LLAN BRYN MAIR WIND FARM

Supplementary Environmental Information
October 2013



Volume I – Non-Technical Summary
Volume II – Main Text

power for good

BAT ASSESSMENT

1 NON-TECHNICAL SUMMARY

1.1.1 RES UK & Ireland Ltd ('RES') applied to the Department of Energy and Climate Change (DECC) for consent to construct and operate a wind farm development (hereafter, 'the Wind Farm Proposal' ('WFP')) and proposed offsite highways works (Llanerfyl to Talerddig road) - hereafter referred to as the 'Offsite Highways Works' ('OHW') (as detailed in Appendix 10.1 of the 2013 SEI) on land between the villages of Llanerfyl and Llanbrynmair, north-west of Newtown, Powys in April 2009.

1.1.2 To support the application five rounds of Supplementary Environmental Information (SEI) were submitted during 2010-2012. The planning application for this wind farm is currently under consideration and is due to be appraised at the Mid-Wales (Powys) Conjoined Wind farms Public Inquiry.

1.1.3 The proposal has undergone considerable changes since the original submission. To update and consolidate these changes RES have combined all relevant information into a single consolidated SEI package (that does not include information relating to bats), which was published in August 2013. This document is the second SEI submission of 2013, the purpose of which is to update the baseline survey information and the existing assessment of likely significant effect of the WFP and the OHW on the bat resource of the study area. This document should be read in conjunction with the 2013 consolidated SEI submission.

1.1.4 The Proposal is shown in Figure 3.6 (SEI August 2013, Volume III) and is situated 13km west of Welshpool in mid-Wales. The WFP site is an undulating plateau, bounded to the east by Afon Gam in Cwm Nant yr Eira and by Clegyrnant watercourse to the west. It lies over Silurian geology, covers approximately 17 square kilometres and runs from roughly 200 metres a.s.l. in Cwm Nant yr Eira up to 475 metres near Llyn Gwyddior. It contains extensive areas of conifer plantation, agriculturally improved pasture, and unimproved upland habitats, such as acid grassland with smaller areas of heath and mire.

1.1.5 Bat surveys were updated in 2013, after bat surveys were previously undertaken in 2006 and 2011, to take account of new standard guidance for bat surveys published in 2012 by BCT (Hundt, 2012) as well as updates to the layout of both the WFP and OHW. The 2013 surveys supercede those previously undertaken although the latter have been summarised as background context. The study identifies the species assemblage present as well as key habitat features used by bats and the relative activity of individual bat species using the site. Surveys undertaken during May-August 2013 included a desk study, walked and driven transect surveys, automated bat detector surveys and bat roost surveys. At least five species of bats (the *Myotis* genus comprises 7 species in the UK) were recorded; noctule *Nyctalus noctula*, common pipistrelle *Pipistrellus pipistrellus*, soprano pipistrelle *Pipistrellus pygmaeus*, *Myotis* sp., and brown long-eared bat *Plecotus auritus*. Moderate to low levels of activity were recorded for the two pipistrelle species and low levels of activity were recorded for *Myotis* sp., noctule and brown long-eared bat. A peak in activity was recorded in July-August with little activity recorded in May-June. Most bat activity was associated with boundary features such as the edge of coniferous plantation, with

significantly lower levels of activity recorded for all species (except noctule) over the proposed turbine locations, in comparison to boundary habitat features.

1.1.6 In the interim guidance produced by Natural England on bats and onshore wind turbines each bat species has been categorised with respect to the likelihood of individuals and populations of the species being effected by the operation of wind turbines. This is taken into account in the assessment process which concludes that there is unlikely to be a significant negative effect on the populations of any individual bat species recorded during surveys at the site, although there is a small risk of individual bats being killed.

2 GLOSSARY

BCT – Bat Conservation Trust
CCW – Countryside Council for Wales
CIEEM – Chartered Institute of Ecology and Environmental Management
EcIA – Ecological Impact Assessment
ES – Environmental Statement
LBAP – Local Biodiversity Action Plan
NE – Natural England
NRW – Natural Resources Wales
SAP – Species Action Plan
SEI - Supplementary Environmental Information
TMP – Traffic Management Plan

3 INTRODUCTION

3.1.1 This document has been prepared by BSG Ecology. It provides updated survey results and a reassessment of the potential effects on bats of the WWFP and the OHW.

3.1.2 It updates and supersedes all previous information provided concerning bats in the Ecology chapter of the original ES, as well as the previous SEI relating to bats, and updating the assessment for the WFP and OHW. A summary of the 2006 and 2011 surveys are included as background contextual information but the results of these surveys are not relied upon to inform the assessment.

3.1.3 The assessment provides baseline information, evaluates the bat resource, identifies potential impacts on bats, assesses the significance of those impacts, describes mitigation measures to avoid, reduce, remedy or compensate for those impacts, and assesses the significance of the residual effects based on the magnitude of the impact and the sensitivity of the receptor. The SEI also discusses ongoing management and monitoring measures. Such assessments are considered for the construction, operation and decommissioning phases of the project.

3.1.4 The WFP area is shown in Figure 3.6 (SEI August 2013, Volume III) and is situated 13km west from Welshpool in mid-Wales. The site is exposed, windswept and notably colder than the surrounding lowland landscape for much of the year. Rather species-poor acid, marshy or improved pasture and conifer plantations cover large parts of the Site, but there are also large areas containing a mosaic of mire, marshy and acid grassland, and some heathland. The WFP site is mainly divided by fences. Sheep and cattle were grazing parts of the WFP site at the time of the survey.

3.1.5 The WFP will include 30 wind turbines with micro-siting of up to 100m, associated transformers, crane hardstandings, rotor assembly pads, temporary and permanent anemometer masts, access tracks, watercourse crossings, on-site underground cabling, substation compound and welfare buildings; borrow pits, temporary construction compounds and a batching plant (See Chapter 3 of the SEI August 2013 for details).

4 RELEVANT LEGISLATION AND POLICY

4.1.1 There are a number of national, regional and local policies that relate to nature conservation, ecology, and specifically to bats. Reference to these provides an indication of the likely requirements and expectations of statutory authorities in relation to planning applications within a given area. A brief outline of the relevant planning policy and guidance that relates to nature conservation and ecology is provided below. All relevant policies are further considered in Chapter 2 of the SEI August 2013.

