Beinn Ghlas Wind Farm Bat Survey Report and Assessment of Potential Risk

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Summary

Alba Ecology Ltd. was commissioned by Ventient Energy to conduct a bat survey for the proposed Beinn Ghlas Wind Farm, Taynuilt, Argyll. The Study Area was characterised by open, undulating hill terrain (averaging around 400m a.s.l.) which was part of an upland plateau. The habitat was largely made up of blanket bog, heath and grassland which was used for sheep grazing. There is an existing wind farm present within the Study Area.

Main Findings

- A targeted desk study was conducted of the proposed Beinn Ghlas Wind Farm area to assess the suitability of the habitats present for bats. This assessment concluded that the Study Area had low bat habitat suitability.
- A search for potential roost sites was conducted within the Study Area in 2022. No suitable areas with potential bat roosts were recorded.
- Bat activity surveys were conducted within the Study Area using static bat detectors (Anabat Express and Anabat Swift) across the early, mid and late-season periods in 2022. Static bat detectors were placed at 13 different locations between May and September 2022. These surveys recorded four bat species: common pipistrelle *Pipistrellus pipistrellus*, soprano pipistrelle *Pipistrellus pygmaeus*, Daubenton's *Myotis daubentonii* and brown long-eared bats *Plecotus auritus*.
- With all locations where static detectors were deployed taken into consideration, a total of 500 nights recording were made.
- There was a total of 111 bat passes recorded throughout this survey period (i.e. 500 nights). The majority of these were common and soprano pipistrelle, with a small number of Daubenton's and brown long-eared passes recorded.

Given the results from desk study and bat activity surveys, there was evidence that the Study Area was used by very small numbers of primarily common and soprano pipistrelle, though also some Daubenton's and brown long-eared were also recorded.

The overall potential risk of the Proposed Development to bats was assessed, following standard guidance, as 'low' for all bat species recorded.

Introduction

Beinn Ghlas Wind Farm is owned by Beaufort Wind Ltd (hereafter "the Applicant") which is a wholly owned subsidiary of Ventient Energy Ltd. Beinn Ghlas Wind Farm is located south-west of Taynuilt in Argyll, Scotland. It comprises of 14 wind turbines and has been operational since May 1999. In June 2022, planning consent was secured (subject to the agreement of a revised S75 agreement) to operate the wind farm for an additional ten years to August 2033.

A repowering project has been proposed at Beinn Ghlas by the Applicant. As part of the planning process, Alba Ecology Ltd. was commissioned to undertake a bat survey within the Application Boundary. This work included a bat habitat suitability assessment and bat activity surveys. As part of the Environmental Impact Assessment (EIA) process, a range of potentially sensitive and legally protected ecological receptors in the area including bats were identified for survey. All bat species are legally protected under domestic and European legislation (Conservation (Natural Habitats, &c.) Regulations 1994 (as amended))[1].

The surveys were conducted within the Study Area (**Figure 1**) which included the Application Boundary plus a 200 m buffer. The roost survey was conducted within the entire Study Area, while the bat activity survey was conducted in suitable habitat within the Application Boundary where indicative layouts indicated that turbines would likely be situated. The centre of the Application Boundary is situated at Ordnance Survey (OS) Grid reference NM 975 260, south of Taynuilt, roughly halfway between Loch Awe and Oban, in Argyll.

The Study Area is characterised by undulating hill terrain in an upland plateau, with the summit of Beinn Ghlas (512 m above sea level (above sea level (3a.s.l)) by its western edge. The existing Beinn Ghlas Wind Farm aside, it is made up of blanket bog, heath and grassland. This was primarily used as land for low level sheep grazing. To the south of the Study Area, there was an area of coniferous plantation forestry (some young, some more mature). There were several small and medium-sized burns within the Study Area. While some of these watercourses were named, many were not. The named watercourses included the Laggan Burn, Allt Carnaich and Eas Ruadh.

This document reports the findings of the bat habitat suitability assessment, bat roost and bat activity surveys undertaken by Alba Ecology Ltd. in 2022.

Legal Protection

The following account summarises the legal protection afforded to the target survey species, bats. The informal, plain English nature of this summary means that it cannot be substituted for the actual legislation, its amendments or its subordinate Orders, Licences and Regulations and we therefore urge it to be used with care. Where a formal or definitive answer on legal protection is needed, this requires the opinion of a qualified lawyer and reference to the original published legislation.

All species of bats occurring in Scotland are classed as European Protected Species (EPS) under the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended). There is no change to the protection of European protected species as a result of EU Exit.

It is an offence to deliberately or recklessly:

- capture, injure or kill a wild bat;

[1] *UK Government (1994), The Conservation (Natural Habitats, &c.) Regulations 1994.*

- harass a wild bat or group of bats;
- to disturb a wild bat in a roost (any structure or place it uses for shelter or protection);
- to disturb a wild bat while it is rearing or otherwise caring for its young (this would be a 'maternity' roost);
- to obstruct access to a bat roost or to otherwise deny the animal use of the roost;
- to disturb such a wild bat in a manner that is, or in circumstances which are, likely to significantly affect the local distribution or abundance of that species; and
- to disturb a wild bat in a manner that is, or in circumstances which are, likely to impair its ability to survive, breed, reproduce, rear or otherwise care for its young.

