Hagshaw Hill Wind Farm Repowering

Bat Survey Report

Technical Appendix 7.2

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EXECUTIVE SUMMARY

MacArthur Green was commissioned by the Applicant, Hagshaw Hill Repowering Ltd, to carry out bat surveys at the Hagshaw Hill Wind Farm Repowering site, by Douglas, South Lanarkshire (hereafter referred to as the 'Proposed Development').

These surveys were undertaken to inform the ecological assessment for the Proposed Development Environmental Impact Assessment Report.

This report presents the results of the bat survey work undertaken between May and September 2018 (inclusive) at the Proposed Development site (the 'site').

Three bat species (common and soprano pipistrelle bats and Daubenton's bat) and two genus groups (*Nyctalus* and *Myotis* spp.) were recorded within the study area during the temporal (static detector) surveys.

High risk species (*Nyctalus* spp.) were recorded across the study area with the static bat detector at location 24 recording the greatest bat activity index (BAI) for *Nyctalus* species in August.

Low activity levels were recorded for medium and low collision risk species. Temporal surveys identified a potential foraging corridor along the planation edge in the northern section of the survey area for medium collision risk species (common and soprano pipistrelle species) at static bat detector locations 9 and 10.

A total of 16 potential bat trees were recorded along the proposed access track to the south of the site. Of these potential bat trees two are within 30m of the proposed access track.

1 INTRODUCTION

MacArthur Green was commissioned by the Applicant, Hagshaw Hill Repowering Ltd, to carry out bat surveys at the Hagshaw Hill Wind Farm Repowering site, by Douglas, South Lanarkshire (hereafter referred to as the 'Proposed Development'). The Proposed Development site (the 'site') corresponds to the site boundary presented in Figure 7.5.

A survey plan for bats was conducted during the period of May to September 2018 (inclusive). The survey plan included:

- Preliminary bat roost assessment as part of the Protected Species Surveys; and
- Temporal (static) surveys.

The aim of the surveys was to identify roosting potential, quantify site usage and seasonal variation of activity levels within the study area. Surveys were carried out during the main bat activity period from May to September.

These surveys were undertaken to inform the ecological assessment for the Hagshaw Hill Wind Farm Repowering Environmental Impact Assessment (EIA) Report.

2 THE PROPOSED DEVELOPMENT AND STUDY AREA

The Proposed Development is a repowering of the existing Hagshaw Hill Wind Farm, replacing the existing 26 turbine wind farm with 14 modern and larger turbines. Of these 14 turbines, seven will be within the existing Hagshaw Hill Wind Farm site boundary, with the other seven within an area of land adjacent to the south.

The bat study area covers open hill ground around the existing Hagshaw Hill Wind Farm at Hagshaw Hill, Broomerside Hill and Common Hill, southwards towards Low Broomerside. This ground contains a mix and mosaic of upland modified bog, wet heath and marshy and acid grasslands. These habitats are also intensively grazed by sheep and cattle.

The study area in which temporal (static) and preliminary roost surveys were completed encompassed the boundary of the site and an access track in the southern section of the site which runs along a dismantled railway line as shown in Figure 7.5.

The study area is also surrounded by a number of operating wind farms, including Hagshaw Hill Extension Wind Farm, Galawhistle Wind Farm and Nutberry Wind Farm, as well as a number of proposed wind farm development sites.

3 BATS AND WIND FARMS

3.1 Policy and Guidance

All bats species are protected under the following legislation:

- The Habitats Directive 92/43/EEC (as amended);
- The Wildlife and Countryside Act 1981 (as amended); and

- The Nature Conservation (Scotland) Act 2004 (as amended).

Details pertaining to the legal status of bats are included within Annex 1.

In the UK, guidelines have been produced with regards to assessing the ecological impact upon bats from wind farm developments. These guidelines aid in producing mitigation and compensation strategies to minimise any negative impact upon local bat populations. The following guidance documents have been used in the preparation of this report:

- Natural England (2014) Bats and onshore wind turbines: interim guidance. TIN051. Third Edition;
- Hundt L (2012) Bat Surveys: Good Practice Guidelines, 2nd Edition, Bat Conservation Trust;
- Collins, J. (ed) (2016) Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edn). The Bat Conservation Trust, London; and
- Rodrigues L., *et al*. (2014) Guidelines for consideration of bats in wind farm projects, revision 2014. EUROBATS Publication Series No. 6.

3.2 Potential Impacts

A study conducted by Exeter University found that most bat fatalities at UK wind farms were common pipistrelle bats, soprano pipistrelle bats and noctule. In addition, single carcasses of brown long-eared bat, Nathusius' pipistrelle bat and Natterer's bat were recorded (DEFRA, 2016). The estimated casualties of the study ranged from 0 to 5.25 bats per turbine per month, and from 0-77 bats per site per month during the survey period (July to October) with considerable variation between sites. The study also found that the percentage casualty rates for soprano pipistrelle, common pipistrelle and noctule bats were higher than the relative proportions of their calls recorded from ground level acoustic surveys.

In the UK three taxa groups have been identified as high risk collision species, with 98% of bat mortality predominantly among taxa adapted to open-air foraging: *Nyctalus*, P*ipistrellu*s and *Eptesicus* (Rydell *et al*. 2010).

Natural England interim guidance (2014) includes a collision risk assessment for British bat species. This is divided into two parts: (i) bat species likely to be threatened due to impacts from wind turbines and (ii) bat populations likely to be threatened due to impacts from wind turbines (shown in table 3-1 and 3-2). Different bat species are considered to be at different levels of risk depending on their habitat preferences, flight behaviour and population status.

Since the publication of the Natural England interim guidance research work at UK onshore wind farms recorded the most bat fatalities to be medium collision risk species (common pipistrelle and soprano pipistrelle) and a high collision risk species (noctule bats) (DEFRA, 2016). Surveys have therefore been carried out for all bat species with the assessment taking into consideration both Natural England's interim Guidance and recent research work by DEFRA (2016).

Table 3-1 Bats likely to be at collision risk from wind turbines (taken from Natural England, 2014)

Low Risk	Medium Risk	High Risk
Myotis species	Common pipistrelle	Noctule
Long-eared bats	Serotine	Leisler's
Horseshoe bats	Soprano pipistrelle	Nathusius' pipistrelle
	Barbastelle	

Table 3-2 Populations likely to be threatened due to impacts from wind turbines (taken from Natural England, 2014)

Low Risk	Medium Risk	High Risk
Myotis species	Serotine	Noctule
Long-eared bats	Barbastelle	Leisler's
Horseshoe bats		Nathusius' pipistrelle
Soprano pipistrelle		
Common pipistrelle		

Bats travel between hibernacula sites to summer roosts in spring and autumn and therefore could be impacted negatively if wind farms were positioned between these two areas.

A synthesis of European and American data by the Swedish Vindval research programme concluded the following habitats to be high risk locations for wind farms; coasts, wetlands, forested hills and ridges. Turbines sited along linear landscapes such as lake shores, rivers, treelines, hedgerows, etc., are also considered to increase the likelihood of collision (Rydell *et al.*, 2012). This study also found that peak mortality usually (90%) occurred on nights with low wind speeds in late June to early October and to a lesser extent (10%) also in April-June. The Exeter University (DEFRA, 2016) study found that most nights on which bat casualties occurred had low mean wind speeds (≤5m/s at ground level; c.a. <10m/s at nacelle level) and maximum night-time temperature of >10°C, although casualties were only found in 3.6% of nights with low wind speeds during the study.

Rydell found that bat mortality increased with turbine tower height and rotor diameter. Mortality increase with rotor diameter was also found in the UK study (DEFRA, 2016), but nacelle height was not found to be linked to increased risk.

3.3 Study Area Assessment

The appropriate level of effort for a bat survey at a proposed wind farm development depends on the scale of its likely impact, which in turn depends on the size of the study area and the quality of the habitat. Bat Conservation Trust (BCT) guidance (Hundt, 2012) provides recommendations of minimum standards of survey effort in instances where sampling is required. To determine the survey effort, the study area must be assigned as a high, medium or low risk site. Appendix 2 contains the BCT assessment table "Factors to consider when determining the survey effort and site risk", which was used to determine the survey effort of the study area.

The study area was assigned a medium value due to its geographical location which is located within the range of high collision risk species (*Nyctalus* spp.) and its low foraging/commuting suitability with the study area dominated by exposed open moorland which is considered suboptimal foraging and commuting habitat for bats.