4.1.2 The following legislation relates to bats:

- The Conservation (Natural Habitats, &c.) Regulations 2010 (as amended);
- The Wildlife and Countryside Act 1981 (as amended);
- The Countryside and Rights of Way (CRoW) Act 2000;
- The Natural Environment and Rural Communities Act 2006.

4.1.3 Particular attention has been paid to the planning policy and strategy documents listed below:

- Planning Policy Wales - Technical Advice Note 5: Nature Conservation and Planning (September 2009);
- Powys Local Development Plan: Preferred Strategy (March 2012);
- Powys Unitary Development Plan (UDP) 2001 – 2016 (Adopted 1st March 2010);
- Powys UDP – Supplementary Planning Guidance – Interim Development Control Guidance (IDCG): Biodiversity Conservation and Enhancement in Development Proposals (April 2009);
- Powys UDP – Supplementary Planning Guidance – Second Draft Interim Development Control Guidance: Wind farm Development in Powys (2008);
- UK Post-2010 Biodiversity Framework (JNCC; July 2012);
- Environment Strategy for Wales (Welsh Government; 2006); and
- Our Partnership with Nature: A Local Biodiversity Action Plan for Powys (Powys County Council; October 2002).

4.1.4 The following Powys County Council Unitary Development Plan (Approved 1st March 2010) policies have also been considered:

- Policy ENV3 – Safeguarding Biodiversity and Natural Habitats;
- Policy ENV4 – Internationally Important Sites;
- Policy ENV5 – Nationally Important Sites;
- Policy ENV6 – Sites of Regional and Local Importance; and
- Policy ENV7 – Protected Species.

4.1.5 The following Powys County Council Local Development Plan – Preferred Strategy (March 2012) policy has also been considered:

- Policy LDP SP3 – Natural, Historic Environment and Landscape.

5 APPROACH AND METHODS

5.1 Consultation

5.1.1 NRW (formerly CCW) responded to the 2008 ES on 11th November 2010. In this response NRW objected to the planning application raising a number of concerns in relation to bats. Further survey work on bats was carried out in 2011 and reported in the form of Supplementary Environmental Information (SEI) 2011. NRW responded to the new information in a letter dated 12th of October 2012.

5.1.2 In this letter NRW maintained an objection and commented that in relation to bats the SEI 2011 "lacks clarity and information previously requested by CCW (now NRW) has still not been provided" (Paragraph 55). The information previously requested and listed in Annex 5 was:

- The assessment has not identified or surveyed roosts in the vicinity of the site. This is important to identify potential risk areas with high bat densities;
- Figure 8.2 was not identified in the SEI and should be provided to NRW;
- Where trees are to be felled on off-site roads suitable mitigation measures should be included in planning conditions to avoid impacts on bats.

5.1.3 NRW also commented on the need for turbine blade tips to be at least 50m from woodland edge and watercourses as set out in the interim guidance TIN051 prepared by Natural England. The letter also noted that Turbines 12 and 13 appeared to be closer to such features than 50m. NRW also proposed that pre-commencement surveys should be undertaken to inform avoidance and mitigation measures for bats during "felling and construction periods". Survey is also required to provide a baseline for post-construction monitoring (Paragraph 58).

5.1.4 NRW also set out a range of post-consent requirements that are detailed in the response prepared by BSG Ecology on 18th July 2013 to the letter from NRW dated 12th of October 2012 (Appendix 1).

5.1.5 Further correspondence via e-mail and telephone has taken place since July but no formal response from NRW has been received at the time of preparing this proof of evidence. However, correspondence is on-going and it is hoped that a statement of common ground will be forthcoming.

5.1.6 In their Statement of Case (SoC) NRW do not make reference to bats, but retain the right to comment further on any new supplementary environmental information that may be forthcoming following preparation of the SoC. At the time of preparing this proof NRW had not been issued with the final Bat SEI.

5.2 Methods of Evaluation and Impact Assessment

Ecological Impact Assessment Methods

5.2.2 This assessment has been undertaken based on the Guidelines for EcIA in the United Kingdom developed by the CIEEM1 (IEEM, 2006), which is generally recognised as current best practice. The purpose of the guidelines is to provide decision makers with clear, well-reasoned and concise information about the likely significant ecological effects associated with a project. The guidelines include advice on best practice in four key areas of EcIA:

- Identifying and evaluating ecological features;
- Characterising and quantifying impacts and assessing their significance;
- Minimising adverse effects and maximising benefits through the scheme design process; and
- Identifying legal and policy implications and their consequences for decision-making.

Valuing Ecological Resources and Features

5.2.3 The IEEM guidelines for EcIA (IEEM, 2006) recognise that evaluation is a complex process and that a number of factors need to be considered in attributing value to ecological receptors. These include:

- Designated sites and features;
- Biodiversity value;
- Potential value;
- Secondary or supporting value; and

- Legally protected sites and species.

5.2.4 The guidelines state that the assigning of value is a matter of professional judgement which should be guided by the importance and relevance of each of the factors listed above so as to allow each ecological resource or receptor to be valued having regard to a Geographic Frame of Reference (set out below).

5.2.5 With regard to assessments of biodiversity value, there are various characteristics that can be used to identify ecological resources or features that are likely to be important in terms of biodiversity, and these include:

- Rare or uncommon species in the local, national or international context;
- Endemic or locally distinct sub-populations of a species;
- Species on the edge of their distribution;
- Notably large populations of animals or concentration of animals considered uncommon or threatened in a wider context;
- Species-rich assemblages of bats;
- Ecosystems and their component parts, which provide the habitats required by the above species, populations and/or assemblages;

5.2.6 In order to evaluate the importance of ecological features identified in the desk study and field surveys, all ecological resources or features to be assessed are assigned a value in relation to their geographical context. The following hierarchy is used:

[1] The Chartered Institute of Ecology and Environmental Management.

