal, according to Marnell *et al.,* 2019, list for Ireland consists of all terrestrial species native to Ireland or naturalised in Ireland before 1500. The IUCN Red List categories and criteria are used to assess that status of wildlife. This was recently completed for the terrestrial mammals of Ireland. Apart from the two following two mammal species (grey wolf *Canis lupus* (regionally extinct) and black rat *Rattus rattus* (Vulnerable)), the remaining 25 species were assessed as least concern in the most recent IUCN Red List publication by NPWS (Marnell *et al*., 2019).

9.1.5 Irish Bat Species

All Irish bat species are protected under the Wildlife Act (1976) and Wildlife Amendment Acts (2000 and 2010). Also, the EC Directive on The Conservation of Natural habitats and of Wild Fauna and Flora (Habitats Directive 1992), seeks to protect rare species, including bats, and their habitats and requires that appropriate monitoring of populations be undertaken. All Irish bats are listed in Annex IV of the Habitats Directive and the lesser horseshoe bat *Rhinolophus hipposideros* is further listed under Annex II. Across Europe, they are further protected under the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention 1982), which, in relation to bats, exists to conserve all species and their habitats. The Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention 1979, enacted 1983) was instigated to protect migrant species across all European boundaries. The Irish government has ratified both these conventions.

Also, under existing legislation, the destruction, alteration or evacuation of a known bat roost is an offence. The most recent guidance document is "Guidance document on the strict protection of animal species of Community interest un the Habitats Directive (Brussels, 12.10.2021 C(2021) 7391 final".

Regulation 51(2) of the 2011 Regulations provides –

(*"(2) Notwithstanding any consent, statutory or otherwise, given to a person by a public authority or held by a person, except in accordance with a licence granted by the Minister under Regulation 54, a person who in respect of the species referred to in Part 1 of the First Schedule—*

(a) deliberately captures or kills any specimen of these species in the wild, (b) deliberately disturbs these species particularly during the period of breeding, rearing, hibernation and migration,

(c) deliberately takes or destroys eggs of those species from the wild,

(d) damages or destroys a breeding site or resting place of such an animal, or

(e) keeps, transports, sells, exchanges, offers for sale or offers for exchange any specimen of these species taken in the wild, other than those taken legally as referred to in Article 12(2) of the Habitats Directive,

shall be guilty of an offence."

The grant of planning permission does not permit the commission of any of the above acts or render the requirement for a derogation licence unnecessary in respect of any of those acts.

Any works interfering with bats and especially their roosts, may only be carried out under a derogation licence granted by National Parks and Wildlife Service (NPWS) pursuant to Regulation 54 of the European Communities (Birds and Natural Habitats) Regulations 2011 (which transposed the EU Habitats Directive into Irish law).

There are eleven recorded bat species in Ireland, nine of which are considered resident on the island. Eight resident bat species and one of the vagrant bat species are vesper bats and all vespertilionid bats have a tragus (cartilaginous structure inside the pinna of the ear). Vesper bats are distributed throughout the island. Nathusius' pipistrelle *Pipistrellus nathusii* is a recent addition while the Brandt's bat has only been recorded once to-date (Only record confirmed by DNA testing, all other records has not been genetically confirmed). The ninth resident species is the lesser horseshoe bat *Rhinolophus hipposideros*, which belongs to the Rhinolophidea and has a complex nose leaf structure on the face, distinguishing it from the vesper bats. This species' current distribution is confined to the western seaboard counties of Mayo, Galway, Clare, Limerick, Kerry and Cork. The eleventh bat species, the greater horseshoe bat, was only recorded for the first time in February 2013 in County Wexford and is therefore considered to be a vagrant species. A total of 41 SACs have been designated for the Annex II species lesser horseshoe bat (1303), of which nine have also been selected for the Annex I habitat 'Caves not open to the public' (8310).

Irish bat species list is presented in Table A along with their current status.

Table A: Status of the Irish bat fauna (Marnell *et al.*, 2019).

Species: Common Name	Irish Status	European Status	Global Status
Resident Bat Species ^			
Daubenton's bat *Myotis daubentonii*	Least Concern	Least Concern	Least Concern
Whiskered bat *Myotis mystacinus*	Least Concern	Least Concern	Least Concern
Natterer's bat *Myotis nattereri*	Least Concern	Least Concern	Least Concern
Leisler's bat *Nyctalus leisleri*	Least Concern	Least Concern	Least Concern
Nathusius' pipistrelle *Pipistrellus nathusii*	Least Concern	Least Concern	Least Concern
Common pipistrelle *Pipistrellus pipistrellus*	Least Concern	Least Concern	Least Concern
Soprano pipistrelle *Pipistrellus pygmaeus*	Least Concern	Least Concern	Least Concern
Brown long-eared bat *Plecotus auritus*	Least Concern	Least Concern	Least Concern
Lesser horseshoe bat *Rhinolophus hipposideros*	Least Concern	Least Concern	Least Concern
Possible Vagrants ^			
Brandt's bat Myotis brandtii	Data deficient	Least Concern	Least Concern
Greater horseshoe bat *Rhinolophus ferrumequinum*	Data deficient	Near threatened	Near threatened

^ Roche *et al.,* 2014

9.2 Appendix 2 Tables from Collins (2016)

Table 1a: Building Bat Roost Classification System & Survey Effort (Adapted from Collins, 2016 and Marnell *et al.*, 2022).

