BASELINE BAT SURVEY REPORT

Proposed Stronafian Forest Community Windfarm

Cowal, Argyll and Bute

for

Quadrat Scotland

5th July 2015

www.wildsurveys.co.uk
Room 109 St James Business Centre, Linwood Road, Paisley PA3 3AT
Telephone 0141 887 2770 Mobile 07788 826 480 Fax 0871 5030923

EXECUTIVE SUMMARY

The proposed Stronafian Forest Community Windfarm development will include the erection and operation of a two turbine windfarm with associated access tracks and ancillary infrastructure. This report outlines the results of bat survey work undertaken on the site in 2014 which included: a preliminary walkover habitat assessment; manual activity (transect) surveys; and static automated bat detector surveys. The survey area (zone of influence) is defined as a 200m buffer from turbine bases and a 50m buffer from the proposed access track.

No bat roosts were identified on the site and no suitable roosting sites were identified within 200m of the turbine bases. No trees or buildings are currently expected to be removed as part of the construction and upgrading of the proposed access track onto the site from the public road. In addition, no suitable roosting features were identified within 50m of the proposed track footprint. The transect surveys recorded very low levels of activity during the three survey periods and only two species of bat were recorded. The static detector surveys recorded very low levels of activity overall and these varied only slightly between survey seasons. Activity recorded at the automated detector locations was considered to be representative of only a few individual Soprano pipistrelle bats, travelling infrequently to the site to forage. Simple comparison of activity levels at different detector locations did not identify any strong link to habitat preference for foraging. No evidence was found to suggest that bats were commuting across the site.

The site is assessed to be **of local value** to each ecological receptor (bat species) identified during these surveys. The impacts of the construction phase of the development are assessed to be neutral with regard to roosting bats and low with regard to foraging and commuting bats. Similarly within the limitations of the prediction of any future baseline, the decommissioning phase is predicted to result in neutral and low magnitude impacts. The impacts of the operation phase of the development are assessed to be of low magnitude for both species of bat recorded on the site. As a result, the combined impacts are predicted to be of **minor significance** for the duration of the Stronafian Forest Community Windfarm. Only standard mitigation recommendations for potential operational effects on bats are therefore recommended, as summarised:

- Natural England TN051 recommends at least a 50m buffer from the edge of the turbine's rotor-swept area to any suitable habitat features such as trees, hedges and water bodies. The site plan is to key-hole areas in the woodland around the turbine bases. Following the TN051 calculation the minimum buffer around each turbine base must be at least 65.2m from the woodland edge and 47.4m from any watercourses. This calculation is based on a hub height of 60m, a blade length of 26.5m and a maximum feature height of 20m.

Following standard mitigation recommendations, no significant residual impacts are predicted for bat species on the site.

CONTENTS

APPENDICIES

DRAFT REPORT:

Prepared by	**Jenny Wallace**	22/10/14	Signed by
Revision v1	Jenny Wallace	05/07/15	
Reviewed by	**Morna McBean**	23/10/14	Signed by

1 INTRODUCTION

1.1 Scope

The following report provides the results of bat survey work undertaken in 2014 at the proposed Stronafian Forest Community Windfarm site on the Cowal Peninsula in Argyll and Bute (site centre at National Grid Reference: NS 017 842). Survey was commissioned by Quadrat Scotland and included: a preliminary walkover habitat assessment; manual activity (transect) surveys; and static bat detector surveys. The survey area (zone of influence) is defined as a 200m buffer from turbine bases and a 50m buffer from the proposed access track.

1.2 Site Summary

The proposed Stronafian Forest Community Windfarm is located approximately 2km east of the hamlet of Clachan of Glendaruel on East Cowal, situated on and around the summit of Cruach nam Mult (279m). The proposed site area is extremely small, equating to only an estimated 0.11km^2.

The turbines are proposed for an open area of habitat, predominantly comprised of blanket bog and felled conifer brash on marshy grassland. This open habitat is bordered to the north, south, east and west by sitka spruce, *Picea sitchensis,* dominated conifer plantation. The site is located at an elevation of between 200 and 279m altitude and does not support any large watercourses or areas of broadleaved woodland. However, a number of small un-named burns drain the site to the east and west of the proposed turbine locations before merging at the southern boundary of the site.

In general, the surrounding landscape supports habitats very similar to those found on the site: the area is typically comprised of undulating upland habitat (up to 450m in altitude) on coastal peninsulas with a network of large conifer plantation forestry blocks to the north, south, east and west. Native broadleaf woodland habitats also exist in the surrounding landscape, in the more sheltered valley bottoms of Glendaurel to the west and Auchenbrek to the south, which also support land used for grazing pasture.

1.3 Site Proposals

At the time of survey, it is understood that the proposed development will include the erection and operation of a two turbine windfarm with associated access tracks and ancillary infrastructure. The turbines will be a maximum of 86.5m to tip height. The proposed access track route will follow the existing forestry road from the south, which leaves the B836 at Stronafian. The track then travels north through existing forestry and clearfell habitat until it reaches the site at its south eastern tip. The proposed site layout is shown in Map 1 in Appendix I.

1.4 Legal Situation

Bats are European Protected Species (EPS) under the Habitats Directive 92/43/EEC. The Habitats Directive has been transposed into National laws by means of the *Conservation (Natural Habitats, &c.) Regulations 1994* (as amended in Scotland) commonly known as the 'Habitats Regulations'. Following a European Court of Justice ruling against the UK Member State in 2005, there have been several amendments to the Regulations which apply only to Scotland (including in 2004, 2007, 2008, 2011 and 2012). Thus, the Scottish Regulations do not mirror the 2010 Regulations which apply in England and Wales. The Habitats Regulations transpose the Habitats Directive to give bats, their breeding sites and resting places a high level of strict protection. A summary of this legal protection is provided in Appendix XI.

2 SURVEY METHODS

2.1 Introduction

Surveys were undertaken once per survey season (i.e. spring, summer and autumn) between June and September 2014. The spring survey period was undertaken in early June, summer survey period in July/August and autumn survey period in September. The timing of surveys was designed to incorporate differences in activity levels throughout the bat active period which runs from April to October (subject to seasonal and geographical variations). Methods are based on current best practice guidance from the Bat Conservation Trust (Hundt, 2012) and have been adapted based on the suitability of the site.

2.2 Desk Study

A data search was undertaken to review information available within the public domain. Information was gathered to identify the status of bat species within 5km of the site, and extended up to 10km for *Nyctalus* bat species which will fly far greater distances to forage. Data was obtained from the following sources:

- The NBN Gateway[1]
- Wild Surveys Survey Records Database
- Cowal Bat Group
- Additional Information from the *Scottish Leisler's Bat Project*[2]
- Aerial photography and OS maps for the area were used to try to identify any mature broadleaf woodland habitat (i.e. habitat likely to support features suitable for roosting bats) within a 5km radius from the site.

2.3 Site Walkover and Habitat Assessment

A walkover of the site was undertaken on 10th June 2014. The aim of this survey was to carry out a general assessment of the suitability of the site to support roosting and foraging bats within 200m of the proposed turbine locations as shown on Map 1 in Appendix I. Target notes were made where any roosting habitat was identified along with any areas likely to provide key foraging or commuting habitat. The survey was undertaken by two experienced bat surveyors, as discussed in Section 2.6.

2.4 Transect Activity Surveys

The proposed wind farm site area is very small (estimated 0.11km^2) therefore only one transect route was required in order to provide good coverage of the different habitats on site. Different habitats include clearfell brash, blanket bog, coniferous woodland edge and small un-named watercourses which cut across the southern boundary of the site. The transect route is 2km in length and includes a total of 11 point count stops of five minutes, which were undertaken at pre-determined locations along the transect route (as shown on Map 2 in Appendix I). The aim of the transect surveys was primarily to determine levels of activity throughout the site, as well as to evaluate any links between different habitat features and bat activity.

Transect surveys were undertaken once per survey season on: 10th June 2014 (spring survey period); 22nd July 2014 (summer survey period); and 24th September 2014 (autumn survey period). Transects started generally between 30 minutes before sunset, and sunset, in order to cover for the possibility of early emerging bat species, such as *Nyctalus* bats. Transects continued for approximately two hours and were walked in alternate directions per survey month, in order to provide coverage of different areas of the site at different times of the night. Each transect survey was undertaken by two experienced bat surveyors for health and safety reasons.

All bat activity was recorded by bat detectors and noted on a recording form by the surveyors. Information recorded included a grid reference and any additional notes concerning the type of bat activity observed, such as foraging, commuting and/or social calling. *Echo Meter 3* and *AnaBat* bat detectors were used for the transect surveys. Both of these detectors record data to a memory card, which is then downloaded and

[1] **The NBN Gateway is an online biological records database. It can be accessed at: http://data.nbn.org.uk/**

[2] **The Scottish Leisler's Bat Project' is a voluntary research project which has been undertaken in south-west Scotland by John Haddow and Stuart Spray between 2010 – 2014.**

analysed using *Analook* software to confirm species identification. A summary of the transect survey information for all three survey periods is provided in Table 4 in Appendix II.

2.5 Static Bat Detector Activity Surveys

Three static *AnaBat*[3] bat detectors were deployed at three locations (Locations 1 to 3) as shown on Map 2 (Appendix I). The detector locations were chosen to (i) cover different habitat features on the site and (ii) sample the proposed turbine locations. For example, detectors were placed at the plantation edge, in the open blanket bog and in the clearfell brash. A brief habitat description for each *AnaBat* location is provided in Table 9 in Appendix II.

The aim of the static detector survey was to record data for a number of consecutive nights in varying weather conditions as well as gathering information about bat activity throughout the whole night. Detectors were therefore deployed on site for a minimum of seven nights per survey season and were programmed to start recording half an hour before sunset (to cover the emergence time for all relevant species) and to continue until half an hour after sunrise. Detectors recorded for seven nights in June, thirteen nights in July/August and seven nights in September as detailed in Table 8 in Appendix II.

The *AnaBat* records all data to a CF memory card and these were downloaded and analysed to identify the species present using *Analook* software[4]. Activity levels were derived from these data, based on the number of 'bat passes' recorded. For these baseline surveys, bat passes have been defined as *'one fifteen second recording file which contains at least one bat call'.* Activity levels were calculated as based on average nightly passes, which were achieved by dividing the total number of passes by the total number of night's survey for each survey period. A further '*Bat Activity Index'* was then calculated by averaging the average bat passes per night for each location. This bat activity index was used to eliminate bias towards survey periods with more survey data i.e. more nights of survey.

2.6 Personnel

Wild Surveys Ltd specialises in carrying out commercial bat surveys and has been involved in a number of major development and infrastructure projects across Scotland over the last decade. All employees are members of the Chartered Institute of Ecology and Environmental Management (CIEEM) and have many years of field experience. Surveys were undertaken by Helen Lundie, Steven Gregory, Susan Craig, Jenny Wallace and Mhairi Jack. Helen Lundie, Susan Craig and Jenny Wallace all hold valid Scottish Natural Heritage (SNH) bat roost visitor licenses.