- International importance (e.g. Special Areas of Conservation that are designated for their bat interest);
- National importance (e.g. Sites of Special Scientific Interest that are wholly or partly designated for their bat interest);
- Regional importance (e.g. EA regional biodiversity indicators, important features in NE Natural Areas);
- County importance (e.g. Local Nature Reserves or Sites of Importance for Nature Conservation that are wholly or partly designated for their bat interest);
- Important within the District (e.g. a lake that provides good foraging habitat for a number of common bat species)
- Local (parish) importance (e.g. occasional presence of a bat species that is thought to be uncommon).
- Important within the site and immediate environs e.g. a small population of a common species of bat (i.e. within the zone of influence only);
- Negligible importance would usually be applied to areas such as built development or areas of intensive agricultural land.

5.2.7 The evaluation has been carried out to assess the importance of the Site for different species of bats and the predicted zone of influence of the proposals. In this respect only those species that have potential to be effected by the proposed operations have been considered.

5.2.8 It should be noted that it is usual to consider habitats and species together when ascribing a value to a feature using this geographic context. However, there are circumstances where an ecologist may feel it necessary to assign a value to a particularly valuable species. In assigning value to species it is necessary to consider the species distribution and status including a consideration of trends based on available historical records.

Predicting and Characterising Ecological Impacts

5.2.9 Impacts on bats are characterised, where appropriate, in terms of ecosystem structure and function; and in terms of impact on the integrity of a feature (such as a roost, foraging area or commuting route). Reference is made as appropriate to: positive or negative effects; extent; magnitude; duration; reversibility; timing and frequency; and cumulative effects. These can be quantitative or qualitative, direct or indirect.

Determining the Ecological Significance of Impacts

5.2.10 IEEM Guidance indicates that an ecologically significant impact on bats would be an impact (negative or positive) on the conservation status of bat species within a given geographical area (IEEM, 2006). This constitutes the guiding principle in determining whether an impact is significant and if so at what level.

5.2.11 A beneficial or adverse effect is determined to be significant or not, in ecological terms, in relation to the integrity of the defined site or ecosystem(s) and/or the conservation status of bats within a given geographical area, which relates to the level at which it has been valued. If an effect is found not to be significant at the highest geographical level at which the resource or feature has been valued, it may be significant at a lower geographical level.

5.2.12 The value of any feature that will be significantly affected at a given geographical level is then used to determine the implications, in terms of legislation, policy and/or development control. IEEM (2006) states:

"*if an ecological resource or feature is likely to experience a significant impact, the consequences in terms of development control, policy guidance and legislation will depend on the level at which it is valued. Significant impacts on features of ecological importance should be mitigated (or compensated for) in accordance with guidance derived from policies applied at the scale relevant to the value of the feature or resource. Any significant impacts remaining after mitigation (the residual impacts), together with an assessment of the likelihood of success in the mitigation, are the factors to be considered against legislation, policy and development control in determining the application*".

Confidence in Predictions

5.2.13 Following an assessment of the significance of any residual impacts a judgement is made in relation to each resource or receptor, about the degree of confidence in the impact assessment.

5.2.14 A measure of certainty is also applied to the likely success or otherwise of measures to mitigate negative ecological effects. In addition the available degree of detail, at this stage in the development of the scheme, about a particular mitigation measure, can also affect certainty.

5.2.15 In this assessment, confidence in prediction is expressed by reference to a scale of probablility with High equivalent to a certainty or near-certainty of an outcome occuring through Medium and Low to Very Low, when the probability of an outcome not occuring would be certain or near-certain.

Mitigation and Assessment of Residual Impacts

5.2.16 The residual impacts are those significant impacts that remain after implementation of mitigation and compensation measures. These impacts and an assessment of the likely success of any mitigation measures will be considered against legislation and planning policy in making a planning decision.

Further Guidance on Assessing Bat Sensitivity to Wind Turbines

5.2.17 In the guidance produced by Natural England on bats and onshore wind turbines (2012), each UK bat species has been assessed to try and determine their risk of collision with wind turbines. The level of risk (here defined as 'sensitivity') for each species is classified as high, medium or low based on what is known of the species' habitat preferences, echolocation characteristics, weight, wing-shape, flight speed and height, hunting techniques, flight behaviour and use of the landscape. Table 5.1 assigns species of bats a category of likely level of sensitivity to death through interation with operational wind turbines.

5.2.18 In addition, the guidance assesses the potential threat (high, medium or low) posed to species from mortality caused by collision with wind turbines. This assessment is based on current UK population estimates for each species in combination with the collision risk assessment for each species.

5.2.19 Table 5.2 lists the likely level of sensitivity of bat populations to wind-farm related negative effects. which are based on current population estimates published by the JNCC/Tracking Mammals Partnership (Battersby [Ed]., 2005). Both tables have been adapted from Natural England (2012).

Table 5.1: The likelihood of bat species being killed by wind turbines.

High-sensitivity	Medium-sensitivity	Low-sensitivity
Noctule	Common pipistrelle	*Myotis*[2] species
Leisler's bat	Soprano pipistrelle	Long-eared bats
Nathusius' pipistrelle	Serotine	Horseshoe bats
	Barbastelle	

Table 5.2: Threat to UK bat populations from wind turbines.

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

5.3 Site Surveys Overview

5.3.1 Field surveys for bats were initially undertaken to establish a baseline and identify potentially sensitive species during 2006, and updated in 2011 and 2013. Standard survey techniques were employed to sample and describe the bat community and then allow an evaluation of the importance of the site and features within it for bats. Update surveys were undertaken in 2013 to take account of new standard guidance for bat surveys published in 2012 by BCT (Hundt, 2012).

5.3.2 As with all time limited ecological surveys, the results outlined below give a snapshot of conditions at the time of survey; however, the spatial and temporal extent of the survey is sufficient to be confident that the baseline is robust.

5.4 Limitations to Surveys

5.4.1 No significant limitations were recorded to the 2006 and 2011 bat surveys.

5.4.2 For the 2013 surveys BCT guidance (2012) recommends that surveys are carried out in temperatures of greater than 10°C. During the walked transect surveys, the temperature dropped below 10°C during one survey in May, June and August with a low of 8.2°C recorded on 19th June. All of these surveys were commenced in temperatures of greater than 10°C. This is not considered to be a constraint in the sense that the surveys were

[2] Refers to any bat species of the genus *Myotis*.

representative of the weather conditions at the WFP area in 2013. The spring of 2013 was notably cold[3] and much of the WFP area is upland (more than 300m above sea level), and often several degrees cooler than surrounding, lower-lying areas.

