

# Appendix 11E

## Bat Survey Report

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# Appendix 11E

## Bat Survey Report



# 1. Introduction

Wood Environment & Infrastructure UK Ltd (Wood) has been commissioned by RWE to undertake a series of surveys in order to identify the baseline bat activity at a remote upland forested site called Enoch Hill 2 (referred to as the Site) (main Site only) which is located approximately 6km south west of New Cumnock, East Ayrshire (Figure 11E.1).

Bat surveys were previously undertaken at the site by EnviroCentre in 2014<sup>1</sup> and a summary of the findings of those surveys, together with relevant survey information from other RWE projects in proximity to the site including Enoch Hill Wind Farm, is provided in Section 3.1 below.

NatureScot consider that bat surveys should be repeated if there has been a significant change to a site or to proposals; the survey results detailed in this report update the baseline protected species information for the site as appropriate for consideration of potential effects of any wind farm development at Enoch Hill 2. This report sets out the methods used, the current baseline in relation to bat species at the site and includes an evaluation of the site in respect of bats which draws on all of the known bat activity data at and around the site.

The Extended Phase 1 habitat survey of the access track includes an assessment of the potential for bat habitat<sup>2</sup>.

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<sup>1</sup> Summary document incorporating tables and charts has been made available to Wood for information.

<sup>2</sup> Wood (2018). *Monquhill Wind Farm: Baseline Ecology Report of Proposed Access Route*.

## 2. Methods

### 2.1 Desk study

A data request for bat records and bat roosts within a 5km radius of the Site boundary was submitted to the South West Scotland Environmental Information Centre (SWSEIC), formally known as Dumfries and Galloway Environmental Records Centre in 2020. Analysis of species data focussed only on records made within the last ten years, as older records may give an inaccurate picture of the current ecological interest within the site and the surrounding area (Appendix 11A).

The desk study involved a review of the following documents for information on bat records and in particular the presence and location of roosts:

- EnviroCentre 2014 bat report<sup>1</sup>; and
- Wood bat survey reports for Benbrack<sup>3</sup>, Quantans Hill, Lorg<sup>4</sup> and Enoch Hill<sup>5</sup> wind farms<sup>6</sup>.

Biological records data from the Dumfries and Galloway Environmental Records Centre (DGERC) obtained on behalf of RWE for the Benbrack, Quantans Hill and Lorg wind farm projects and dating back to 2010, were also interrogated for bat roost records within a 15km search radius of the site, and for wider detail on the bat assemblage in the wider area.

### 2.2 Survey scope

The Bat Conservation Trust (BCT) has developed minimum standards for bat surveys at potential wind farm sites, which are referred to here as the 2012 BCT Guidelines<sup>7</sup> (these were the prevailing guidelines at the time the bat survey strategy was initially designed). Some aspects of bat survey guidelines (for example, general guidance on bat roost inspection surveys, emergence/re-entry surveys and bat activity surveys) have been superseded with the publication of the 2016 BCT Guidelines<sup>8</sup>. Both sets of guidelines have been considered in the development of survey methods for Enoch Hill 2. This guidance has now been superseded by the 2019 SNH et al guidance<sup>9</sup>.

A desk-based assessment of the likely level of risk posed to local bat populations by the proposed development was carried out on the basis of known information about the site and surrounding area (i.e. based on the 2014 survey data<sup>1</sup>) and this information is shown in Table 2.1.

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<sup>3</sup> Wood (2010) Benbrack Wind Farm Bat Survey Report

<sup>4</sup> Wood (2013) Lorg Wind Farm Bat Survey Report

<sup>5</sup> Wood (2014) Enoch Hill Wind Farm. Bat Survey Report

<sup>6</sup> All reports by Wood (formerly AMEC Environment & Infrastructure UK Ltd) and prepared on behalf of RWE. These sites are all situated within a radius of approximately 20km of the Monquhill site, in broadly comparable elevations and habitat types.

<sup>7</sup> Hundt, L. (2012). *Bat Surveys: Good Practice Guidelines. Surveying for Onshore Wind Farms*. 2<sup>nd</sup> Edition. Bat Conservation Trust, London. (replaced by publication of the 3<sup>rd</sup> Edition in 2016).

<sup>8</sup> Collins, J. (ed.) (2016). *Bat Surveys for Professional Ecologists: Good Practice Guidelines* (3<sup>rd</sup> Edition). The Bat Conservation Trust, London.

<sup>9</sup> <https://www.nature.scot/sites/default/files/2019-01/Bats%20and%20onshore%20wind%20turbines%20-%20survey%2C%20assessment%20and%20mitigation.pdf>

Table 2.1 Site Risk Analysis

Potential risk factor	Potential risk level	Comment
<b>Geographical location</b>	Medium	Site located in South West Scotland within range of three high risk species: noctule ( <i>Nyctalus noctula</i> ), Leisler's ( <i>N. leisleri</i> ) and Nathusius' pipistrelle ( <i>Pipistrellus nathusii</i> ). The site is located within Carsphairn Forest which is heavily afforested (Sitka spruce conifer plantation).
<b>Potential roost features</b>	Low	Conifer plantation forestry has inherent low suitability for roosting bats due to the high planting densities and scarcity of cracks and crevices which bats use for roosting.  There may be some roost features in buildings at the site itself but this is likely to be the only potential roost feature within the site boundary.  Outwith the site boundary mature trees and buildings in the Doon, Nith and Afton glens (which circle the site to the west, north and east respectively) have been demonstrated to support roosting bats, and it is assumed that bats will commute along river valleys and other prominent features to foraging areas such as those found within parts of the site.
<b>Foraging habitat suitability</b>	Low	Dominated by conifer plantation woodland which is relatively unproductive in terms of insect prey species. Foraging activity is likely to be concentrated on forest rides and edges particularly where there is running water.
<b>Commuting route suitability</b>	Low	Blocks of commercial plantation forestry have inherently low commuting suitability; small/low-flying species (pipistrelle and <i>Myotis</i> ) are likely to use rides, walls and watercourses locally; high flying species will follow larger topographical cues such as river valleys and forestry edges.
<b>Species likely to be present – High risk populations<sup>10</sup></b> <b>Noctule</b> <b>Leisler's</b> <b>Nathusius' pipistrelle</b>	Medium	Site located within range of three high risk species.  Existing site data confirm occasional visits from Leisler's bat in summer and autumn; this species is also recorded on the adjacent Enoch Hill, Benbrack, Lorg and Quantans Hill areas, together with isolated suspected noctule.  Leisler's bat is thought to be the more frequently encountered <i>Nyctalus</i> species in South West Scotland <sup>11</sup> ;  Nathusius' pipistrelle is rare throughout its range but is widespread across the UK <sup>12</sup> .
<b>Species likely to be present – Medium risk populations (high collision risk)</b> <b>Common pipistrelle (<i>P. pipistrellus</i>)</b> <b>Soprano pipistrelle (<i>P. pygmaeus</i>)</b>	Medium <sup>13</sup>	Soprano pipistrelle bat activity dominated at all detector locations at Enoch Hill 2 in 2014; common pipistrelle were also recorded. However, due to the poor quality of habitat within the survey area which is dominated by dense coniferous plantation woodland, bat activity on-site is low and so the potential risk level is Medium.
<b>Species likely to be present – low risk populations</b> <b>Brown long-eared (<i>Plecotus auritus</i>)</b>	Low	<i>Myotis</i> species are present. Brown long-eared bats not recorded.  Populations of these species are at low risk from wind turbines.

<sup>10</sup> Based on Natural England (2012). *Bats and Onshore Wind Turbines – Interim Guidance*. TIN 051.

<sup>11</sup> E.g. Haddow, J. (2012). *Looking for Leisler's in Scotland*. Auritus Consulting.

<sup>12</sup> E.g. <http://www.nathusius.org.uk/Distribution.htm>.

<sup>13</sup> Potential risk level has been increased from Low to Medium to reflect NatureScot's most recent published guidance *Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation* (NatureScot et al., 2019)

Potential risk factor	Potential risk level	Comment
Daubenton's ( <i>Myotis daubentonii</i> ) Natterer's bat ( <i>M. nattereri</i> ) Whiskered bat ( <i>M. mystacinus</i> )		

Based on the above and on previously obtained bat survey data the potential risk level is considered to be **low**. The 2012 BCT guidelines recommended for bat surveys to be undertaken for a minimum of one season (i.e. one year) and within 200m + rotor radius of potential turbine locations. The guidelines state:

- For low risk sites: one bat activity transect survey per season [spring, summer, autumn]; five consecutive nights' automated surveys at ground level per season; and, where automated surveys at height are used, five consecutive nights' automated surveys per season.

A bat study scope was devised which took into account the revised layout of the proposed development and which aimed to confirm (or otherwise) whether there had been any change to the existing baseline (as determined by previous surveys). The scope of the study was as follows.

- A desk study of existing data taken from previous reports and publicly available data;
- External bat roost assessment surveys of Monquhill Farmhouse and associated outbuildings, complemented by dusk emergence and dawn re-entry surveys (together with infra-red cameras on one occasion) to determine presence/absence of bats within the building;
- Winter surveys to identify potential hibernation roost activity at Monquhill Farmhouse;
- Bat activity transect (manual) surveys; and
- Automated (static) detector surveys were undertaken once per season, to coincide with the manual surveys.

No bat activity surveys at height were undertaken due to the absence of features on which to deploy detection equipment at height.

Accurate temperature, wind and relative humidity data were available from the Enoch Hill meteorological mast (met mast) which is situated at NS 56525 07055 approximately 1.2km west of the site boundary.

Detailed methodologies for the study elements are provided in the remainder of this section.

## 2.3 Bat roost assessment

There is a single building present within the site at Enoch Hill 2, comprising a disused farmhouse of stone construction with partly rendered (harling) walls and slate roof, together with corrugated iron/wooden lean-to structures on the eastern and western aspects of the building (collectively referred to as Monquhill Farmhouse). Although currently disused (and estimated as having been out of use for at least a decade) the farmhouse remains intact although with spalling of rendered surfaces and cracks on the outside walls, and gaps beneath roof slates. A fully collapsed corrugated iron outbuilding or byre is present a short distance from the farmhouse but this was deemed both unsafe and unsuitable for bat roosting, being reduced to a heap of rusting panels.

A preliminary roost assessment involving an exhaustive search of the exterior of the building was undertaken on 4 May 2016 by Senior Ecologist Claire Hopkins (SNH bat licence no. 20423). A torch and binoculars were used to scrutinise the roof and walls for signs of bats indicating possible roost access points such as droppings, staining or visible bats.

Due to warning signs on the door of the farmhouse no attempt was made to access the interior of this structure although adjacent lean-tos were entered for the purpose of survey.

## 2.4 Emergence / re-entry surveys

It was deemed that the preliminary roost assessment results indicated a reasonable likelihood of a roost being present, and combined with the impracticalities of a full internal inspection, a series of dusk emergence and dawn re-entry surveys was undertaken as follows:

- 07 September 2016 (dusk);
- 28 September 2016 (dawn);
- 18 May 2017 (dusk); and
- 26 June 2017 (dusk).

Timings for the surveys followed those recommended in the 2016 BCT guidelines (15 minutes before sunset to 90 minutes after sunset; and 90 minutes before sunrise to 15 minutes after sunrise) and details of the survey timings and weather conditions are provided in **Annex 11A**. Two experienced surveyors equipped with AnaBat SD2 detectors were stationed at the south eastern and the north western corners of Monquhill Farmhouse during the surveys, and surveyors were able to see two walls/roofs from their respective vantage points, thus full coverage of the house and lean-tos was possible. Notes were made of all bat activity, along with details of direction of flight and any other observed behaviour (e.g. social calls or “swarming” activity<sup>14</sup>). Two video cameras and infra-red lamps were utilised on the final survey in June 2017 to supplement surveyor visuals and footage from the two cameras was reviewed manually in the office to check for additional footage of bats emerging/re-entering roosts.

## 2.5 Winter (hibernation) survey

Surveys were undertaken at Monquhill Farmhouse during winter 2016-2017 in order to determine the use (or likely use) of the cottage and associated outbuildings for hibernation. During hibernation – which typically spans November to March depending on weather conditions – bats enter extended periods of torpor where their metabolic rates are reduced, along with body temperature and breathing rate, to coincide with harsh weather and lack of insect prey. Bats may hibernate singly or in small groups and roosts need to offer appropriate climatic conditions (stable low temperatures above freezing, and with high relative humidity) and have low levels of disturbance. Bats will tend to rouse from torpor occasionally to drink and feed and for this reason the winter survey involved deploying SM2 detectors around and inside the buildings at Monquhill in order to detect activity. Given that access to Monquhill Farmhouse is not possible (see section 2.9), four SM2 detectors were set up around the outside of the building and one within the outhouse on the western side of the cottage. Detectors were deployed on 14 December 2016 and recorded between the following periods:

- 14 – 21 December 2016 (7 nights);
- 18 - 25 January 2017 (7 nights); and
- 28 February – 8 March 2017 (8 nights).

Detectors were set up in the same way as above, but set to record for an additional half-hour either side of sunrise/sunset.