2.7 Survey Limitations

- Differentiating between the echolocation calls of the common pipistrelle *Pipistrellus pipistrellus* (which echolocates at a peak frequency of approximately 45 kHz) and the soprano pipistrelle *Pipistrellus pygmaeus* (which peaks at approximately 55 kHz) can be very difficult where recordings peak at the intermediate frequency of 50 kHz (Russ, 2012). These passes are therefore simply classified as pipistrelle species (*Pipistrellus sp*.)
- A bat pass has been defined as '*one fifteen second recording file which contains* ***at least*** *one bat call*'. This method of classifying a bat pass allows for comparison between data at different locations, but cannot quantify numbers of individual bats. For example, if four bats were foraging over the detector for 15 seconds, by definition, this would only be recorded as one bat pass. In comparison, one bat could simply fly past the detector briefly, and this would also be defined as a single bat pass. This bias exists in one form or another with all methods of automated data collection in the absence of a surveyor and the challenges of acoustic monitoring are widely documented (Hayes, 2000; Sherwin, *et al.,* 2000; Vaughan *et al.,* 1997). Although unable to infer exact numbers of individuals, it is considered that the approach used in this study does allow for effective comparison across the site whilst indicating the presence or absence of different

[3] **The *AnaBat* is a frequency division bat detector which records bat echolocation calls using a unique technology which records in frequency division without amplitude retention.**

[4] ***Analook* is free analysis software created by *Titley Scientific*, which allows 15 second sound recordings to be viewed as 2D sonograms and analysed using various tools to identify different species of bat.**

species. Indeed, where two or more different species are present within a 15 second sound file, all are considered individually and a bat pass attributed to each.

- No survey was undertaken for hibernating bats. However, no sites with any hibernation potential were identified during the walkover survey.
- At the time of survey, the lack of a meteorological mast or presence of suitable mature trees within the turbine area onto which a microphone could be mounted meant that no 'Activity at Height' survey was undertaken on the site in 2014. However, at this stage it was considered that ground level baseline surveys in 2014 could be used to assess whether additional at height surveys would be required for the site in 2015. For example if particularly high levels of activity were recorded or the presence of high flying *Nyctalus* bat species was confirmed, then additional at height surveys on the site may be necessary to inform an impact assessment.

2.8 Site Evaluation and Impact Assessment

A site evaluation and impact assessment has been undertaken, based on IEEM guidance (IEEM, 2006) and is a staged process. Results of the evaluation and impact assessment can be found in Section 5. The first stage of the process is to **assign a value to each ecological receptor recorded on the site**, based on the nature conservation values of the ecological interests at the site, which are judged according to their importance in an international to local scale as outlined in Table 25 in Appendix VII. The zone of influence is defined as the area which the development is likely to affect. For the purposes of this impact assessment, the zone of influence refers to the survey area which is 200m from all turbine bases and 50m from proposed access tracks.

The second stage of the process is then to **evaluate the magnitude of the various impacts** of the development on bat species. Impacts are assessed based on the phase of the development, so are considered separately under the following headings: '***construction'***, ***'operational'*** and '***decommissioning'*** impacts. As part of the assessment, consideration is given to the following parameters: whether the impact is likely to have a positive or negative effect on bat species; the duration of the impact; whether the impacts are reversible in the long term; how frequently the development is likely to cause an impact; and whether the effects coincide with critical life-stages or seasons for bat species.. Table 26 Appendix VII defines the magnitude of impacts of each ecological receptor (based on IEEM guidance).

The third and final stage of the assessment is to assess whether those identified impacts are **Ecologically Significant** or not. An ecologically significant impact is defined as '*an impact (negative or positive) on the integrity of a defined site or ecosystem and/or the conservation status of habitats or species within a given geographical area'* (IEEM, 2006). The significance of the impact for this site has been determined through a combination of professional judgement, IEEM guidance and a contextual understanding of the site.

2.9 Mitigation Considerations

Mitigation is considered where effects are considered to be significant in order to try to reduce significant impacts to the level of non-significance. Where no significant impacts are predicted only standard precautionary mitigation, following industry guidance, is recommended.

3 RESULTS AND DISCUSSIONS

3.1 Desk Study Results

A summary of information obtained through the desk study is provided in the tables and text below. Full details can be found in Appendix III. The desk study identified records of common pipistrelle, soprano pipistrelle and brown long eared bat within 5km of the site. Only a limited number of records were found and the majority were gathered from the Wild Surveys roost survey database from 2013 and 2014. No records of *Nyctalus* bat species were found within 10km of the site. However, additional information from the Scottish Leisler's Bat Project identified that Leisler's bats *Nyctalus leisleri* have been recorded on the Isle of Bute, approximately 15km from the site.

3.1.1 NBN Gateway

Table 1: NBN Gateway Search Results

Species	Grid Squares	Notes
Brown long-eared bat ***Plecotus auritus***	NS08, NR97	Record from 2013, recorded approximately 2.3km from the site. Details of record type unknown.

3.1.2 Wild Surveys Records

Table 2: Wild Surveys Records Results

Species	Site Name / Grid Reference	Distance to Site	Year Recorded
Brown long-eared bat ***Plecotus auritus***	Dunans Castle NS 040 911	8km	2013 / 2014
Soprano pipistrelle ***Pipistrellus pygmaeus***	Stronafian NS 015 821	1.6km	2013
Common pipistrelle ***Pipistrellus pipistrellus***	Stronafian NS 015 821	1.6km	2013

3.1.3 Cowal Bat Group Records

Andy Kerr of the Cowal Bat Group was contacted on 15th October 2014 and asked for any bat group records within 5km of the site. Andy was able to confirm both soprano pipistrelle and brown long-eared bat roost sites within Glendaruel village, which is located approximately 2km west of the site.

3.1.4 Additional Information: Scottish Leisler's Bat Project

John Haddow (Auritus Wildlife Consultancy Ltd) was contacted for information on *Nyctalus* bat species following his involvement in the '*Scottish Leisler's Bat Project':* a voluntary project which has been carrying out research into Leisler's bats in south-west Scotland over the last four years. As part of the project, John has been collecting records of Leisler's bats across the south-west from which he has produced a map showing their currently known distribution. A summary of the initial findings from the Scottish Leisler's Bat Project from 2012, including the distribution map, can be found in Appendix III. This map shows that no records of Leisler's or Noctule bats (*Nyctalus noctula*) have been previously recorded within 10km of the site. Our survey area was not part of John's survey project. However, in addition to the records published by the 2012 review, Leisler's bat passes were also recorded on the Isle of Bute at Loch Fad and Loch Ascog in 2013 and Mount Stuart House in 2014 (Simmons 2014 pers. comm. 16th October). The closest of these locations is Loch Ascog, which is located approximately 15km south of the site.

3.2 Site Walkover and General Habitat Assessment

3.2.1 Suitable Roosting Opportunities

The walkover did not identify any suitable roosting opportunities for bats on the site or within the zone of influence. The dominating habitats within the proposed turbine area are blanket bog, wet heath and clearfell brash on open hillside. The conifer plantation which surrounds the site is comprised almost entirely of either young sparse regeneration or densely packed semi-mature conifers, which, due to their growth regime, are unlikely to support features which could be used by roosting bats. For example; trees with cavities, holes, cracks and splits allowing bats to roost within them. No suitable mature or semi-mature broadleaf or coniferous trees were identified on the site or within 200m of the turbine bases. Aerial photography and OS maps for the area were used to try to identify any mature broadleaf woodland habitat (i.e. habitat likely to support features suitable for roosting bats) within a 5km radius from the site. The nearest areas of this suitable habitat are located over 2km from the zone of reference: on the lower slopes near Stronafian and Auchnagarron to the south of the site; as well as along the valley bottom of Glen Daruel. In addition, no built structures were identified within 200m of the turbine bases. The closest buildings are located at Clachan of Glendaruel, approximately 2km to the east of the site and in the sheltered glen at approximately 40m altitude (compared to the 279m at the top of the site). Buildings at Auchnagarron also exist approximately 2km to the south of the proposed site at approximately 50m altitude. Both sets of buildings are likely to provide suitable roosting opportunities for a variety of bat species.

3.2.2 Suitable Foraging and Commuting Habitat

The site does not support any large watercourses or water bodies. However, a number of small un-named burns flow through the site to the east and west of the proposed turbine locations, on the peripheries of the zone of influence. These burns will provide some foraging opportunities for bats, but are only small and are therefore unlikely to be well used as commuting routes between roost sites, or to and from regularly used foraging areas. The areas of blanket bog and wet heath on the site are likely to be rich in *Diptera* and *Lepidoptera*, providing suitable foraging prey for a variety of bat species. The site is, however, relatively high in altitude and is located over 2km from the nearest buildings and mature woodland with roosting opportunities (refer Paragraph 3.2.1). The more exposed and windy conditions experienced on the site, coupled with the distance required for bats to travel to it, is likely to significantly reduce the numbers of bats using the site to forage.

In general, the surrounding landscape up to 10km supports habitats very similar to those found on the site. The Cowal peninsula is bordered on three sides by sea lochs and is typically comprised of undulating hills (up to 450m in altitude) with networks of large conifer plantation forestry forming mosaics with typical upland habitats of bog, heath and marshy grasslands. Native broadleaf woodland areas cling to inaccessible sections of coast and in the glens, with the flatter flood plains and lower slopes used primarily for livestock grazing. Habitats in the wider Cowal area therefore mirror those found on the site itself and immediate surrounding area. Features of particular interest in the nearby surrounding area with regard to providing good habitat for foraging bats include: the River Reul, which flows parallel to the site through Glendaruel c.2km to the west; the Auchenbreck Burn c.2km to the south of the site; and Loch Riddel, the large sea loch meeting the mainland just west of Auchenbreck.

3.2.3 Proposed Access Track

The proposed access track follows the existing forestry road from the south, which leaves the B836 at Stronafian. It winds north through existing forestry and clearfell habitat until it reaches the site at its south eastern tip. It is understood at the current time that no trees or buildings will be removed as part of the construction of the access track. No bat roosting suitable features were identified within 50m of the proposed access track footprint.

3.3 Transect Activity Survey Results

The following paragraphs provide a summary of activity observed during the transect surveys. Full details of target notes made during the surveys can be found in Tables 12 to 14 in Appendix IV. All bat passes recorded

during the transect surveys have been presented on Map 3 in Appendix I. This map shows the location and species of each bat pass recorded during the three transect surveys (combined).