5.4.3 During the automated surveys, two detectors deployed in May and one in June recorded three nights of data instead of the anticipated five, with one detector in August collecting four nights of data (as opposed to five). This is likely to be due to premature battery failure. This amounts to a loss of seven nights data from a total of 478 nights collected. In the context of overall effort, and the results of survey work, this is highly unlikely to have affected the conclusions drawn in this assessment.

5.4.4 No significant information gaps have been identified, and it is concluded that the baseline surveys provide a robust data set on which to carry out the assessment.

5.5 Methods of 2006 Surveys

5.5.1 A summary of the methods of the 2006 bat surveys, undertaken by Ecology Matters, is provided below as taken from the original ES (produced in 2008).

5.5.2 Methods for the 2006 surveys were derived from Eurobats guidance (Rodrigues *et al.*, 2008) and following discussions with the Countryside Council for Wales (CCW) (now Natural Resources Wales (NRW)).

5.5.3 The following survey methodology was developed by Ecology Matters to assess proposed windfarm sites for bat usage, and was employed at the WFP Site.

- Daylight inspection: The Site was surveyed in daylight to assess the suitability of the habitat for bats in terms of feeding areas and flight lines, to identify a survey transect route and position for a static detector, and to identify any potential roost sites within the Site.
- Activity Survey: A transect route was devised that sampled the different habitat types, probable bat habitats within the Site and probable flight lines onto the Site, but was also safe to walk in the dark. Details of the transect route are given in Appendix 6.1. The Site was surveyed on four occasions (twice in the north and twice in the south) over the main period of bat activity (breeding season) and once during the autumn when bats tend to move around to mating and hibernation sites.

5.5.4 Each survey started at least one hour after sunset in order to allow time for bats to reach the Site from their roosts. A surveyor walked the transect route for approximately two hours mapping any bat passes. The surveyor carried a frequency division Bat Box Duet detector recording to an mp3 player which recorded all bat sounds during the survey period.

5.5.5 The sound files were later analysed using computer software (BatSound) to determine the bat species. A static detector (Anabat) was also left in situ during the period of each survey.

[3] http://www.metoffice.gov.uk/climate/uk/summaries/2013

5.6 Methods of 2011 Surveys

5.6.1 A summary of the methods of the 2011 bat surveys is provided below, as taken from the SEI 2011.

5.6.2 Following consultation with CCW (now NRW) and Ecology Matters it was agreed to update the 2006 surveys and that it would be acceptable to undertake surveys using static recording bat detectors to obtain information on the extent of bat activity on the site.

5.6.3 These surveys were undertaken by Ecology Matters Ltd. Five static recording detectors (Anabats) were deployed on the wind farm site for ten consecutive nights. The Anabats were positioned in areas where bat activity had been detected during the surveys in 2006 and using sites that were relatively easy to reach. The locations of the Anabats are shown in Figure 8.1 in the 2011 SEI; each location is numbered A4 to A8:

- Anabat A4 was located on a fence post on the north edge of the Nant Ffridd y Castell (SH 9673 0906) towards the north edge of the site at an approximate height above sea level of 340m.
- Anabat A5 was located at tree top height on the edge of a small block of conifer forest near Ffridd Pwll-y-warthol (SH 9271 0363, 347m).
- Anabat A6 was located on a fence post within a cattle grazed field near Llechwedd Gwyn (SH 9436 0527, 390m).
- Anabat A7 was located on the ground in an area of wet grassland approximately 20m from conifer woodland at Bryn Gwyn (SH 9355 0320, 330m).
- Anabat A8 was located on a fence post next to a cattle grazed field just to the north of
- Cwmderwen on Eithin-llwyn (SH 9494 0605, 370m).

5.6.4 The Anabats were set to record each night from one hour before sunset to one hour after sunrise.

5.7 Methods of 2013 Wind Farm Proposal Surveys.

5.7.1 The bat survey methods were derived with reference to guidance documents produced by NE (2012) and BCT (Hundt, 2012).

5.7.2 The determination of the baseline conditions present at the Site were undertaken through a combination of desk study and field surveys.

5.7.3 A desk study was carried out to collate existing records from the Site and the surrounding area, including areas that could be affected by the OHW, and to inform the necessary field surveys. Additional information was also obtained from the baseline surveys carried out for the adjacent proposed Carnedd Wen wind farm site.

5.7.4 The field survey work for bats was undertaken to inform the assessment for the WFP (for the main turbine development) and also the OHW. The assessment has been split into two parts to cover these two discrete proposals.

5.7.5 Field surveys to inform the assessment for the WFP comprise the following elements:

- Site appraisal survey;
- Walked transect survey;

- Automated bat detector survey; and
- Roost survey.

Desk Study

5.7.6 The Biological Information Service for Powys were approached for records of low and medium-sensitivity species of bats within 5km of the Site, and statutory designated sites (designated for bats) and high-sensitivity bats within 10km. Additional information was also obtained from the baseline surveys carried out for the proposed Carnedd Wen wind farm site adjacent.

5.7.7 Information obtained during the course of a desk study is dependent upon people and organisations having made and submitted records for the area of interest. As such, a lack of records for a particular protected species does not automatically mean that they do not occur in the study area. Likewise, the presence of records for protected species does not automatically mean that these species still occur within the area of interest, only that conditions were once suitable. This is particularly true with older records.

Site Appraisal Survey

5.7.8 The guidance for methods of baseline pre-construction survey described within the BCT Guidelines (2012) is based upon identifying the likely level of sensitivity for bats associated with a particular site. For the WFP this involved assessing the quality of the habitats for bats during an initial site appraisal and also taking account of the likely on-site assemblage of bats based on the results of previous surveys, desk study and the known habitat preferences of UK bats. Three main elements determine habitat quality for most bats: the presence of potential roosting habitat and foraging habitat, and the extent to which the habitats present in the site are connected to those in the surrounding landscape. The BCT guidance supports NE guidance in terms of its assessment of the level of sensitivity associated with bat populations and uses the same classifications of high, medium and low sensitivity for both species and survey sites.