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<sup>14</sup> Swarming is a behaviour typically observed when bats are returning to a roost; as it usually takes longer for bats to return to a roost than to leave it. Returning bats may pass the roost entrance multiple times, and may even land close to the access point before entering. Where several bats are involved there may be social calling and/or chasing behaviour.

## 2.6 Manual bat activity survey

Bat activity transect surveys were undertaken once per season (spring, summer and autumn 2016) by two surveyors walking along a single transect route, starting and ending at Monquhill Farmhouse, and encompassing forest rides, open moorland on Strandlud Hill, burns and access tracks within Carsphairn Forest, as well as Monquhill Farmhouse itself.

The surveys were undertaken in appropriate weather conditions (i.e. temperatures of over 7 degrees<sup>15</sup>, no greater than moderate wind speeds, no/negligible rainfall). The method involved walking at a slow pace with a hand-held bat detector (AnaBat SD2+, Titley Electronics). Surveys started at approximately 10-15 minutes before sunset and lasted around 2 – 2.5 hours. The timings, along with weather conditions observed during surveys, are detailed in **Annex 11E.2**. The transect routes are shown on Figures 11E.2, 11E.3 and 11E.4.

## 2.7 Static bat activity survey

Automated (static) detector surveys were undertaken once per season, to coincide with the manual surveys in spring, summer and autumn 2016. Seven detectors were deployed across the variety of available habitats including forestry rides, open moorland on Strandlud Hill, riparian habitat and Monquhill Farmhouse; a control detector was placed outwith the site in Afton Glen. The locations of the static detectors are detailed in Figure 11E.1 and Table 2.2. The detectors were programmed to operate between 1 hour before sunset and 1 hour after sunrise<sup>16</sup> full-time until their collection after a minimum of 5 nights' recording.

Song Meter SM2+ bat detectors (Wildlife Acoustics) were selected to record bat activity. The surveys relied on detectors being set up with pre-programmed Secure Digital High Capacity (SDHC) memory cards (settings information is shown in Box 1) and microphones were replaced on each survey to ensure high sensitivity. Microphones were all set up at a height of approximately 1 – 1.5m (using small stakes to keep microphones above vegetation and out of reach of mice) and were therefore sampling bat activity at "ground level".

Box 1	SM2+ bat detector settings
<b>Recording time</b>	60 minutes before sunset until 60 minutes after sunrise on a daily basis (adjusted for Monquhill site location), Latitude: 55.32°N Longitude: 4.23°W.
<b>Advanced settings</b>	Sample rate 192000, High pass filter 16kHz, trigger level; 12dB, 2s.
<b>Recording medium</b>	2x 32GB SDHC Class 10 memory cards pre-set using Song Meter Configuration Utility programme.
<b>Power</b>	Internal D cell batteries
<b>Microphone</b>	Single omnidirectional SMX-US microphone with 2m extension cable.

Because static detector surveys rely on remote monitoring of bat activity, no data is available about the direction of travel or the behaviour of the bat (except where "feeding buzzes" or social calls were distinguishable during call analysis). It is also not possible to determine whether activity can be attributed to individual bats passing the microphone multiple times or many bats passing once. The absolute number of bats is therefore not known; instead the relative levels of bat activity based on bat passes is discussed<sup>17</sup>.

<sup>15</sup> Note that the 2016 BCT guidelines recommend appropriate survey weather as being at temperatures of above 10 degrees. However, we argue that this value is unnecessarily high for a site in Scotland, where temperatures may exceed 10 degrees for only a few nights per season and where bats are well adapted to foraging in temperatures of as low as 6 degrees.

<sup>16</sup> This exceeds the standard of 30 minutes before sunset and 30 minutes after sunrise; within the battery capabilities at low light.



<sup>17</sup> Bat calls are flexible by nature, with individual bats adjusting their calls according to their behaviour, the prevailing weather conditions and the presence of other bats, thus the same bat may produce echolocation calls that look very different each time it passes a microphone; there is also a degree of overlap between individuals and even between species which means that calls may look similar in AnaLook even if they are produced by a different bat.





Table 2.2 Static detector locations

Detector Name / Number	Habitat description / detector deployment dates	Photograph
<p><b>Location1</b> <b>Afton Glen</b>  <b>NS 62917 08367</b></p>	<p>Detector is situated on a fence post adjacent to Bolt Burn on the edge of a forestry plantation in Afton Glen.</p> <p>Detectors functional between:</p> <p>04/05/16 – 17/05/16 (13 nights)</p> <p>28/06/16 – 15/07/16 (16.5 nights)</p> <p>12/10/16 – 20/10/16 (7.5 nights)</p>	
<p><b>Location.2</b> <b>Fence/2nd ride</b>  <b>NS 57995 06444</b></p>	<p>Detector is situated on a fence post within a woodland ride approx. 50m north of a deer viewing platform.</p> <p>04/05/16 – 17/05/16 (13 nights)</p> <p>28/06/16 – 14/07/16 (16 nights)</p> <p>12/10/16 – 20/10/16 (8 nights)</p>	

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Detector Name / Number	Habitat description / detector deployment dates	Photograph
<b>Location3</b> <b>Monquhill</b> <b>Farmhouse</b> <b>NS 59104 06748</b>	<p>Detector located on a wall immediately to the south of Monquhill Farmhouse. Narrow river valley, open improved grassland and immature plantation forestry stands present in vicinity.</p> <p>04/05/16 – 16/05/16 (12 nights)</p> <p>28/06/16 – 14/07/16 (16 nights)</p> <p>12/10/16 – 21/10/16 (8.5 nights)</p>	
<b>Loaction4</b> <b>Caravan</b> <b>NS 59376 07071</b>	<p>Detector is situated on a fence post on the northernmost edge of the site where woodland edge and Glenhastel Burn reach the open slopes of Ewe Hill. Close to a disused caravan at the end of the navigable forestry track.</p> <p>04/05/16 – 17/05/16 (13 nights)</p> <p>28/06/16 – 16/07/16 (17.5 nights)</p> <p>12/10/16 – 20/10/16 (8 nights)</p>	

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Detector Name / Number	Habitat description / detector deployment dates	Photograph
<b>Location 5 First ride</b> <b>NS 58488 06590.</b>	Detector is situated in middle of an open forestry ride north of Strandlud Hill.  04/05/16 – 18/05/16 (14 nights) 28/06/16 – 16/07/16 (13 nights) 12/10/16 – 21/10/16 (8.5 nights)	
<b>Loaction 6 Strandlud Hill</b> <b>NS 58088 05859</b>	Detector is on gently sloping ground to south west of Strandlud Hill.  04/05/16 – 19/05/16 (14.5 nights) 28/06/16 – 14/07/16(16 nights) 12/10/16 – 21/10/16 (8.5 nights)	



Detector Name / Number	Habitat description / detector deployment dates	Photograph
<b>Location</b> <b>7Strandlud Pond</b> <b>NS 58293 06217</b>	Detector is adjacent to a small pond near the top of Strandlud Hill in the centre of the site.  04/05/16 – 17/05/16 (13 nights) 28/06/16 – 13/07/16 (15 nights) 12/10/16 – 21/10/16 (9 nights)	

\* All detectors were functional for at least the minimum requirement of 5 consecutive nights per season. In spring and summer 2016 in excess of 10 consecutive nights' data were obtained from all of the detectors. Only in autumn, when long night length and cooler temperatures expedite battery exhaustion, were fewer than 10 nights' recording achieved.

## 2.8 Analysis

Bat passes (here defined as discrete bursts of echolocation calls and characterised by individual AnaLook call files<sup>18</sup>) were manually processed by Claire Hopkins and counted using the Count Files function in AnaLook which produces a simple list of date-time (24 hour)-species label-number of passes. These lists – the raw data – were then manipulated in Excel.

The analysis of bat activity data included the calculation of Bat Activity Indices (BAI)<sup>19</sup> to account for the fact that the absolute number of bat passes can only be compared when the number of recording nights (BAI per night) or the number of hours (BAI per hour) are taken into account. BAI per night requires the number of complete nights a bat detector was functioning to be known (this information is included in Table 2.2 above) and the BAI per hour requires the number of hours each detector was functioning to be known (i.e. 1 hour before sunset until 1 hour after sunrise, multiplied by the number of nights of survey).

Despite the analysis of call parameters using tools in AnaLook some bat calls could not be identified to species level. This is particularly true with *Myotis* species, and with common/soprano pipistrelle bats; and with noctule/Leisler's bats; whose call parameters overlap. An identification to genus level (i.e. *Myotis*, *Pipistrellus* or *Nyctalus* species) was necessary where identification to species level was ambiguous.

## 2.9 Limitations

Access was not possible into the main part of Monquhill Farmhouse due to locked doors and windows and the presence of signs warning of unsafe structure. This prevented surveyors from undertaking internal

<sup>18</sup> It is acknowledged that pulses of sound is a more accurate unit of measurement, being the smallest unit possible (ref. Sowler, S. & Middleton, N. (2013). 'Bat passes' – redundant or still useful? Article in IEEM's In Practice, issue 79, March 2013). However, we consider that for direct comparisons of relative bat activity between species/genera passes as defined above is the more appropriate term of measurement here. It also enables direct comparison with other EC&R sites on which the same approach to call analysis has been taken.

<sup>19</sup> Bat activity index – a means of estimating the number of passes per unit time (e.g. one night/one hour) – is calculated by dividing the number of passes by the unit time.

inspections of the building at any time of year. It was possible to deploy detectors around the outside of the building, and in an unlocked lean-to structure on the western side of the cottage, as detailed in section 2.5 above.

Bat call analysis at one of the detector locations – Afton Glen in Spring 2016 – revealed a large number of passes from *Pipistrellus* species, and, unusually in the experience of the analyst and in that part of Scotland, the call parameters of many of these calls overlapped with the upper limits of Nathusius' pipistrelles. However, analysis of a number of social calls which were also detected during that time period from pipistrelle species, and comparison with the library of Nathusius' bat social calls<sup>20</sup>, together with the fact that none of the suspect calls were at the lower end of the expected frequency range for this species, led the analyst to conclude that the calls were all in fact common pipistrelle. Nathusius' pipistrelle is therefore discounted from the site species list and is not discussed further in this report.

Internal (D type) batteries are used to power SM2 detectors and the longevity of batteries is dependent upon weather (in particular temperature). In inside conditions D cell batteries can last up to 20 nights, but deploying outside will inevitably affect their capacity. This was evident in the autumn surveys where fewer than the recommended 10 consecutive nights' activity could be recorded at any of the detector locations (see Table 2.2 for details). All detector locations were able to record for at least 7.5 nights (which exceeds the requirement of 5 nights minimum) and results reported below take into consideration the number of recording nights, in the form of Bat Activity Indices (BAI). Winter surveys were inevitably less productive, with detectors active for only 3-7 nights at a time. However, any activity could be anticipated to be picked up by the remaining detectors, all of which are within 10m of the next nearest detector.

The 'control' (Afton Glen) static detector apparently failed during the autumn recording session, resulting in no bat activity being recorded. The ramifications of this are taken into account in the discussion below.

The bat surveys were undertaken during 2016-2017 using the most up to date guidance at that time to determine the survey methods<sup>21,22</sup>. However, this guidance is now superseded by 2019 SNH et al guidance<sup>23</sup>. One of the main changes as a result of the new guidance is the increased level of potential vulnerability to both common and soprano pipistrelle bats from wind turbines. The 2016 guidance suggested that both common and soprano pipistrelle bats had a low collision risk with wind turbines however this has now been increased to a high collision risk (with a medium population vulnerability). As such the potential risk to both common and soprano pipistrelle bats as a result of the proposed development has increased from low to medium. However, given the small scale development (2 turbines), the low habitat risk (small number of roost features and low quality foraging habitat within the Site which is dominated by conifer plantation woodland) the site risk analysis remains low. The survey effort undertaken at the Site generally exceeds the survey effort requirement of 2019 guidance for a low risk site which would require only two static detectors placed at the proposed turbine locations during spring, summer and autumn for 10 consecutive nights. However, a total of seven static detectors were deployed across the site (including the two turbine locations) over spring, summer and autumn. The number of nights recorded in autumn was below the recommended 10 nights e.g 8.5 nights and 9 nights at the turbine locations (Annex11E.3), however all other recording periods exceeded the recommended 10 consecutive nights. Overall, it is considered that the survey effort during the 2016 surveys meets the survey effort criteria of the most up to date 2019 guidance.

<sup>20</sup> Middleton, N., Froud, A. and French, K. (2014). *Social calls of the Bats of Britain and Ireland*. Exeter: Pelagic Publishing.

<sup>21</sup> Hundt, L. (2012). *Bat Surveys: Good Practice Guidelines. Surveying for Onshore Wind Farms*. 2<sup>nd</sup> Edition. Bat Conservation Trust, London. (replaced by publication of the 3<sup>rd</sup> Edition in 2016).

<sup>22</sup> Collins, J. (ed.) (2016). *Bat Surveys for Professional Ecologists: Good Practice Guidelines* (3<sup>rd</sup> Edition). The Bat Conservation Trust, London.

<sup>23</sup> <https://www.nature.scot/sites/default/files/2019-01/Bats%20and%20onshore%20wind%20turbines%20-%20survey%2C%20assessment%20and%20mitigation.pdf>

## 3. Results

### 3.1 Desk study

The results of the SWSEIC data search for bat records and bat roosts within 5km of the Site boundary is presented in **Table 3.2**. Only records within the last 10 years have been included in this search.