Very low levels of activity were recorded during the transect survey in June with only two common pipistrelle bat passes recorded towards the end of the transect route at approximately 90 minutes after sunset. These passes were very brief and emitted by an individual. The bat was recorded close to the plantation edge and within the vicinity of the small un-named burns which cut through the recently clear felled habitat to the east of the site. During the July transect, similarly low levels of activity were recorded with again one common pipistrelle bat recorded towards the end of the transect route in a similar location to the individual recorded in June. An additional soprano pipistrelle bat was also recorded during this transect at 105 minutes after sunset, again near to the end of the route at point count 11, where the watercourses intersect on the southern peripheries of the site. Both bat passes in July were very brief and the bats were not observed suggesting they were commuting across the site at the time of detection. Results from the September transect mirrored those from June and July, with one pipistrelle bat recorded around point count 11, towards the end of the survey. The pipistrelle bat in question could not be identified to species level and was not observed. The pass was very brief; again suggesting the bat in question was simply passing through the site area at the time of detection.

In summary, activity levels recorded during the transect surveys were very low throughout all three survey seasons and representative of only small numbers of individual bats. Only two common species of bat were recorded: common and soprano pipistrelle. The highest levels of activity were recorded during the July transect, where two passes from two different species of bat were recorded. Bat passes from all three surveys were recorded towards the south east of the site, near the plantation edge and small intersecting watercourses.

3.4 Static Detector Survey Results

Bat activity levels recorded by the static *AnaBat* detectors were very low across the site. The detectors operated for a total of 72 nights (combined) and in total (across all locations), only 30 bat passes were recorded. Two species of bat were confirmed by the detectors, these were:

- Common pipistrelle
- Soprano pipistrelle

Table 3 provides a summary of the data recorded at each location per survey period. Results are shown as **total passes** (all species combined) for each location for each period and also as an **average number of passes per night**. The average nightly passes are calculated by dividing the total number of passes by the total number of night's survey for each survey period. The **bat activity index** was then calculated by averaging the average nightly passes, to eliminate any bias towards locations and survey periods with a greater survey effort. For example, the spring and autumn survey periods recorded data for seven nights, whereas the summer survey period detectors recorded for thirteen nights.

Table 3: Static Detector Survey Summary

Location	Spring (June)		Summer (July/Aug)		Autumn (September)		Bat Activity Index
	Total Passes	Av. Passes per night	Total Passes	Av. Passes per night	Total Passes	Av. Passes per night	
L1	0	0	0	0	11	1.57	**0.52**
L2	1	0.14	1	0.07	0	0	**0.07**
L3	1	0.14	2	0.07	14	2.00	**0.76**
Totals	**2**	**0.28**	**3**	**0.14**	**25**	**3.57**	**-**

3.4.1 Comparison of Activity Levels per Detector Location

One of the objectives of the automated detector survey was to identify patterns of bat activity across the site by comparing levels of activity at different detector locations. In order to do so, a **Bat Activity Index** was calculated for all species (combined) to eliminate bias towards locations and survey periods with greater survey effort (as presented in Table 2).

Location 3 showed the highest level of activity, with an activity index of 0.76, compared to Locations 1 and 2 with indices of 0.52 and 0.07, respectively. Detector Location 3 is situated in open moorland habitat on the boundary and positioned to detect activity over a large area of clearfell. Location 1 is situated on a fenceline close to immature spruce plantation edge and Location 2 is located near to the summit of Cruach nam Mult, again in open moorland habitat. In June, Locations 2 and 3 recorded the highest levels of activity with 0.14 average passes per night each. No bats were recorded at Location 1 during this survey period. In July, Location 3 recorded the highest levels of activity, with an average of 0.15 passes per night, compared to 0 and 0.07 average passes per night for locations 1 and 2, respectively. In September, Location 3 again recorded the highest levels of activity with 2 average passes per night, compared to 1.57 and 0.21 at locations 1 and 2. Figure 2 in Appendix VI shows a summary of the overall results per location per survey season.

Given the extremely low levels of activity at all locations it is not possible to make a robust assessment of activity levels in relation to different habitat types surveyed. However, the following provides a general discussion regarding the possible reasons for the different levels of activity recorded at the different locations on site. Detector Location 3 recorded the highest overall levels and this detector was located in open habitat close to an area of clearfell at 270m altitude and within 150m of a number of small burns. This location is also the closest location to the main forest road which snakes up the hill through coniferous forestry, opening out onto the site at its most southerly point (see Map 2 in Appendix I). This last point is considered to be the most significant variable relating to the higher levels of activity achieved at Location 3 and is based on the assumption that the forest road itself is likely being used as the key commuting route by the small numbers of individuals recorded on the site i.e. that the majority of individuals recorded have accessed the site via the forest road from roosting locations lower down in the valley. Indeed, these results mirror those of the transect surveys, where bat passes were only recorded towards the south of the site close to the forest track and convergence of small watercourses. Location 1 recorded the second highest levels of activity and this detector was located close to coniferous woodland to the north of the site, also at 270m altitude. Although the furthest location away from the forest road and proposed commuting route to the south of the site, it is also the most sheltered location on the site which may explain the slightly higher levels of activity than Location 2. Location 2 recorded the lowest levels of activity overall. This detector was located close to the summit of the hill at approximately 279m altitude and the furthest location from any typical foraging features such as woodland edge or watercourse. Overall, activity levels were highest towards the south of the site, at lower altitudes and closest typical foraging features. However, again, given such low levels of activity, it is very difficult to draw any significant conclusions.

Detailed results of the automated detector survey for each location are presented in Tables 15 to 24 in Appendix V and are summarised in Figures 1 to 3 in Appendix VI.

3.4.2 Comparison of Activity Levels per Survey Season

Bat activity levels recorded during the autumn survey period in September were marginally greater than activity levels recorded during the spring and summer survey periods in June and July/August, as shown in Figure 2 (Appendix VI). The lowest levels of activity were recorded in July/August. Given the extremely low levels of activity recorded throughout the survey periods, it is again very difficult to draw any meaningful conclusion to the results. Overall, activity levels varied only very slightly between survey seasons, equating to little more than the difference between 1 or 2 bat passes per night. Such minimal differences could simply represent the presence or absence of one individual flying within detection range of the detector and therefore cannot accurately be compared.

3.4.3 Comparison of Activity Levels per Species

Two species of bat were recorded on the site: common pipistrelle and soprano pipistrelle. The most commonly recorded species was the soprano pipistrelle bat, with 27 passes in total over the whole survey period (72 nights of survey). Soprano pipistrelle bats were recorded during all three survey periods. In comparison, only 6 common pipistrelle bat passes were recorded and all were recorded during the autumn survey period, with no passes recorded at all during the spring or summer survey periods. Bat passes per species per survey season are presented on Figure 3 in Appendix VI.

Both common and soprano pipistrelle bats are widespread and common in Scotland with estimated population figures from 1995 (550,000 individuals) indicating that pipistrelle species alone comprise over 85% of the entire Scottish bat population (JNCC, 1995). No additional bat species were recorded on the site. This includes other common species such as Daubenton's bat *Myotis daubentonii* (estimated Scottish population 40,000 individuals in 1995) and brown long-eared bat *Plecotus auritius* (estimated 27,500 individuals in 1995).

Common pipistrelle bats have a broad habitat preference, typically foraging along treelines, hedgerows and rivers (Dietz et al, 2009). Soprano pipistrelle bats also have similarly broad habitat preferences, although they tend to favour riparian areas and can often be found in more cluttered habitats (Dietz *et al.,* 2009). In addition to their being significantly more abundant in Scotland, the pipistrelle's broad habitat preferences are likely to be a major factor relating to their presence on the site in the absence of other species. This is particularly relevant given the site's upland location, lack of typically good foraging habitat and extended distance from suitable roosting opportunities. For example, Daubenton's bat is predominantly associated with riparian habitats and typically forages over ponds or slow flowing rivers (Dietz *et al*, 2009). The lack of substantial watercourses or water bodies on the site (refer Paragraph 3.2.2) would therefore limit its appeal for the species as a suitable foraging area. Given the distance of the site from good potential roosting habitat, this would also significantly limit the likelihood of records from passing bats, simply commuting through or past the site to and from more suitable areas of foraging.

4 RESULTS SUMMARY

No bat roosts were identified on the site and no suitable roosting sites were identified within 200m of the proposed turbine bases. The woodland edge habitat at the site peripheries and small watercourses that drain to the east and west of the proposed turbine area provide some suitable foraging habitat for bats. However, the site is located at a relatively high altitude and, in general, lacks high quality foraging features such as large water bodies or mixed broadleaved woodland.

No trees or buildings will be removed as part of the construction of the proposed access track which will follow the existing forest road, leaving the B836 at Stronafian. In addition, no suitable roosting features were identified within 50m of the currently proposed access track footprint.

The transect surveys recorded very low levels of activity and only two common species of bat were recorded: common pipistrelle and soprano pipistrelle. All activity was recorded to the south of the site near the plantation edge and where small burns intersect. No bats were recorded within the proposed core turbine area.

Only two species of bat were recorded during the automated surveys (common and soprano pipistrelle bats), occurring infrequently throughout the three periods: spring, summer and autumn. Activity levels were very low overall and varied only slightly between survey seasons. They were at their highest during the autumn period in September and at their lowest during the summer period in July/August. Activity recorded at the automated detector locations was considered to be representative of only a few individuals, travelling infrequently to the site to forage. Indeed, activity levels were so low that only 30 bat passes were recorded across the whole site during a total of 72 nights of survey, equating to the equivalent of one bat pass being recorded on the site once every 2.4 days. A basic comparison of activity levels at different detector locations did not identify any strong link to habitat preference. No evidence was found to suggest that bats were commuting across the site. However, it was considered likely that the few individuals recorded would have accessed the site by commuting up the current forest road, which will be upgraded and used as the main access track as part of development plans.

5 SITE EVALUATION AND IMPACT ASSESSMENT

5.1 Introduction

The site evaluation and impact assessment have been undertaken, based on IEEM guidance (IEEM, 2006). The first stage of the process is to **assign a value to each ecological receptor** recorded on the site, based on the nature conservation values of those ecological receptors, which are judged according to their importance in an international to local scale as outlined in Table 25 in Appendix VII. For the purpose of this report, each bat species present on site is assessed as an individual ecological receptor, as presented in Table 4. The zone of influence is defined as the survey area, encompassing a 200m buffer from turbine bases and a 50m buffer from the proposed access track. The second stage of the process is then to **evaluate the various impacts** of the development on each ecological receptor (each bat species). Impacts are assessed based on the phase of the development, so are considered separately as '***construction', 'operational'*** and '***decommissioning***' impacts. Stage 3 then looks at the **significance** of those potential impacts, which is determined for each ecological receptor, including the residual impacts (after any mitigation measures have been considered)

5.2 Stage 1: Evaluation of Ecological Receptors on the Site

As summarised in Section 4, only two species of bat were recorded on the site and activity levels recorded were very low. Based on survey results within the zone of influence, each ecological receptor is evaluated and assigned a value as presented in Table 4, as outlined in Table 25, Appendix VII:

Table 4: Site Value per Ecological Receptor

Ecological Receptor	Rational	Value	Justification
Common pipistrelle	Protected species recorded on the site (see legislation summary in Appendix VIIII).	**Local**	Common and widespread throughout south-west Scotland. Low levels of activity recorded within the zone of reference.
Soprano pipistrelle		**Local**	Common and widespread throughout south-west Scotland. Low levels of activity recorded within the zone of reference.