5.7.9 A site appraisal was carried out by Matt Hobbs and Elaine Dromey in April 2013 and confirmed the site sensitivity-level for bats for the WFP as being low, based on previous survey results (from 2006 and 2011), the exposed, upland setting and the limited diversity and scale of the foraging and roosting habitats present for bats to exploit. More details are provided under separate sections covering each survey method below.

5.7.10 For a site that is assessed as 'low-sensitivity' surveys would normally be carried out during three months (in spring, summer and autumn), e.g. May, July and September. There was no opportunity to collect data from the autumn during update surveys in 2013 due to the timescales imposed by the Public Inquiry process. To compensate for this, the frequency of surveys was increased and more data collected during the key breeding period for bats (May-August).

5.7.11 The survey also helped to inform the level of further survey that should be undertaken through identifying:

- The precise routes that will be used for the walked and driven transect surveys (see below) taking into account access/terrain issues; and

- The locations where automated bat detectors will be deployed (see below).

Walked Transect Survey

5.7.12 The site was divided into four clusters of turbines that could each be covered by a single evening transect walk, where it was safe to access land on foot and at night. Each cluster (including a 200m buffer zone around each turbine) was defined as an individual Survey Area (SA) and the Site was split into four SAs, with SA1 the most northerly and SA4 the most southerly. The transect routes were also designed to sample a representative proportion of each habitat present within the survey area, based on areas that were accessible and safe to walk at night. Figure 1[4] shows the boundaries of the four survey areas, as well as the locations of automated detectors (see below).

5.7.13 At each of the four SAs, monthly transects were undertaken between May and August 2013. The surveys involved walking a predetermined transect route through the site and recording all bat echolocation calls using bat detectors as well as noting any bat activity heard or seen on standardised recording forms.

5.7.14 Two surveyors (for health and safety reasons) walked the transect route at dusk. Surveys were carried out only when weather conditions were suitable for bats to be active, avoiding temperatures below 10°C, heavy rain and high wind speeds. Each transect started at sunset and took 2-3 hours to complete. The timing of the surveys covered the bat emergence period and the period of most intense foraging activity when invertebrate prey is most abundant (Altringham, 2003). Surveys started at sunset as required by BCT (2012) guidance. This may give an indication of whether bats are roosting close to the site; a conclusion that may be indicated by records of bats close to their typical emergence time from roosts.

5.7.15 The direction and start point of each transect route was altered for each survey to ensure that different parts of the site were surveyed at different times of the night. This approach was adopted to remove any bias that could be introduced into the survey data if each transect was walked in the same direction. This bias could result in any given point on the transect route being visited at approximately the same interval after sunset.

Automated Bat Detector Survey

5.7.16 Wildlife Acoustics SM2 bat detectors were used to record bat activity (bat echolocation calls) at fixed points throughout the site. The number of locations that were surveyed depended on the number and quality of habitat features in proximity to proposed turbine locations. The BCT guidance stipulates that where turbines are within 100m plus the rotor swept radius of medium or higher quality habitat features for bats, such as woodland, watercourses, or hedgerows then pairs of automated detectors should be deployed simultaneously for five nights at both locations in each recording period. This approach allows a direct comparison to be made between the level of bat activity at open turbine locations and adjacent habitat features.

5.7.17 Seven of the proposed turbine locations are within 100m (plus the rotor swept radius) of plantation woodland (R9, R12, R13, R16, R26 and R27) or a river valley (R40). At these

[4] All figures are contained in a separate Appendix.

locations, pairs of detectors were deployed monthly as described above. At all other locations detectors were deployed every other month during May-August.

5.7.18 Another nine turbines are in or within 100m of plantation areas (R4, R5, R18, R19, R31, R35, R36, R37 and R39) that will be cleared as part of the habitat restoration scheme. The other 13 turbine locations (R6, R7, R8, R14, R15, R17, R23, R24, R25, R32, R38, R41, R42, R43) are in open areas away from defined habitat features.

5.7.19 At turbine locations either close to habitat features that WILL be removed during construction (effectively built in open habitats); or in open areas beyond 100m from habitat features; a single detector was put out at (or near, where inacessible) the turbine location every other month. R19 was not accessible and this location (or a position close to it) was not surveyed.

5.7.20 If the exact location of a turbine was inaccessible in dense plantation, the nearest accessible point to the turbine was used, e.g. at R4, R18, R35, R36 and R37. For R35 and R36, one detector (rather than two) was placed on a corner of habitat equidistant from both proposed turbines as the turbines are close together in uniform habitat. Where plantation areas are due to be cleared and turbines will be erected in open areas (post-clearance), bat detectors were deployed on the edge of the plantation to give an indication of the value to bats of the plantation area that would be lost, rather than an indication of what the value of the new (post-construction) habitat would be.

5.7.21 These groups of detector locations were split into four groups to enable comparison between the relative activity recorded at each, and particularly between those at habitat features (Groups 1A and 2) and those at open turbine locations (Groups 1 and 3):

- Group 1 – seven detectors at turbine locations within 100m of habitat features (R9, R12, R13, R16, R26, R27, and R40);
- Group 1A – seven detectors at adjacent habitat features paired with turbines (R9A, R12A, R13A, R16A, R26A, R27A, and R40A);
- Group 2 – seven detectors at or near turbine locations in or near forestry that will be cleared prior to construction (R4, R5, R18, R31, R35-36, R37, and R39).
- Group 3 – 14 detectors at turbine locations in open areas (R6, R7, R8, R14, R15, R17, R23, R24, R25, R32, R38, R41, R42, and R43).

5.7.22 Of these groups they can be split into those at habitat features (Groups 1A and 2) and those at open turbine locations (Groups 1 and 3).

5.7.23 In summary, there were 14 locations where detectors were deployed monthly and 21 locations where detectors were deployed every other month over the survey period. The detectors were left in situ for 5 days at each survey point, and set to record from half an hour before sunset to half an hour after sunrise, the period when bats are usually active. The duration of recording per night varied throughout the survey period according to day/night length.