3.4 Desk-based Study

A desk-based study using the Scottish Leisler's Bat Project data was undertaken in order to inform the survey effort assessment and impact prediction of the ES with regards the presence of *Nyctalus* spp. within or adjacent to the study area.

Scottish Leisler's Bat Project'. records were supplied to MacArthur Green by John Haddow in May 2015. These records are from the whole of southern Scotland and include long-term monitoring at proposed wind farms, other developments and on-going research work being carried out by the Scottish Leisler's Bat Project from 2010 to 2014.

Leisler's bat records within 20km of the Proposed Development turbine area, excluding the proposed access tracks as shown in Figure 7.6.

3.5 Survey Design

For a medium value study area BCT guidelines recommend a minimum survey effort of at least one visit per month between April and October for spatial (transect) and temporal (static detector) surveys, with temporal surveys collecting data for a minimum of five nights.

As the study area, particularly around proposed turbine locations is predominantly open moorland with low roosting, foraging and commuting suitability, the use of spatial surveys which requires surveyors to walk a transect across the study area was seen as not appropriate in this instance. Instead, temporal surveys were carried out with increased survey effort applied to the survey which is above what is outlined as a minimum survey requirement in Hundt (2012). A minimum of 10 nights per survey visit was therefore covered, with a total of 10 Anabat locations used once a month for the proposed 14 turbine site.

BCT guidance (Hundt, 2012) for proposed wind farm sites indicates that the survey period is from April to October. Surveys were carried out from May to September, excluding April and October as Scotland often experiences suboptimal weather conditions for bat surveys during these months. The Bat Survey Guidelines (Collins, 2016) define the optimal survey period for static detector surveys in Scotland as from May to August with sub-optimal surveys possible in April and September, therefore the survey season applied to this study is within survey guideline requirements (Collins, 2016).

3.6 Preliminary Bat Roost Assessment

In accordance with BCT Guidelines (Hundt, 2012) potential roost features such as buildings, stone walls and trees within the study area were surveyed for potential roost features (PRF) on the following dates;

- 24 May 2018
- 21 June 2018

The preliminary bat roost surveys followed the assessment methodology as set out in Collins (2016) whereby a potential bat roost is assigned a value of low, moderate of high suitability which determines the likelihood of bats being present and the need for further survey work such as a climbing inspection and/or dusk and dawn surveys (refer to Annex 3).

3.7 Temporal Surveys – Static Detectors

Temporal surveys involved leaving static Anabat detectors (Express and Swift) within the study area in order to record activity overnight and over prolonged periods of time. Ten Anabat detectors were placed at ten locations.

The locations of the static detectors are shown in Figure 7.5. The detectors were attached onto a 1.2m wooden stake and placed at these locations.

The surveys were undertaken in May, June July August and September inclusive and therefore covered spring, summer and autumn seasons, which is in line with BCT guidance (Hundt 2012) for a medium value site. Each detector recorded bats from dusk to dawn with detectors starting 30 minutes before dusk and finishing 30 minutes after dawn.

Total automated survey effort is considered sufficient to provide a representative sample of bat activity within the study area with the temporal data collected above the minimum survey requirements for a medium value site. Table 3-3 shows a summary breakdown of the temporal survey effort.

Cattle damage to the Anabat detector occurred in May and in June at locations 1, 2, 3, 4, 5 and 7– as shown in Table 3-3. Some stakes and detectors were pushed over, while some detectors had their microphones damaged or the microphone was missing. Due to this damage the location of the detectors in the southern section of the study area at locations 1, 2, 3, 4 and 5 were moved to locations 21, 22, 23, 24 and 25, and were placed alongside stone walls or fences which would make them less obvious to the cattle and less likely to be damaged. In some cases the log files recorded microphone sensitivity issues due to this damage but in other cases the log files recorded no errors.

Table 3-3 Summary of Temporal Surveys

Survey Date	Location	Total Survey (hrs:mins:secs)	Total Number of Complete Survey Nights	Notes
May 01-11/05/18	1	92:43:00	10	Pushed over by cattle and found on the ground
	2	92:43:15	10	
	3	92:43:26	10	
	4	92:42:48	10	Pushed over by cattle and found on the ground
	5	92:42:26	10	
	6	92:42:22	10	
	7	28:34:00	3	Damage by cattle and microphone missing
	8	93:31:00	10	
	9	93:31:00	10	
	10	93:31:00	10	
	Total	**866:24:17**	**93**	
June 07-18/06/18	1	83:12:23	11	
	2	83:12:48	11	Pushed over by cattle and found on the ground
	3	07:39:30	1	Pushed over by cattle and found on the ground
	4	83:12:03	11	Damage by cattle and microphone broken
	5	83:11:32	11	Microphone broken
	6	83:32:00	11	
	7	83:33:00	11	
	8	83:30:00	11	
	9	83:30:00	11	
	10	83:30:00	11	
	Total	**758:03:02**	**100**	
July 13-23/07/18	21	82:22:00	10	
	22	82:22:00	10	
	23	82:20:00	10	
	24	82:41:09	10	
	25	82:40:38	10	
	6	82:40:33	10	
	7	82:19:00	10	
	8	82:40:29	10	
	9	82:40:22	10	
	10	82:39:56	10	
	Total	**825:26:38**	**100**	
August 10-20/08/18	6	99:37:00	10	
	7	100:10:31	10	
	8	100:10:12	10	
	9	69:09:00	7	
	10	50:25:00	10	
	21	99:39:00	10	
	22	100:11:00	10	
	23	100:11:03	10	

Survey Date	Location	Total Survey (hrs:mins:secs)	Total Number of Complete Survey Nights	Notes
	24	99:38:00	10	
	25	99:37:00	10	
	Total	**918:47:48**	**97**	
September 06-17/09/18	6	131:49:00	12	
	7	144:15:00	12	
	8	144:14:00	12	
	9	144:14:00	12	
	10	144:14:00	12	
	21	144:15:00	12	
	22	144:14:00	12	
	23	144:56:40	12	
	24	144:56:30	12	
	25	144:14:00	12	
	Total	**1431:22:10**	**120**	
Total Survey (hrs:mins:secs)	**4,800:03:55**	**Total Survey (complete nights)**	**510**	

3.8 Method of Analysis

The analysis of bat data is subject to required expertise and experience, therefore the Anabat data was analysed by Ecologists experienced in bat call analysis using Kaleidoscope Viewer and AnalookW 4.3.19 software.

A bat registration is a sequence of bat pulses which is captured on a 15 second Anabat sound file when a bat echolocates close to an Anabat detector. One sound file is counted as one bat registration. As an individual bat can pass a particular feature while foraging and record numerous registrations, it is not possible to estimate the number of individual bats. Therefore, in accordance with BCT guidance (Hundt, 2012) an activity index is used instead which calculates bat registrations per hour or per night. This allows the analysis of bat activity to estimate abundance and/or activity. The bat activity index (BAI) is calculated as bat registrations per hour (brph) or per night (brpn) using the following equation:

BAI (per hour) = Total number of bat registrations / number of hours of recording [brph].

BAI (per hour) = Total number of bat registrations / number complete recording nights [brpn].

The data was analysed using Kaleidoscope 4 Auto ID classifier. The Auto ID classifier identifies Scottish bat species and has an accuracy rate of 96% for soprano and common pipistrelles (Wildlife Acoustics, 2016). The accuracy rate for other Scottish bat species is lower; therefore all other bat species were manually reviewed by an experienced bat Ecologist using Kaleidoscope Viewer and AnalookW software. This method of analysis is in line with current guidelines (Collins, 2016) for data analysis which recommends the manual checking of all non-*Pipistrellus* calls when using automated methods. Sound files labelled as noise were not reviewed manually.

In the absence of any recognised standard criteria to define levels of bat activity (e.g. what quantifies low, medium or high activity) professional judgement has been used, taking into consideration geographical location and experience gained through conducting similar surveys at other study areas in the region and throughout Scotland.

4 BAT SURVEY LIMITATIONS

The survey design and effort was created in accordance with Hundt (2012) guidelines as shown in Annexes 2 and 3. The surveys carried out are considered to be sufficient to meet the guideline standards as discussed in Section 3.5 – Survey Design.