Suitability Category	Description (examples of criteria)	Survey Effort (Timings)
Negligible	Building have no potential as a roost site Urban setting, heavily disturbed, building material unsuitable, building in poor condition etc.	No surveys required.
Low	Building has a low potential as a roost site. No evidence of bat usage (e.g. droppings)	One dusk or dawn survey.
Medium	Building with some suitable voids / crevices for roosting bats. Some evidence of bat usage Suitable foraging and commuting habitat present.	At least one survey in May to August, minimum of two surveys (one dusk and one dawn).
High	Building with many features deemed suitable for roosting bats. Evidence of bat usage. Largely undisturbed setting, rural, suitable foraging and commuting habitat, suitable roof void and building material.	At least two surveys in May to August, with a minimum of three surveys (at least one dusk survey and one dawn survey).

Table 1b: Tree Bat Roost Category Classification System (adapted from Collins, 2016).

Tree Category	Description
1 High	Trees with multiple, highly suitable features (Potential Roosting Features = PRFs) capable of supporting larger roosts
2 Moderate	Trees with definite bat potential but supporting features (PRFs) suitable for use by individual bats;
3 Low	Trees have no obvious potential although the tree is of a size and age that elevated surveys may result in cracks or crevices being found or the tree supports some features (PRFs) which may have limited potential to support bats;
4 Negligible	Trees have no potential.

9.3 Appendix 3 Site Risk Assessment & Impact Assessment

According to NaturScot, 2021 wind farms can affect bats in the following ways:

- Collision mortality, barotrauma and other injuries (although it is important to consider these in the context of other forms of anthropogenic mortality)
- Loss or damage to commuting and foraging habitat, (wind farms may form barriers to commuting or seasonal movements, and can result in severance of foraging habitat);
- Loss of, or damage to, roosts;
- Displacement of individuals or populations (due to wind farm construction or because bats avoid the wind farm area).

According to the NaturScot, 2021 to ensure that bats are protected by minimising the risk of collision, an assessment of impact at a site requires an appraisal of:

- The level of activity of all bat species recorded at the site assessed both spatially and temporally.
- The risk of turbine-related mortality for all bat species recorded at the site during bat activity surveys.
- The effect on the species' population status if predicted impacts are not mitigated.

In addition, it is recommended to consider the relevant factors in the assessment process:

- Is the bat species at the edge of its range
- Cumulative effects
- Presents of protected sites
- Proximity of maternity roosts
- Key foraging areas
- Key flight lines
- Possible migration routes.

Using Table 3 (See Appendices for details) in the NaturScot (2021) guidelines the following risk assessment for the individual turbines in relation to each bat species recorded was completed using the following values:

- Project Size = Medium (18 turbines);
- Habitat Risk = Low;
- Proposed tall wind turbines.

Therefore a value of 3 is applied to this proposed development site (Stage 1 Site Risk Assessment) and this is multiplied by the EcoBat value for the three most common bat species recorded which are also High Risk species (i.e. Leisler's bat, common pipistrelle and soprano pipistrelle) for two separate value categories. However as there is a large array of static surveillance units located across the proposed development area, a table was produced to determine which static unit results are used to assess each proposed turbine location (Please see Appendices for this table).

The overall value of the site is based on a summary of Tables as presented in Appendices.

- Highest Ecobat activity category recorded;
- Most frequent activity category (i.e. median value).

Overall assessment value (i.e. Turbine Risk value) is then compared to the ranges below:

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

Extracted from NaturScot (2021)

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.

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

9.4 Appendix 4 Core Sustenance Areas

Please note that there is a greater number of bat species resident in the UK compared to Ireland and therefore some of the species listed below are not resident in Ireland.