It is also an offence to destroy the roosts of any species of bat in Scotland, whether deliberately or recklessly.

Methods

NatureScot standing advice (NatureScot *et al.* 2023) recommends following guidance from two main sources. Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edition) (The Bat Conservation Trust (BCT), 2016)[2] and a collaborative guidance from NatureScot, Natural England, Natural Resources Wales, RenewableUK,. Scottish Power Renewables, Ecotricity Ltd., the University of Exeter and Bat Conservation Trust. Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation (NatureScot *et al*, 2021).

The potential impacts of wind farms on bats are considered likely to be:

- mortality due to direct collision with turbine blades or from barotrauma (mortality due to damage to bats' lungs caused by sudden change in air pressure close to the turbine blades);
- loss of or damage to commuting and foraging habitat;
- loss or damage to roosts, and
- displacement of individual or populations (due to wind farm construction or because bats avoid the wind farm area).

Potential impacts on bats, and therefore survey effort, are likely to increase with the number and quality of suitable bat habitat features within a development area.

Three survey methods were used to survey potential bat use of the Study Area:

- targeted desk study;
- bat roost survey; and
- bat activity surveys (comprising static bat detector surveys).

This was followed by an assessment of potential risk of the Proposed Development on the bat species identified.

[2] *Bat Conservation Trust (2023), Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edition)*

Targeted Desk Study

The best practice bat survey guidance (NatureScot *et al*, 2021) requires surveyors to start by assessing the need for and purpose of a survey, before commencing any fieldwork. Three main issues to consider when assessing the need for a bat survey are: (i) extent and quality of bat habitat in and surrounding the Study Area (e.g. woodlands, linear features, hedges and watercourses), (ii) proximity of designated sites for bats (e.g. Site of Special Scientific Interest (SSSI)/Special Areas of Conservation (SAC)) and (iii) buildings or other potential roost sites and the wider area in terms of potential to support bats.

The extent and quality of potentially suitable bat habitat features in the Study Area were ascertained through a walkover of the Study Area and the use of habitat data (Beinn Ghlas Wind Farm Habitat Survey Report (Avian Ecology, 2022) and Beinn Ghlas Wind Farm Peatland Condition Assessment (PCA) Survey Report (Alba Ecology, 2022)). The best practice guidance (NatureScot *et al*, 2021) lists an overview of factors that need to be considered, such as, the habitat type present, the known roost sites, the altitude and exposure etc.

The Beinn Ghlas Natural Heritage Desk Study (Alba Ecology, 2022) was consulted in reference to designated sites and species records of bats. In addition, a search for records of bats within a 10 km radius of the Study Area (with 1 km resolution) was conducted using records obtained from the National Biodiversity Network (NBN) Atlas . Additionally, the number and size of operational wind farms within 10 km of the Study Area was ascertained from the Scottish parliament's Information Centre.

All records of bats within 10 km of the Study Area were searched for on the NBN Atlas paying due regard to the restrictions on the NBN Atlas as per CIEEM guidance (2020).

All bat records for the Study Area plus a 10km buffer were downloaded on the NBN Atlas website in January 2023. As per NBN Atlas guidance for commercial use, only the records which have an Open Data licence (coded CCO, CC-BY and OGL) have been considered and presented here. These data "*can be used for any purpose*" (NBN Atlas, 2023). Those data with a non-commercial licence (CC-BY-NC) were not included and were not inspected or considered. This is accordance with the NBN Atlas terms and conditions for commercial use (NBN Atlas, 2023).

It should be noted that the Data Provider, Original Recorder [where identified], and the NBN Trust bear no responsibility for any further analysis or interpretation of that material, data and/or information.

Provision of the data by the recorders is neutral and should not be regarded, either explicitly or implicitly, as approving or opposing any project informed by the data.

As with all desk studies, the data collected are only as good as the data supplied to the recording schemes. The recording schemes and recorders provide disclaimers in relation to the quality and quantity of the data they provide, and these should be considered when examining the outputs of this desk study. No attempt has been made to verify these records. Common (vernacular) names are used where they have been provided by the recorder.

Roost Surveys

Potential bat roosts were identified by daytime walkover surveys and visual assessments of potentially suitable roost locations and features in the Study Area (which included a 200 m buffer from the Application Boundary as recommended by best practice guidance (NatureScot *et al,* 2021)).

Activity Surveys

Bat activity surveys were completed within the Study Area. These were static bat detector surveys.

The main aim of the activity surveys is to collect data during the period of most likely high bat activity period at suitable locations across the Study Area. Consequently, bat activity surveys were specifically conducted during the warmest months, with the lowest wind speeds, May-September 2022. The previous version of the bat survey guidance (NatureScot *et al,* 2019) prescribed the use of full spectrum bat detectors for the static survey. This change in guidance (zero-crossing detectors had been acceptable prior to this) meant that it became difficult to purchase large numbers of full spectrum bat detectors in the period between the guidance coming out and the start of the survey period. This was recognised by NatureScot, and as a result, the update to the guidance (NatureScot *et al*, 2021), allowed a mix of full-spectrum and zero-crossing detectors to be used in surveys.