Table 3.2 Records of legally protected/ priority species within 2km of the Site boundary (2010-2020)

Species	Number of records	Year of most recent record	Conservation designation
<b>Myotis</b> bat	4	2016	HabRegs2, WCA5
Whiskered/ Brandt's bat	2	2016	HabRegs2, WCA5
Daubenton's bat	5	2016	HabRegs2, WCA5, SBL
Natterer's bat	5	2016	HabRegs2, WCA5, SBL
Leisler's bat	4	2016	HabRegs2, WCA5
Pipistrelle bat	9	2016	HabRegs2, WCA5
Common pipistrelle bat	9	2016	HabRegs2, WCA5, Ayr-LBAP
Soprano pipistrelle bat	9	2016	HabRegs2, WCA5, Ayr-LBAP, SBL
Brown long-eared bat	2	2016	HabRegs2, WCA5, SBL

**Notes:**  
**HabRegs2** – The Conservation (Natural Habitats & c) Regulations 2010 (Schedule 2); **WCA 5** – Wildlife and Countryside Act (Schedule 5); **WCA9/INV** – Non-native species listed in Schedule 9 of Wildlife and Countryside Act; **Ayr-LBAP** – Ayr Local Biodiversity Action Plan; **SBL** – Scottish Biodiversity List

A review of the summary of data received from the Envirocentre 2014 bat report returned the following for the Monquhill site:

- Static surveys undertaken in May, August and September 2014 recorded for 5-7 consecutive nights. Common pipistrelle comprised 24% of the bat passes; soprano pipistrelle 59% and both Leisler's bat and *Myotis* species returned 4% of the passes. It is not known what the missing 9% is accounted by; and
- Three manual surveys undertaken in May, June and October 2016 returned single bat passes from pipistrelle species including soprano pipistrelle.

A review of past reports undertaken by Wood on behalf of RWE since 2011 provided the following information relating to bats and bat roosts:

- Benbrack (located approximately 5.5km south west of the site):
  - ▶ There are no statutory or non-statutory sites designated for the presence of bats in Dumfries and Galloway or Ayrshire;
  - ▶ An information request to Dumfries and Galloway Environmental Record Centre (DGERC) returned no bat records within 15km of Benbrack (within D&G only);

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- ▶ A search of Scottish Natural Heritage's (SNH) interactive tool (SNHi – since superseded) returned records of *Pipistrellus* sp. and Daubenton's bat;
  - ▶ No roosts were found within the Benbrack study area;
  - ▶ Static detector surveys in 2012 returned records of soprano pipistrelle, common pipistrelle, *Nyctalus* sp. (i.e. noctule *N. noctula* or Leisler's *N. leisleri*)<sup>24</sup> and *Myotis* sp. (i.e. Daubenton's, Natterer's or whiskered bat)<sup>16</sup>; and
  - ▶ Static detector surveys in 2013 including surveys "at height" using two meteorological masts, returned very low numbers of bat passes. Leisler's bat was confirmed to be present, with a peak in August; a single *Nyctalus* sp. pass "at height" was returned.
- Quantans Hill (located approximately 9km south of the site):
    - ▶ A desk study undertaken in 2011 returned records of *Pipistrellus* sp., brown long-eared bat and common pipistrelle from a DGERC data request;
    - ▶ A small soprano pipistrelle summer (possibly maternity) roost and small roosts for soprano and common pipistrelle were found in farm buildings at Marbrack;
    - ▶ Static detector surveys and transect surveys undertaken in 2011 recorded common and soprano pipistrelle, *Myotis* sp. including Daubenton's bat, and noctule;
    - ▶ Met mast surveys undertaken in 2013 returned passes from *Myotis* sp., common and soprano pipistrelle, brown long-eared and two noctule passes; and
    - ▶ Seasonal static detector and transect surveys undertaken in 2015 returned common and soprano pipistrelle, *Myotis* species including Daubenton's bat, and Leisler's bat (summer only).
  - Lorg (located approximately 6km south east of the site):
    - ▶ A desk study undertaken in 2013 returned records of eight of the nine species present in D&G and Ayrshire being present within 15km of Lorg. These are soprano and common pipistrelle, Daubenton's, natterer's, whiskered, noctule, Leisler's and brown long-eared;
    - ▶ Surveys undertaken on two met masts (at ground level and at height) in 2013 returned only one pass at height and returned Leisler's, common and soprano pipistrelle and both *Myotis* and *Nyctalus* species; and
    - ▶ Lorg Farmhouse – a disused collection of buildings in the centre of the Lorg site – was found to support a soprano pipistrelle roost and potentially common pipistrelle and Daubenton's bat as well.
  - Enoch Hill (situated directly adjacent and to the north of the proposed extension site).
    - ▶ Craigdullyear Mine – located at approx. NS664154 or 11km north east of the Monquhill site boundary – is a known hibernaculum (i.e. winter hibernation roost) for at least four species: Daubenton's, Natterer's, whiskered bat and brown long-eared bat. Surveys undertaken by Amec Foster Wheeler in 2012 confirmed the presence of *Myotis* species and brown long-eared as well as two pipistrelle species within and around the mine;
    - ▶ Surveys undertaken during 2013 appropriate for a low risk site confirmed the presence of common and soprano pipistrelle and *Myotis* species including Daubenton's bat. Relatively high Leisler's bat (*Nyctalus*) activity was recorded at detector locations at lower elevations in

<sup>24</sup> due to a degree of overlap between the call parameters of noctule and Leisler's bats it is not possible to rule out the presence of either species; ambiguous calls are noted as *Nyctalus* sp. Similarly *Myotis* calls are difficult to isolate with certainty.

the north of the Enoch Hill site and it was concluded that this species likely forages over the site during summer; and

- ▶ Surveys undertaken during 2014 included roost surveys in the Nith Glen, and monitoring of at-height bat activity at two met masts on site (returning pipistrelle, *Myotis* and Leisler's bat calls in low numbers), together with static detectors at ground level and in the glen.

A recent study<sup>25</sup> of high risk bat species in southern Scotland indicates spatial variation in the distribution of the high risk species noctule and Leisler's, with little overlap in range between the two and with Leisler's bat being the dominant species in the west (i.e. where the site is located) and noctule in the east and south. Relatively few of the areas studied contributed a disproportionate percentage of the overall activity and this indicates that the species are localised<sup>26</sup>. These observations are reaffirmed by our own observations at other wind farm development sites in southern Scotland as detailed above, with only Quantans Hill returning confirmed (isolated) records of noctule.

## 3.2 Bat roost assessment survey results

A single building – Monquhill Farmhouse – was assessed for its suitability to support roosting bats. Whilst no bat droppings or other signs of bat activity were recorded during the daytime roost assessment survey, as recorded in Section 2.2 above it was concluded that there was a reasonable likelihood of a roost being present given presence of potential access points in the roof and stone walls and the building was considered to provide high roosting potential. The results of further survey effort at Monquhill Farmhouse are shown in sections 3.3 and 3.4 below.

## 3.3 Emergence/re-entry survey results

A total of four surveys were undertaken at Monquhill Farmhouse in autumn, spring and summer; survey details are provided in **Annex 11E.1** and Photograph 1 shows the location of bat roosts identified.

Individual bats were seen to be emerging from or re-entering roosts – all located on the western wall of the farmhouse – on three out of the four surveys and three species (soprano and common pipistrelle and *Myotis* species [suspected Daubenton's bat]) were confirmed to use the building for roosting.

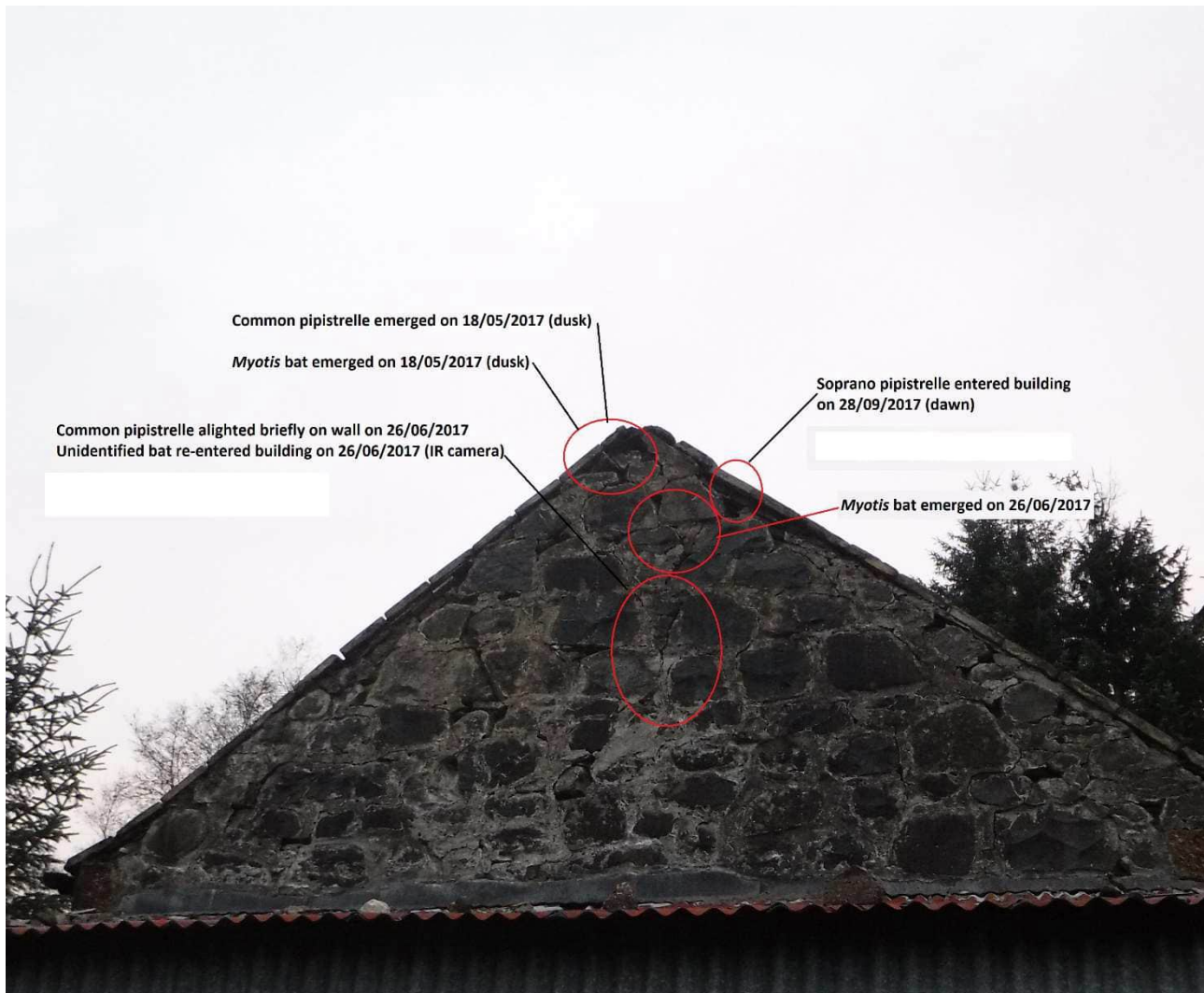
It is considered that sufficient survey effort has been employed to demonstrate that the farmhouse is used regularly as a small, mixed-species non-maternity and non-hibernation roost.

<sup>25</sup> <https://www.nature.scot/sites/default/files/2017-10/Publication%202017%20-%20SNH%20Commissioned%20Report%201008%20-%20A%20survey%20of%20high%20risk%20bat%20species%20across%20southern%20Scotland.pdf>

<sup>26</sup> Newson, S.E., Evans, H.E., Gillings, S.M Jarrett, D. and Wilson, M.W. (2017). *A survey of high risk bat species across southern Scotland*. Scottish Natural Heritage Commissioned Report no. 1008.



Photograph 1 – location of bat roosts on western wall of Monquhill Farmhouse (circled in red).



### 3.4 Winter (hibernation) survey results

Bat detectors deployed between December 2016 and March 2017 returned no bat activity.

Weather conditions experienced during the winter of 2016-17 have been reported to have been relatively dry and mild, with temperature anomalies recorded nationally in December, January and February<sup>27</sup>. Particularly mild or unseasonable weather can have a profound effect on hibernation behaviour in bats, resulting in more attempts to forage and reduced periods of torpor<sup>28</sup>. As such, if bats were hibernating at Monquhill Farmhouse during the monitoring periods there is a reasonable likelihood that any arousing and flying bats would have been detected. Whilst it cannot be ruled out that small numbers of bats may use the building for roosting during winter there is no evidence to suggest that it was used in the periods studied, therefore the building is assumed not to be used as a hibernation roost.

<sup>27</sup> <http://www.metoffice.gov.uk/climate/uk/summaries/2017/winter>. Accessed 06/04/2017.

<sup>28</sup> E.g. [http://www.bats.org.uk/pages/climate\\_change.html](http://www.bats.org.uk/pages/climate_change.html); Hope, P.R., Jones, G. (2012). Warming up for dinner: torpor and arousal in hibernating Natterer's bats (*Myotis nattereri*) studied by radio telemetry. *Journal of Comparative Physiology B*, vol. 182, Issue 4 pp 569-578.