In summary, the site is assessed to be of **local value** to bats, both at individual species level and at community level.

5.3 Stage 2: Assessment of Impacts

5.3.1 Construction Impacts: Bats

Construction impacts for each ecological receptor are considered in relation to (1) bat roosts and (2) foraging and commuting bats.

1. Any loss of or disturbance to bat roosts as a result of the development would be encountered during the construction of the access track onto the site. For example, as a result of the felling of trees containing bat roosts or disturbance to bat roosts in buildings or trees next to the proposed route. No bat roosts were identified on the site and no suitable trees or buildings were identified within 200m of the turbine bases or within 50m of the proposed access track after it leaves the B836 at Stronafian. Construction impacts relating to bat roosts **for all ecological receptors** on the site are therefore considered likely to be **neutral.**

2. Activity levels recorded on the site were very low and no significant foraging areas or commuting routes were identified. The proposed turbines are to be located within recently clear felled conifer plantation habitat (see Map 1 in Appendix 1) to the north of the site, where slightly lower levels of activity were recorded. The construction of the access tracks and turbine bases will lead to the loss of some available foraging habitat in these clearfell areas both during construction and in the longer term. However, given the baseline low levels of activity on the site and the small percentage of the site that will be lost to

infrastructure, the construction impact on foraging and commuting bats is considered to be **minor to neutral for all ecological receptors.**

5.3.2 Operational Impacts: Bats

The main impact associated with the operation phase of the windfarm is from injury or death to bats through collision or the effects of barotrauma[5]. Although there is a general lack of research in to these effects in the UK, evidence is available from North America and continental Europe which has found that windfarms can have direct effects on bats and bat populations (Arnet et al., 2011; Georgiakakis et al., 2012; Jameson and Willis, 2012). Little in the way of published literature on the subject is available in the UK and the few bat deaths have been reported at UK windfarms have been pipistrelles (Duffy and Steward, 2008; Jones *et al.,* 2009). However, this is likely to be the result of a lack of post construction monitoring carried out to date, rather than lack of fatalities themselves. It is also difficult to predict accurately the extent of effects as there is little reported research highlighting changes in behaviour that may take place as a result of the turbines. For example, it is possible that the presence of the turbines could displace bats from the immediate area and lower the risk of collision effects. This effect has been observed in the case of small wind turbines (units generating <50 kW) whereby bat activity within 5m of the turbine reduced from 84% to 24% as wind speed (associated with the operation of the turbine) increases from 0 to 14 m/s (Minderman *et al*., 2012). Alternative research (Jones *et al* 2009) has shown that bats may be attracted to turbines. Given the lack of currently available information regarding impacts in the UK, a precautionary approach is taken based on available guidance documents as outlined in the following section.

5.3.2.1 Operational Impacts to Individual Ecological Receptors (Bat Species)

Based on available information of example flight heights, speeds, hunting techniques, habitat preference and migration (although not specifically in relation to behaviour near wind turbines) Natural England has produced guidance which allocates species of UK bats into different risk categories of high, medium or low (Natural England, 2012). Tables 5 and 6 summarise the risk of those species which are found in Scotland.

Table 5: Scottish species of bats likely to be at risk from collision with wind turbines

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

Table 6: Scottish bat populations likely to be threatened due to impacts from wind turbines

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

Those species found to be present on the site are highlighted in the tables above. The only two species recorded on the site were the common and soprano pipistrelles which are common and widespread throughout south-west Scotland (Harris and Yalden, 2008). These two pipistrelle species are assessed by Natural England (NE) guidance TN051 to be of medium risk in terms of collision, although low risk in terms of any threat to population. Taking into account the very low levels of activity recorded on the site and the generally low foraging heights of the common and soprano pipistrelle bats, it considered that very few pipistrelle bats using the site would be at risk of collision with the turbines. The populations of both species are assumed to be at optimal levels and in favourable conservation status in the local area and any direct losses

[5] **Barotrauma injuries occur when bats fly near to a moving turbine blade and suffer internal hemorrhaging as a result of the rapidly decreasing air pressure in the lee of the turning blade (Baerwald *et al.,* 2008)**

are not assessed to have any impact at the population level. The operational effects on these species are therefore considered likely to be a negative impact of **low magnitude** for the project lifespan.

5.3.3 Decommissioning Impacts

The decommissioning phase of the proposed development will remove a low to very low risk of the direct loss of individual bats and may return the habitat to blanket conifer plantation. Overall, within the limitations of the knowledge of future bat populations at Stronafian and surrounding land management, no measureable impacts are predicted. The impacts to **all species of bat populations** are assessed to be of **neutral value.**

5.4 Stage 3: Evaluating the Significance of Impacts Identified

The following section quantifies the predicted impacts of the proposed development. These impacts are measured by taking account of the value of each bat species and each impact in combination with the predicted effects. Where impacts are considered to be ecologically significant, mitigation recommendations are put forward with the aim of reducing the impacts to the point of insignificance. In this case, no medium or high impacts were predicted therefore only standard mitigation is recommended (Section 6).

5.4.1 Construction Impacts

The impact of the construction phase of the development is assessed to be neutral with regard to roosting bats and low to neutral with regard to foraging and commuting bats for each ecological receptor. The magnitude of the likely impact to bats will be negative impacts of **low magnitude** and of **minor significance** for the duration of the construction phase**.**

5.4.2 Operational Impacts

The impacts of the operation phase of the development are assessed to be low for both species of bat recorded on the site. Therefore, the operation of the windfarm is considered to be a negative impact of **low magnitude** which is considered likely to be of **minor significance** for **all ecological receptors**.

5.4.3 Decommissioning Impacts

The predicted impacts as a result of the decommissioning phase of the proposed development are assessed to be of **neutral magnitude** to **all ecological receptors** and therefore of **no significance.**

6 MITIGATION RECOMMENDATIONS

As outlined in Section 5, the proposed windfarm development at Stronafian is not assessed to lead to any ecologically significant impacts on bats. On a precautionary basis, only standard mitigation recommendations for potential operational effects on bats are therefore recommended, as follows:

6.1 Access Track Pre-construction Survey

Survey results did not identify any roosts on the site and no significant impacts to roosting bats are predicted. However, best practice measures (including pre-construction surveys) are advised along the route of the access track to ensure there are no additional constraints in the event that proposals should change.

6.2 Standard Buffers from Turbine Bases

Natural England's Technical Information Note TIN051 (Natural England, 2012) recommends that to minimise the risk to bat populations, a 50m buffer should be maintained around any feature (trees, watercourses, hedges etc.) into which no part of the turbine can intrude. This means the edge of the rotor swept area needs to be at least 50m from the nearest part of each habitat feature. Therefore, 50m should be the minimum stand-off distance from blade tip to the nearest feature. It is incorrect to measure 50m from the turbine base to the habitat feature at ground level as this would bring the blade tips very close to the canopy of a tall hedgerow and potentially put bat populations at risk. Instead, it is necessary to calculate the distance between the edge of the feature and the centre of the tower using the formula below, where: bl = blade length, hh = hub height, fh = feature height (all in metres):

$$b = \sqrt{(50 + bl)^2 - (hh - fh)^2}$$

In the case of the proposed turbines at Stronafian Forest, these will be the Enercon E53 model with a hub height of 60m, tip height of 86.5m and blade length of 26.5m. The feature height for woodland is calculated to be 20m and is based on the maximum height that the trees will grow to in their lifetime. For buffers relating to watercourse features, the feature height is simply expressed as O. Therefore, based on a hub height of 60m and a blade length of 26.5m, the minimum buffer around each turbine base must be at least 65.2m from the forest edge and at least 47.4m from any watercourses.

<u>Current proposed turbine locations do not fall within these buffer zones therefore no additional mitigation to this effect is required unless there are any changes to layout options.</u>

6.3 At Height Surveys

As noted in the limitations section of this report, no 'activity at height' surveys were undertaken in 2014. Given the incredibly low levels of activity recorded on the site and lack of bat species considered to be at high risk from collision (i.e. *Nyctalus* bat species and Nathusisus' pipistrelle *Pipistrellus nathusii*) it is considered very unlikely that additional at height surveys will provide any further information relating to use of the site by bats. Therefore, no further activity surveys are recommended.

6.4 Residual Impacts

Following standard mitigation recommendations, no significant residual impacts to bat species on the Stronafian site are predicted.

7 REFERENCES

Altringham, J (2011) Bats: From Evolution to Conservation. Oxford University Press ISBN 978-0-920711-4

Arnett, E. Huso, M. Schirmacher, M. Hayes J (2010) Altering turbine speed reduces bat mortality at wind-energy facilities. *Frontiers in Ecology and the Environment* **9**: 209–214.

Baerwald, E.F; D'Amours, G.H; Klug, B.J; Barclay, R.M. (2008) Barotrauma is a significant cause of bat fatalities at wind turbines. Current Biology Volume 18, Issue 16**.** Pages R695–R696

Dietz, C. Von Helversen, O., Neill, D (2009) Bats of Britain, Europe and Northwest Africa. A & C Black, London

Duffy, J. Stewart M (2008) Turbine Search Methods and Carcass Removal Trials at the Braes of Doune Windfarm. Natural Research Information Note 4. Natural Research Ltd, Banchory, UK

Georgiakakis, P. Kret, E. Cárcamo, B., Douta, B. Kafkaletou-Diez, A. Vasilaki, D. Papadatou, E (2012) Bat Fatalities at Windfarms in North-Eastern Greece. *Acta Chiropterologica* **14**:2, 459-468

Haddow, J (2012) Looking for Leisler's – in Scotland. Report for Central Scotland Bat Group, November 2012.

Hayes, J (2000) Assumptions and practical considerations in the design and interpretation of echolocation-monitoring studies. *Acta Chiropterologica* 2:225–236

Henry, M. Thomas, DW. Vaudrey, R. and Carrier M (2002) Foraging Distances and Home Range of Pregnant and Lactating Little Brown Bats (*Myotis lucifugus*) *Journal of Mammalogy*, **83:**3, 767-774

Hughes, PM., Rayner, JM (1993) The flight of pipistrelle bats, *Pipistrellus pipistrellus*, during pregnancy and lactation. Journal of Zoology (London) 230:541-555.