4.1 Detector Data Loss and Data Accuracy

Cattle damaged occurred to Anabat detector in May at locations 1, 4 and 7 and in June at locations 2, 3, 4 and 5, as shown in Table 3-3. While some log files (nightly Anabat excel files which shows how the detectors were running) recorded microphone sensitivity issues, other log files recorded no such issues, so in those instances it is not clear how much data were lost, as it is not known when the damage occurred during the 10 night deployment period. However, even when considering the worst case scenario of no data being recorded during these occasions, the loss of data is not considered to be significant in the context of the amount of data collected and the number of locations surveyed. Furthermore, as the habitats within the study area are homogenous, some comparisons can be made in relation to activity levels with nearby Anabat locations which recording over this time period.

The preliminary roost surveys were carried out in late May and June. At that time of year the tree canopy is full which can make it difficult to assess all areas of the tree. Where this occurred the surveyor made a note of the survey limitations and the tree was given a moderate or low to moderate category rating which requires further survey if the tree is within 30m of infrastructure such as an access track or within 200m of a proposed turbine.

Anabat detectors are a commonly used bat detector for acoustic monitoring at wind farm sites, however all bat detectors have limitations and will only monitor bat activity within a limited area, for Anabats usually around 30 metres, depending on a variety of environmental factors. Furthermore, due to passive monitoring methodologies depending on sound reaching the microphone, the detection rate of bat calls varies with a bias towards loud bat calls with quieter calls, namely brown long-eared bats, potentially being under recorded. As a result of equipment limitations, only relative rather than direct statistical comparisons of bat activity can be made between species and only a set area within the study area can be sampled.

Myotis species calls often overlap in call frequency depending on their surrounding environs i.e. cluttered or open space. This often makes it difficult to identify *Myotis* bats to species level. If *Myotis* calls could not be identified to species level they were recorded as *Myotis* species. It is possible that for *Myotis* spp. these recordings could represent *Myotis* species not identified.

Due to overlap in the call structure of Leisler's and noctule bat calls and the resulting uncertainty of identification for some calls, BAI was summarised to genus level i.e. *Nyctalus* spp., even when

identification to species level was undertaken. Both species are categorised as high collision and population risk species.

Some temporal calls were assigned an unknown value (NoID), due to a very faint call or incomplete calls that could not be identified to species level on the spectogram.

Kaleidoscope Auto ID classifier can mislabel bat calls as noise files. From data analysis at other sites it was found that 1% of noise files contained bat calls that could be identified to species level. As noise files were not manually checked, it can be assumed that there was a small loss of bat data.

Recent research work by Exeter University found that activity levels do not necessary determine the risk level of the site to bats, with sites that recorded high levels of bat activity recording no casualties, while sites with low levels of bat activity recording casualties (DEFRA,2016). The report concluded that it is important to not just rely on activity rates, when making an assessment of the site on bats, but to also incorporate factors such as geographical location, habitat suitability, flight corridors, roost suitability and nearby roost locations into the assessment.

The information currently available on bat behaviour in the UK is not sufficient to fully assess the threat that wind turbines may pose to populations (Natural England, 2014), therefore any assessment is made based on the best available data.

4.2 Recording Higher Altitude Activity

Nyctalus species are relatively more active at a height of 30m than those species with high frequency echolocation calls such as *Myotis* spp. A study on the difference of bat activity in relation to bat detector height however found the difference between *Nyctalus* passes at the high altitude and lower altitude detectors not to be statistically significant (Collins and Jones, 2009). Additionally, not all sites in the study by Collins and Jones (2009) recorded more *Nyctalus* passes at height: two sites recorded more passes at the lower detectors than the higher detectors suggesting that factors such as habitat type can determine the height activity of *Nyctalus* species. The study suggests that surveying from ground level should provide a sufficiently accurate account of the species composition of bat populations, including high flying species such as *Nyctalus* sp., with the possible exception of closed canopy woodland situations.

A study by DEFRA (2016), which placed some detectors on the nacelle of wind turbines, and some at ground level, did however advise that recording from ground level may underestimate the abundance of soprano pipistrelle and noctule bats within the at risk zone of the turbine rotor sweep. Most bat activity was recorded at ground level compared with the nacelle for all species, despite it being likely that a greater amount of 3-dimensional space was surveyed at height. For Leisler's, the mean proportion of bat passes recorded at height was 21%, with noctule at 25%. There were however, no clear linear relationships between the elevation of the detector and the ratio of passes for all species recorded (ground to height), and there was considerable variability between sites. The authors also concluded that ground level monitoring may be sufficient for evaluating common and soprano pipistrelle risks, because activity at ground rather than height was a better predictor of fatality.

At-height and ground level detector surveys were carried out for the proposed Douglas West and Dalquhandy DP Renewable Energy Project, which is adjacent to the site (MacArthur Green, 2017). A 13 foot blimp was used to float a calibrated bat detector at an elevation of 60m from one location over open moorland habitat. A survey was undertaken in October 2014 with further surveys between May and September in 2015. Across the site, low levels of *Nyctalus sp.* were recorded every month except in September and October in 2014. They were also recorded at every static location. In total, four bat passes out of 2,222 across the site were recorded at-height, comprising two common pipistrelle records, and single *Myotis sp.* and *Nyctalus sp.* records. The results suggested that *Nyctalus sp.* were not more active at height than at ground level with the ground detector at ground level below the blimp (0.1 bpph) recording similar activity levels to the detector at height (0.2 bpph). The location with the most *Nyctalus sp.* passes (0.31 bpph) was along a plantation edge.

At the proposed Dalquhandy Wind Farm site in 2011 and 2012, *Nyctalus* bats were recorded at low activity rates, and made up 1 % of all bat passes. Bat activity rates within edge habitats were higher than in open water, closed habitats, or at height.

At the proposed Cumberhead Wind Farm site in 2014, *Nyctalus* activity was recorded across the majority of static locations within the survey area, mainly in July, albeit at very low frequency (5.1 % of total bat activity). Only one Nyctalus species call was recorded during at-height surveys.

For the Proposed Development, it is therefore considered that based on the overall evidence, conducting static detector surveys at ground level only is sufficient to conduct a robust of the assessment of bat activity at the site. Survey results in Section 5 show that overall *Nyctalus* activity levels were low, and desk studies have shown similar results in the local area, with no known roost sites in the vicinity of the site.

5 SURVEY RESULTS

5.1 Desk-based Study

A search was carried out on records from the 'Scottish Leisler's Bat Project' supplied to MacArthur Green by John Haddow in May 2015, which is shown in Table 5-1 and Figure 7.6. In total 6 *Ncytalus* spp. records were found to be within 20km of the study area. These records are passive monitoring records from Anabat detectors.

Table 5-1 Nearest *Nyctalus* records to the Study Area

ID	Location	Distance to Study Area km	Year	Record Type	Species
1	Near Strathaven	11	2010	Anabat	Leisler's
2	Near Douglas	4	2008	Anabat	Leisler's
3	Lesmahagow	8	2012	Anabat	Leisler's
4	Near Kirkconnel	20	2011	Anabat	Noctule
5	Coalburn	5	2014	Anabat	Leisler's
6	Abington	15	2013	Anabat	Leisler's

5.2 Tree Surveys

In accordance within BCT Guidelines (Hundt, 2012) potential roost features such as buildings, stone walls, and trees within 200m of a proposed turbine or adjacent to the (30m) proposed access track were surveyed for potential roost features (PRF) as part of the protected species surveys.

The survey recorded 16 potential bat trees with 11 of these trees recording moderate potential roost features while three trees recorded moderate to low potential roost features and two trees recorded low potential roost features. All of these potential bat trees are situated along the proposed access track to the south of the site. Of these potential bat trees two are within 30m of the proposed access track and are all located within a section of woodland which runs alongside the southern boundary of the track (TN 7 and TN 8; see Annex 3). These bat trees have moderate roost suitability. All of the potential bat trees which were recorded can be climbed or endoscoped from the ground apart from TN 13 which is too dangerous to climb. All of these target notes are shown in Annex 3 with recommendations for further survey work outlined.

There were no potential roost features within 200m of proposed turbines.

5.3 Temporal Surveys – Static Detectors

Static detectors were deployed at 10 locations within the study area for at least 10 nights per survey month[1] in May to September (refer to Figure 7.5). The total bat registrations recorded for each species is shown in Table 5-2. In total 3 bat species (common pipistrelle, soprano pipistrelle, and Daubenton's) and two genus groups (*Nyctalus* spp. and *Myotis* spp.) were recorded during the temporal (static) surveys with a total registration count of 674 and a mean BAI/hr (brph) of 0.14 recorded.