The number of bat detector locations suggested in the guidance is largely based on the number of turbines proposed. "*Where developments have more than ten turbines, detectors should be placed within the developable area at ten potential turbine locations plus a third of additional potential turbine sites"* (NatureScot *et al*, 2021). At the time when surveys were to commence, two initial indicative turbine layouts were available (with up to potentially 19 turbines). However, these were not fixed and the discrepancies between the layouts, as well as the potential for additional changes meant that an area-based approach was adopted. The only concession to the initial layouts was that the western side of the Application Boundary (Figure 1) had been excluded from consideration as a likely location for turbines. As a result, the area-based approach was taken in the eastern half of the Application Boundary.

This area-based approach, with 13 locations spread across the Study Area focused on those areas with prominent linear features which, in an upland setting with low suitability for bats, would potentially be more important. The locations of the 13 static bat detectors are shown in Figure 1. The survey used static bat detectors (a combination of 7 Anabat Swift full-spectrum and 6 Anabat Express zero-crossing). The detectors had been checked to ensure they were working correctly and (if necessary) serviced and repaired by Titley Scientific in early 2022.

Bat activity surveys using static bat detectors within the Study Area were conducted between May and September 2022 (**Table 1**). They were left out for a minimum of 10 nights in each of the early, mid and late-season periods as specified by best practice bat survey guidance (NatureScot *et al,* 2021).

The best practice bat survey guidance suggests that the recording dates should not run from the end of one season directly into the next (i.e. there should be a break between the two recording periods) (NatureScot *et al,* 2021). However, following a relatively cool and wet early season period, the weather forecast for the area was very good running into early June (the start of the mid-season period). As a result, a decision was taken to carry on directly from the early session recording dates to take advantage of this good period of weather. In addition, a second period of mid-season recording was implemented, beginning on the 15 of June.

Number	Location	Orientation	Dates (early season)	Dates (mid-season)	Dates (late season)
1	NM9752226512	N	20-31 May	1-10 June & 15-23 June	19-30 September
2	NM9732226670	NW	20-31 May	1-10 June & 15-23 June	19-30 September
3	NM9731725941	S	20-31 May	1-10 June & 15-23 June	19-30 September
4	NM9716725592	SW	20-31 May	1-10 June & 15-23 June	19-30 September
5	NM9739025434	S	20-31 May	1-10 June & 15-23 June*	19-30 September
6	NM9809225627	SE	20-31 May	1-10 June & 15-23 June	19-30 September
7	NM9782826438	NE	20-31 May	1-10 June & 15-23 June	19-30 September
8	NM9845225974	S	20-31 May	1-10 June & 15-23 June*	19-30 September
9	NM9846526493	E	20-31 May	1-10 June & 15-23 June	19-30 September*
10	NM9813427062	W	20-31 May	1-10 June & 15-23 June*	19-30 September
11	NM9673925954	W	20-31 May	1-10 June & 15-23 June	19-30 September
12	NM9700926021	NE	20-31 May	1-10 June & 15-23 June	19-30 September
13	NM9666225731	SW	20-31 May	1-10 June & 15-23 June*	19-30 September