Table 1. Core Sustenance Zone sizes calculated for UK bat species

Species	CSZ radius (km)
Greater horseshoe bat *Rhinolophus ferrumequinum*	3
Lesser horseshoe bat *Rhinolophus hipposideros*	2
Barbastelle *Barbastella barbastellus*	6
Brown long-eared bat *Plecotus auritus*	3
Grey long-eared bat *Plecotus austriacus*	3
Daubenton's bat *Myotis daubentonii*	2
Natterer's bat *Myotis nattereri*	4
Whiskered/Brandt's/Alcathoe bat *Myotis mystacinus/brandtii/ alcathoe*	1
Bechstein's bat *Myotis bechsteinii*	3**
Common pipistrelle *Pipistrellus pipistrellus*	2
Soprano pipistrelle *Pipistrellus pygmaeus*	3
Nathusius pipistrelle *Pipistrellus nathusii*	3
Noctule *Nyctalus noctula*	4
Leisler's bat *Nyctalus leisleri*	3
Serotine *Eptesicus serotinus*	4

** Note: There may be justification with Annex II and other rare species to increase the CSZ to reflect use of the landscape by all bats in a population. We suggest increasing the CSZ of Bechstein's bat to at least 3km, reflecting its very specific habitat requirements.

Bat Conservation Trust (2020) Core Sustenance Zones and habitats of importance for designing Biodiversity Net Gain for bats. BCT, London.

9.5 Appendix 5 Historical Bat Survey Results

The following is a summary of the bat data recorded during 2016 and 2018 bat surveys.

9.5.1 Summary of 2016 Static Surveillance on masts.

Table A: Summary of bat species recorded by sound recording units located on masts (2016) (taken from Bat Eco Services, 2018).

	Lough Bannow Mast (100m) 4m height	**Lough Bannow Mast (100m) 50m height**	**Derryaroge Mast (80m) 4m height**	**Derryaroge Mast (80m) 50m height**
Date	**June**	**June**	**June**	**June**
Species	Soprano pipistrelle, brown long-eared bat, Leisler's bat	Soprano pipistrelle, Leisler's bat	Soprano pipistrelle, brown long-eared bat, Leisler's bat, *Myotis* spp.	No recordings
Date	**July**	**July**	**July**	**July**
Species	Soprano pipistrelle, brown long-eared bat, Leisler's bat, common pipistrelle	Soprano pipistrelle, common pipistrelle, Leisler's bat	Soprano pipistrelle, brown long-eared bat, Leisler's bat, *Myotis* spp.	Soprano pipistrelle, common pipistrelle, Leisler's bat
Date	**August**	**August**	**August**	**August**
Species	Soprano pipistrelle, common pipistrelle, Leisler's bat	Common pipistrelle, Leisler's bat	Soprano pipistrelle, common pipistrelle, Leisler's bat	No bats recorded
Date	**September**	**September**	**September**	**September**
Species	Soprano pipistrelle, common pipistrelle, Leisler's bat	Leisler's bat	Leisler's bat	No bats recorded
Date	**October**	**October**	**October**	**October**
Species	No bats recorded	Leisler's bat, Nathusius' pipistrelle	Leisler's bat, Common pipistrelle	No bats recorded
Date	**November**	**November**	**November**	**November**
Species	No bats recorded	No bats recorded	Soprano pipistrelle	No bats recorded

9.5.2 Summary of 2016 and 2018 bat surveys

Table B: Bat Survey Dates completed during 2016 bat surveys (taken from Bat Eco Services, 2018).

Anemometer Static Units			Static Units		Walking Transects	Driving Transects
Unit 3	***Unit 4***	***Unit 5***	***Unit 1***	***Unit 2***		
24th to 30th June 2016	24th to 30th June 2016	None (battery failure)			24th June 2016	25th June 2016
1st to 10th July 2016	1st to 10th July 2016					
15th to 23rd July 2016	15th to 20th July 2016	15th to 31st July 2016	15th to 18th July 2016	15th to 18th July 2016	17th July 2016	18th July 2016
17th to 28th August 2016	17th to 20th August 2016	17th to 28th August 2016	28th to 29 August 2016	28th to 29 August 2016	28th August 2016	28th to 29 August 2016
2nd to 13th September 2016	2nd to 5th September 2016	2nd to 13th September 2016	6th to 8th September 2016	6th to 8th September 2016	6th to 7th September 2016	8th September 2016
9th to 18th October 2016	9th to 11th October 2016	9th to 18th October 2016	17th to 18th October 2016	17th to 18th October 2016	17th October 2016	18th October 2016
12th to 18th November 2016	12th to 14th November 2016	12th to 20th November 2016	16th to 18th November 2016	16th to 18th November 2016	16th November 2016	

June 2018

- Static Units Surveillance 17th (dusk) to 18th (dawn) June 2018 (all five units)
- Walking Transects 16th (dusk) to 17th (dawn) June 2018

9.5.3 Total hours of bat surveying completed in 2016 and 2018

A total of 2,004 hours of surveying was completed during the full season bat survey in 2016.