### 3.5 Manual bat activity survey results

Three dusk bat activity surveys were undertaken in May, June and October 2016.

Very low levels of bat activity were recorded during the surveys with no bat passes recorded at all on the May survey, a single *Myotis* pass during the June survey and a single soprano pipistrelle pass recorded during the October survey. The species recorded were also recorded during static monitoring surveys (see section 3.6). On both occasions the passes were recorded along conifer plantation edges and the passes were brief, consistent with bats passing between roosts and foraging areas associated with emergence after sunset. The direction of travel could not be determined.

Detailed survey results together with weather conditions experienced are provided in **Annex 11E.2** and Figures 11E.2, 11E.3 and 11E.4.

### 3.6 Static bat activity survey results

Tables and charts showing the detailed static bat activity survey results from 7 detector locations within and outside of the site boundary are provided in 0.

The number of recording nights achieved by each detector are shown in **Annex 11E.3** (Table 11C.1). A minimum of 7.5 nights of recording was achieved on every detector on every survey period and in most cases this was exceeded. This represents over 2 nights of data more than the recommended 5 consecutive recording nights, thus improving the sample size and statistical power of the data.

A total of 15,893 bat passes were recorded within the three recording periods (see Table 11C.2). A chart in 0 shows the proportion of passes represented by each species. At least five species were recorded: brown long-eared, common and soprano pipistrelle, Leisler's and Daubenton's bat. Passes which could not be accurately assigned to species level could be identified to genus and *Myotis*, *Nyctalus* and *Pipistrellus* species were each recorded. Common pipistrelle passes dominated with over 78% of the total bat activity, followed by soprano pipistrelle (18.9%), Daubenton's bat (1.4%) and with other species/species groups combining to give less than 1% of the total activity. Brown long-eared was only recorded on one occasion although this species is frequently under-represented in acoustic surveys due to its quiet calls.

Taking the number of recording nights into account the data were interrogated further to identify peaks of activity according to detector location, as shown in Table 11C.3 and associated chart. The peak bat activity was in spring at Location 1 (Afton Glen) with over 960 passes per night<sup>29</sup>. Activity at locations 3 (Monquhill Farmhouse) and 4 (Caravan) were moderate and apparently increased in the autumn. Activity at locations 2 (Fence/2<sup>nd</sup> ride), 5 (First ride), 6 (Strandlud Hill) and 7 (Pond) all had very low or no bat activity.

Species composition according to detector location is shown in Table 11C.4. Because many of the species/species groups represented across the site were detected in such low numbers there is a skew in the data:

- Brown long-eared (Location 3 only);
- Common pipistrelle (Locations 1, 2, 3, 4 and 5);
- Daubenton's (Locations 1, 2, 3, 4 and 5);
- Leisler's (Location 1 only);
- *Myotis* sp. (Locations 1, 2, 3 and 6);

<sup>29</sup> NB the detector at location 1 failed in Autumn

**Draft - see disclaimer**

- *Nyctalus* sp. (Location 3 only);
- Soprano pipistrelle (Locations 1, 2, 3, 4 and 5); and
- Pipistrelle sp. overlaps with common and soprano pipistrelle records.

## 4. Discussion and Recommendations

### 4.1 Legislation

All bat species in Scotland are afforded legal protection under the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended). This makes it an offence to deliberately or recklessly:

- capture, injure or kill a wild bat;
- harass a wild bat or group of wild bats;
- disturb a wild bat in a roost (any structure or place which it uses for shelter or protection);
- disturb a wild bat while it is rearing or otherwise caring for its young;
- obstruct access to a bat roost or to otherwise deny the animal use of the roost;
- disturb a wild bat 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; and
- disturb a wild bat 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.

In addition it is an offence of strict liability (i.e. it does not have to be demonstrated that the action was deliberate or reckless) to damage or destroy a bat roost, irrespective of whether it is occupied at the time.

### 4.2 Bats and wind farms

#### Overview

Research-based evidence for the effects of wind farm construction, operation and decommissioning on bats, their behaviour and populations has been growing since the first reports of bat mortality from wind turbines in the USA in 1981.

Potential effects during construction can be summarised as:

- temporary disturbance to roosting bats from construction activities (noise, vibration and lighting);
- temporary loss and degradation of foraging habitats or severance of local commuting routes via vegetation removal along cable/overhead line routes and in areas of construction compounds and crane pads; and
- temporary disturbance to commuting and foraging bats from construction activities (noise, vibration and lighting).

Bats and their roosts are protected under the above legislation and the effects of construction activities on roosting behaviour are well-documented<sup>30</sup>. Temporary effects on foraging and commuting habitats resulting from construction of access roads and foundations have been cited as having the potential to cause small-medium impacts on bats, e.g. as a result of vegetation clearance or pollution events, depending on the site and the species that are using the site.

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<sup>30</sup> E.g. Stone, E. (2013). *Bats and lighting. Overview of current evidence and mitigation.*  
[http://www.bats.org.uk/data/files/Bats\\_and\\_Lighting\\_-\\_Overview\\_of\\_evidence\\_and\\_mitigation\\_-\\_2014.pdf](http://www.bats.org.uk/data/files/Bats_and_Lighting_-_Overview_of_evidence_and_mitigation_-_2014.pdf)

Potential effects during decommissioning are assumed to be similar to those during construction.

Potential effects during operation can be summarised as:

- permanent loss of foraging habitat within the footprint of a wind farm development including turbines and access roads, which results in a reduction in food resources for bats;
- collisions with fast-moving turbine blades resulting in trauma injuries (bats are not known to be killed by direct collisions with stationary blades);
- barotraumas<sup>31</sup>; and
- alterations to bats' behaviour as a result of the presence of wind turbines.

One of the main causes of impacts associated with wind farms and bats is direct mortality. It is not clear why bats may be attracted to wind turbines although some actively visit turbines to feed on insects that accumulate around the turbine towers and blades; a modification to habitats has also been cited as a reason for bats being attracted to the turbines<sup>32</sup>; and bats which use trees or which are seeking social opportunities may be disproportionately at risk<sup>33</sup>. There are very few deaths associated with particular wind speeds (e.g. most foraging occurs at wind speed of <4m/s); few bats are known to feed at >8m/s although noctules are more tolerant to higher wind speeds<sup>34</sup>.

The pattern of mortality is not fixed and seasonal variations in mortality with a peak in August and September have been documented elsewhere<sup>35</sup>.

The highest mortality rates have been found within bat species which are adapted to catch insect prey in the open air (i.e. several metres away from trees and other obstacles). Such species are morphologically and physiologically adapted to straight and fast flight and are the species most often observed flying at turbine rotor height. The bat species found in Scotland which show higher mortality rates are noctule, Leisler's bat and Nathusius' pipistrelle and their populations are categorised as being at 'high risk' from the effects of wind turbines in the BCT Guidelines.

The findings of a recent UK-wide study<sup>36</sup> has indicated that noctules and pipistrelle species are indeed being killed by wind turbines although there is not sufficient evidence to confirm if wind turbines pose a threat to UK bat populations.

## Assessing the effects of wind farms on bats

When assessing the likely impacts of a proposed wind farm development on individual bats and local bat populations, appropriate survey techniques need to be employed. In the case of a wind farm development at Enoch Hill 2 the survey requirements for low risk sites proposed by the BCT guidelines were met through the completion of seasonal bat activity transect surveys undertaken in May, June and October 2016, along with seasonal ground-level static detector surveys in spring, summer and autumn (10 days per month of activity

<sup>31</sup> Barotraumas are internal injuries sustained as a result of rapid changes in air pressure at turbine blades, as distinct from direct contact with the blades. Detailed in Baerwald, E.F., D'Amours, G.H., Klug, B.J. and Barclay, R.M.J. (2008). Barotrauma is a significant cause of bat fatalities at wind turbines. *Current Biology* vol. 18.

<sup>32</sup> Reviewed in Tosh, D.G., Montgomery, W.I. & Reid, N. (2014). *A review of the impacts of wind energy developments on biodiversity*. Report prepared by the Natural Heritage Research Partnership (NHRP) between *Quercus*, Queen's University Belfast and the Northern Ireland Environment Agency (NIEA) for the Research and Development Series No. 14/02

<sup>33</sup> P. M. Cryan, P. M. Gorresen, C.D. Hein, M. R. Schirmacher, R. H. Diehl, M. M. Huso, D. T. S. Hayman, P. D. Fricker, F. J. Bonaccorso, D. H. Johnson, K. Heist, and D. C. Dalton (2014). *Behavior of bats at wind turbines*. PNAS vol. 111 no. 42, pp. 15126–15131.

<sup>34</sup> E.g. Dietz, C., von Helversen, O. and Nill, D. (2007). *Bats of Britain, Europe and Northwest Africa*.

<sup>35</sup> Ahlen I., Baagoe H.J. & Bach L. (2009). Behaviour of Scandinavian bats during migration and foraging. *Journal of Mammalogy* 90(6):1318-1323

<sup>36</sup> Matthews, F., Richardson, S., Lintott, P. and Hosken, D. (2016). *Understanding the risk to European Protected Species (bats) at onshore wind turbine sites to inform risk management*. Final report, University of Exeter.

analysed<sup>37</sup>), complemented by a desk-based study and consultation exercise (see Section 2.1 of this report, and Table 2.1).

Surveys were designed to identify the likelihood of impacts listed above occurring and how this may affect individual bats as well as the favourable conservation status of local bat populations. According to BCT survey guidelines most effort should focus on bat populations which are most likely to be affected by direct mortality and may be most threatened by the development (see Table 4.1).

Table 4.1 Bat populations likely to be threatened due to impacts from wind turbines (from SNH (2019) Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation)

Low	Medium	High
Long-eared bat	Soprano pipistrelle	Nathusius' pipistrelle
<i>Myotis</i> species	Common pipistrelle	Noctule
		Leisler's

In particular, recent evidence has indicated that records of dead bats in the UK are almost exclusively noctule and pipistrelle species, and that the proportions of soprano pipistrelle and noctule bat casualties are higher than their estimated relative national abundance, and also than the relative proportions of their calls recorded in ground-level acoustic surveys<sup>26</sup>.

Based on the findings of European studies (e.g. Rydell *et al.* 2012<sup>38</sup>) the differences in the numbers and proportions of bat species which are killed at wind turbines reflects local/regional differences in the occurrence of high risk species. The risk of bats being killed by wind turbines varies between species as outlined in Table 4.2. Impacts to individuals of each species also need to be considered, as different species will exploit different landscape features at different times of the year. Efforts should be made to identify significant concentrations of bats, particularly those species identified as high risk, as indicated in Table 4.2.

Table 4.2 Bat populations likely to be at risk of individual casualties from wind turbines (from SNH (2019) Bats and Onshore Wind Turbines: Survey, Assessment and Mitigation)

Low	Medium	High
<i>Myotis</i> species		Noctule
Long-eared bat		Leisler's
		Nathusius' pipistrelle
		Common pipistrelle
		Soprano pipistrelle

While this issue is still a contentious one and a great level of uncertainty still exists, effort still needs to be made to identify whether there is a risk of direct mortality as a result of the development to bat populations using the area.

<sup>37</sup> Note that battery life was insufficient in autumn 2016 but that a minimum of 7.5 nights' data were collected and analysed for each detector.

<sup>38</sup> Rydell, J., Engstrom, H., Hedenstrom, A., Larsen, J.K., Petterson, J. and Green, M. (2012). The effect of wind power on birds and bats – a synthesis. Report 6511 for the Swedish Environmental Protection Agency.

## Implications for bats at Enoch Hill 2

The only feature within the site which is considered suitable to support roosting bats is at Monquhill Farmhouse, which has been shown to support very low numbers of at least three species (common pipistrelle, soprano pipistrelle and *Myotis* species (thought to be Daubenton's bat) – see Section 3.3). Given the emergence/re-entry patterns, which have been established through a series of surveys throughout the year in 2016-17, it is considered that the farmhouse represents an occasional roost or day roost, and does not represent a hibernation or maternity roost, which would have a higher conservation value. As has been observed at other similar sites nearby (e.g. Lorg, Quantans Hill and Enoch Hill), buildings which are otherwise isolated from other similar features will be used by bats for roosting, and there are a number of opportunities for foraging nearby which would make exploitation of such features – even on a sporadic basis – beneficial to individuals which roost or hibernate elsewhere within a locality (e.g. at lower altitudes or where optimal/near-optimal food resources are available).

The SNH (2019) require a study area of 200m plus rotor radius from proposed turbine locations for potential roost features; other sources<sup>39</sup> have recommended buffers of 2km from maternity roosts to turbines to reduce the potential for effects on flying bats (in particular juveniles) but there is no evidence that this would apply to Enoch Hill 2.

Roost records returned from the desk study were a mixture of species that are at low risk (Daubenton's, brown long-eared bat) and medium risk at population level (common and soprano pipistrelle) from wind farm development (, ) and there are no known noctule, Leisler's or Nathusius' pipistrelle roosts within the desk study area.