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

Jameson, J. Willis, C (2012) Bat Mortality at a Wind Power Facility in Central Canada. *Northwestern Naturalist* **93**:3,194-202

JNCC Joint Nature Conservation Council (1995) A Review of British Mammals: Population Estimates and Conservation Status of British Mammals Other Than Cetaceans. ISBN 1 873701 68 3

Jones, G (1995) Flight performance, echolocation and foraging behaviour in noctule bats *Nyctalus noctula*. *Journal of Zoology*, **237:** 303–312.

Jones, G. Cooper-Bohannon, R. Barlow, K. Parsons, K (2009) Scoping and Method Development Report: Determining the potential ecological impact of wind turbines on bat populations in Britain. University of Bristol and the Bat Conservation Trust

Minderman, J. Pendlebury, C. Pearce-Higgins, JW. Park, K (2012) Experimental Evidence for the Effect of Small Wind Turbine Proximity and Operation on Bird and Bat Activity. *PLoS ONE*, 7 (7), Art. No.: e41177.

Natural England (2012) Technical Information Note TIN051 – Bats and Onshore Wind Turbines Interim Guidance. Natural England Publications, Peterborough

Russ, J (2012) British Bat Calls: A Guide to Species Identification. Pelagic Publishing, Exeter.

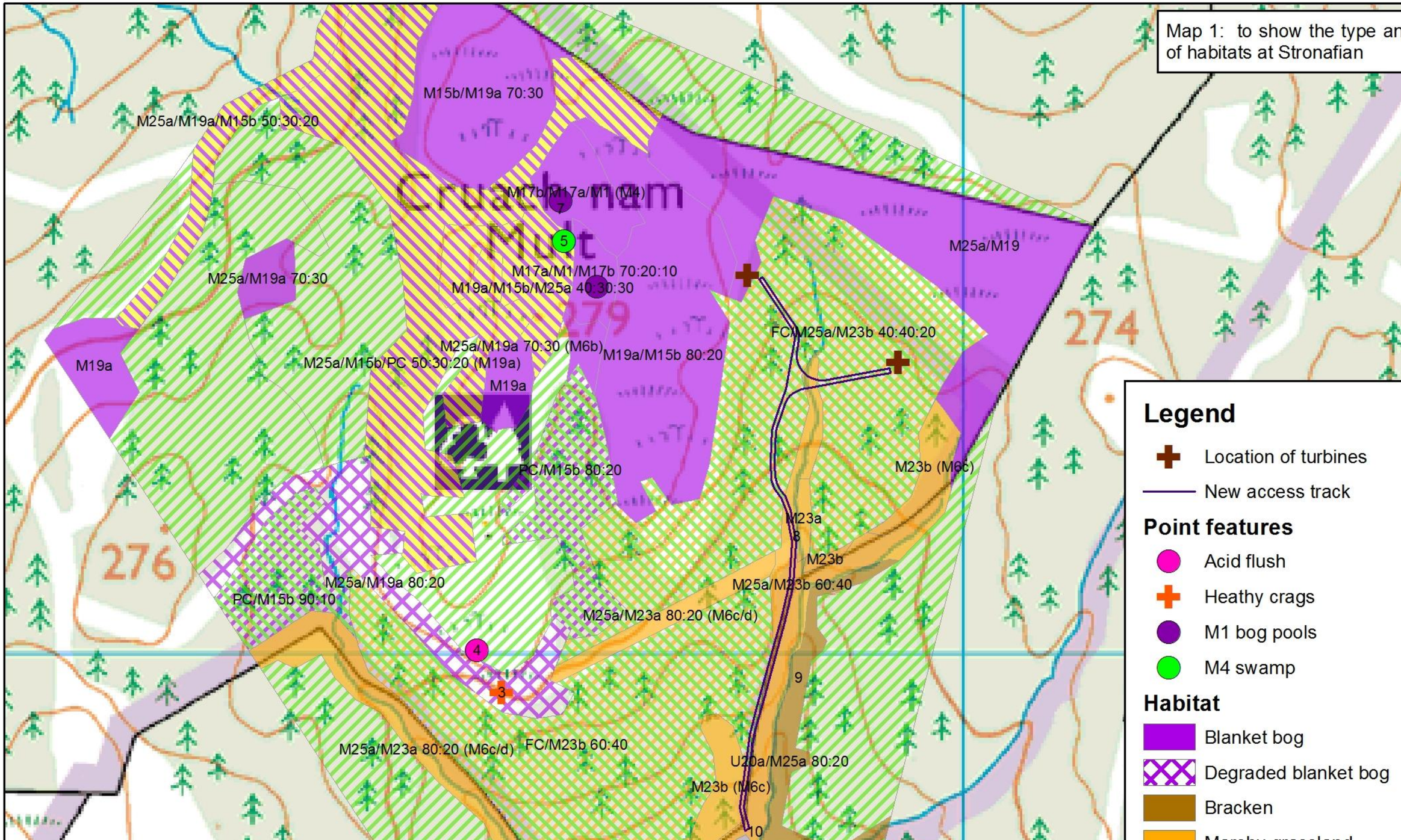
Simmons, H (2014) Pers. comm. 16th October 2014.

Sherwin, R. Gannon, W and Haymond, S (2000) The efficacy of acoustic techniques to infer differential use of habitat by bats. *Acta Chiropterologica* **2**:145–153.

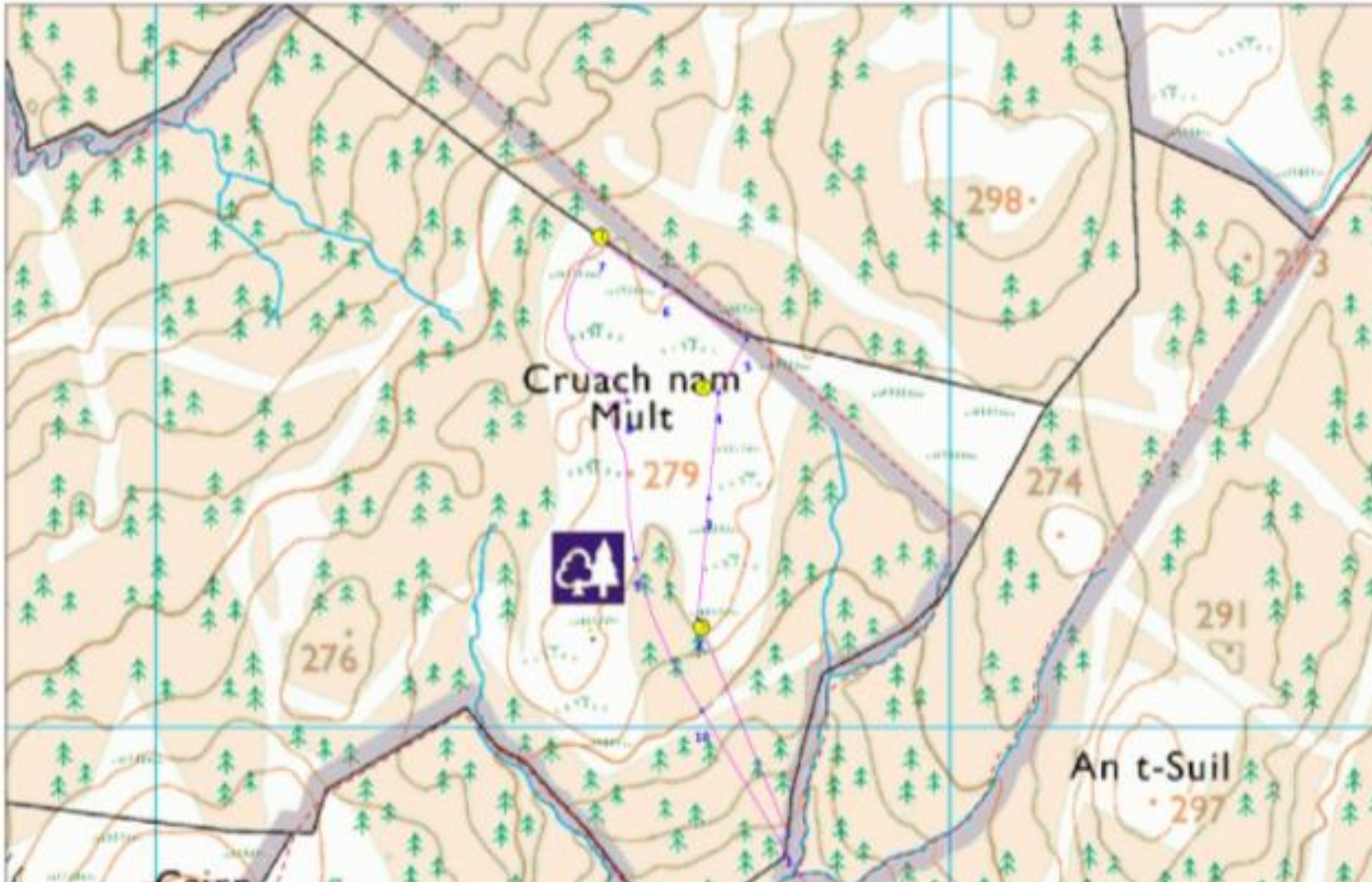
Vaughan, N. Jones, G and Harris, S (1997) Identification of British bat species by multivariate analysis of echolocation call parameters. *Bioacoustics* **7:**189–207