The most commonly recorded brph was common pipistrelle (359 registrations and 0.07 brph), followed by soprano pipistrelle (222 registrations and 0.05 brph), *Nyctalus* spp. (66 registrations and 0.01 brph), *Myotis* spp. (18 registrations and 0.004 brph) and Daubenton's (3 registrations and 0.001 brph). Species composition of the study area is shown in Graph 1.

Tables 5-3 to 5-7 show the temporal (static) activity of the site per month with Graphs 2 to 4 showing the brph of species categorised into their collision risk category as per Natural England interim guidance (2014). When looking at individual months it can be seen that May had a very low activity rate with 2 registrations (0.002 brph). No high risk species were recorded during this month. In June activity rates increased to 171 registrations (0.23 brph) with 11 (0.01 brph) high risk species (*Nyctalus* spp. (NYC)) registrations recorded. In July bat activity numbers again increased to 303 registrations (0.10 brph) with 25 high collision risk species (*Nyctalus* spp.) registrations (0.03 brph) for this genus. In August the total registrations decreased with 160 registrations recorded, but for high risk species (*Nyctalus* spp.) their activity rate increased to 29 registrations (0.03 brph). Activity numbers in September dropped to 38 registrations (0.3 brph). One registration (0.001 brph) was recorded for a high risk species during this time period.

[1] Some detectors did not run for the full deployment period – see table 3-3

The majority of registrations recorded per month were from *Pipistrellus* species (common (PIPPIP) and soprano pipistrelle (PIPPYG) bats) which this genus accounting for 86% of the registrations recorded. Other records = MYODAU = *Myotis/*Daubenton's bat, MYO = *Myotis sp.*

Table 5-2 Summary of Temporal Survey Results (BAI/hr)

Loc.	PIPPIP	PIPPYG	NYC	MYODAU	MYO	NoID	Reg.	BAI [brph]
1	17	22	2	0	0	0	41	**0.23**
2	11	3	1	0	0	0	15	**0.09**
3	0	0	0	0	0	0	0	**0.00**
4	0	0	0	1	0	0	1	**0.01**
5	38	39	2	0	0	0	79	**0.45**
6	4	4	3	0	0	0	11	**0.02**
7	2	4	3	0	0	0	9	**0.02**
8	11	8	1	0	2	1	23	**0.05**
9	150	40	6	0	2	0	198	**0.42**
10	48	26	2	0	1	0	77	**0.17**
21	27	15	0	0	0	1	43	**0.13**
22	19	43	11	2	4	3	82	**0.25**
23	5	7	5	0	7	1	25	**0.08**
24	22	11	27	0	2	0	62	**0.19**
25	5	0	3	0	0	0	8	**0.02**
Total Reg.	359	222	66	3	18	6	674	
Total BAI [brph]	**0.07**	**0.05**	**0.01**	**0.001**	**0.004**	**0.001**	**0.14**	

Table 5-3 Summary of Activity Totals- May – 01-11/05/2018

Loc.	PIPPIP	PIPPYG	NYC	MYODAU	MYO	Reg.	BAI [brph]
1	1	0	0	0	0	1	**0.01**
2	0	0	0	0	0	0	**0.00**
3	0	0	0	0	0	0	**0.00**
4	0	0	0	1	0	1	**0.01**
5	0	0	0	0	0	0	**0.00**
6	0	0	0	0	0	0	**0.00**
7	0	0	0	0	0	0	**0.00**
8	0	0	0	0	0	0	**0.00**
9	0	0	0	0	0	0	**0.00**
10	0	0	0	0	0	0	**0.00**
Total Reg.	1	0	0	1	0	2	
Total BAI [brph]	**0.001**	**0.000**	**0.000**	**0.001**	**0.000**	**0.002**	

Table 5-4 Summary of Activity Totals – June – 07-18/06/2018

Loc.	PIPPIP	PIPPYG	NYC	MYODAU	MYO	Reg.	BAI [brph]
1	16	22	2	0	0	40	**0.48**
2	11	3	1	0	0	15	**0.18**
3	0	0	0	0	0	0	**0.00**
4	0	0	0	0	0	0	**0.00**
5	38	39	2	0	0	79	**0.95**
6	1	4	1	0	0	6	**0.07**
7	0	0	0	0	0	0	**0.00**
8	4	1	0	0	0	5	**0.06**
9	9	6	4	0	1	20	**0.24**
10	1	4	1	0	0	6	**0.07**
Total Reg.	80	79	11	0	1	171	
Total BAI [brph]	**0.11**	**0.10**	**0.01**	**0.00**	**0.001**	**0.23**	

Table 5-5 Summary of Activity Totals – July – 13-23/07/2018

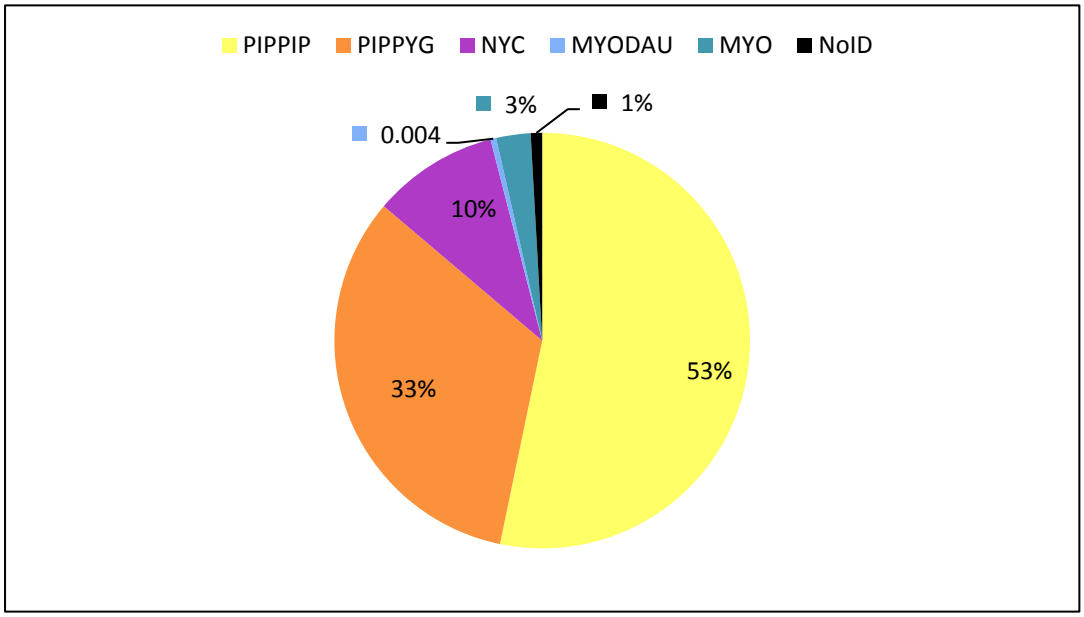
Loc.	PIPPIP	PIPPYG	NYC	MYODAU	MYO	Reg.	BAI [brph]
6	3	0	2	0	0	5	**0.06**
7	1	2	3	0	0	6	**0.07**
8	5	5	1	0	1	12	**0.15**
9	125	17	2	0	1	145	**1.75**
10	47	20	1	0	1	69	**0.83**
21	0	0	0	0	0	0	**0.00**
22	10	13	5	2	1	31	**0.38**
23	2	1	2	0	4	9	**0.11**
24	8	3	6	0	1	18	**0.22**
25	5	0	3	0	0	8	**0.10**
Total Reg.	206	61	25	2	9	303	
Total BAI [brph]	**0.25**	**0.07**	**0.03**	**0.002**	**0.01**	**0.37**	