Table 1: *Locations and dates of static bat detector deployments in 2022.*

**partial data loss for these periods due to memory card failure/corruption.*

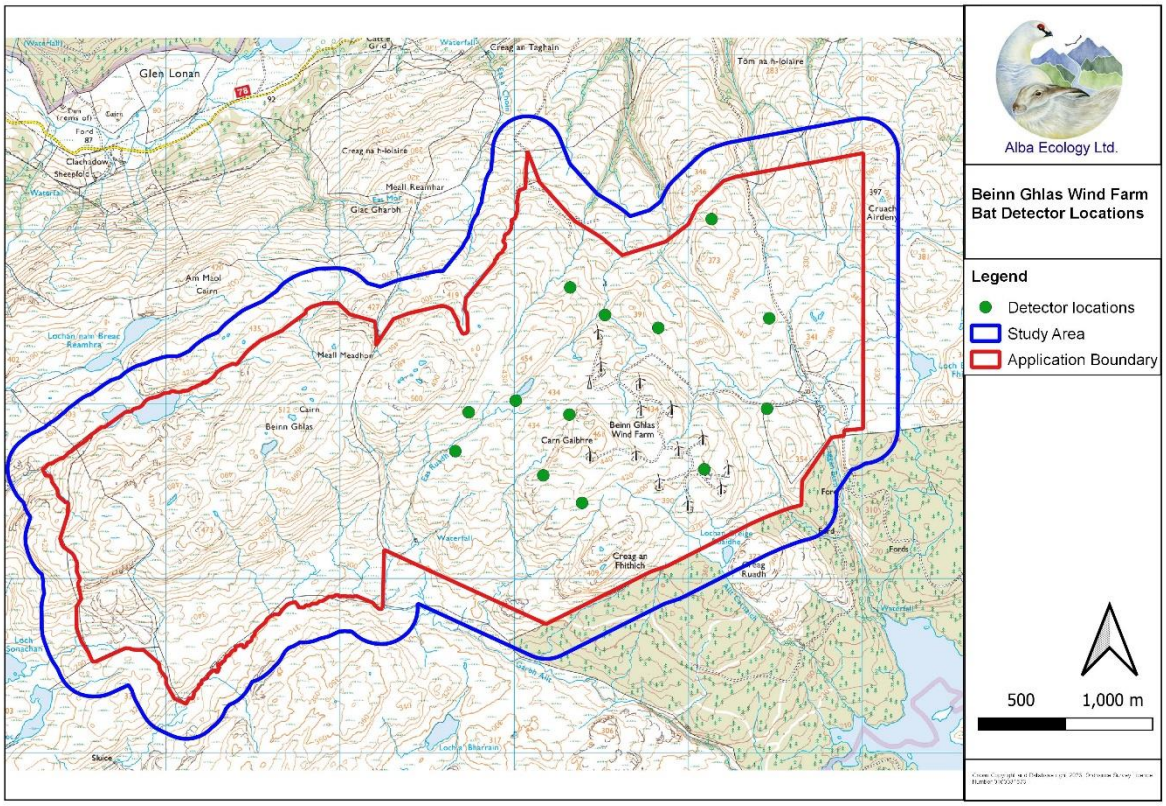

Figure 1: *The Study Area, the locations of the static bat detectors during the survey.*

The detectors were each set to record for a period of 41 nights during May-September 2022. For the whole season combine this resulted in a total of over 528 nights of recordings. Operational failure of the detectors/data cards occurred on seven occasions across the survey period. This resulted in lost data for 28 location nights, giving a cumulative total of 500 nights recorded. The loss of data recordings is a recognised limitation for this type of survey work and, for this survey, only resulted in ca. 5 % if location nights lost. Given that additional nights were incorporated into the survey and a low proportion of the data was lost the data presented is considered robust.

The detectors were set to record only during night, from half an hour before sunset to half an hour after sunrise. This gave a total recording time of 3,726 hours over 13 detector locations over 447 cumulative nights recording (this takes into account the failure of the five detectors for a total of 34 location nights).

The total number of bat passes recorded in the total time gives the mean Bat Activity Indices, though the location of the recordings, the species recorded, seasonality and the apparent use of any nearby linear features were also considered in evaluation.

In analysing bat activity levels, professional judgement has been used previously in the absence of any recognised standard measure to define levels as being high, medium or low. This took into consideration location and habitats as well as professional experience. The updated best practice guidance (NatureScot *et al,* 2021) recommends the use of the online tool Ecobat© [©] as a measure of activity levels. Ecobat© [©] is a programme created by The Mammal Society which analyses activity levels during nights where bat activity was recorded and assigns a value to the activity levels (low, low/moderate, moderate, moderate/high or high) for each location on each night. These values are based on a comparison with other surveys within the local area (the size of the comparison radius can be adjusted within the program). While this provides an objective assessment of activity levels in a given area, the reliability of the results can be impacted by how many previous surveys within the

comparison radius have been submitted to Ecobat© ©. At the time of analysing the results, an issue had arisen with the Ecobat© software and it was under maintenance with no timescale for it to be reinstated. As a result, this feature was not available (NatureScot are aware of this according to the Ecobat© website). Therefore, site specific details, knowledge of bat species behaviour and professional judgement has been used to assess the bat activity levels as high, medium or low. While the appraisal of activity levels was ascertained using professional judgement, the risk assessment took this appraisal and used the tables in the best practice guidance (NatureScot *et al,* 2021) to provide an assessment of risk. (**Shown in Figure 3**).

Recent best practice guidance (NatureScot *et al*, 2021) also recommends using weather data to inform the results. Weather data for the area was obtained from the Open Meteo website[3].This was used in conjunction with Met Office weather station data (Met Office, 2023)[4].

The weather conditions can factor into the number of nights that bats would be likely to be recorded during the survey. Though it is not absolute, it is less likely that bats would be flying during low temperatures, excessive wind or heavy rain. As a result, some of the surveyed nights would be considered unsuitable for bats due to weather conditions. These were when temperatures were consistently below 8 ^{o}C, windspeeds of over 5 m/s or heavy, constant rain (NatureScot *et al,* 2021).

Static bat detector recordings were analysed using Kaleidoscope and Analook software in 2022-23.

Assessment of Potential Risk

According to best practice guidance (NatureScot *et al,* 2021) estimating the vulnerability of bat populations to wind farms is based on three factors:

1. Relative abundance of each species.
2. Inherent collision risk of each species.
3. Bat activity recorded at the site.

NatureScot and co-workers best practice guidance (2021) provides the information regarding the relative abundance and potential collision risk of bat species in Scotland. This is reproduced in Table 2.