Species composition (as recorded in static [ground-level] detector surveys) was broadly similar to that of other upland sites close to commercial forestry plantations (i.e. Benbrack, Quantans Hill, Lorg and Enoch Hill) as reported earlier in this section. As such, soprano pipistrelle and common pipistrelle activity dominated, with *Myotis* species following; brown long-eared and *Nyctalus* (Leisler's bat) activity was very low.

Comparatively high levels of bat activity were consistently recorded at glen level (i.e. the Afton Glen) compared with on the site; as discussed in the Enoch Hill Wind Farm report (where the same patterns were noted) this is likely to reflect the generally higher quality and increased diversity of foraging habitats and habitat complexity together with overall lower exposure to wind enjoyed at lower altitudes; as well as the increased availability of roosts.

### Pipistrelle species

Pipistrelle species (common and soprano bats only) dominated the activity on-site, accounting for 97.8% of all activity (78.6% and 18.9% respectively; the remaining 0.3% made up from calls which could not be accurately ascribed to one or other species due to their overlapping call frequencies at around 50 kilo Hertz (kHz).

No calls were attributed to Nathusius' pipistrelle, which is rare although widespread across the UK. Recent southern Scotland surveys indicate that southern Scotland is likely to contain at least a few maternity colonies and a few hundred individuals. The risks to this species from further wind farm development at Enoch Hill 2 are considered negligible as the current evidence suggests that this species does not use the site.

Summer roosts of both soprano and common pipistrelles tend to be in crevices around the outside of newer buildings, the average roost consisting of 200 individuals<sup>40</sup>. However roosts can also be found in trees and bat boxes where pipistrelles can also be found in autumn and over winter. The desk study identified several roost and field records for these species at other wind farm proposed sites adjacent to the Enoch Hill 2 site

<sup>39</sup> Burrows, L. (2013). Noctule bats and wind turbines. Feature article in CIEEM In Practice. Pp 11 – 15.

<sup>40</sup> BCT (2010). Species Information Sheets – Soprano pipistrelle and Common pipistrelle.



and it is likely that populations are concentrated in the villages and wooded areas in the glens. Pipistrelles tend to emerge from their roost 20-30 minutes after sunset and forage mainly on small insects such as midges. Soprano pipistrelles appear to have a closer affinity to riparian landscapes where they can be found feeding over wetland habitats. Common and soprano pipistrelles are known to travel 5km from the roost<sup>41</sup> and although they have broad habitat preferences they show preferences for riparian woodland and parkland and tend to avoid very open habitat such as moorland and grassland where linear features are comparatively rare<sup>42</sup>. They often forage along regularly-used flightpaths (Swift, Undated).

Both soprano and common pipistrelle were recorded at all locations on the site; foraging and social calling behaviour were also observed in many of the calls, implying the regular presence of more than one bat using features across the site. The Afton Glen detector accounts for the majority of the recorded bat activity of these species and it is considered that this location would provide the most productive insect prey resource and that activity will be concentrated in this area, with forays onto the moorland and forested areas including the site during suitable weather conditions.

There are also high numbers of pipistrelles recorded at Monquhill Farmhouse (Location 3) and the caravan (location 4) which are likely to be from bats exiting/entering the roost site and foraging around this site. There are very low numbers of bat passes within the main development site suggesting that bats are roosting on site but are foraging around the roost site as well as outside of the Site.

While soprano and common pipistrelle bats are two of the most common and widespread of all species of bat resident within Scotland, changes in agricultural practices throughout the UK have accelerated their decline over recent decades. Populations are being continuously monitored through surveys such as the National Bat Monitoring Programme (NBMP) and through data collected in the field by professionals. Bats have also been included as one of the UK Biodiversity Indicators since 2008. The 2014 State of the UK's bats report<sup>43</sup> indicates that common pipistrelle populations are increasing, according to upward trends in field surveys, although soprano pipistrelle – a priority species in the UK – did not show any significant change in the years up to 2013.

Soprano and common pipistrelle bats have been assessed as being at medium risk at the species level, but their individual populations are assessed as being high risk from wind turbines (see Tables 4.1 and 4.2). Relatively low levels of pipistrelle bat activity were recorded at all detector locations within the Site in comparison with a control detector positioned outside the site boundary at Location 1 Afton Glen, with very low mean Bat Activity Indices are considered likely to represent small numbers of bats passing multiple times during foraging. Activity was seen to be lowest at those locations which are remote from the main river valleys. The above factors indicate that the risks to local pipistrelle bat populations are likely to be very low.

### Brown long-eared bat

No brown long-eared activity was recorded at the site.

The brown long-eared bat is widespread throughout most of Britain (except in northern Scotland and offshore Isles) (e.g. Dietz et al. 2009). This species of bat is often associated with open woodland which can include deciduous and coniferous habitats. They can be found foraging and commuting along hedgerows, treelines and sheltered valleys. During the summer, brown long-eared bats often roost in the roofs of buildings and can be found often in clusters around ridge ends or around chimneys. They are often found to hibernate in cooler places such as within crevices in caves. They are commonly found to occupy holes in trees, bat and bird boxes.

<sup>41</sup> Avery, M. I. 1991. Pipistrelle. In: The Handbook of British Mammals (Ed. by G. B. Corbet & S. Harris), pp. 124-128. Oxford : Blackwell. Also Swift (Undated). Bat species in Scotland. <http://www.snh.gov.uk/docs/C208532.pdf>.

<sup>42</sup> <http://www.bio.bris.ac.uk/research/bats/britishbats/batpages/commonpipi.htm>.

<sup>43</sup> BCT (2014). State of the UK's bats 2014. [http://www.bats.org.uk/pages/nbmp\\_reports.html](http://www.bats.org.uk/pages/nbmp_reports.html). This is the most recent report and the 2017 State of the UK's bats report was due in autumn 2017.



Due to the fact that this species was not recorded at the site, and because the preferred foraging and roosting habitats of this species are absent from the site, and also given the low risks to this species from turbine development, it is concluded that this species is not at risk from turbine development at Enoch Hill 2.

### *Myotis* species

*Myotis* species activity recorded during static detector surveys was identified only to genus level due to the large overlap in call frequencies within the genus *Myotis* which allows for a level of subjectivity in call identification (see Section 2.4).

It was not possible to definitively categorise *Myotis* bat calls to species level. The higher number of calls from this species group at detector location 3 (Monquhill Farmhouse) is likely to be a result of *Myotis* bats exiting/entering the roost at Monquhill Farmhouse. Only very low levels of activity were recorded within the site (Annex 11E.3) suggesting that although the bats are roosting within the Site, they are foraging/commuting outside of the Development Site.

*Myotis* bats can travel long distances, flying at low altitudes, from their roosts to their foraging grounds, typically up to 6km from their roost. These bats are fairly widespread throughout the UK and appear to be increasing over most of their range and typically exploit aquatic and wetland habitats with a dietary preference for small flies, caddis flies and mayflies.

All species within the genus *Myotis* are afforded the same level of protection but no *Myotis* species have been included on the UK BAP priority species list or the SBL.

As they have been assessed as being at low risk both at a species and population level, it is considered unlikely that *Myotis* bats would be adversely affected by any proposed wind farm development at Monquhill.

### *Nyctalus* species

Even small increases in mortality rates can have significant effects on populations of noctule and Leisler's bats, which have comparatively short average lifespans and low birth rates (e.g. Dietz *et al.* 2009). Noctule and Leisler's bats have been assessed as being at high risk at both the species and population levels (see Tables 4.1-4.2).

Low numbers of Leisler's passes (total 36) were recorded at the Afton Glen (control) detector location with no confirmed noctule activity at all. A single *Nyctalus* pass was recorded at Monquhill Farmhouse (a single individual, assumed to be passing through the site), and because of the absence of confirmed noctule activity this pass is assumed to have been Leisler's bat. Noctule is considered to be absent from the site.

Leisler's bats are considered to be scarce in Britain, with the UK population being estimated as 28,000 (Battersby, 2005) and recent estimates are that the Scottish population exceeds early estimates<sup>26</sup>. Leisler's bats are assessed as being at high risk from wind turbines at both the individual and population levels. Their wing morphology makes them high, fast and efficient fliers, the compromise being that they are best suited to open habitats as they are not very manoeuvrable. They also forage over long distances<sup>44</sup> with several foraging areas visited in a night from a roost. This species has been noted to prefer foraging over pasture as well as woodland edge and riparian habitats, and even forages over coastal areas.

The recent report on high risk bat species in southern Scotland<sup>26</sup> indicates that the site is on the periphery of the known distribution of Leisler's bat in this region, although the habitats adjacent to the control detector in Afton Glen reflect the habitat preferences of this species. The observed small numbers of passes per night during spring and summer 2016 (the autumn detector failed as acknowledged in section 2.9) is representative of a small number of individuals foraging within the glen. As there are no data for autumn 2016 it is not known whether there is any seasonal variation in activity, however, the data collected from the

<sup>44</sup> Altringham, J. D. (2003). British Bats. New Naturalist Series, London.

Enoch Hill site (as reported in section 3.1) indicate that the open areas at lower elevations of the glens are of higher value to this species relative to upland areas.

Leisler's bats do pass through the site, however, the overall evidence indicates that this occurs rarely and that activity is concentrated at lower elevations where the most favourable roosting and foraging habitat is. Whilst it is acknowledged that any Leisler's bats which do use the site are likely to be at the extreme edge of their range within south west Scotland, the site itself is not thought to be representative of the preferred roosting, foraging or commuting routes and when combined with data collected from Enoch Hill in 2012-14 the risk to Leisler's bats from wind turbine development is considered to be low.

# Annex 11E.1

## Emergence/re-entry survey details

Table 11A.1 Emergence/re-entry survey details – Monquhill Farmhouse

	07 September 2016 (dusk)	28 September 2016 (dawn)	18 May 2017 (dusk)	26 June 2017 (dusk)
<b>Surveyors</b>	Claire Hopkins Jenny Sneddon	Jenny Sneddon Kristi Leyden	Claire Hopkins David Knox	Claire Hopkins Jenny Sneddon
<b>Weather conditions</b>	Warm – 14-18 degrees No rain 80% cloud cover Calm	Mild – 12-13 degrees No rain 90% cloud cover Light wind with moderate gusts	Chilly – 9.5 – 8 degrees No rain <10% cloud cover Calm	Mild – chilly: 13 – 9 degrees Very light rain 100% cloud cover Calm Lots of midges flying
<b>Survey start/end times</b>	19.40 – 21.25 (15 mins before sunset to 90 minutes after sunset)	05.45 – 07.30 (90 minutes before sunrise to 15 minutes after sunrise)	21.10 – 23.00 (15 minutes before sunset to 90 minutes after sunset)	21.47 – 23.45 (15 mins before sunset to 90 minutes after sunset)
<b>Species recorded</b>	Common pipistrelle Soprano pipistrelle <i>Myotis</i> sp. Possible brown long-eared (not determined)	Common pipistrelle Soprano pipistrelle	Common pipistrelle Soprano pipistrelle <i>Myotis</i> sp.	Common pipistrelle <i>Myotis</i> sp. Unidentified pipistrelle bat (common or soprano)
<b>Key notes</b>	Single burst of echolocation from common pipistrelle and observation of a bat flying over house around 20 minutes after sunset. <b>Emergence not confirmed.</b>	Soprano pipistrelle bat entered a roost on the western side of the farm building above lean-to at 06.50 (25 minutes before sunrise). <b>Roost confirmed (Soprano pipistrelle).</b>	Common pipistrelle bat emerged (+ social call) at 21.58 from western gable; single <i>Myotis</i> sp. (small – possibly Daubenton's bat) flew out from gable end towards valley at 22.52. <b>Roost confirmed (common pipistrelle + <i>Myotis</i>)</b>	Common pipistrelle appeared over the burn, circled once and alighted briefly on the western wall at 22.23; a few minutes later a bat was observed (on IR camera) entering a crack on the wall. <i>Myotis</i> emerged from western wall at 23.30. <b>Roost confirmed (possible common pipistrelle + <i>Myotis</i>)</b>

## Annex 11E.2

# Manual bat activity survey details

Details of walked transect surveys – see section 3.5 and Figures 11E.2, 11E.3 and 11E.4.

Table 11B.1 Manual bat activity survey – spring 2016

Site Name	Date	Survey type	Sunset	Survey start	Survey end
Enoch Hill 2	25/05/2016	Dusk transect	21.38	21.38	23.38
Temperature (°C)	Precipitation	Cloud cover	Moon phase	Wind speed/direction	Surveyors
10 at start, 8 at end	Light rain second hour	50%	No moon visible	Calm, moderate gusts occasionally	Jenny Sneddon Natalie Hirst
Real time	Location	Species	Max no. individual bats	Bat passes	Notes
No bats recorded					

Table 11B.2 Manual bat activity survey – summer 2016

Site Name	Date	Survey type	Sunset	Survey start	Survey end
Enoch Hill 2	27/06/2016	Dusk transect	22.02	22.02	00.05
Temperature (°C)	Precipitation	Cloud cover	Moon phase	Wind speed/direction	Surveyors
10 at start, 8 at end	None	90%	No moon visible	Calm	Jenny Sneddon Natalie Hirst
Real time	Location	Species	Max no. individual bats	Bat passes	Notes
23:45	NS 58482 06580	<i>Myotis</i> sp.	1	1	Single pass along conifer edge

Table 11B.3 Manual bat activity survey – autumn 2016

Site Name	Date	Survey type	Sunset	Survey start	Survey end
Monquhill	12/10/2016	Dusk transect	18.23	18.23	20.30
Temperature (°C)	Precipitation	Cloud cover	Moon phase	Wind speed/direction	Surveyors
10 at start, 8 at end	None	100%	¾ moon	Calm	Jenny Sneddon David Knox
Real time	Location	Species	Max no. individual bats	Bat passes	Notes

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Site Name	Date	Survey type	Sunset	Survey start	Survey end
20:24	NS 58960 06690	Soprano pipistrelle	1	1	Single pass along forestry path near Monquhill Farmhouse

## Annex 11E.3

### Static bat activity survey details

Details of static bat detector surveys – see Figure 11E.1 for detector locations and section 3.6 for analysis.