Table 5-6 Summary of Activity Totals – August – 10-20/08/2018

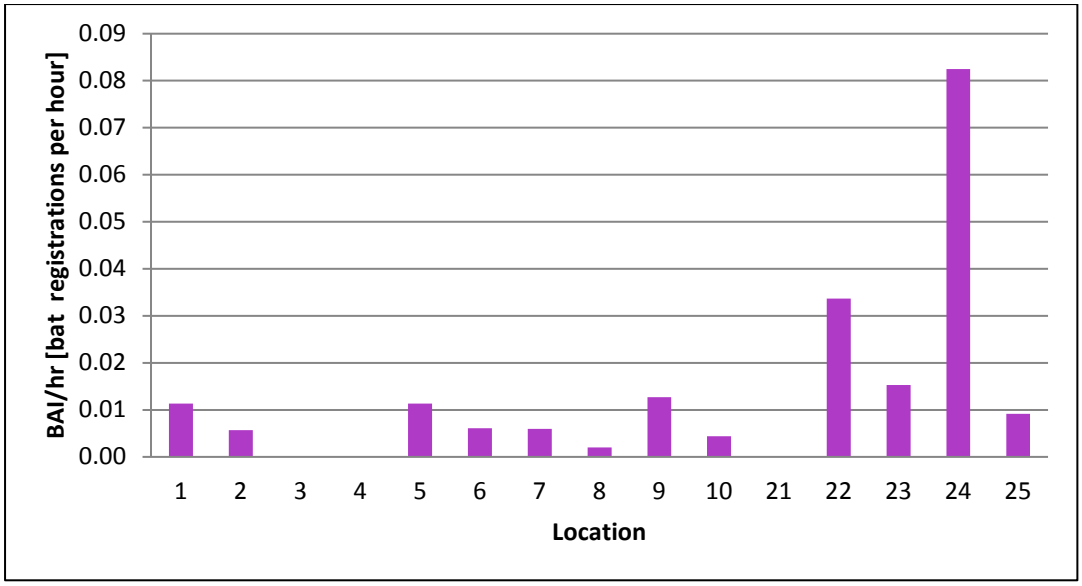
Loc.	PIPPIP	PIPPYG	NYC	MYODAU	MYO	NoID	Reg.	BAI [brph]
6	0	0	0	0	0	0	0	**0.00**
7	0	2	0	0	0	0	2	**0.02**
8	2	2	0	0	0	1	5	**0.05**
9	16	16	0	0	0	0	32	**0.46**
10	0	1	0	0	0	0	1	**0.02**
21	22	8	0	0	0	0	30	**0.30**
22	9	27	6	0	1	3	46	**0.46**
23	1	4	3	0	2	0	10	**0.10**
24	8	6	20	0	0	0	34	**0.34**
25	0	0	0	0	0	0	0	**0.00**
Total Reg.	58	66	29	0	3	4	160	
Total BAI [brph]	**0.06**	**0.07**	**0.03**	**0.00**	**0.00**	**0.00**	**0.17**	

Table 5-7 Summary of Activity Totals – September – 06-17/09/2018

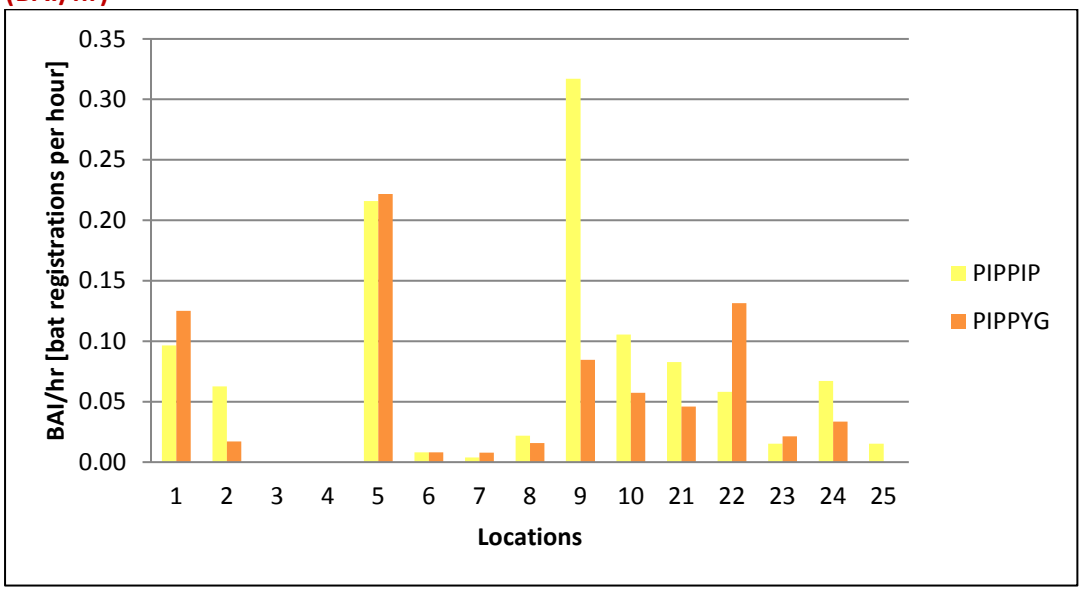
Loc.	PIPPIP	PIPPYG	NYC	MYODAU	MYO	NoID	Reg.	BAI [brph]
6	0	0	0	0	0	0	0	**0.00**
7	1	0	0	0	0	0	1	**0.01**
8	0	0	0	0	1	0	1	**0.01**
9	0	1	0	0	0	0	1	**0.01**
10	0	1	0	0	0	0	1	**0.01**
21	5	7	0	0	0	1	13	**0.09**
22	0	3	0	0	2	0	5	**0.03**
23	2	2	0	0	1	1	6	**0.04**
24	6	2	1	0	1	0	10	**0.07**
25	0	0	0	0	0	0	0	**0.00**
Total Reg.	14	16	1	0	5	2	38	
Total BAI [brph]	**0.01**	**0.01**	**0.001**	**0.00**	**0.003**	**0.001**	**0.03**	



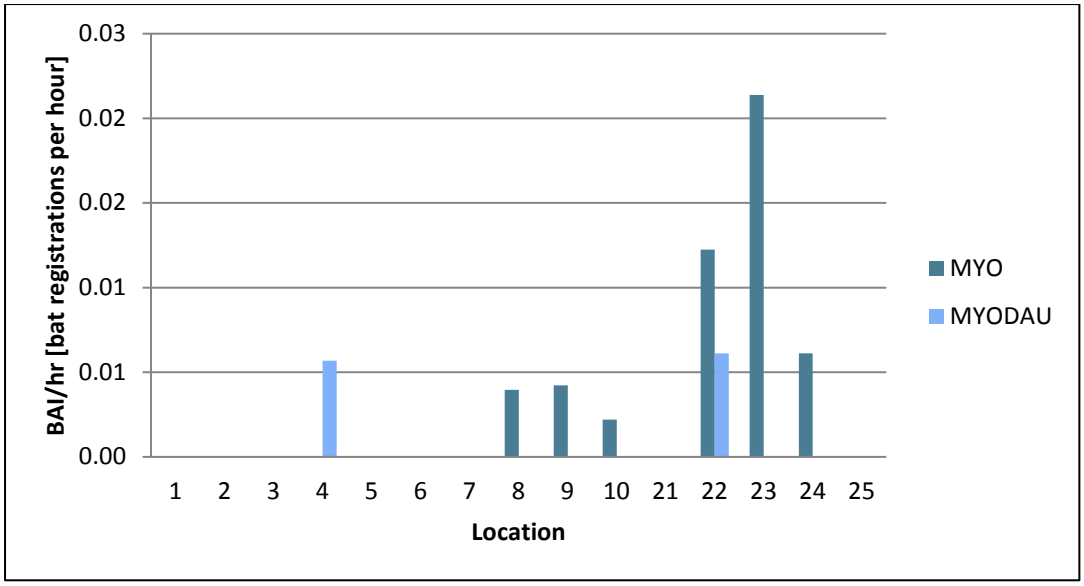
Graph 1 Temporal Survey Results: Species Composition of Study Area (BAI/hr)



Graph 2 Temporal Activity of High Collison Risk Species (*Nyctalus* spp.) within Study Area (BAI/hr)



Graph 3 Temporal Activity of Medium Collison Risk Species within Study Area (BAI/hr)



Graph 4 Temporal Activity of Low Collison Risk Species within Study Area (BAI/hr)

6 COLLISION AND POPULATION RISK FROM TURBINES

Table 5-8 presents the total number of bat registrations per night per visit for high, medium and low risk species. The unit of average registrations per night is the preferred unit used by Scottish Natural Heritage (SNH) to determine the requirement for curtailment. A value of more than 1 bat registration on average for *Nyctalus* spp. per deployment period is considered to be the value which triggers the assessment of curtailment as per consultation between MacArthur Green and SNH (email, 28/03/18). Consideration of curtailment at a turbine also needs to factor in geographical location, habitat suitability, flight corridors, roost suitability and nearby roost locations into the assessment (DEFRA, 2016).