Table C: Total number of bat survey hours completed in the 2016.

Month	Type	Hours	Type	Hours
June	Surveillance	108	Transects	5
July	Surveillance	497	Transects	5
August	Surveillance	342	Transects	5
September	Surveillance	400	Transects	8
October	Surveillance	310	Transects	5
November	Surveillance	316	Transects	3
	TOTAL	**1,973**		**31**

An additional 30 hours of surveillance (five static units) and 8 hours of walking transects (2 survey teams) was completed in June 2018. Therefore a total of 2,042 hours of bat surveying was competed for the 2018 report (Bat Eco Services, 2018).

9.6 Appendix 6 2021/2022 Static Surveillance Locations & Results

Table A: 2021/2022 Static Surveillance Periods and Location of static units deployed in relation to proposed turbine locations.

EcoBat Code	Static Unit Type	ITM Easting	ITM Northing
Autumn 1	SM4 U6	608050	764924
Autumn 2	Mini 1	608317	764308
Autumn 3	Mini 3	609398	763641
Autumn 4	Mini 2	609233	764204
Autumn 5	Mini 4	609841	764096
Autumn 6	Mini 6	606052	765610
Autumn 7	Mini 5	605915	766530
Autumn 8	SM4 U4	605648	767760
Autumn 9	Mini 8	605718	767910
Autumn 10	Mini 9	606970	766305
Autumn 11	SM4 U1	604008	769676
Autumn 12	Mini 10	603558	770687
Autumn 13	Mini 11	604504	769743
Autumn 14	Mini 12	604592	770817
Autumn 15	SM4 U2	603922	771717
Spring 1	SM4 U2	603992	769726
Spring 2	Mini 12	603559	770690
Spring 3	SM4 U4	603180	771326
Spring 4	SM4 U6	604046	771222
Spring 5	Mini 3	604581	770311
Spring 6	Mini 6	605651	768571
Spring 7	Mini 10	605646	767756
Spring 8	SM4 U7	606352	766193
Spring 9	Mini 11	606770	766702
Spring 10	SM4 U8	606058	765618
Spring 11	Mini 5	607920	764565
Spring 12	Mini 4	609386	763642
Spring 13	Mini 8	609839	764101
Spring 14	SM4 U5	609659	764650
Spring 15	Mini 1	609852	765247
Summer 1	Mini 1	603745	770237
Summer 2	Mini 4	604579	769675
Summer 3	Mini 5	608312	764406
Summer 4	Mini 6	606216	768373
Summer 5	Mini 8	606658	767061
Summer 6	SM4U7	604578	770590
Summer 7	SM4U1	606507	768373
Summer 8	SM4U2	605932	766576
Summer 9	SM4U3	604380	770981
Summer 10	SM4U4	605844	765823
Summer 11	SM4U6	609037	763859
Summer 12	SM4U8	607962	764805
Summer 13	SM4U9	609847	764315
Summer 14	SM4U10	607020	766284

Table B: 2021 Autumn Static Surveillance Results

Ppy – soprano pipistrelle, Ppip = common pipistrelle, Pna = Nathuius' pipistrelle, Nl = Leisler's bat, Md = Daubenton's bat, Mm = Whiskered bat, Mn = Natterer's bat, Myotis = *Myotis* species, Pa = brown long-eared bat.

EcoBat Tool Code	Ppy	Ppip	Pna	Nl	Md	Mm	Mn	Myotis	Pa	Total Passes	Duration
Autumn 1	13	33	0	5	13	2	16	8	9	**99**	20 nights
Autumn 2	9	3	0	37	0	0	2	1	1	**53**	20 nights
Autumn 3	44	67	2	0	2	1	4	0	1	**121**	20 nights
Autumn 4	10	18	0	2	6	1	9	4	4	**54**	20 nights
Autumn 5	16	12	0	6	5	2	4	2	16	**63**	20 nights
Autumn 6	2	2	0	1	5	2	9	0	1	**22**	20 nights
Autumn 7	49	69	0	4	11	1	30	7	2	**173**	20 nights
Autumn 8	6	17	0	0	0	0	0	0	0	**23**	20 nights
Autumn 9	1	17	0	4	9	2	14	3	6	**56**	20 nights
Autumn 10	9	20	0	4	5	3	14	4	2	**61**	20 nights
Autumn 11	0	0	0	0	0	0	0	0	0	**0**	20 nights
Autumn 12	16	1	0	1	7	0	7	3	1	**36**	20 nights
Autumn 13	1	3	0	2	4	0	7	1	1	**19**	20 nights
Autumn 14	2	5	0	0	4	1	3	2	0	**17**	20 nights
Autumn 15	23	15	0	1	13	3	10	13	3	**81**	20 nights

Table C: 2022 Spring Static Surveillance Results

Ppy – soprano pipistrelle, Ppip = common pipistrelle, Pna = Nathuius' pipistrelle, Nl = Leisler's bat, Md = Daubenton's bat, Mm = Whiskered bat, Mn = Natterer's bat, Myotis = *Myotis* species, Pa = brown long-eared bat.