Table 11C.1 Number of recording nights

	Location .1 Afton Glen	Location.2 Fence/2nd ride	Location.3 Monquhill Farm	Location.4 Caravan	Location.5 First ride	Location 6 Strandlud Hill	Location7 Pond
<b>Spring</b>	13	13	12	13	14	14.5	13
<b>Summer</b>	16.5	16	16	17.5	13	16	15
<b>Autumn</b>	7.5	8	8.5	8	8.5	8.5	9

Table 11C.2 Number of bat passes

Species	Spring	Summer	Autumn	Total
<b>Brown long-eared</b>	1			1
<b>Common pipistrelle</b>	10771	1187	534	12492
<b>Daubenton's</b>	62	83	80	225
<b>Leisler's</b>	7	29		36
<b>Myotis sp.</b>	69	10	7	86
<b>Nyctalus sp.</b>	1			1
<b>Pipistrelle sp.</b>	6	22	22	50
<b>Soprano pipistrelle</b>	1815	963	224	3002
<b>Total</b>	<b>12732</b>	<b>2294</b>	<b>867</b>	<b>15893</b>

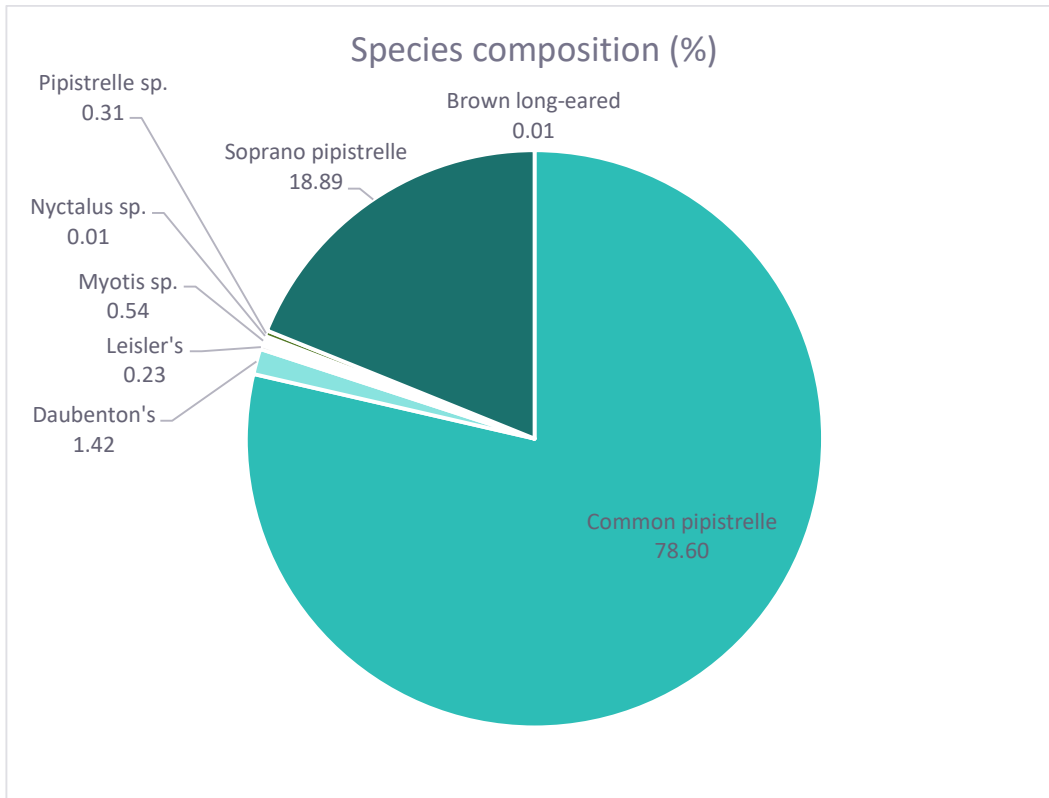
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Table 11C.3 Bat activity index per night by location

<b>BAI/night</b>	<b>Spring</b>	<b>Summer</b>	<b>Autumn</b>
<b>Location 1 Afton Glen</b>	960.23	103.94	0.00
<b>Location 2 Fence 2nd ride</b>	0.31	0.38	0.38
<b>Location 3 Monquhill Farmhouse</b>	18.58	19.44	55.53
<b>Location 4 Caravan</b>	1.00	13.77	48.88
<b>Location 5 First Ride</b>	0.64	1.62	0.00
<b>Location 6 Strandlud Hill</b>	0.00	0.00	0.12
<b>Location 7 Pond</b>	0.00	0.00	0.00

Data have been corrected according to the number of detection nights (see Table 3.8 above)



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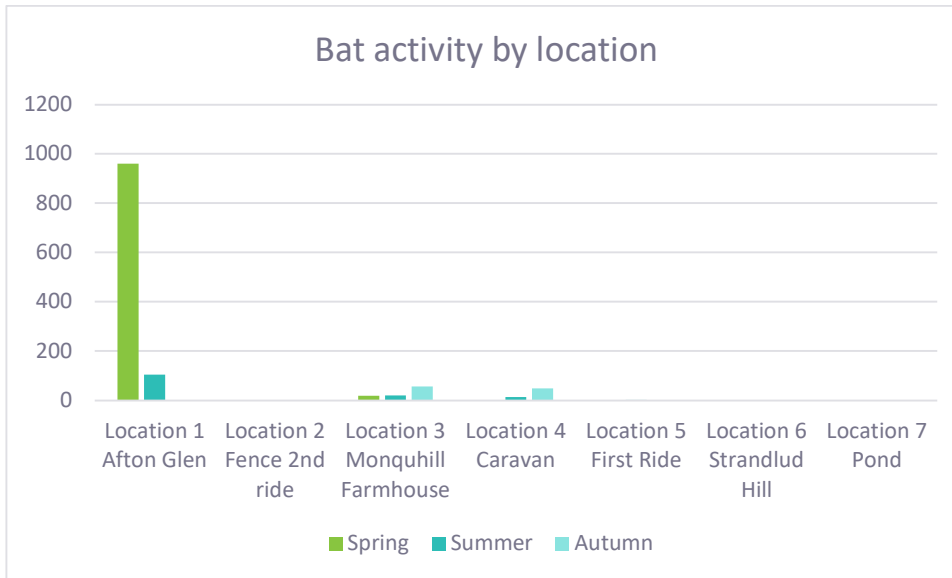


Table 11C.4 Species composition by detector location

	Location 1 Afton Glen	Location 2 Fence/ 2nd ride	Location 3 Monquhill Farmhouse	Location 4 Caravan	Location 5 First Ride	Location 6 Strandlud Hill	Location 7 Pond
<b>Brown long-eared</b>	0	0	1	0	0	0	0
<b>Common pipistrelle</b>	11526	5	770	190	1	0	0
<b>Daubenton's</b>	77	4	41	77	26	0	0
<b>Leisler's</b>	36	0	0	0	0	0	0
<b>Myotis sp.</b>	56	0	22	7	0	1	0
<b>Nyctalus sp.</b>	0	0	1	0	0	0	0
<b>Pipistrelle sp.</b>	4	0	24	22	0	0	0
<b>Soprano pipistrelle</b>	2499	4	147	349	3	0	0

Summary:

Brown long-eared (Location 3 only)

Common pipistrelle (all locations except 6 and 7)

Daubenton's (all locations except 6 and 7)

Leisler's (Location 1 only)

Myotis sp. (Locations 1, 2, 3 and 6)

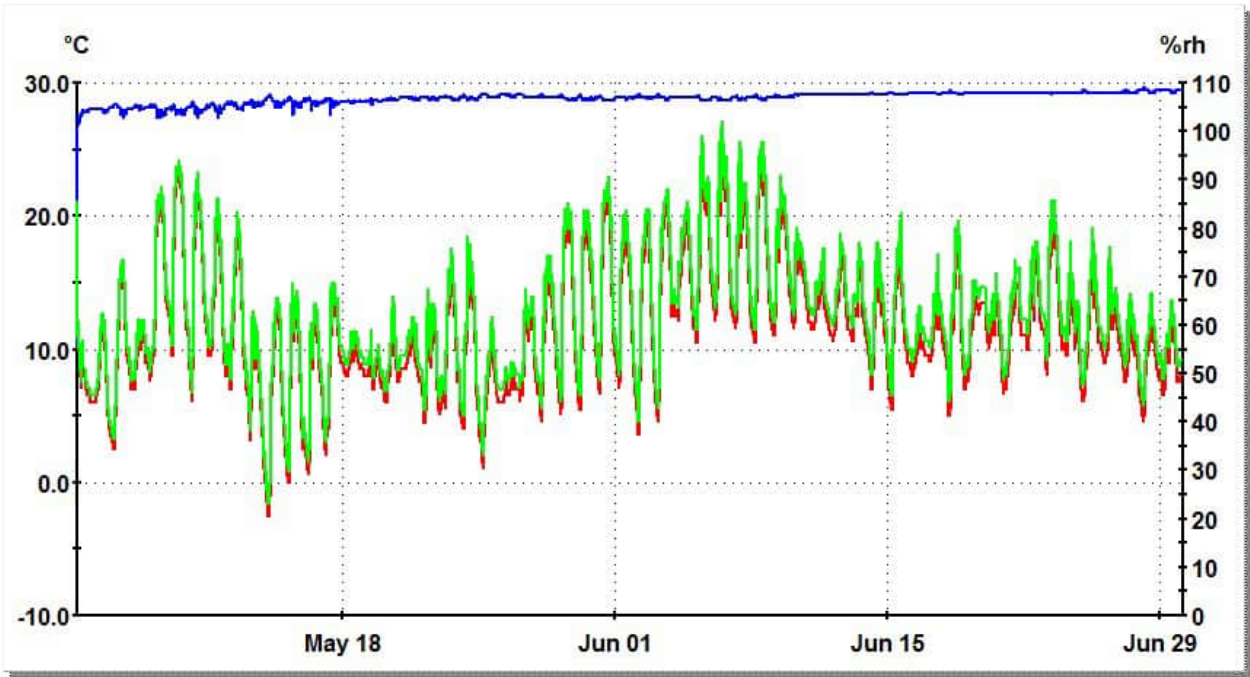
Nyctalus sp. (Location 3 only)

Soprano pipistrelle (all locations except 6 and 7)

Pipistrelle sp. overlaps with common and soprano pipistrelle records.

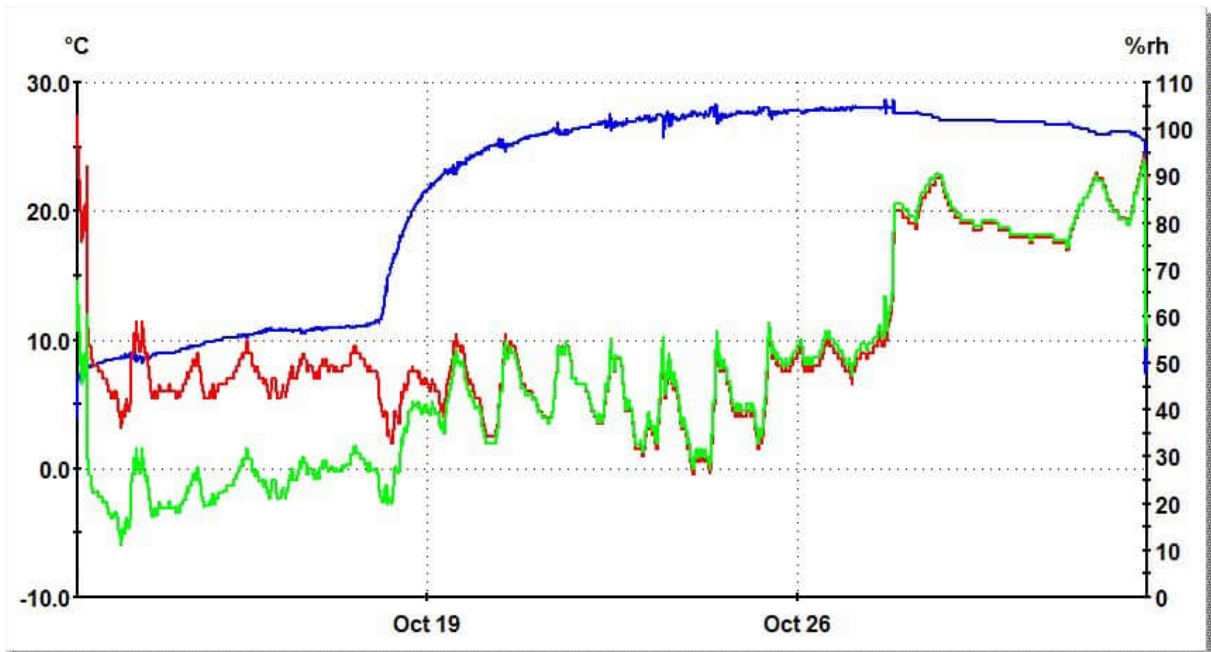
Temperature/humidity readings covering the spring (4 May – around 19 May) and autumn (12 Oct – around 21 Oct). Note that no reading is available for the summer surveys.