Relative abundance	Scotland	Collision risk		
		Low collision risk	Medium collision risk	High collision risk
	Common species			Common pipistrelle Soprano pipistrelle
	Rarer species	Brown long-eared bat Daubenton's bat Natterer's bat		
	Rarest species	Whiskered bat Brandt's bat		Nathusius' pipistrelle Noctule bat Leisler's bat

[3] *Open Meteo Website. Available at: www.open-meteo.com*
[4] *Met Office weather station datasets. Available at: https://www.metoffice.gov.uk/research/climate/maps-and-data/data/index*

Table 2: *Level of potential vulnerability of populations of Scottish bat species (NatureScot et al, 2021, adapted from Wray et al, 2010).*

Combining the level of potential vulnerability identified in **Table 2** with bat activity recorded within the Study Area informs the assessment of potential risk. The guidance provides a risk assessment in two stages, Stage 1 an initial site risk assessment, and Stage 2 overall risk assessment. Stage 1 gives an indication of potential site risk based on a consideration of habitat and development related features. Stage 2 considers the site assessment in relation to the bat activity on the site. These stages were completed to objectively assess the potential risk of the Proposed Development on bats.

The Risk Assessments are reproduced in **Figure 2** and **Figure 3.**

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.

Figure 2: *Stage 1 – Initial site risk assessment. (Reproduced from NatureScot et al, 2021).*

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

Figure 3: *Stage 2 – Overall risk assessment. Reproduced from NatureScot et al, 2021).*

Results

Targeted Desk Study

A Phase 1 Habitat Survey of the Study Area was carried out in 2021 (Beinn Ghlas Wind Farm Habitat Survey Report (Avian Ecology, 2022). The Study Area was recorded as primarily blanket bog and wet heath along with areas of acid grassland, dry heath and marshy grassland. There were several small watercourses within the Study Area.

The extent and quality of potentially suitable bat habitat features in the Study Area were assessed using best practice guidance (NatureScot *et al,* 2021 and BCT, 2016) (**Table 3**).

Features in and around the Study Area	**Suitability for bats (with reference to Figure 2)**
Blanket bog, upland heath, young plantation forestry.	**Low,** low quality bat foraging and commuting with some more moderate features in small patches.
Several small watercourses.	**Low**, some moderate foraging linear features. However, some were ephemeral. None flowed from headwater lochs, and they were not connected to any nearby medium/high quality bat foraging/commuting habitat.
Potential roost sites.	**Low**, little potential for roost sites. Mostly open bog and heath providing low potential. Buildings and oak woodland lower down the hill, ca. 1-2km from Study Area.
Altitude/exposure.	**Low,** relatively high altitude; open aspect windy Study Area, ranging up to 512m a.s.l., although average ca. 400m a.s.l. around proposed turbines. Regular prolonged periods of very low temperatures in winter, spring and autumn.
Nearby designated sites for bats.	**None,** within 10km of the Application Boundary.
Known nearby roost sites.	**Low,** One confirmed roost around 8km from Study Area.

Table 3: *Extent and quality of bat habitats within the Study Area and surroundings.*

The habitat suitability assessment indicated that the Study Area had **low** bat habitat suitability across all features assessed.

The Beinn Ghlas Desk Study (Alba Ecology, 2022) and NatureScot Site Link website (2023) recorded no designated sites with bats as a qualifying feature were found within 10 km of the Study Area. The Beinn Ghlas Desk Study did not include any records for bats within 2 km of the Study Area. Historical records of bat species (NBN Atlas, 2023) were of the soprano pipistrelle, Daubenton's, noctule and brown long-eared bats (**Table 4**). No historic records of bats within the Study Area itself were found.

Best practice guidance recommends noting nearby wind farms as part of the assessment on bats. In additional to the existing and operation Beinn Ghlas Wind Farm the Carraig Gheal Wind Farm is currently operational around 4-5 km from the proposed Beinn Ghlas Wind Farm (Scottish Parliament Information Centre, 2022).

Species	Distance from Study Area	Origin of record
Soprano pipistrelle	~4 km	NBN Atlas
Brown long-eared	~8 km	NBN Atlas
Daubenton's	~5 km	NBN Atlas
Noctule *Nyctalus noctula*	~10 km	NBN Atlas

Table 4: *Historic records of bat presence within 10 km (NBN Atlas, 2023).*

Roost Surveys

The Study Area was thoroughly surveyed looking for potentially suitable bat roost sites during May 2022. None were recorded.

Bat Activity Survey

Static bat detectors recorded a total of 111 individual bat passes during the whole survey period May to September 2022 (**Tables 5 & 6**). These included a total of four species of bat:

- Common pipistrelle;
- Soprano pipistrelle;
- Daubenton's; and
- Brown long-eared bat.

There were small numbers of bat passes recorded across all but one of the detector locations (location 5 (NM 97390 25434), which recorded no bat passes throughout the entire survey period) within the Study Area and across the whole survey period. Some nights recorded more passes than others, the likelihood being that there would be more bat activity recorded on nights with better weather conditions. The number of bat passes recorded was relatively evenly spread across the Study Area and the whole survey period.