EcoBat Tool Code	Ppy	Ppip	Pna	Nl	Md	Mm	Mn	Myotis	Pa	Total Passes	Duration
Spring 1	54	100	0	76	4	1	7	3	0	**245**	13 nights
Spring 2	89	484	0	95	11	3	3	0	4	**689**	13 nights
Spring 3	24	25	0	0	0	1	0	0	0	**50**	13 nights
Spring 4	0	0	0	0	0	0	0	0	0	**0**	13 nights
Spring 5	0	0	0	0	0	0	0	0	0	**0**	13 nights
Spring 6	338	1159	0	10	0	2	1	2	1	**1513**	13 nights
Spring 7	75	671	0	94	9	1	2	2	7	**861**	13 nights
Spring 8	12	103	0	42	6	2	0	3	1	**169**	13 nights
Spring 9	8	159	18	32	1	0	3	0	0	**221**	13 nights
Spring 10	17	218	0	91	1	0	1	2	1	**331**	13 nights
Spring 11	6	413	0	54	1	0	0	0	1	**475**	13 nights
Spring 12	3	150	0	12	3	0	0	0	0	**168**	13 nights
Spring 13	0	4	0	0	0	0	0	0	0	**4**	13 nights
Spring 14	63	1188	0	20	9	2	1	0	3	**1286**	13 nights
Spring 15	5	56	0	6	1	0	0	0	1	**69**	13 nights

Table D: 2022 Summer Static Surveillance Results

Ppy – soprano pipistrelle, Ppip = common pipistrelle, Pna = Nathuius' pipistrelle, Nl = Leisler's bat, Md = Daubenton's bat, Mm = Whiskered bat, Mn = Natterer's bat, Myotis = *Myotis* species, Pa = brown long-eared bat.

EcoBat Tool Code	Ppy	Ppip	Pna	Nl	Md	Mm	Mn	Myotis	Pa	Total Passes	Duration
Summer 1	33	46	1	10	1	0	0	1	1	**93**	11 nights
Summer 2	73	71	0	36	2	6	1	1	0	**190**	11 nights
Summer 3	44	42	1	26	5	1	0	2	4	**125**	11 nights
Summer 4	114	192	0	23	44	3	42	21	7	**446**	11 nights
Summer 5	56	58	0	8	0	0	0	0	0	**122**	11 nights
Summer 6	133	78	1	37	14	1	22	40	11	**337**	11 nights
Summer 7	91	212	0	34	6	4	37	14	6	**404**	11 nights
Summer 8	244	922	0	16	5	0	0	0	4	**1191**	11 nights
Summer 9	0	0	0	0	0	0	0	0	0	**0**	11 nights
Summer 10	4	7	0	0	0	0	0	0	0	**11**	11 nights
Summer 11	34	45	0	8	13	0	2	2	2	**106**	11 nights
Summer 12	40	29	0	10	1	1	36	9	2	**128**	11 nights
Summer 13	93	100	0	20	30	0	3	14	14	**274**	11 nights
Summer 14	19	44	0	26	3	0	3	2	11	**108**	11 nights

Table E: Total number of bat passes and average numb er of bat passes recorded on each static unit deployed during 2021/2022 static surveillance.

EcoBat Tool Code	Total Passes	Duration	Average
Autumn 1	**99**	20	4.95
Autumn 2	**53**	20	2.65
Autumn 3	**121**	20	6.05
Autumn 4	**54**	20	2.70
Autumn 5	**63**	20	3.15
Autumn 6	**22**	20	1.10
Autumn 7	**173**	20	8.65
Autumn 8	**23**	20	1.15
Autumn 9	**56**	20	2.80
Autumn 10	**61**	20	3.05
Autumn 11	**0**	20	0.00
Autumn 12	**36**	20	1.80
Autumn 13	**19**	20	0.95
Autumn 14	**17**	20	0.85
Autumn 15	**81**	20	4.05
Spring 1	**245**	11	22.27
Spring 2	**689**	11	62.64
Spring 3	**50**	11	4.55
Spring 4	**0**	11	0.00
Spring 5	**0**	11	0.00
Spring 6	**1513**	11	137.55
Spring 7	**861**	11	78.27
Spring 8	**169**	11	15.36
Spring 9	**221**	11	20.09