APPENDIX I – MAPS

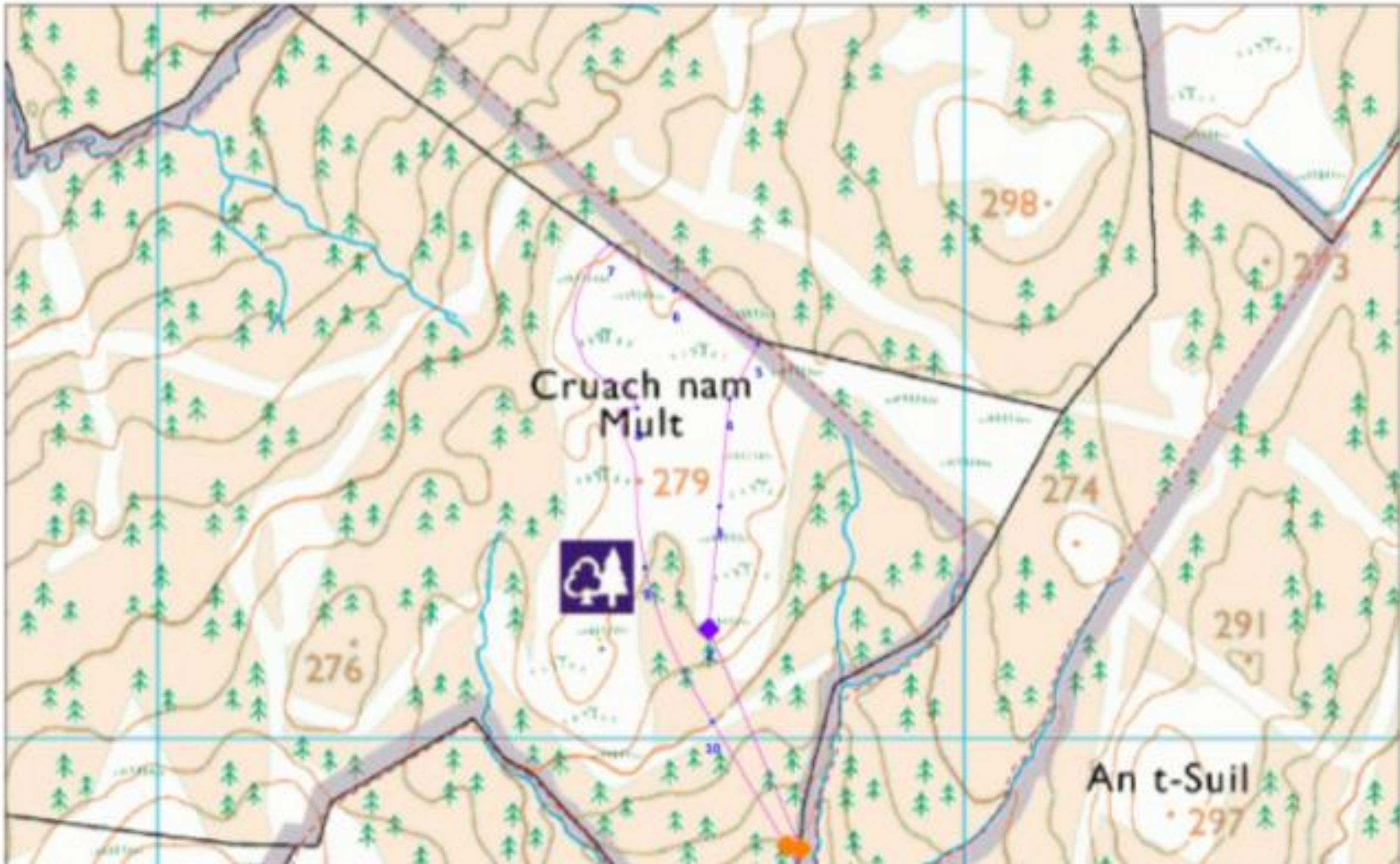
Map 1 – Proposed Site Layout



Map 2 – Static Detector Locations and Transect Route



Map 3: Transect Survey Results



8 APPENDIX II – SURVEY SUMMARY TABLES (METHODOLOGY)

Table 7: Transect Survey Information

Survey Season:	Spring: June	Summer: July	Autumn: September
Date:	10.06.2014	22.07.2014	24.09.2014
Sunset / Start time:	22.00 / 21.35	21.50 / 21.40	19.15 / 18.45
Weather summary:	Dry, calm evening, partially cloudy with an average temperature of 14 °C	Dry, calm evening, partially cloudy with an average temperature of 15 °C	Dry evening with a light breeze, partly cloudy. Average temperature of 13°C

Table 8: Static Detector Survey Information

AnaBat	Survey Dates (Spring)	No. Nights	Survey Dates (Summer)	No. Nights	Survey Dates (Autumn)	No. Nights
L1	02.06.14 – 08.06.14	7	28.07.14 – 08.08.14	13	10.09.14 – 16.09.14	7
L2	02.06.14 – 08.06.14	7	28.07.14 – 08.08.14	13	10.09.14 – 16.09.14	7
L3	02.06.14 – 08.06.14	7	28.07.14 – 08.08.14	13	10.09.14 – 16.09.14	7

Table 9: Static Detector Locations - Habitat Descriptions

Locations	Grid Ref	Habitat Description
L1	NS 01562 84617	Located on a boundary fence line close (approx 15m) to immature spruce plantation edge.
L2	NS 01691 84428	Located close to the summit of Cruach nam Mult in open blanket bog habitat.
L3	NS 01689 84127	Located on a small spruce tree out in the open habitat, positioned to record activity over clearfell habitat.

9 APPENDIX III – DESK STUDY RESULTS

Table 10: NBN Desk Study Results

Location	Colintraive Proposed Windfarm	Grid Squares	NS 016 842	Date of Search	15th October 2014
Wild Surveys Bat Species	**No of Records within 5 km**	**Approximate distance in km**	**Site name/Grid Ref**		**Date**
Soprano pipistrelle	1	1.6km	Stronafian NS 015 821		2013
Common pipistrelle	1	1.6km	Stronafian NS 015 821		2013
Brown long eared bat	0, but present within 10km	8km	Dunans Castle NS 040 911		2014
NBN Bat Species	**No of Records within 5 km**	**Approximate distance in km**	**Site name/Grid Ref**		**Date**
Common pipistrelle	0				
Soprano pipistrelle	0				
Nathusius' pipistrelle	0				
Daubenton's bat	0				
Natterer's bat	0				
Whiskered bat	0				
Brown long eared bat	1	2.3km	NS 01 87		2013
Noctule bat	0				
Leisler's bat	0				

Table 11: Additional Desk Study Information

Argyll and Bute Local Biodiversity Action Plan

Bat Species know to occur within the area.

- The bat species known to occur in this area are Soprano pipistrelle, Common pipistrelle, Daubenton's bat, Brown long-eared bat and Noctule bat.

Species Selected For Action

- Red Squirrel
- Water Vole
- Otter
- Scottish Wildcat
- Soprano pipistrelle bat
- Brown long-eared bat
- Noctule bat

Designated Site Search- Statutory, Non Statutory and Local Nature Reserves within 2 km

***Site Name*, Location, Grid Reference**	**Status - feature**	**Approximate distance in km**
Ruel Estuary NS 015 814	SSSI – Saltmarsh, Flood-plain fen, Fen Meadow, Upland oak woodland	2KM SOUTH

9.1 Scottish Leisler's Bat Project Information

Looking for Leisler's – in Scotland

Up to 2009, other than occasional records from elsewhere in Scotland, the only part of the country with a known population of the species was one corner of the southwest – the Cree Valley and Glen Trool in Dumfries and Galloway.

Figure 1. The known distribution of the Scottish Leisler's bat population up to 2009

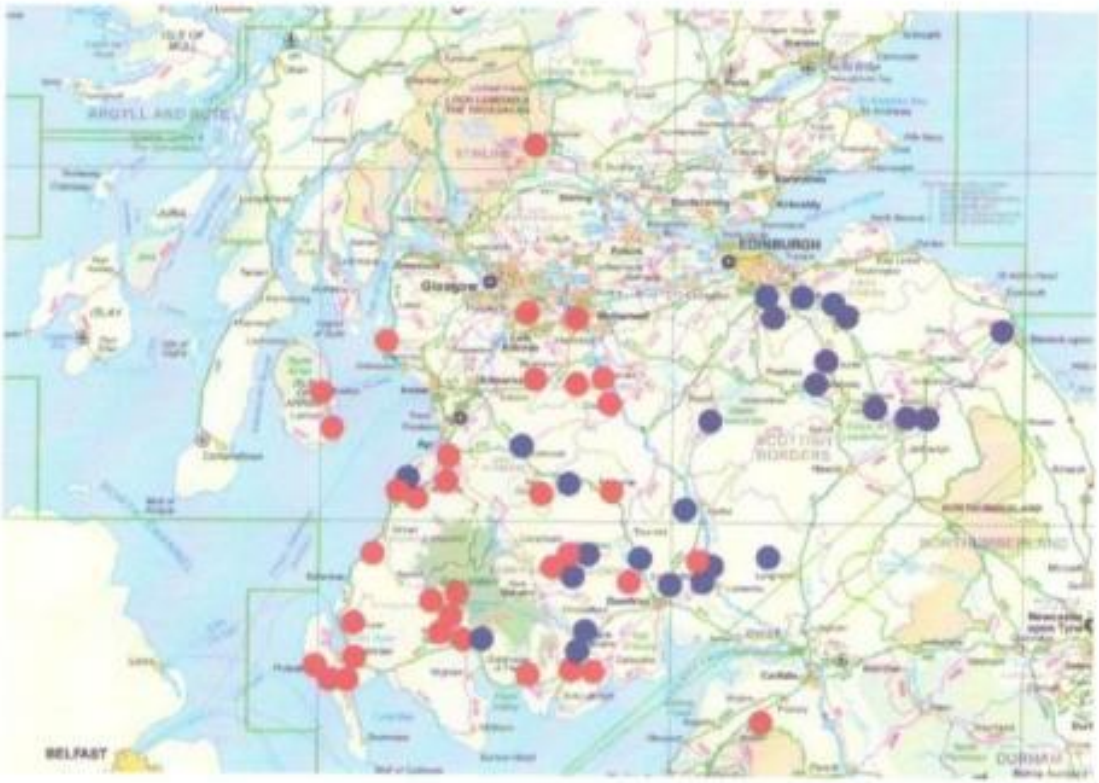
Experience in recognising Leisler's bat from Anabat and sound recordings was gained while radiotracking these bats for the first time in the Cree Valley area during summer 2010. Following that, *Nyctalus* recordings from the whole of southern Scotland were analysed. These included a number of long-term monitoring projects at proposed wind farm sites and other types of bat survey.

The analysis showed that in fact the species had been overlooked in the west of Scotland, and the distribution is much wider than previously recognised.

A series of spots on a map does not, of course, tell the whole story. It appears that Leisler's bat is the dominant species of the two *Nyctalus* bats in the west and south of Scotland, except for an area around Dumfries and Castle Douglas where the commonest species is noctule. Elsewhere in the "core area" for Leisler's bats in Scotland any records of noctule are infrequent. In the southeast of Scotland all good recordings that have been analysed show typical noctule calls. The dividing line, to date, is the M74 motorway.

Figure 2. The currently understood distribution of the two *Nyctalus* species (based on analysis of Anabat recordings, and some sound recordings, as well as bats in the hand) One record from Cumbria is included, but this was the only recording from England analysed. Leisler's bat occurs widely in Ireland, where it is the only *Nyctalus* species, and the same is true of the Isle of Man, just off the map to the south.

Red spots = **Leisler's bat** *Nyctalus leisleri*; blue spots = **noctule** *Nyctalus noctula*.



Any evidence of roosting, so far, in Scotland, shows that Leisler's bat roosts mainly in trees, and does not use buildings in the way that the species does in Ireland, where large maternity roosts can be found in houses.

Thanks are due to the many who contributed recordings for identification, and to all those who have taken part in the Scottish Leisler's Bat Project in 2010 to 2012. In July 2011 the project successfully used radio telemetry to find the first known breeding colony of Leisler's bat in Scotland, in Culzean Country Park, South Ayrshire (a National Trust for Scotland property). The colony was studied again in July 2012 and remains the only known breeding site in Scotland

November 2012 J Haddow, Central Scotland Bat Group / Auritus Wildlife Consultancy
email auritus@btinternet.com

10 APPENDIX IV - TRANSECT SURVEY RESULTS

See Map 2 in Appendix I for visual representation of transect routes.