The 111 individual bat passes (including four species of bat) were recorded in a total of 3,956.5 hours of recording. This represents a mean bat activity index of 0.03 Bat passes per hour (bpph), or 0.22 bat passes per night (over 500 nights). The range was between a low of 0 bpph to a high of 1.08bpph (calculated from the highest number of passes in a single night from a single detector, on 21 June 2022 at location 3 (NM 97317 25941)).

It is not possible to definitively identify individual bats using the bat detectors only the number of bat passes. Bats fly back and forth, and so the number of bat passes is unlikely to reflect the number of individual bats.

Common pipistrelle

A total of 50 passes by common pipistrelle bats were recorded during the whole survey period (early, mid and late-season). This was considered to be a low number of bat passes for this common and well researched species.

The number of common pipistrelle passes recorded was relatively evenly spread across the Study Area. The maximum number of passes recorded across the entire Study Area in one night, was only 13 passes.

More than half of the records of common pipistrelle passes were during the mid-season (35 out of 50 bat passes). The additional nights the detectors were recording for, plus the warm weather during this period could contribute to this result.

Soprano pipistrelle

A total of 44 passes by soprano pipistrelle bats were recorded during the whole survey period (early, mid and late-season). This was considered to be a low number of bat passes for this common and well researched species.

The number of soprano pipistrelle passes recorded was relatively evenly spread across the Study Area. The maximum number of passes recorded across the entire Study Area in one night, was only 8 passes.

Around half of the records of soprano pipistrelle passes were during the mid-season (23 out of 44 bat passes). The additional nights the detectors were recording for, plus the warm weather during this period could both contribute to this result.

Daubenton's bat

A total of 14 passes by Daubenton's bat were recorded during the whole survey period (early, mid and late-season). These were distributed across the Study Area and across the survey period. A total of nine of the 14 passes were at detector location 12 (which was located by a small, unnamed lochan) during the late season period.

Brown long-eared bat

A total of 3 passes by brown-long-eared bat were recorded during the whole survey period (early, mid and late-season). These were all recorded at location 10 during the late-season period. Location 10 was at the north east end of the Study Area, nearest to areas of scattered trees along watercourse valleys (ca. 400 m from the trees and watercourse).

Detector location number	Ealy season bat passes	Mid-season bat passes	Late-season bat passes	Total bat passes	Total nights recording	Total hours
1	3	18	9	30	41	322
2	0	3	0	3	38	302.5
3	4	11	1	16	41	322
4	1	4	0	5	40	315.5
5	0	0	0	0	34	276.5
6	4	11	0	15	41	322
7	0	5	0	5	40	315.5
8	0	1	0	1	33	270
9	0	4	0	4	37	281
10	2	0	11	13	37	296
11	6	0	0	6	41	322
12	1	1	9	11	39	309
13	0	2	0	2	38	302.5
Total	21	60	30	111	500	3956.5

Table 5: *Total number of bat passes at each location along with total nights and hours recorded.*

Detector location number	Total number of bat passes	Nights recording	Early-season BAI	Mid-season BAI	Late-season BAI	Overall BAI
1	30	41	0.03	0.15	0.09	0.09
2	3	38	0.00	0.03	0.00	0.01
3	16	41	0.04	0.09	0.01	0.05
4	5	40	0.01	0.03	0.00	0.02
5	0	34	0.00	0.00	0.00	0.00
6	15	41	0.04	0.09	0.00	0.05
7	5	40	0.00	0.04	0.00	0.02
8	1	33	0.00	0.01	0.00	0.00
9	4	37	0.00	0.03	0.00	0.01
10	13	37	0.02	0.00	0.11	0.04
11	6	41	0.06	0.00	0.00	0.02
12	11	39	0.01	0.01	0.09	0.04
13	2	38	0.00	0.02	0.00	0.01

Table 6: *Total number of bat passes and bat activity index (BAI) for each detector location across three seasons. The BAI is the number of bat passes per hour (bpph)*

Ecobat© © Comparison

During analysis of the survey (January and February 2023) data, the Ecobat© website and software was unavailable, with no timescale available for its return.

The Ecobat© website stated:

"*Ecobat© is currently offline for essential maintenance.*

The Ecobat© apps (both Within Night and Per Night) are currently offline for essential maintenance. Please keep checking this webpage for further updates.

NatureScot are aware of this maintenance which is preventing users from accessing Ecobat© reports.

We are unable to provide information on when Ecobat© will be back online, as we do not currently have a timeline for when the essential maintenance will be complete" (Ecobat© , 2023)

Therefore, according to the Ecobat© website, NatureScot is aware of this issue. As a result, no use of the Ecobat© software was completed, and levels of activity are calculated using previous experience, site species data and professional judgement.

Given that NatureScot are aware of the issue and have issued no further guidance, that there is no timeline for the Ecobat© software to be restored, and that using previous experience, site species data and professional judgement was the standard method used prior to Ecobat© being available (Ecobat© was launched in 2017, and was first considered in the original (2019) iteration of the updated survey guidance (NatureScot *et al.* 2021)), this approach is considered the most appropriate and robust way forward.