Spring 10	**331**	11	30.09
Spring 11	**475**	11	43.18
Spring 12	**168**	11	15.27
Spring 13	**4**	11	0.36
Spring 14	**1286**	11	116.91
Spring 15	**69**	11	6.27
Summer 1	**93**	13	7.15
Summer 2	**190**	13	14.62
Summer 3	**125**	13	9.62
Summer 4	**446**	13	34.31
Summer 5	**122**	13	9.38
Summer 6	**337**	13	25.92
Summer 7	**404**	13	31.08
Summer 8	**1191**	13	91.62
Summer 9	**0**	13	0.00
Summer 10	**11**	13	0.85
Summer 11	**106**	13	8.15
Summer 12	**128**	13	9.85
Summer 13	**274**	13	21.08
Summer 14	**108**	13	8.31

9.7 Appendix 7 PRE -2021/2022 Static Surveillance Locations & Results

Take from report: Bat Eco Services (2018) Derryadd Wind Farm, Lanesborough, Co. Longford. Bat Survey Final (November 2018). Report prepared for Bord na Mona & Tobin Consuting Engineers.

Table 4.7: Summary of bat species recorded by Static Units Surveillance during Full Season Bat Survey (June – November 2016) at 15 locations and five additional locations in June 2018. Species encounters are colour coded according to Bat Habitat Type: Blue = Edge, Yellow = Open and Red = Closed.

	SP	CP	LEIS	BLE	MYOTIS	Nath Pip
Survey Dates	**No of bat passes recorded (per night)**					
Static Site 1 15/6/16-16/6/16 Lough Bannow (Zone 3)	24	68	0	5	0	0
Static Site 1 16/6/16-17/6/16 Lough Bannow (Zone 3)	16	79	4	0	4	0
Static Site 2 15/6/16-17/6/16 Lough Bannow (Zone 3)	13	20	7	0	0	0
Static Site 2 16/6/16-17/6/16 Lough Bannow (Zone 3)	8	43	8	0	3	0
Static Site 3 17/6/16-18/6/16 Lough Bannow (Zone 3)	18	13	2	0	5	0
Static Site 3 18/6/16-19/6/16 Lough Bannow (Zone 3)	10	27	10	0	1	0
Static Site 4 17/6/16-18/6/16 Derryaroge (Zone 3)	0	16	1	0	27	0
Static Site 4 18/6/16-19/6/16 Derryaroge (Zone 1)	15	52	14	0	3	0
Static Site 5 28/8/16-29/8/16 Derryadd (Zone 2)	9	21	5	1	17	0

Static Site 6 28/8/16-29/8/16 Derryadd (Zone 2)	9	3	5	0	11	0
Static Site 7 6/9/16-7/9/16 Lough Bannow (Zone 3)	39	**171**	22	0	7	0
Static Site 8 6/9/16-7/9/16 Derryaroge (Zone 1)	34	78	14	0	3	0
Static Site 9 7/9/16-8/9/16 Derryadd (Zone 2)	86	**280**	7	0	11	0
Static Site 10 7/9/16-8/9/16 Derryadd (Zone 2)	30	**119**	0	0	7	0
Static Site 11 9/10/16-10/10/16 Derryadd (Zone 2)	53	15	8	0	0	0
Static Site 12 9/10/16-10/10/16 Derryadd (Zone 2)	19	12	6	0	0	0
Static Site 13 16/11/16-17/11/16 Derryarogue (Zone 1)	0	0	0	4	0	0
Static Site 13 17/11/16-18/11/16 Derryarogue (Zone 1)	0	0	0	0	0	0
Static Site 14 16/11/16-17/11/16 Lough Bannow (Zone 3)	4	9	0	0	0	0
Static Site 15 17/11/16-18/11/16 Lough Bannow (Zone 3)	3	7	0	0	0	0
Static Site 16 17/6/18-18/6/18 Derryaroge (Zone 1)	6	43	3	3	2	0
Static Site 17 17/6/18-18/6/18 Derryaroge (Zone 1)	0	0	0	0	0	0
Static Site 18 17/6/18-18/6/18 Lough Bannow (Zone 3)	0	0	0	0	0	0
Static Site 19 17/6/18-18/6/18 Lough Bannow (Zone 3)	36	17	1	0	0	0
Static Site 20 17/6/18-18/6/18 Derryadd (Zone 2)	37	12	2	0	0	0

10. Bat Species Profile

10.1 Leisler's bat

Ireland's population is deemed of international importance and the paucity of knowledge of roosting sites, makes this species vulnerable. However, it is considered to be widespread across the island. The modelled Core Area for Leisler's bats is a relatively large area that covers much of the island of Ireland (52,820km^2). The Bat Conservation Ireland Irish Landscape Model indicated that the Leisler's bat habitat preference has been difficult to define in Ireland. Habitat modelling for Ireland shows an association with riparian habitats and woodlands (Roche *et al.,* 2014). The landscape model emphasised that this is a species that cannot be defined by habitats preference at a local scale compared to other Irish bat species but that it is a landscape species and has a habitat preference at a scale of 20.5km. In addition, of all Irish bat species, Leisler's bats have the most specific roosting requirements. It tends to select roosting habitat with areas of woodland and freshwater.