Table 5-8 Summary of Temporal Survey Results per visit (BAI/night [brpn]). Values of ≥1.00 brpn for high risk species are highlighted.

Population Risk		High	Medium	Low	
Collison Risk		High	Medium	Low	
Loc.	visit	NYC	PIP SPP	MYO	MYODAU
1	May	0.00	0.10	0.00	0.00
1	June	0.18	3.45	0.00	0.00
2	May	0.00	0.00	0.00	0.00
2	June	0.09	1.27	0.00	0.00
3	May	0.00	0.00	0.00	0.00
3	June	0.00	0.00	0.00	0.00
4	May	0.00	0.00	0.00	0.10
4	June	0.00	0.00	0.00	0.00
5	May	0.00	0.00	0.00	0.00
5	June	0.18	7.00	0.00	0.00
6	May	0.00	0.00	0.00	0.00
6	June	0.09	0.45	0.00	0.00
6	July	0.20	0.30	0.00	0.00
6	August	0.00	0.00	0.00	0.00

Population Risk		High	Medium	Low	
Collison Risk		High	Medium	Low	
6	September	0.00	0.00	0.00	0.00
7	May	0.00	0.00	0.00	0.00
7	June	0.00	0.00	0.00	0.00
7	July	0.30	0.30	0.00	0.00
7	August	0.00	0.20	0.00	0.00
7	September	0.00	0.08	0.00	0.00
8	May	0.00	0.00	0.00	0.00
8	June	0.00	0.45	0.00	0.00
8	July	0.10	1.00	0.10	0.00
8	August	0.00	0.40	0.00	0.00
8	September	0.00	0.00	0.08	0.00
9	May	0.00	0.00	0.00	0.00
9	June	0.36	1.37	0.09	0.00
9	July	0.20	14.20	0.10	0.00
9	August	0.00	4.58	0.00	0.00
9	September	0.00	0.08	0.00	0.00
10	May	0.00	0.00	0.00	0.00
10	June	0.09	0.45	0.00	0.00
10	July	0.10	6.70	0.10	0.00
10	August	0.00	0.10	0.00	0.00
10	September	0.00	0.08	0.00	0.00
21	July	0.00	0.00	0.00	0.00
21	August	0.00	3.00	0.00	0.00
21	September	0.00	1.00	0.00	0.00
22	July	0.50	2.30	0.10	0.20
22	August	0.60	3.60	0.10	0.00
22	September	0.00	0.25	0.17	0.00
23	July	0.20	0.30	0.40	0.00
23	August	0.30	0.50	0.20	0.00
23	September	0.00	0.34	0.08	0.00
24	July	0.60	1.10	0.10	0.00
24	August	**2.00**	1.40	0.00	0.00
24	September	0.08	0.67	0.08	0.00
25	July	0.30	0.50	0.00	0.00
25	August	0.00	0.00	0.00	0.00
25	September	0.00	0.00	0.00	0.00

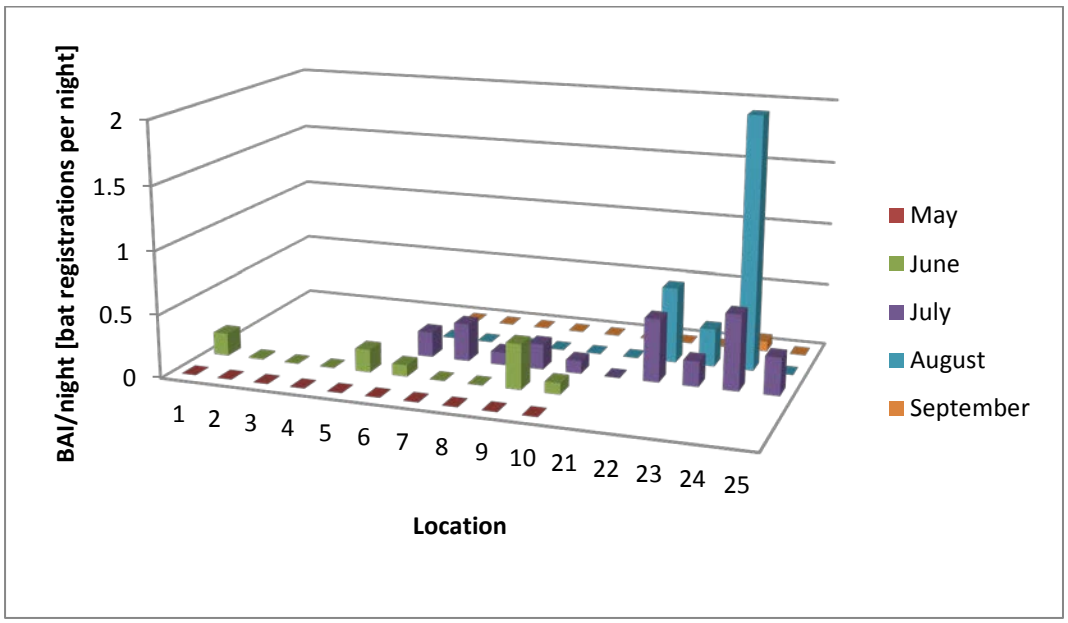
As of yet there is no BAI/night curtailment figure for medium collision risk (soprano and common pipistrelle bats) or low risk species (*Myotis* spp. and brown long-eared bat). Therefore, this report does not use a BAI/hr curtailment figure for medium risks species and instead uses a precautionary activity figure of 20 registrations on average per night which is considered a medium activity rate and a figure of 40 registrations on average per night which is considered a high activity rate. This figure of 20 and 40 registrations on average is considered appropriate due to the favourable

conservation status, geographical range and the low population and medium collision risk of common and soprano pipistrelle bats.

For low risk species a precautionary activity figure of 25 registrations on average per night is considered a medium activity rate and a figure of 40 registrations on average per night is considered a high activity rate. These figures are considered to be appropriate due to the favourable conservation status, geographical range and the low population and collision risk status of *Myotis* spp.

6.1 High Collision Risk Species

For high risk species an average registration per survey period of >1 BAI/night was recorded at location 24 in August (2.00 brpn) for *Nyctalus* spp. as illustrated in Table 5-8 and Graph 5. Location 24 was situated along the eastern central boundary of the study area and is approximately 182m from turbine T6. T6 is separated from location 24 by a steep gully, with the Windrow Burn flowing south along its topography towards a block of conifer woodland at Windrow Wood where this burn then joins with the Douglas Water. It is possible that the connectivity of suitable bat habitats in this area resulted in location 24 recording >1 BAI/night (brpn) at this location.



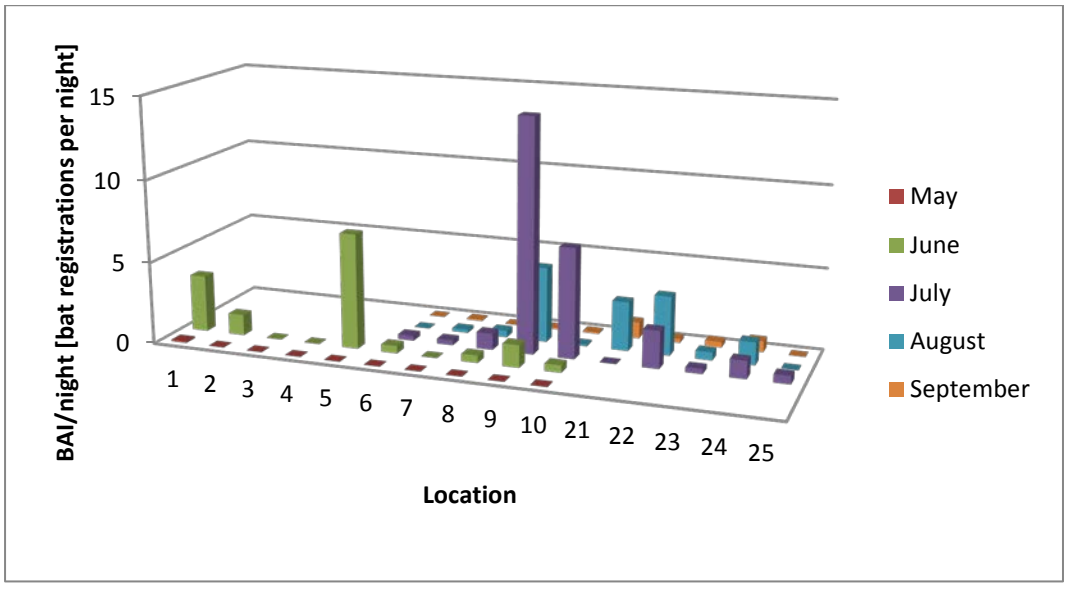
Graph 5 Temporal Activity of High Collision Risk Species (*Nyctalus* spp.) within the Study Area per Month (BAI/night)

6.2 Medium Collision Risk Species

The greatest activity seen throughout the temporal survey was a result of medium risk species such as common pipistrelle and soprano pipistrelle numbers (accounting for 86% of registrations). These bat species are classed as being at medium risk of collision but are at low risk at the population level due to their distribution and abundance within the UK.