Roost Survey

5.7.24 The BCT guidance recommends that a daytime inspection of structures and trees suitable for roosting bats be carried out within 200m of the developable area (turbine envelope) and

that further surveys should be carried out if evidence of 'significant' roosts of medium and/or high-sensitivity species is found within this survey area. The guidance also suggests that further survey should be carried out if the desk-study identifies roosts that could be affected by the development.

5.7.25 An assessment of potential roosting habitat within 200m of the developable area was carried out by Matt Hobbs and Elaine Dromey during the site appraisal survey in April 2013.

5.8 Methods of 2013 Offsite Highway Works Surveys

5.8.1 As part of the OHW works there will be a number of modifications to the Llanerfyl to Talerddig road. A preliminary assessment of the planned modifications to the access route on bats was carried out on 17-18 April 2013. This survey assessed where works may effect features potentially used by bats for foraging/commuting (principally roadside hedgerows and tree lines) and also structures (trees and bridges) that may support roosting bats. This involved inspecting areas along the route where modifications affecting hedgerows, trees and bridges are planned.

5.8.2 Field surveys to further inform the assessment for the OHW comprised the following elements:

- Driven transect survey;
- Automated bat detector survey;
- Inspection surveys; and
- Emergence and re-entry survey

Driven Transect Survey

5.8.3 Driven transect bat surveys were carried out in May, July and August, to determine the activity of bats along the access route. Driven transect surveys follow a predetermined route. The car was driven at around 15mph and a number of stopping points (of two minute duration) were included along the route. Listening points were chosen in areas where bat activity is likely to be highest, for example, along hedgerows, by woodland or by water features. An SM2 detector was placed in the car with an omnidirectional microphone attached by cable and bracket approximately 30cm above the roof of the car. The route was driven in both directions with a different start point each survey to ensure that different parts of the route were surveyed at different times of the night.

Automated Bat Detector Survey

5.8.4 During the preliminary survey sections of hedgerow were inspected that have been identified as requiring removal/replanting to examine whether the loss of hedgerow on one side of the road would lead to severance of foraging/commuting habitat for bats. The focus of this was potential impacts on lesser horseshoe bat; a rare species of high conservation importance that is present, albeit in low numbers, over much of Wales (and that had the potential to occur within the OHW area) (Battersby, 2005) and that generally requires continuous habitat structures/linear features for foraging/commuting. This species is not thought to cross wide gaps in hedgerows and, as such, it was considered that the loss of

hedgerows along the access route had the potential to lead to fragmentation of potential habitat for this species.

Inspection Survey

5.8.5 As part of the preliminary survey an inspection was carried out of any trees that will need to be removed or trimmed as a result of works to the access route as well as two bridges (Gosen and Diosig) that will be widened to facilitate access. The survey was undertaken from ground level using binoculars (where necessary) and features suitable for roosting bats, such as split limbs, cracks, hanging bark and/or cavities were recorded onto standardised field survey sheets.

5.8.6 An inspection of the Gosen Bridge was undertaken on 18 April 2013 by Matt Hobbs[5] and Elaine Dromey, both experienced bat workers, although only the south side of the bridge could be accessed at the time of the survey.

5.8.7 An inspection of the Diosig Bridge was undertaken on 16th July 2013 by Anton Kattan[6]. This bridge and other habitat features along the access route that were likely to be affected by the development were surveyed to assess their potential use by bats. Of these features, Diosig Bridge, Gosen Bridge, an ash tree and a section of hedge which are going to be impacted by the access route were considered to require additional survey effort.

5.8.8 The inspection of the bridges involved a search of all external elevations or evidence of bats such as droppings, feeding remains, staining and scratch marks. Close focussing binoculars and high-powered torches (1 million candlepower) were used to visually search the external elevations.

5.8.9 Bats may use a variety of roosting opportunities within bridges, for example, cracks and crevices within stonework where they are difficult to see. The absence of evidence (such as droppings) does not necessarily mean that roosting bats are not present as bats may not be roosting in the accessible or visible parts of a bridge structure, and they do not always leave visible signs (particularly if the roosts have been recently established, support small numbers of bats or are temporary in nature). The absence of roosting bats in a structure can be very difficult to prove for this reason. As a result an assessment of the buildings' potential to accommodate roosting bats was also made with the location of potential roosting features plotted on a plan of the bridge.

Emergence and Re-entry Survey

5.8.10 A single ash tree that will be removed at Section 1.17 of the OHW route has potential for roosting bats as do both of the bridges. BCT (2012) guidance recommends that if a structure/tree has any potential for roosting bats then one to three surveys (dependant on the roosting potential- one for low potential, two for low-moderate, three for high) should be undertaken in the period May – August.

5.8.11 At each of the features, two dusk emergence surveys and one dawn re-entry survey were undertaken, in addition, at the Ash tree a second dawn re-entry survey was included. The dusk surveys commenced approximately 15 minutes before sunset and continued until

[5] Countryside Council for Wales license number: 42958:OTH:CSAB:2013
[6] Countryside Council for Wales license number: 35112:OTH:CSAB:2011

approximately two hours after sunset. The dawn survey commenced approximately 2 hours before sunrise and finished 15 minutes after sunrise. Surveyor positions were chosen to ensure coverage of all potential roost features.

5.9 Materials and Data Analysis

5.9.1 Full details of the equipment and the data analysis methods used are provided in Appendix 1.1.

6 BASELINE CONDITIONS

6.1 Desk Study Results

6.1.1 No statutory protected nature conservation sites designated wholly or partly for their bat interest are located within 10km of the site.

6.1.2 A total of 160 bat records were returned from the search area, with none of these from within the Site. The closest record was of a pipistrelle roost 3.5km from the site boundary. A number of bat records were returned from close to the OHW area along the Talerdigg to Llanerfyl road. These comprised records of *Myotis* spp. and pipistrelle spp. with two potential pipistrelle roost records apparently within Llanerfyl.