Weather Data

Weather data showed that while the entire survey period was largely suitable due to warm temperatures, low wind speed and dry conditions, there were some nights where survey conditions were sub-optimal or unsuitable. The majority of these nights were in the early season, where around seven of the 12 nights recording would be considered sub-optimal. This was despite the survey being conducted in the latter part of the early season (the time where the best chance of suitable weather occurrence during this part of the season). There were fewer nights of sub-optimal weather during the mid and late season periods (with four nights in the mid-season and three in the late season). The majority of these nights were as a result of low temperatures. This resulted in a total of 27 nights recording in suitable conditions.

Given the variability of weather in western Scotland these results are not considered unusual and the survey should be considered robust.

Assessment of Potential Risk

The assessment of potential risk to bats is required on those species which have an inherent high risk of collision. According to the guidance (NatureScot *et al*, 2021) and **Table 2**, two species recorded are considered to have a high risk of collision with wind turbines, these were common pipistrelle and soprano pipistrelle.

Stage 1: Initial Site Risk Assessment

Habitat Risk - Following best practice guidance (NatureScot et al, 2021), and as depicted in **Figure 2,** the habitat around the Proposed Development has been considered as **low** habitat risk. This is due to the lack of nearby potential roost sites and the generally low-quality foraging habitat (blanket bog and wet heath) that could be used by numbers of foraging bats. While the Study Area has linear watercourse features, they are small and tend to disappear into the groundwater rather than run through the Study Area to another location or run from large headwater lochs. Further, the Study Area is relatively high altitude, open aspect and windy with prolonged periods of (often very) low temperatures in winter, spring and autumn.

Project size - Following the guidance, and as depicted in **Figure 2**, the size of the Proposed Development has been considered as **medium-large**. This is due to the turbine number being classified as medium (12 turbines in the most recent indicative layout) while the turbines proposed were greater than 100 m in height (up to 149.5 m). Therefore, the turbines themselves would be classed as large.

Following the guidance, Stage 1 of the assessment of potential risk a site risk level of 2-3, **low-medium.**

Stage 2: Overall Risk Assessment for Common Pipistrelle

The overall risk assessment is usually completed by multiplying the site risk level from Stage 1 of the assessment with the results from the Ecobat© data. As it is important to understand both the “typical” (median) and the unusually high levels of bat activity at a site, so important peaks are not overlooked, both the highest Ecobat© category and the most frequent category[5] are assessed for common pipistrelle. With Ecobat© being currently unavailable this has been completed using the data from the site and professional judgement. The most frequent number (mode) of bat passes and the highest

[5] The 2021 guidance states “the most frequent activity category”. In mathematical terms, this would be termed the mode. However, the 2021 guidance incorrectly uses the term ‘median’ which is actually the middle number in a sequence of numbers.

number of pat passes for each species were given a score of low, medium or high bat passes and were compared to the site risk level shown in **Figure 3**. Low medium and high were based on previous experience with the Ecobat© software and relative activity levels observed in similar habitats elsewhere.

Common pipistrelles were recorded on 16 of the 41 nights where detectors were present within the Study Area. Therefore, the most frequently recorded number of bat passes (the mode) was no passes (0)[6]. Using **Figure 3**, the risk of the typical activity level (calculated by multiplying the site risk level and the activity level) was nil (0). Therefore, the typical risk for common pipistrelles is determined as **low**.

The highest recorded number of common pipistrelle passes, at any detector, across the whole Study Area and survey period, was three bat passes at detector locations 1 and 4 in the early and mid-seasons. This is considered a low number of bat passes. Using **Figure 3**, the overall risk, (calculated from the site risk level and the activity level) was 3, which is determined, by the 2021 guidance as **low**.

There were a total of 41 nights recorded, and only five nights had three common pipistrelle bat passes (four occurrences at location 1 and one at location 4). With only occasional other small numbers of common pipistrelle passes which did not correspond to important bat activity events such as swarming or commuting. As a result, it is considered that overall, the risk of the Proposed Development for common pipistrelle is assessed as **low**.

Stage 2: Overall Risk Assessment for Soprano Pipistrelle

Soprano pipistrelles were recorded on 18 of the 41 nights. Therefore, the most frequently recorded category was no bat passes (0)[7]. Using **Figure 3**, the risk of the typical activity level (calculated by multiplying the site risk level and the activity level) was nil (0), which is determined, by the 2021 guidance as **low**.

The highest number of bat passes recorded on one night, at a single bat detector location was 5 passes of soprano pipistrelle. This occurred on a single night during the late season. Given the location and habitats (and previous experience with the Ecobat© software), this would likely be considered moderate. Using Figure 3, the overall risk, (calculated from the site risk level and the activity level) was 6-9, which is determined, by the 2021 guidance as **Moderate** for this single night. All other nights had fewer than 5 passes.

Therefore, the overall risk assessment of the Proposed Development for soprano pipistrelle is **low**.