Medium risk species (common and soprano pipistrelle) did not record a BAI of >20 brpn. The highest activity rates for medium risk species were recorded in July at location 9 (14.20 brpn) and at location

10 (6.70 brpn) as illustrated in Table 5-8 and Graph 6. Both locations 9 and 10 are situated in the northern section of the study area along the edge of conifer planation. Common and soprano pipistrelle bats forage along edge habitats with both of these species using an echolocation calls suited to edge habitat with a call that features both a QCF (quasi constant frequency) and FM (frequency modulated) component, which allows a call to be loud and travel far while also collecting detail of the bat's environment. Common and soprano pipistrelle bats typical forage along edges such as treelines, large hedgerows and water edge (Russ, 1999). Plantation edge gives shelter to invertebrate species especially when there are environmental conditions such as wind and rain. The increase in common and soprano activity rates at locations 9 and location 10 in July is likely to be the result of the proximately of the planation edge at these locations and the environmental conditions during the survey.

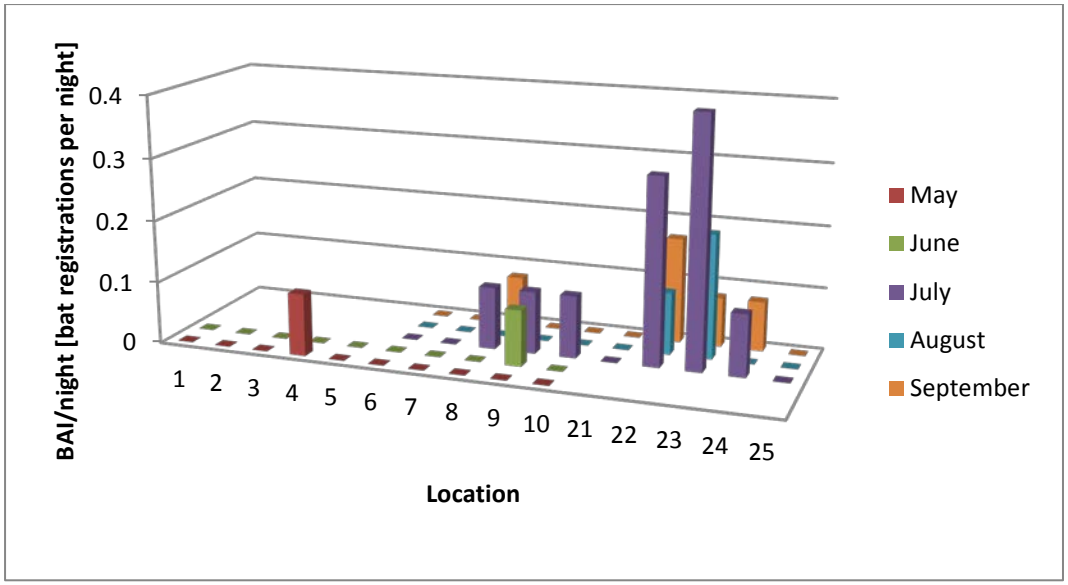


Graph 6 Temporal Activity of Medium Collision Risk Species (*Pipistrellus* spp.) within the Study Area per Month (BAI/night)

6.3 Low Collision Risk Species

These species are at low risk for collision and also at low risk at the population level (Natural England, 2014).

The BAI/night for *Myotis* spp. and brown-long eared bats within the study area are considered to be low for low collision risk species as shown in Table 5-8 and graph 7.



Graph 7 Temporal Activity of Low Collision Risk Species (*Myotis* spp. & brown long-eared bat) within the Study Area per Month (BAI/night)

7 DISCUSSION

7.1 Survey Overview

Much of the variation in activity between and within surveys can be accounted for by changes in weather but also by the fidelity of bats to particular foraging areas and commuting routes.

Three bat species (common and soprano pipistrelle bats and Daubenton's) and two genus groups (*Nyctalus* and *Myotis* spp.) were recorded within the study area during the temporal surveys.

For high risk species (*Nyctalus* spp.) an average registration per survey period of >1 BAI/night(brpn) was achieved at location 24 in August (2.00 brpn) for *Nyctalus* spp. A BAI >1 brpn requires the assessment of curtailment at this location.

No high or medium activity levels were recorded for medium and low collision risk species, however the temporal (static surveys) did identify a potential feeding corridor along the planation edge in the northern section of the survey area for medium collision risk species at locations 9 and 10, with activity rates in July of 14.20 brpn and 6.70 brpn at these locations, respectively.

A total of 16 potential bat roost trees were recorded along the proposed access track to the south of the site. Of these potential bat roost trees two are within 30m of the proposed access track and are all located within a section of woodland which runs alongside the southern boundary track (TN 7 and TN 8; see Annex 3).

No bat roosts or potential bat roosts were located within 200m of a turbine, or within the wider study area.

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Annex 1. Protected Species Legal Status

All bat species receive protection under the Conservation Regulations (1994) (as amended).

The information contained in this Annex is a summarised version of the legislation and should be read in conjunction with the appropriate legislation as set out in its complete form.

It is an offence to:

- Deliberately or recklessly to capture, injure or kill a wild animal of a European protected species;
- Deliberately or recklessly:
    - Harass a wild animal or group of wild animals of a European protected species;
    - Disturb such an animal while it is occupying a structure or place which it uses for shelter or protection;
    - Disturb such an animal while it is rearing or otherwise caring for its young;
    - To obstruct access to a breeding site or resting place of such an animal, or otherwise to deny the animal use of the breeding site or resting place (i.e. roost sites);
    - To disturb such an animal in a manner that is, or in circumstances which are, likely to significantly affect the local distribution or abundance of the species to which it belongs; or
    - To disturb such an animal in a manner that is, or in circumstances which are, likely to impair its ability to survive, breed or reproduce, or rear or otherwise care for its young;
- To damage or destroy a breeding site or resting place of such an animal

Legal and Conservation Status of UK Bat Species taken from Bat Conservation Trust

Source: http://www.bats.org.uk/pages/bats_and_the_law.html

Species	Legislation / Convention													
	Bern Convention Appendix II	Bonn Convention Appendix II	WCA	Habitats Directive Annex IV	Habitats Directive Annex II	Habs Regs 1994 (as amended) *Scotland*	Conservation of Habs & Species Regs 2010	Conservation Regs (N Ireland) 1995	CROW Act 2000	NERC Act 2006	Wild Mammals Protection Act	UK BAP Priority species	IUCN Red List*	EUROBATS Agreement
Greater horseshoe bat	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	LC	✓
Lesser horseshoe bat	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	LC	✓
Daubenton's bat	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		LC	✓
Natterer's bat	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		LC	✓
Whiskered bat	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		LC	✓
Brandt's bat	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		LC	✓
Bechstein's bat	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	NT	✓
Alcathoe bat	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		DD	✓
Noctule	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	LC	✓
Leisler's bat	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		LC	✓
Serotine	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		LC	✓
Common pipistrelle	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		LC	✓
Soprano pipistrelle	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	LC	✓
Nathusius' pipistrelle	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		LC	✓
Brown long-eared bat	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	LC	✓
Grey long-eared bat	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		LC	✓
Barbastelle	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	NT	✓
Greater mouse-eared bat	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓		LC	✓

*IUCN categories: LC is Least Concern, NT is Near Threatened, DD is Data deficient; see www.iucnredlist.org for more details.