10.1 Spring Survey Period

Table 12: Transect Survey Information – June

Time	Grid Ref	Species	Notes
21.27 – 21.32	POINT 1: NS 01799 83865	-	No bats recorded
21.42 – 21.47	POINT 2: NS 01685 84137	-	No bats recorded
21.51 – 21.56	POINT 3: NS 01698 84289	-	No bats recorded
22.02 – 22.07	POINT 4: NS 01711 84421	-	No bats recorded
22.10 – 22.15	POINT 5: NS 01746 84489	-	No bats recorded
22.20 – 22.25	POINT 6: NS 01642 84556	-	No bats recorded
22.28 – 22.33	POINT 7: NS 01562 84614	-	No bats recorded
22.44 – 22.49	POINT 8: NS 01596 84410	-	No bats recorded
22.55 – 23.00	POINT 9: NS 01606 84213	-	No bats recorded
23.11 – 23.16	POINT 10: NS 01690 84022	-	No bats recorded
23.29	NS 01782 83869	*Pipistrellus pipistrellus*	Two short passes, commuting bat.
23.31 – 23.37	POINT 11: NS 01830 83787	-	No bats recorded

10.2 Summer Survey Period

Table 13: Transect Survey Information – July

Time	Grid Ref	Species	Notes
21.40 – 21.45	POINT 11: NS 01830 83787	-	No bats recorded
21.59 – 21.04	POINT 1O: NS 01690 84022	-	No bats recorded
22.10 – 22.15	POINT 9: NS 01596 84410	-	No bats recorded
22.33 – 22.38	POINT 8: NS 01596 84410	-	No bats recorded
22.44 – 22.49	POINT 7: NS 01562 84614	-	No bats recorded
22.53 – 22.59	POINT 6: NS 01642 84556	-	No bats recorded
23.06 - 23.11	POINT 5: NS 01746 84489	-	No bats recorded
23.16 – 23.21	POINT 4: NS 01711 84421	-	No bats recorded
23.28 – 23.32	POINT 3: NS 01698 84289	-	No bats recorded
23.36 – 23.41	POINT 2: NS 01685 84137	*Pipistrellus pygmaeus*	One brief pass, bat not seen.
23.42 – 23.47	POINT 1: NS 01799 83865	*Pipistrellus pipistrellus*	Very short pass, not seen.

10.3 Autumn Survey Period

Table 14: Transect 3 Survey Information - September

Time	Grid Ref	Species	Notes
18.45 – 18.50	POINT 1: NS 01799 83865	-	No bats recorded
19.05 – 19.10	POINT 2: NS 01685 84137	-	No bats recorded
19.15 – 19.20	POINT 3: NS 01698 84289	-	No bats recorded
19.23 – 19.28	POINT 4: NS 01711 84421	-	No bats recorded
19.30 – 19.35	POINT 5: NS 01746 84489	-	No bats recorded
19.38 – 19.42	POINT 6: NS 01642 84556	-	No bats recorded
19.46 – 19.51	POINT 7: NS 01562 84614	-	No bats recorded
19.56 – 20.01	POINT 8: NS 01596 84410	-	No bats recorded
20.10 – 20.15	POINT 9: NS 01606 84213	-	No bats recorded
20.20 – 20.25	POINT 10: NS 01690 84022	-	No bats recorded
20.41 – 20.46	POINT 11: NS 01830 83787	*Pipistrellus sp.*	Two bats foraging along the plantation edge and turning circle at track end.

11 APPENDIX V – AUTOMATED DETECTOR SURVEY RESULTS

Results are presented per survey location per survey season and provided as (1) the total number of passes per night (TOTAL) per species at each location and (2) the average number of passes per night (AV PPN).

11.1 Spring Survey Results – Static Detectors (June)

Table 15: Static Activity Summary – Location 1

Species / Date	02.06	03.06	04.06	05.06	06.06	07.06	08.06	Total	AV PPN
P.pipistrellus	0	0	0	0	0	0	0	**0**	**0**
P.pygmaeus	0	0	0	0	0	0	0	**0**	**0**
Pipistrelleus sp.	0	0	0	0	0	0	0	**0**	**0**
Total	0	0	0	0	0	0	0	**0**	**0**

Table 16: Static Activity Summary – Location 2

Species / Date	02.06	03.06	04.06	05.06	06.06	07.06	08.06	Total	AV PPN
P.pipistrellus	0	0	0	0	0	0	0	**0**	**0.00**
P.pygmaeus	0	0	0	1	0	0	0	**1**	**0.14**
Pipistrelleus sp.	0	0	0	0	0	0	0	**0**	**0.00**
Total	0	0	0	1	0	0	0	**1**	**0.14**

Table 17: Static Activity Summary – Location 3

Species / Date	02.06	03.06	04.06	05.06	06.06	07.06	08.06	Total	AV PPN
P.pipistrellus	0	0	0	0	0	0	0	**0**	**0.00**
P.pygmaeus	0	1	0	0	0	0	0	**1**	**0.14**
Pipistrelleus sp.	0	0	0	0	0	0	0	**0**	**0.00**
Total	0	1	0	0	0	0	0	**1**	**0.14**

11.2 Summer Survey Results – Static Detectors (July/August)

Table 18: Static Activity Summary – Location 1

Species / Date	28.07	29.07	30.07	31.07	01.08	02.08	03.08	04.08	05.08	06.08	07.08	08.08	09.08	Total	AV PPN
P.pipistrellus	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0**
P.pygmaeus	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0**
Pipistrelleus sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0**
Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Table 19: Static Activity Summary – Location 2

Species / Date	28.07	29.07	30.07	31.07	01.08	02.08	03.08	04.08	05.08	06.08	07.08	08.08	09.08	Total	AV PPN
P.pipistrellus	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.00**
P.pygmaeus	1	0	0	0	0	0	0	0	0	0	0	0	0	**1**	**0.08**
Pipistrelleus sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.00**
Total	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0.08**

Table 20: Static Activity Summary – Location 3

Species / Date	28.07	29.07	30.07	31.07	01.08	02.08	03.08	04.08	05.08	06.08	07.08	08.08	09.08	Total	AV PPN
P.pipistrellus	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.00**
P.pygmaeus	0	0	1	0	0	0	1	0	0	0	0	0	0	**2**	**0.15**
Pipistrelleus sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0.00**
Total	**0**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0.15**

11.3 Autumn Survey Results – Static Detectors (September)

Table 21: Static Activity Summary – Location 1

Species / Date	10.09	11.09	12.09	13.09	14.09	15.09	16.09	Total	AV PPN
P.pipistrellus	0	0	0	1	1	0	0	**2**	**0.29**
P.pygmaeus	0	2	2	5	0	0	0	**9**	**1.29**
Pipistrelleus sp.	0	0	0	0	0	0	0	**0**	**0.00**
Total	**0**	**2**	**2**	**6**	**1**	**0**	**0**	**11**	**1.57**

Table 22: Static Activity Summary – Location 1

Species / Date	10.09	11.09	12.09	13.09	14.09	15.09	16.09	Total	AV PPN
P.pipistrellus	0	0	0	0	0	0	0	**0**	**0**
P.pygmaeus	0	0	0	0	0	0	0	**0**	**0**
Pipistrelleus sp.	0	0	0	0	0	0	0	**0**	**0**
Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Table 23: Static Activity Summary – Location 1

Species / Date	10.09	11.09	12.09	13.09	14.09	15.09	16.09	Total	AV PPN
P.pipistrellus	1	2	1	0	0	0	0	**4**	**0.57**
P.pygmaeus	4	3	3	0	0	0	0	**10**	**1.43**
Pipistrelleus sp.	0	0	0	0	0	0	0	**0**	**0.00**
Total	**5**	**5**	**4**	**0**	**0**	**0**	**0**	**14**	**2.00**

11.4 Overall Static Detector Summary Table

Table 24: Static Activity Summary – Average Passes Per Night and Activity Index Overall Results

Location	Survey Period	*P.pip*	*P.pyg*	*Pip sp.*	Total AV PPN	Activity Index
1	SPRING	0.00	0.00	0.00	0.00	**0.52**
	SUMMER	0.00	0.00	0.00	0.00	
	AUTUMN	0.29	1.29	0.00	1.57	
2	SPRING	0.00	0.14	0.00	0.14	**0.08**
	SUMMER	0.00	0.08	0.00	0.08	
	AUTUMN	0.00	0.00	0.00	0.00	
3	SPRING	0.00	1.00	0.00	0.14	**0.77**
	SUMMER	0.00	1.00	1.00	0.17	
	AUTUMN	0.57	1.43	0.00	**2.00**	

12 APPENDIX VI – RESULTS FIGURES

Figure 1: Bat Activity Index per Static Detector Location

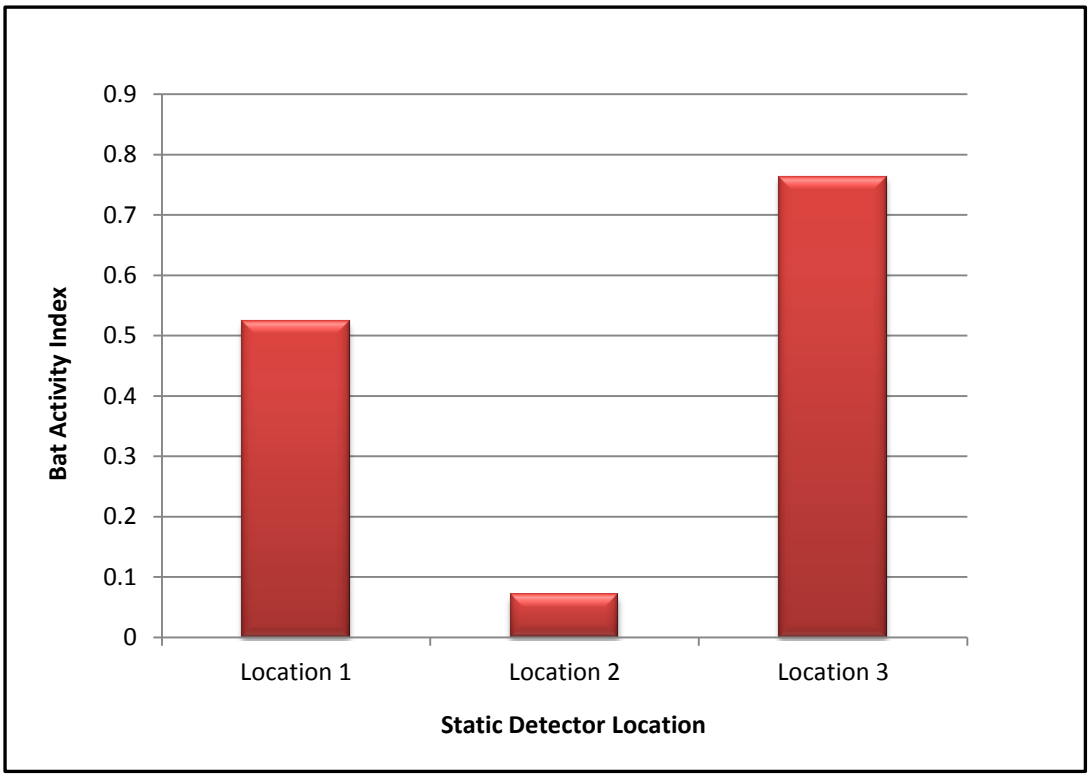


Figure 2: Activity (Average passes per night) per Static Detector Location per Survey Season