Discussion

The bat activity surveys have shown that there were small numbers of bats occasionally using the Study Area. These results suggest that the Study Area was not very important for bats and indeed on most nights there was no bat activity recorded at all. Four species of bat were recorded as occasionally using the Study Area; common pipistrelle, soprano pipistrelle, brown long-eared and Daubenton's bats.

Common pipistrelles feed in a wide range of habitats comprising woodland, hedgerows, grassland, farmland, suburban and urban areas (BCT, 2010a). This species is widely distributed across the UK, extending to northern parts of Scotland and, compared to other bat species, is more often found in relatively exposed locations and feeds both close to and away from rivers (Swift, 2004). It roosts in buildings, trees and bat boxes. It is one of Britain's commonest bat species, with a UK estimated population of between ca. 0.9-7.5 million (mean population est. ca. 3 million) individuals (The Mammal

[6] The mode and the median were both nil (0).
[7] The mode and the median were both nil (0).

Society, 2018). Common pipistrelles are considered to be susceptible to a high risk of collision with wind turbines.

A total of 50 passes by common pipistrelle bats were recorded during the entire survey period (early, mid and late). The number of common pipistrelle passes recorded was relatively evenly spread across the Study Area.

More than half of the records of common pipistrelle passes were during the mid-season (35 out of 50 bat passes). As the detectors were left in-situ for a longer period during this part of the season, this result is not considered to be unusual.

Despite common pipistrelle being potentially susceptible to a high risk of collision with turbines, an assessment of the potential risk, following the standard guidance, suggests that the Proposed Development represents a low overall risk to common pipistrelle.

Soprano pipistrelles usually feed in lowland sites around lakes and rivers, woodland edges, tree lines or hedgerows and in parks and gardens (BCT, 2010b). Typically, the soprano pipistrelle flies between 2-10 m above the ground (BCT, 2010b), which is below the level of the low point of the sweep of the proposed turbines, although potentially in the zone where barotrauma might take place. It roosts in buildings, trees and bat boxes and prefers lowland river valleys with abundant riparian vegetation (Swift, 2004). The soprano pipistrelle is widely distributed across the UK, apart from the very northern parts of Scotland. It has a UK estimated population of between ca. 2-8.5 million (mean est. ca. 4.6 million) individuals (The Mammal Society, 2018). Soprano pipistrelles are considered to be susceptible to a high risk of collision with wind turbines.

A total of 44 passes by soprano pipistrelle bats were recorded during the entire survey period. Despite soprano pipistrelle being potentially susceptible to a high risk of collision with turbines, an assessment of the potential risk, following the standard guidance, suggests that the Proposed Development represents a low overall risk to soprano pipistrelle bats.

Daubenton's bats are strongly associated with bodies of water and watercourses. They are known for flying low over water to catch insects, sometimes directly from the water's surface although they may potentially fly in the zone where barotrauma might take place. Woodland edge and other edge habitats are also habitats where they can be found (Russ, 2012). They have been observed following watercourses for up to 10 km from their roost site (BCT, 2010c). The species has a UK estimated population of ca. 0.03-4.4 million (mean est. ca. 1 million) individuals (The Mammal Society, 2018). Daubenton's bats are considered to have a low susceptible of collision with wind turbines and therefore, the Proposed Development is unlikely to impact upon the small number of Daubenton's bats that use the Study Area.

Brown long-eared bats are closely associated with tree cover (Entwhistle, 1997), and are known to fly slowly and be very agile when in flight. The species has a UK population of ca. 52,000-2.2 million (mean estimate 934,000) individuals (The Mammal Society, 2018). Brown long-eared bats are considered to have a low susceptible of collision with wind turbines and therefore, the Proposed Development is unlikely to impact upon the small number of brown long-eared bats that use the Study Area.

Though little information about the distance from the rotating blade at which bats may experience barotrauma exists, recent research in the USA suggests that the air pressure changes from turbine blades which could potentially be harmful to bats may only occur within a very limited distance (<1 m) around the blade itself (Lawson *et al,* 2018).

The upland Study Area is considered to be relatively poor for bats, which may be associated with the altitude as well as the habitat suitability. There are considered likely to be three main effects of increasing altitude on bats in Scotland. The first is a significant decrease in temperature with a drop of between 0.6 and 1 ºC for every 100 m increase in altitude as a result of the fall in atmospheric pressure (Begon *et al,* 1996). The second is a significant change in habitat availability and likely prey abundance (exposed open upland areas, with no trees or bushes on nutrient poor soils). The third is likely to be an effect of high incidences of poor weather, reducing foraging opportunities. Only a few studies have investigated the effect of altitude on bat distribution and these show a general trend of decreasing relative abundance with increasing altitude, possibly due to a greater heat loss from flight membranes at higher elevations (Vaughan, 1986).

While some nights recording were conducted in sub-optimal weather conditions, (seven during the early season, four during the mid-season and three during the late-season) this would not be considered to be unusual for an upland area of Argyll.

Given the results from the desk study, bat activity and roost surveys, there was no evidence that the Study Area holds bat populations of regional, national or international importance.

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