Annex 2. Determining Survey Effort

Factors to consider when determining the survey effort and site risk (taken from Hundt, 2012)			
Quality of habitat and number of habitat features likely to affect bat mortality rates if altered by development*	**Species likely to use the site***	**Importance of roosts, of species likely to use site, which may be affected by development***	**Potential risk level of development**
No potential habitat for roosting, foraging or commuting bats	None	Local	Lowest
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.	Low number, single low risk species High number, several low risk species	Parish	Low
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.	Low number, medium risk species High number, medium risk species	District County	Medium
Numerous suitable buildings, trees (particularlymature 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.	High number, single high risk species High number, several high risk species High number, all high risk species	National International	High

*As outlined in current scientific research, SNCO guidance and illustrated in Wray *et al*. (2010).

Annex 3. Minimum Standards for Bat Surveys

(Taken from Hundt, 2012)

	Site Risk Level		
	Low risk	**Medium risk**	**High risk**
	Roost survey		
Selection of roosts requiring further survey	If evidence of roosting by medium or high-risk species and/or roosts of district importance is found, further survey should follow SNCO guidance and Hundt (2012) guidelines wherever possible.		
Survey period	Surveys should provide data for one season as a minimum.		
Survey area	Up to 200m + rotor radius from turbine locations or potential turbine locations	Up to 200m + rotor radius from turbine locations or potential turbine locations	Up to 200m + rotor radius from turbine locations or potential turbine locations
Ground level transect surveys	One visit per transect each season (spring, summer and autumn)	One visit per transect each month (April-Oct)	Up to two visits per transect each month may be required (April-Oct)
Automated surveys at ground level	5 consecutive nights for each single or pair of locations within the survey area, per season	5 consecutive nights for each single or pair of locations within the survey area, per month	Up to 2 sets of 5 consecutive nights for each single or pair of locations within the survey area, per month
Automated surveys at height	See Section 10.5.6 [of Hundt, 2012] for situations where at-height survey may be appropriate For surveys undertaken from masts (met mast or other) survey effort is as outlined above for surveys at ground level.		

Annex 4. Guidelines For Assessing the Potential Suitability of Roost Features

(Taken from Collins, 2016)

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

Annex 5. Target Notes

(agl – above ground level; dbh – diameter at breast height)

TN	Feature	Survey Date	Grid Ref	Notes	Assessment	Recommendations
1	Tree	24/05/18	NS 80586 29520	Beech with several knot holes ranging from1.5m above ground level (agl) to 2m. Some broken or rotting limbs. Union present 3-4m agl. Unable to see full extent of tree due to leaf cover.	Moderate to low roost suitability	If felling and/or lopping tree and/or working within root plate the cavity or cavities must be checked. If turbine/s are within 200m or if access track is within 30m the cavity or cavities must be checked. If tree cannot be climbed dusk and dawn surveys will be required.
2	Tree	24/05/18	NS 80591 29503	Ash with several knot holes present. At least 3 large broken limbs with torn ends. Large upper branch has rot hole which looks like it extends up arm. Between 3m & 7m agl. 1.5 - 2m diameter at breast height (dbh). Unable to fully see from the ground level.	Moderate roost suitability	If felling and/or lopping tree and/or working within root plate the cavity or cavities must be checked. If turbine/s are within 200m or if access track is within 30m the cavity or cavities must be checked. If tree cannot be climbed dusk and dawn surveys will be required.
3	Tree	24/05/18	NS 81830 30180	Large Scots Pine tree. Showing little sign of decay. One union present. 4m agl	Low roost suitability	If directly disturbing stone wall or working within 30m buffer zone endoscope inspection to be carried out.
4	Tree	24/05/18	NS 81838 30179	Scots pine with branch tear / break up stem. Split branch also present with fissures. 7m agl	Moderate roost suitability	If felling and/or lopping tree and/or working within root plate the cavity or cavities must be checked. If turbine/s are within 200m or if access track is within 30m the cavity or cavities must be checked. If tree cannot be climbed dusk and dawn surveys will be required.
5	Tree	24/05/18	NS 81840 30183	Scots pine with split branch on lower limb - unsure if cavity would extend in. Split on lower limb but does not look as though it extends in.	Moderate to low roost suitability	If felling and/or lopping tree and/or working within root plate the cavity or cavities must be checked. If turbine/s are within 200m or if access track is within 30m the cavity or cavities must be checked. If tree cannot be climbed dusk and dawn surveys will be required.

6	Tree	24/05/18	NS 81834 30217	Ash with at least 5 knot holes. Several looked smoothed out inside and have good potential. Would be good to endoscope to see extend of cavity.	Moderate roost suitability	If felling and/or lopping tree and/or working within root plate the cavity or cavities must be checked. If turbine/s are within 200m or if access track is within 30m the cavity or cavities must be checked. If tree cannot be climbed dusk and dawn surveys will be required.
7	Tree	24/05/18	NS 81839 30273	Alder with knot hole approx. 4m agl. Unable to fully survey tree due to leaf cover and unable to see if there is a cavity.	Moderate roost suitability	If felling and/or lopping tree and/or working within root plate the cavity or cavities must be checked. If turbine/s are within 200m or if access track is within 30m the cavity or cavities must be checked. If tree cannot be climbed dusk and dawn surveys will be required.
8	Tree	24/05/18	NS 81850 30298	Large beech tree approx. 2-3m dbh. Several broken limbs with fissured edges. At least 2 unions present. Unable to fully survey given leaf cover.	Moderate roost suitability	If felling and/or lopping tree and/or working within root plate the cavity or cavities must be checked. If turbine/s are within 200m or if access track is within 30m the cavity or cavities must be checked. If tree cannot be climbed dusk and dawn surveys will be required.
9	Tree	24/05/18	NS 81891 30385	Birch with several areas with cracked plates of uplifting bark. No other cavities seen from ground level. Approx. 0.6m dbh.	Moderate roost suitability	If felling and/or lopping tree and/or working within root plate the cavity or cavities must be checked. If turbine/s are within 200m or if access track is within 30m the cavity or cavities must be checked. If tree cannot be climbed dusk and dawn surveys will be required.
10	Tree	24/05/18	NS 81895 30399	Willow with one cracked limb. One union. Neither feature looks like they lead to a cavity.	Low roost suitability	If directly disturbing stone wall or working within 30m buffer zone endoscope inspection to be carried out.
11	Tree	24/05/18	NS 81965 30590	Oak with vertical crack through branch. Can see daylight through crack but unable to see if it leads to cavity on other side.	Moderate to low roost suitability	If felling and/or lopping tree and/or working within root plate the cavity or cavities must be checked. If turbine/s are within 200m or if access track is within 30m the cavity or cavities must be checked. If tree cannot be climbed dusk and dawn surveys will be required.

12	Tree	24/05/18	NS 81972 30606	Ash with large tear out on curve of upper limb - looks to extend to a dry cavity.	Moderate roost suitability	If felling and/or lopping tree and/or working within root plate the cavity or cavities must be checked. If turbine/s are within 200m or if access track is within 30m the cavity or cavities must be checked. If tree cannot be climbed dusk and dawn surveys will be required.
13	Tree	24/05/18	NS 81990 30644	Dead tree with knot hole approx. 4m agl. Unable to fully see if it leads up to cavity but looks damp. Rot hole on limb to the south. Not safe to climb.	Moderate roost suitability	If felling and/or lopping tree and/or working within root plate the cavity or cavities must be checked. If turbine/s are within 200m or if access track is within 30m the cavity or cavities must be checked. If tree cannot be climbed dusk and dawn surveys will be required.
14	Tree	21/06/2018	NS 81679 29704	Dead tree with woodpecker holes and open cavities approx. 10 -12m agl.	Moderate roost suitability	If felling and/or lopping tree and/or working within root plate the cavity or cavities must be checked. If turbine/s are within 200m or if access track is within 30m the cavity or cavities must be checked. If tree cannot be climbed dusk and dawn surveys will be required.
15	Tree	21/06/2018	NS 81739 29675	Ash tree with cavities in lower and upper limbs and trunk.	Moderate roost suitability	If felling and/or lopping tree and/or working within root plate the cavity or cavities must be checked. If turbine/s are within 200m or if access track is within 30m the cavity or cavities must be checked. If tree cannot be climbed dusk and dawn surveys will be required.
16	Tree	21/06/2018	NS 81666 29585	Ash tree with cavities suspended from broken limbs.	Moderate roost suitability	If felling and/or lopping tree and/or working within root plate the cavity or cavities must be checked. If turbine/s are within 200m or if access track is within 30m the cavity or cavities must be checked. If tree cannot be climbed dusk and dawn surveys will be required.

Annex 6. Illustration to Show 50m Buffer Zone

(*Taken from Natural England, 2014)*