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— Celsius — dew point — Humidity

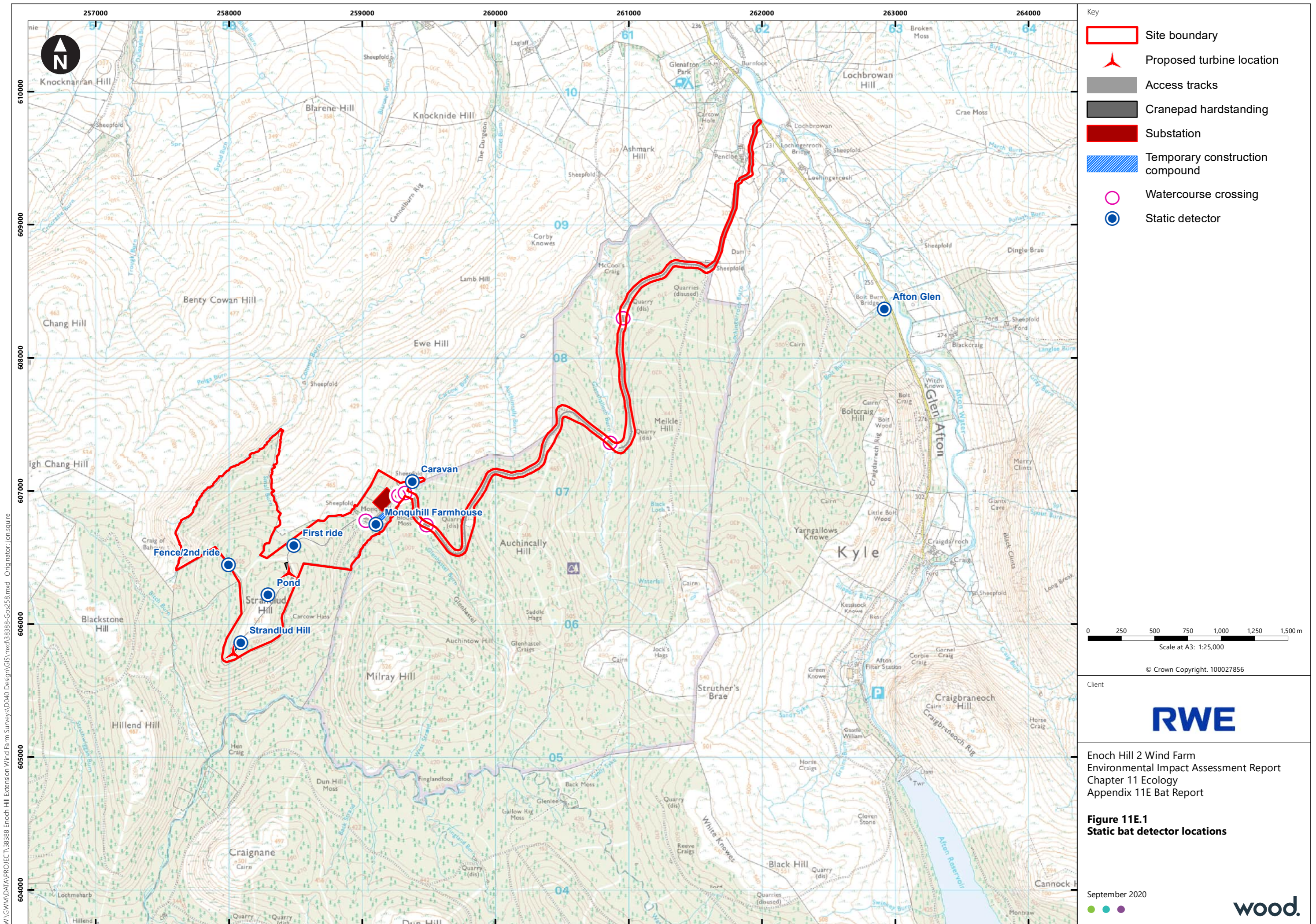
From:- 04 May 2016 07:55:44 To:- 30 June 2016 05:00:44



— Celsius — dew point — Humidity

From:- 12 October 2016 09:19:51 To:- 01 November 2016 14:59:51





- Key
- Site boundary
  - ▲ Proposed turbine location
  - Access tracks
  - Cranepad hardstanding
  - Substation
  - Temporary construction compound
  - Watercourse crossing
  - Static detector

0 250 500 750 1,000 1,250 1,500 m  
 Scale at A3: 1:25,000  
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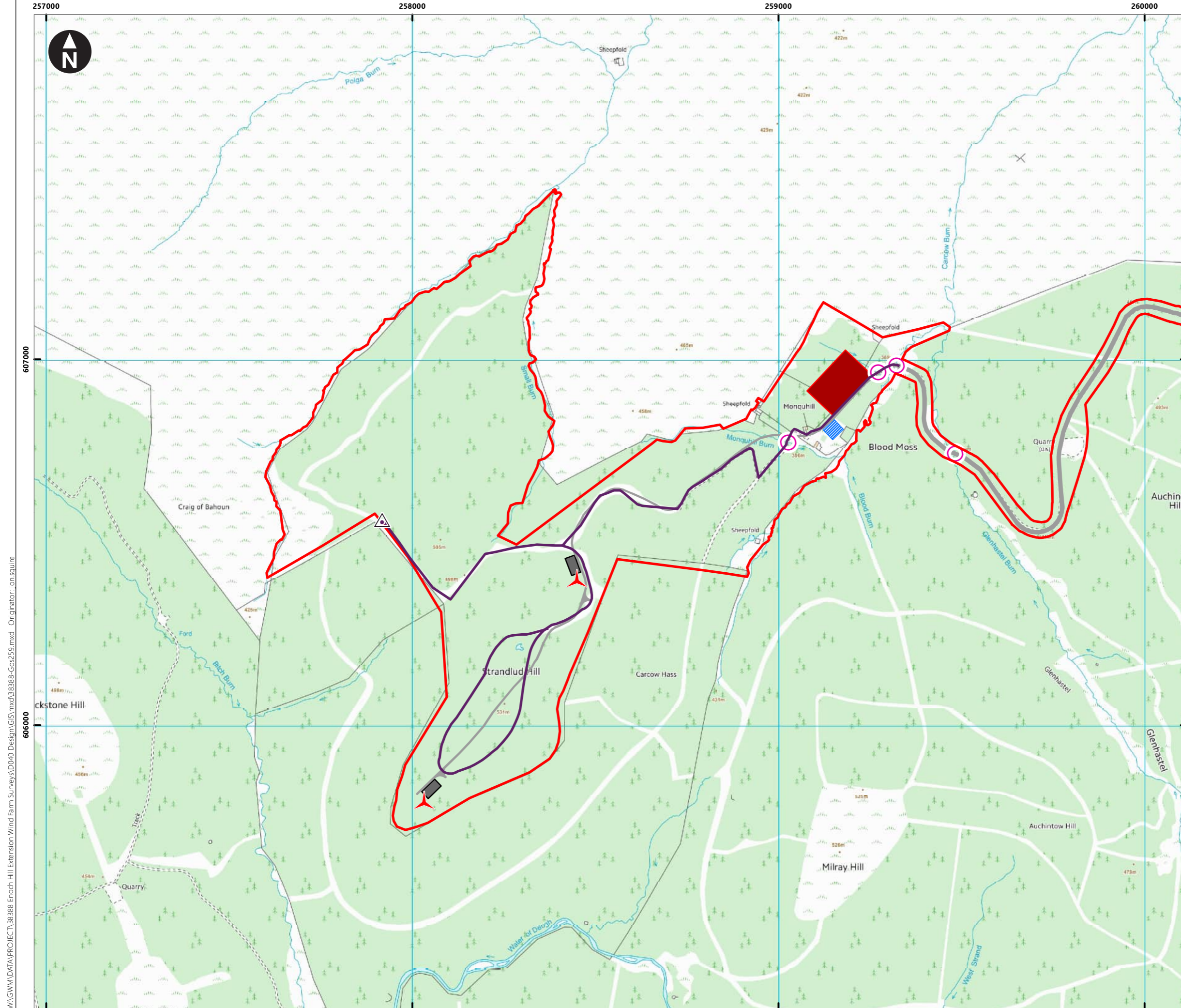


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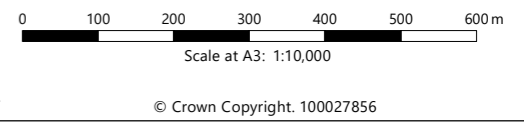
**Figure 11E.1**  
**Static bat detector locations**

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- Key
- Site boundary
  - ▲ Proposed turbine location
  - Access tracks
  - Cranepad hardstanding
  - Substation
  - Temporary construction compound
  - Watercourse crossing
  - Bat transect route
  - ✱ Start/end point
  - ▶ Route/direction
  - Outbound route
- Spring bat activity survey**
- No bats recorded
  - 
  -

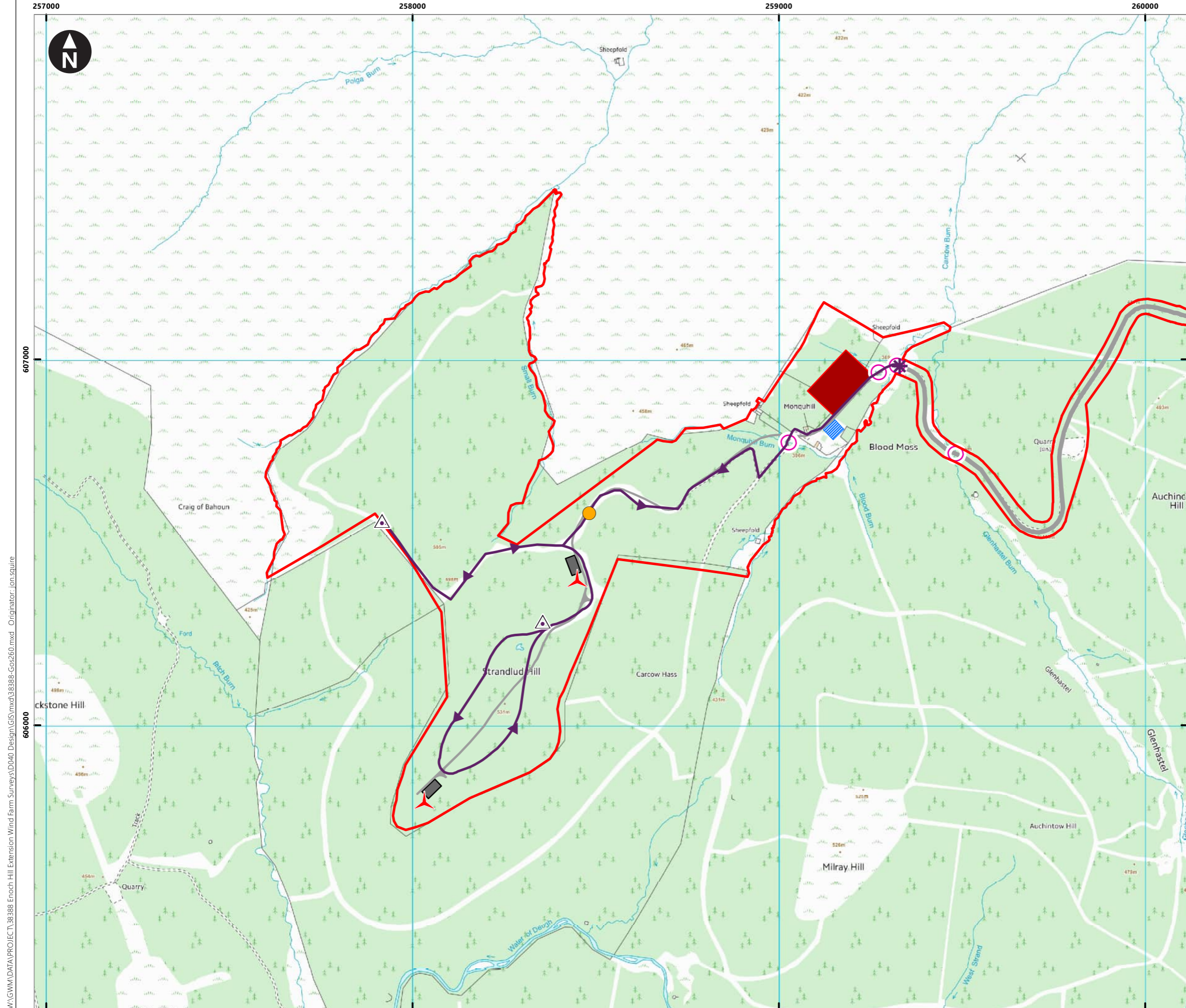


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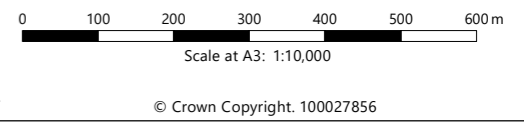
**Figure 11E.2**  
**Spring 2016 bat transect route (with bat activity)**

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- Key
- Site boundary
  - ▲ Proposed turbine location
  - Access tracks
  - Cranepad hardstanding
  - Substation
  - Temporary construction compound
  - Watercourse crossing
  - Bat transect route
  - ✳ Start/end point
  - ▶ Route/direction
  - Outbound route
- Summer bat activity survey**
- Myotis sp.