6.1.3 Records of seven species of bat were returned by the desk study. These were: common pipistrelle (31 records), lesser horseshoe bat *Rhinolophus hipposideros* (19), Natterer's bat *Myotis nattereri* (15), soprano pipistrelle (11), brown long-eared bat (11), noctule (9), Whiskered bat *Myotis mystacinus* (2) with additional records for Pipistrelle sp. (3), *Myotis* sp. (2) and other unidentified bats (57).

6.1.4 The closest lesser horseshoe bat records came from a hibernation site supporting low numbers of bats, approximately 4.5km north of Llanerfyl. There were no noctule roosts identified within the 10km search area, with all records from foraging or commuting individuals, the closest of these is approximately 7km from the nearest turbine location.

6.1.5 In addition to these records, bats were recorded from baseline surveys for the Carnedd Wen proposed wind farm site and reported in the 2008 ES for the site. One additional species was recorded during these surveys that is not mentioned above; serotine (a single record).

6.2 Results of 2006 Surveys

6.2.1 A summary of the results of the 2006 bat surveys is provided below as taken from the original ES (produced in 2008).

6.2.2 Several species of bats were detected in the survey area: common and soprano pipistrelles, brown long-eared, whiskered, Natterer's and noctule bats. Pipistrelles were the predominant species detected.

6.2.3 The majority of bats were found feeding along forest edges although pipistrelles were detected feeding across the open moorland in two areas of the site (one in the far north: SH 967087 and the other in far south: SH 922041).

6.2.4 Pipistrelles were detected on all surveys. Noctule, *Myotis* spp. and brown long-eared bats were detected occasionally.

6.2.5 No roosts were found within the survey area although there are many farms close to the boundary which were not surveyed but will provide suitable roosting sites in outbuildings and in farmhouse roofs. Much bat activity was noted around Cannon Farm (SH 961073) in the north area of the Site and signs of bats roosting were noted.

6.2.6 No bats were detected during the autumn transect surveys in early October. There are no suitable hibernation sites within the survey area and it is likely the survey area is not on any route used by bats flying to hibernation roosts.

6.2.7 Full results of each survey visit are given in Appendix 6.1 (of the 2008 ES).

6.3 Results of 2011 Surveys

6.3.1 A summary of the results of the 2011 bat surveys is provided below as taken from the SEI 2011.

6.3.2 The survey was undertaken between August 2nd and August 12th 2011, with a total of 10 nights of data obtained at most locations. The weather over this period comprised mild nights (between 11°C and 15°C) with occasional showers except for the night of August 10th when there was very heavy rain all night. This rain damaged the microphone of Anabat A6 and only interference was picked up on the last night (11th August). Anabat A7 recorded data for the first six nights only.

6.3.3 The Anabats were set to record each night from 20:15 hours to 06:30 hours. Sunset varied between 21:07 hours on the 2nd August and 20:49 hours on the 11th August. Sunrise varied between 05:31 hours on the 3rd August and 05:46 hours on the 12th August.

6.3.4 Four species of bat were recorded on the Anabats: *Myotis* sp. (not identified to species), common pipistrelle, soprano pipistrelle and noctule.

6.3.5 Common pipistrelle was the most frequently recorded species at A4, A5 and A6 but were also frequently recorded at A8.

6.3.6 Soprano pipistrelle was the most frequently recorded species at A7, although common pipistrelle was also very frequent.

6.3.7 Noctule bat was the most frequently recorded species at A8 although the majority of these bat passes were recorded between 22:00 and 23:00 hours on the 5th and 7th of August. On the 5th August there were 16 noctule passes recorded between 21:55 hours and 22:35 hours. On the 7th August there were 56 noctule passes recorded between 21:50 hours and 22:15 hours. On the 8th August there were 2 noctule passes recorded at 21:40 hours. A noctule bat was also recorded at A7, one pass recorded at 22:00 hours on 3rd August and one pass recorded at 21:30 hours on the 4th August. Noctule bats were not recorded at the other three locations.

6.3.8 *Myotis* bats were recorded at all five locations with the highest number of passes at A4 and A7, though this species was the least recorded.

6.3.9 No other bat species were recorded.

6.3.10 Peak activity time for most of the locations was between 22:00 hours and midnight, although activity at A4 was high throughout the night, where the steep sided stream valley provides good sheltered foraging areas. At A5 there was also a clear peak of activity towards dawn, between 04:00 and 05:00 hours.

6.4 Results of 2013 Wind Farm Proposal Surveys

Walked Transect Survey

6.4.2 Details of transect surveys are included in Table 2.1 in Appendix 2, with number of passess and relative activity Maps showing walked transect routes for each SA as well as the number of passes and species recorded during each transect survey are included in Figures 2-5.

6.4.3 In total 708 bat passes (B7) of at least four species of bats were recorded during 41 hours of walked transect survey time in 2013. Table 6.1 summarises the relative activity level recorded during walked transects for all species. Full details of the number of passes and species recorded during each transect survey are included in Table 2.2 in Appendix 2.

Table 6.1: Number of passes recorded (B) and relative activity (B/h) for each species during all walked transects.

Species	B	B/h
Common pipistrelle	256	6.3
Soprano pipistrelle	222	5.5
Common/soprano pipistrelle	185	4.6
Myotis sp.[8]	29	0.7
Noctule	8	0.2
Common/ Nathusius' pipistrelle	8	0.2

6.4.4 Across the survey season, common pipistrelle was the most frequently encountered species on walked transects with a mean of 6.3 bats per hour (B/h) and 36.2% of all passes recorded as this species (n = 256). Soprano pipistrelle was the second most numerous with 5.5 B/h and common/soprano pipistrelle the third with 4.6 B/h with 94.8% of all the recorded passes identified as bats from the Pipistrellus genus9. Relative activity of less than 1 B/h was recorded for *Myotis* sp. bats (0.7 B/h), common/Nathusius' pipistrelle10 (0.2 B/h) and noctule (0.2 B/h).

6.4.5 Although some calls of pipistrelles overlapped between those of common and Nathusius' pipistrelle *Pipistrellus nathusii*, all calls were within the normal range for common pipistrelle, no calls were identified conclusively as Nathusius' pipistrelle, and it is considered that there is no evidence for this species being present during any surveys. Nathusius' pipistrelle is not considered further in this assessment.