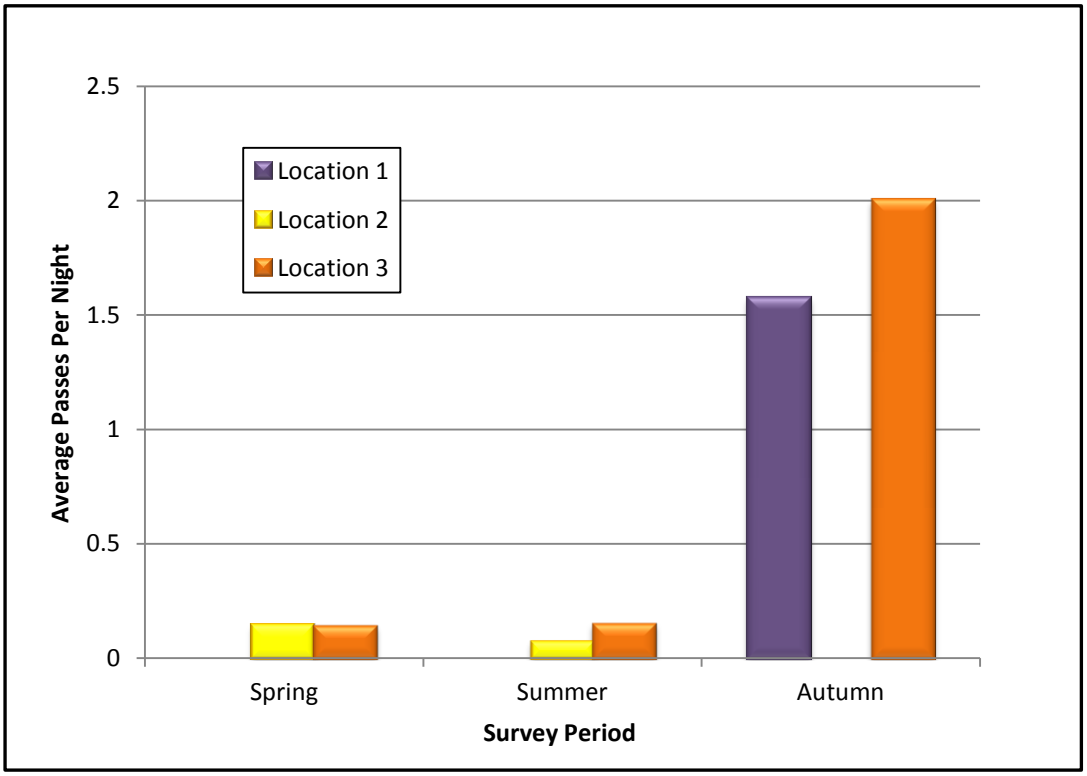
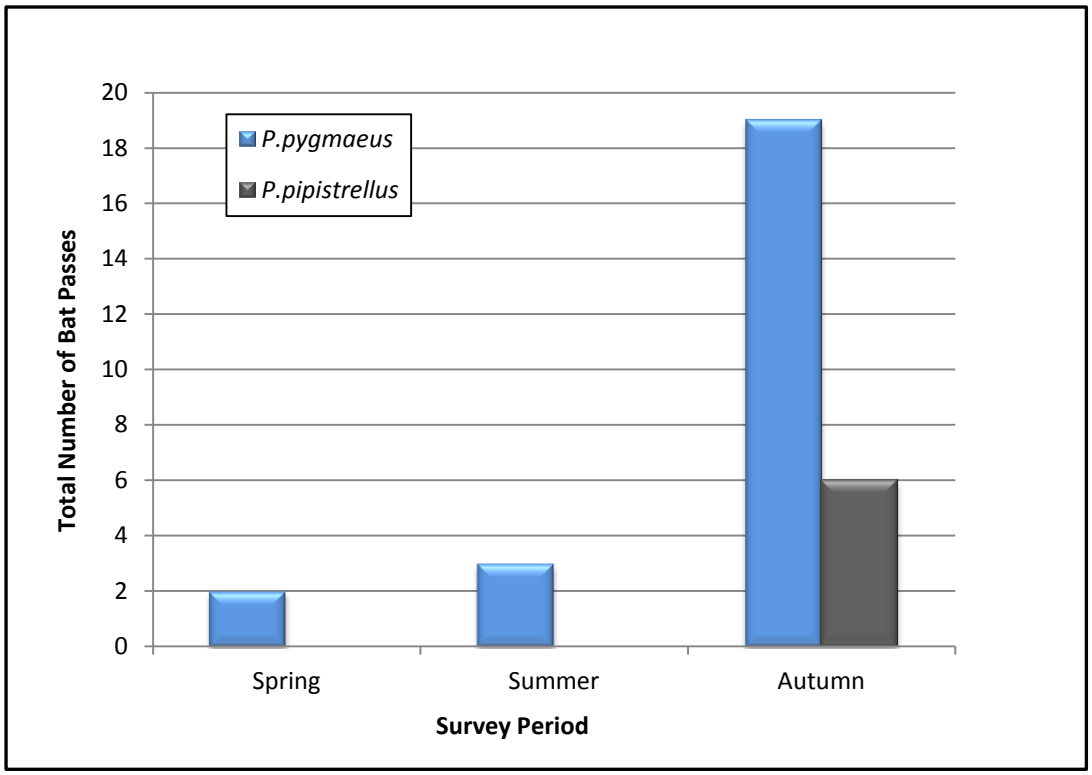


Figure 3: Comparison of Activity Levels per Species per Survey Period



13 APPENDIX VII – IMPACT ASSESSMENT CRITERIA TABLES

Table 25: Guideline Nature Conservation Evaluation Criteria

Level of Value	Examples (not definitive and often dependent on professional judgement)
INTERNATIONAL	Internationally designated or proposed sites (such as Ramsar Sites, Special Protected Areas, Biosphere Reserves and Special Areas of Conservation) meeting the criteria for international designation; or non-designated sites meeting the criteria for international designation. Sites supporting populations of internationally important numbers of species/assemblages.
UK	Nationally designated sites (such as SSSIs, NNRs, Marine Nature Reserves, Nature Conservation Review (NCR) Grade 1 sites); or non-designated sites meeting SSSI selection criteria. Sites supporting populations of nationally important numbers, and/or supplying critical elements of their habitat requirements. Regularly occurring rare bird species (e.g. <300 breeding pairs in the UK).
REGIONAL	Sites containing viable areas of threatened habitats of importance within a regional context, e.g. central or highland Scotland. Sites comfortably exceeding council designations (such as Site of Importance for Nature Conservation [SINC]), but not meeting SSSI selection criteria. Sites containing good quality examples of priority habitats identified in the UK BAP or council LBAPs. Sites supporting viable breeding populations of nationally scarce species on account of their rarity, or supplying critical elements of their habitat requirements. Any regularly occurring population of a nationally important bird species that is threatened or rare in the region (e.g. >1% of the regional population).
LOCAL AUTHORITY AREA	Sites meeting the criteria for Local Authority Area designation (such as Site of Importance for Nature Conservation (SINC) which may include amenity and educational criteria in urban areas. Designated Local Nature Reserves. Sites containing viable areas of any priority habitat identified in the UK BAP or council LBAPs. Sites supporting viable breeding populations of species known to be council rarities (e.g. included in the LBAP), and/or supplying critical elements of their habitat requirements. Any regularly occurring, locally significant population of bird species.
LOCAL	Undesignated sites, features or species considered to appreciably enrich the habitat or species resource within the immediate environs. Examples include species-rich hedgerows, ponds, etc.
NEGLIGIBLE	Low grade and widespread habitats or species. A widespread species with minimal use of an area that does not form a significant element of its habitat requirements.
NEGATIVE	Invasive, alien species, e.g. those scheduled under Section 14, Schedule 9 of the Wildlife and Countryside Act 1981.

Table 26: Definitions of Magnitude of Effects

High (major)	Adverse effects on the integrity or nature conservation status of bat species. Impacts are likely to permanently alter the ecological integrity of the site. Detectable in the short term, medium term and long term.
Medium (moderate)	Would cause significant but not adverse effects on the integrity or nature conservation status of species present in the short and medium term, which may threaten the long-term integrity of the system.
Low (minor)	Would cause a noticeable effect, but would not affect the long term viability of the habitat or species population. Would not cause harm to the long term integrity or conservation status of the site.
Neutral	Would have no detrimental effect on the habitat or population of bat species.
Beneficial / positive	Where the changes are considered to be beneficial to bat species on the site

14 APPENDIX VIII – PHOTOGRAPHS

Photo 1: Static Detector Location 1

Photo 2: Static Detector Location 2

Photo 3: Static Detector Location 3

Photo 4: View looking south over the southern end of the site and recently clear-felled habitat

15 APPENDIX IX – SUMMARY OF RELEVANT LEGISLATION

All bat species in the UK are European Protected Species (EPS) and are fully protected under the EC Habitats and Species Directive 92/43/EEC. The Conservation (Natural Habitats,&c.) Regulations 1994 translates this European legislation into law the UK. These regulations have been amended in Scotland by The Conservation (Natural Habitats, &c.) Amendment (Scotland) Regulations 2004 and 2007 and the Conservation (Natural Habitats, &c.) Amendment (No. 2) (Scotland) Regulations 2008.

The regulations make it an offence to deliberately or recklessly:

- Capture, injure or kill an EPS
- Harass an EPS or group of EPS
- Disturb such an EPS while it is occupying a structure or place it uses for shelter or protection
- Disturb an EPS while it is rearing or otherwise caring for its young
- Obstruct access to a breeding site or resting place of an EPS or to otherwise deny an EPS use of a breeding site or resting place
- Disturb an EPS 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
- Disturb an EPS 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
- Disturb such an animal while it is migrating or hibernating

It is also an offence to:

- damage or destroy a breeding site or resting place of such an animal
- keep, transport, sell or exchange or offer for sale or exchange any wild animal or plant EPS or any part or derivative of one

The legislation and list of offences summarised above are not comprehensive. For a definitive list of offences and exceptions, the legislation itself must be consulted.