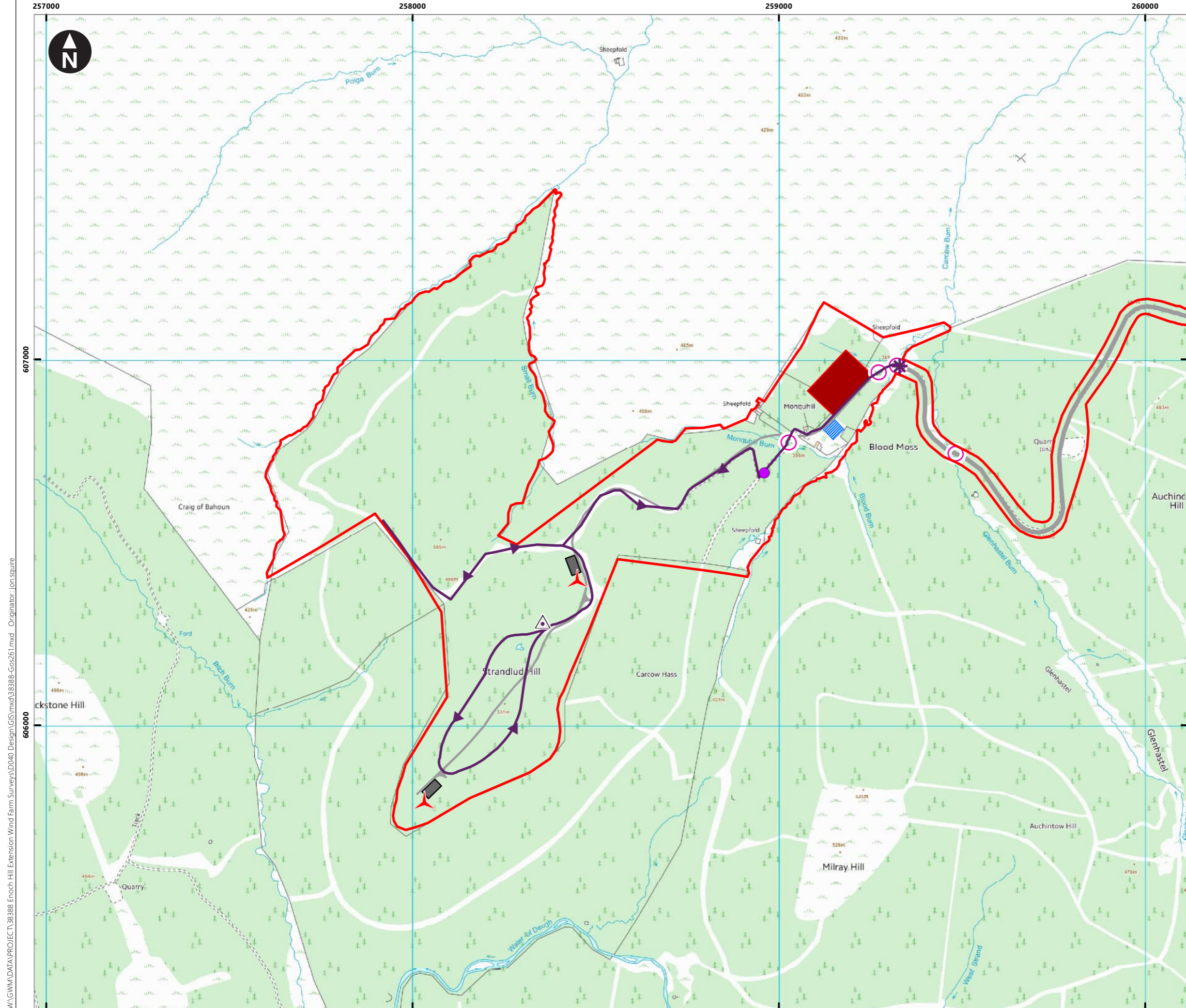


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**Figure 11E.3**  
Summer 2016 bat transect route (with bat activity)

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- Key
- Site boundary
  - ▲ Proposed turbine location
  - Access tracks
  - Cranepad hardstanding
  - Substation
  - Temporary construction compound
  - Watercourse crossing
  - Bat transect route
  - ✱ Start/end point
  - ▶ Route direction
  - Outbound route
- Autumn bat activity survey**
- Soprano pipistrelle

0 100 200 300 400 500 600 m  
 Scale at A3: 1:10,000  
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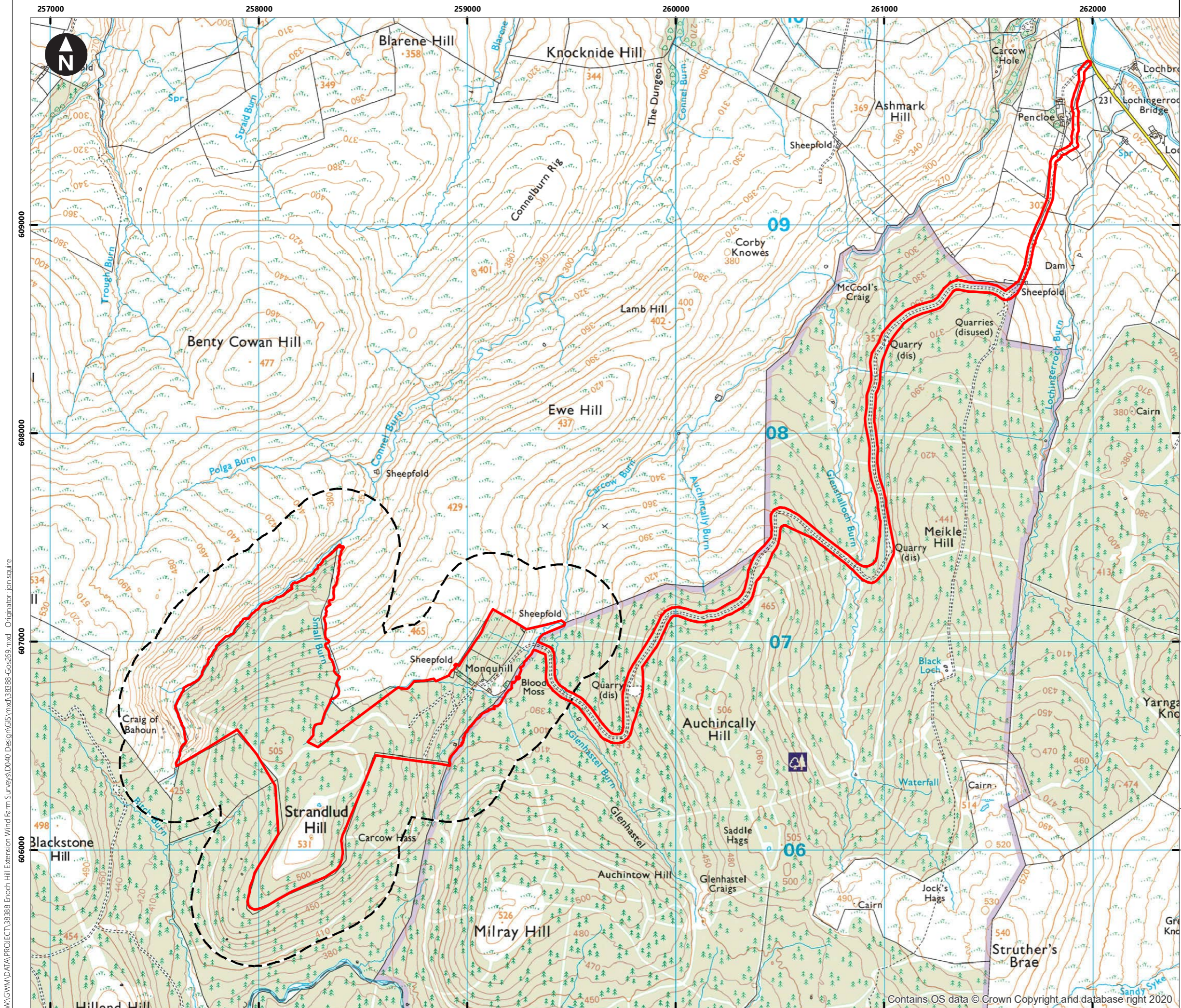


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**Figure 11E.4**  
**Autumn 2016 bat transect route (with bat activity)**

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Key  
 Site boundary  
 Bat study area

0 250 500 750 1,000 m  
 Scale at A3: 1:17,500  
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Enoch Hill 2 Wind Farm

**Figure 1.1**  
 Site location and bat Study Area

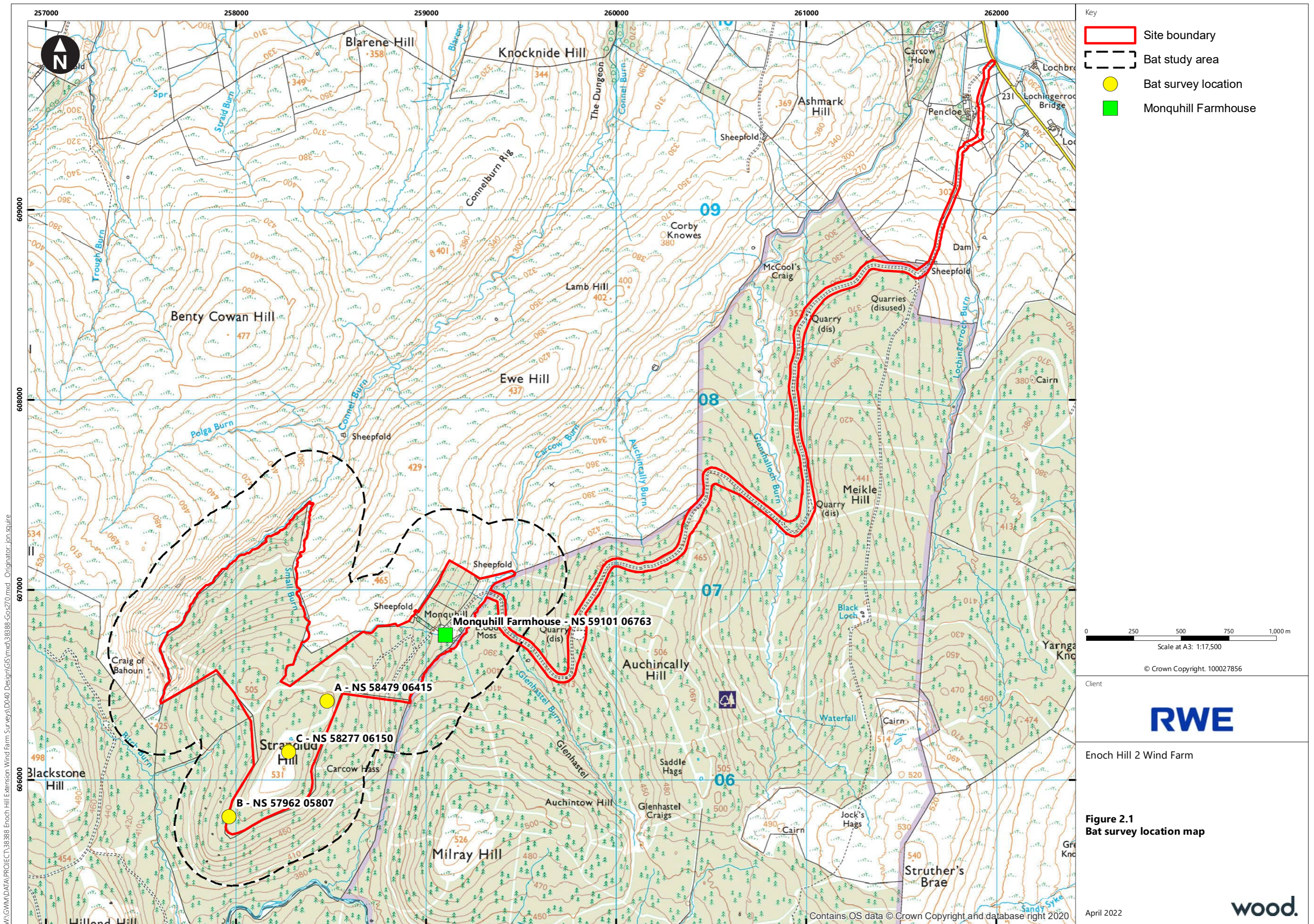
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April 2022







- Key
- Site boundary
  - Bat study area
  - Bat survey location
  - Monquhill Farmhouse

0 250 500 750 1,000 m

Scale at A3: 1:17,500

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Client

**RWE**

Enoch Hill 2 Wind Farm

**Figure 2.1**  
Bat survey location map

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