Irish Status	Near Threatened
European Status	Least Concern
Global Status	Least Concern
Irish Population Trend	2003-2013 ↑
Estimated Irish Population Size	73,000 to 130,000 (2007-2013) Ireland is considered the world stronghold for this species
Estimate Core Area (Lundy *et al. 2011*)	52,820 km^2

Taken from Roche *et al.,* 2014, Lysaght & Marnell, 2016 & Marnell *et al.*, 2019

The principal concerns for Leisler's bats are poorly known in Ireland but those that are relevant for this survey area are as follows:

- Selection of maternity sites is limited to specific habitats;
- Relative to the population estimates, the number of roost sites is poorly recorded;
- Tree felling, especially during autumn and winter months; and
- Increasing urbanisation.

10.2 Common pipistrelle

This species is generally considered to be the most common bat species in Ireland. The species is widespread and is found in all provinces. The modelled Core Area for common pipistrelles is a large area that covers much of the island of Ireland (56,485km^2) which covers primarily the east and south east of the area (Roche *et al.,* 2014). The Bat Conservation Ireland Irish Landscape Model indicated that the Common pipistrelle selects areas with broadleaf woodland, riparian habitats and low density urbanization (<30%) (Roche *et al.,* 2014).

Irish Status	Least Concern
European Status	Least Concern
Global Status	Least Concern
Irish Population Trend	2003-2013 ↑
Estimated Irish Population Size	1.2 to 2.8 million (2007-2012)
Estimate Core Area (km^2) (Lundy *et al. 2011*)	56,485

Taken from Roche *et al.,* 2014, Lysaght & Marnell, 2016 & Marnell *et al.*, 2019

Principal concerns for Common pipistrelles in Ireland that are relevant for this survey area are as follows:

- Lack of knowledge of roosting requirements
- This species has complex habitat requirements in the immediate vicinity of roosts. Therefore, careful site specific planning for this species is required in order to ensure all elements are maintained.
- Renovation or demolition of derelict buildings.
- Tree felling
- Increasing urbanisation (e.g. increase in lighting)

10.3 Soprano pipistrelle

This species is generally considered to be the second most common bat species in Ireland. The species is widespread and is found in all provinces, with particular concentration along the western seaboard. The modelled Core Area for soprano pipistrelle is a large area that covers much of the island of Ireland (62,020km^2). The Bat Conservation Ireland Irish Landscape Model indicated that the soprano pipistrelle selects areas with broadleaf woodland, riparian habitats and low density urbanisation (Roche *et al.,* 2014).

Irish Status	Least Concern
European Status	Least Concern
Global Status	Least Concern
Irish Population Trend	2003-2013 ↑
Estimated Irish Population Size	0.54 to 1.2 million (2007-2012)
Estimate Core Area (km^2) (Lundy *et al. 2011)*	62,020

Taken from Roche *et al.,* 2014, Lysaght & Marnell, 2016 & Marnell *et al.*, 2019

Principal concerns for Soprano pipistrelles in Ireland that are relevant for this survey area are as follows:

- Lack of knowledge of roosts;
- Renovation or demolition of structures;
- Tree felling; and
- Increasing urbanisation (e.g. increase in lighting).

10.4 Brown long-eared Bat

This species is generally considered to be widespread across the island. The modelled Core Area for Brown long-eared bats is a relatively large area that covers much of the island of Ireland (52,820km^2) with preference suitable areas in the southern half of the island. The Bat Conservation Ireland Irish Landscape Model indicated that the Brown long-eared bat habitat preference is for areas with broadleaf woodland and riparian habitats on a small scale of 0.5km emphasising the importance of local landscape features for this species (Roche *et al.,* 2014).

Irish Status	Least Concern
European Status	Least Concern
Global Status	Least Concern
Irish Population Trend	2008-2013 Stable
Biographical Range	km^2
Estimate Core Area (Lundy *et al. 2011)*	49,929 km^2

Taken from Roche *et al.,* 2014, Lysaght & Marnell, 2016 & Marnell *et al.*, 2019

Principal concerns for brown long-eared bats are poorly known in Ireland, but those that are relevant for this survey area are as follows:

- Selection of maternity sites is limited to specific habitats;
- Lack of knowledge of winter roosts;
- Loss of woodland, scrub and hedgerows;
- Tree surgery and felling;
- Increasing urbanisation; and
- Light pollution.

10.5 Natterer's bat

There are three species included in the *Myotis* species family and their echolocation calls are very similar across these three species. The modelled Core Area for Natterer's bats is a relatively large area that covers much of the island of Ireland (52,864km^2). The Bat Conservation Ireland Irish Landscape Model indicated that the Natterer's bat selects areas with broadleaf woodland, riparian habitats and areas with larger scale provision of mixed forest (Roche *et al.,* 2014). Therefore, it is likely that this species is more widespread within the survey area.

Irish Status	Least Concern
European Status	Least Concern
Global Status	Least Concern
Irish Population Trend	Unknown
Estimated Irish Population Size	Unknown
Estimate Core Area (Lundy *et al. 2011)*	52,864

Taken from Roche *et al.,* 2014, Lysaght & Marnell, 2016 & Marnell *et al.*, 2019

Principal concerns for Natterer's bats in Ireland that are relevant for this survey area are as follows:

- Lack of knowledge of roosting requirements;
- This species has complex habitat requirements in the immediate vicinity of roosts. Therefore careful site specific planning for this species is required in order to ensure all elements are maintained;
- Tree felling; and
- Increasing urbanisation (e.g. increase in lighting).

10.6 Daubenton's bat

The modelled Core Area for Daubenton's bats is a relatively large area that covers much of the island of Ireland (41,285km^2) reflecting the distribution of sizeable river catchments. The Irish Landscape Model indicated that the Daubenton's bat habitat preference is for areas with broadleaf woodland, riparian habitats and low density urbanisation (Roche *et al.,* 2014).

Irish Status	Least Concern
European Status	Least Concern
Global Status	Least Concern
Irish Population Trend	2008-2013 Stable
Estimated Irish Population Size	81,000 to 103,000 (2007-2012)
Estimate Core Area (km^2) (Lundy *et al. 2011)*	41,285

Taken from Roche *et al.,* 2014, Lysaght & Marnell, 2016 & Marnell *et al.*, 2019

Principal concerns for Daubenton's bats are poorly known in Ireland but those that are relevant for this survey area are as follows:

- Potential roost loss due to bridge maintenance;
- Loss of woodland and forest clearance;
- Loss of woodland, scrub and hedgerows;
- Tree surgery and felling;
- Increasing urbanisation; and
- Light pollution.

10.7 Whiskered bat

The modelled Core Area for whiskered bats is a relatively small area (29,222 km2) compared to the other two resident *Myotis* bat species. The range is restricted to southern and eastern areas of Ireland. The Irish Landscape Model indicated that the whiskered bat habitat preference is for areas of woodland cover, small areas of pasture, urban and scrub habitat (Roche *et al.,* 2014).

Irish Status	Least Concern
European Status	Least Concern
Global Status	Least Concern
Irish Population Trend	Unknown
Estimated Irish Population Size	Unknown
Estimate Core Area (km^2) (Lundy *et al. 2011)*	29,222

Taken from Roche *et al.,* 2014, Lysaght & Marnell, 2016 & Marnell *et al.*, 2019

Principal concerns for whiskered bats are poorly known in Ireland but those that are relevant for this survey area are as follows:

- Lack of knowledge of roosting requirements, swarming sites
- Riparian habitat loss
- Loss of woodland and forest clearance
- Loss of woodland, scrub and hedgerows
- Tree surgery and felling
- Increasing urbanisation
- Light pollution

10.8 Nathusius' pipistrelle

The modelled Core Area for Nathusius' pipistrelle is a relatively restricted area (13,543km^2) and these areas are primarily associated with large water bodies such as Lough Neagh and the Lough Erne complex. The Bat Conservation Ireland Irish Landscape Model indicated that the Nathusius' pipistrelle habitat preference is large waterbodies (Roche *et al.,* 2014). But due to the paucity of information on this species, the knowledge of this species preference in Ireland is limited, any records recorded for this species is important.

Irish Status	Least Concern
European Status	Least Concern
Global Status	Least Concern
Irish Population Trend	2003-2013 (limited data, probably stable
Estimated Irish Population Size	10,000 to 18,000 (2007-2013)
Estimate Core Area (km^2) (Lundy *et al. 2011)*	13,543

Taken from Roche *et al.,* 2014, Lysaght & Marnell, 2016 & Marnell *et al.*, 2019

The principal concerns for Nathusius' pipistrelle is the fact that roosting sites are poorly known in the Republic of Ireland:

- Lack of knowledge of winter sites and whether migration occurs;
- Renovation or demolition of derelict buildings and structures may cause undocumented roost losses; and
- Water pollution may be a threat to this species because it is particularly associated with lakes.