6.4.6 Bat activity levels varied between transects, with a mean of 17.4 B/h (range; 0.4-85.4 B/h). Fluctuations between surveys are within expected limits, being influenced by factors such as short-term variations in weather conditions and prey availability and seasonal

[7] For the definition of bat passes and relative activity (Bat passes per hour) used in this analysis see 'Materials and Data Analysis' in Appendix 1.
[8] Refers to any bat species of the genus *Myotis*.
[9] See Appendix 1 for identification parameters used for the *Pipistrellus* genus.
[10] It is likely that all records refer to common pipistrelle and Nathusius' pipistrelle was not confirmed as present during any bat surveys on the WFP site

variations. During May, which was cold, an average of 1.3 B/h was recorded, which then rose to a peak in July of 11.7 B/h. Peaks in activity occurred during two surveys, in SA1 on 4 July (85.4 B/h) and SA4 on 22 August (47.4 B/h).

6.4.7 Noctule was the only high-sensitivity species recorded during walked transects, with eight passes recorded during five surveys (see Table 2.2 in Appendix 2). Between one and three passes were recorded from all SAs with up to two passes recorded on three different transects, which suggests that the same bat may have been recorded twice on those occasions. The earliest noctule pass was recorded at 73 minutes after sunset.

6.4.8 All pipistrelle species are classified as medium-sensitivity to collision/barotrauma and low sensitivity to population level effects. During walked transects both species were recorded in all the survey areas, with common pipistrelle recorded during 12 (of 16) transect surveys and soprano pipistrelle during 11. For both species the highest activity levels were recorded in SA1 with an average of 16.2 B/h for common and 12.3 B/h for soprano. For the other survey areas, activity levels were substantially lower. Activity of all pipistrelles increased markedly in July (27.9 B/h) and August (23.1 B/h) with low activity levels recorded in all areas in May and June, except for higher activity levels of soprano pipistrelle in June in SA1 (15.4 B/h) and SA2 (10 B/h). It is likely that the peak in July coincided with a prolonged heatwave and a very pronounced emergence of small flies (*Nematocera* sp.[11]) that are a favoured foraging resource of pipistrelle bats. Most pipistrelles were recorded in sheltered areas (likely to provide concentrations of insects), e.g. along the edge of conifer plantations and in stream valleys during transect surveys.

6.4.9 *Myotis* bats are classified as low-sensitivity. During walked transects, a low level of activity was recorded (0.7 B/h: B = 29) with around half of the passes recorded from SA1(B = 14) in all months with a peak of six passes in August. Low numbers of passes were recorded from all other surveys except the August survey in SA4, when 10 passes were recorded. The location of passes were widely scattered with the majority on the edge of conifer plantations (see Figures 2-5).

Automated Bat Detector Survey

6.4.10 Automated bat detectors were operating for a total of 478 nights, equating to 4376 hours of survey time during May-August 2013. Table 2.3 in Appendix 2 gives details of fixed point bat detector deployment dates and locations with the latter, as well as the extent of the SAs, proposed turbine locations and automated detector locations illustrated in Figure 1. Table 2.4 gives details of the number of passes and relative activity recorded during automated detector surveys.

6.4.11 A total of 38,156 passes from at least five species of bats were recorded. Table 6.2 provides relative activity rates (B/h) for all bats recorded during automated surveys. Figure 6 illustrates the proportion of activity recorded for different species at each automated survey location, with relative activity at each static detector survey location of noctule, common pipistrelle, soprano pipistrelle and *Myotis* sp. illustrated in Figures 7-10 respectively. Data for bats not identified to species-level (e.g. common/soprano pipistrelle) or for which there were insufficient data (*Plecotus* sp.) have not been illustrated.

[11] Generally referred to as midges.

Table 6.2: Total number of passes recorded (*B*) and relative activity (*B/h*) for all bat species during automated surveys.

Species	B	B/h
Common pipistrelle	14672	3.4
Common/soprano pipistrelle	11097	2.5
Soprano pipistrelle	8808	2
Myotis sp.	2610	0.6
Noctule	597	0.1
Common/ Nathusius' pipistrelle	362	0.1
Long-eared bat sp.	10	<0.1

6.4.12 Across the survey season, the highest activity rate was recorded from common pipistrelle, an average of 3.4 bats per hour (B/h). Activity rates of soprano pipistrelle and common/soprano pipistrelle were similar (2 and 2.5 B/h respectively) with 91.6% of all the recorded passes identified as bats from the Pipistrellus genus. Relative activity of less than 1 B/h was recorded for *Myotis* sp. bats (0.6 B/h), common/Nathusius' pipistrelle (0.1 B/h), noctule (0.1 B/h) and also long-eared bat *Plecotus* sp.12 (<0.1 B/h).

6.4.13 The data presented in Table 6.3 indicates that bat relative activity rose dramatically from Spring (May and June) (0.7 B/h) to a peak in Summer (July and August) (16.4 B/h).

Table 6.3: Total number of passes recorded (B) and relative activity (B/h) for all bat species in Spring (May and June) and Summer (July and August).

	Spring		Summer	
Species	B	B/hr	B	B/hr
Long-eared bat sp.	0	0	10	<0.1
Common/ Nathusius' pipistrelle	53	<0.1	309	0.1
Noctule	17	<0.1	580	0.3
Myotis sp.	213	0.1	2397	1.1
Soprano pipistrelle	127	<0.1	8681	3.8
Common/soprano pipistrelle	267	0.2	10830	4.8
Common pipistrelle	433	0.3	14239	6.3
Total	1110	0.7	37046	16.4

High-sensitivity species

6.4.14 In general activity levels for noctule were very low across the site. The overall activity level was skewed by prolonged foraging activity around R27A during August, when 271 passes were recorded during 4-8 August with 93% of these recorded during a two night period.

[12] All *Plecotus* sp. records are assumed to be brown long-eared bat *Plecotus auritus* (see Appendix 1 for full details).

6.4.15 Noctule activity was chiefly recorded during July-August, with few records during May-June (see Table 6.3). The earliest noctule was recorded at 23 minutes after sunset with fairly frequent records after this point and no clear peak in activity during the night. The latest record was (again) 23 minutes before sunrise.

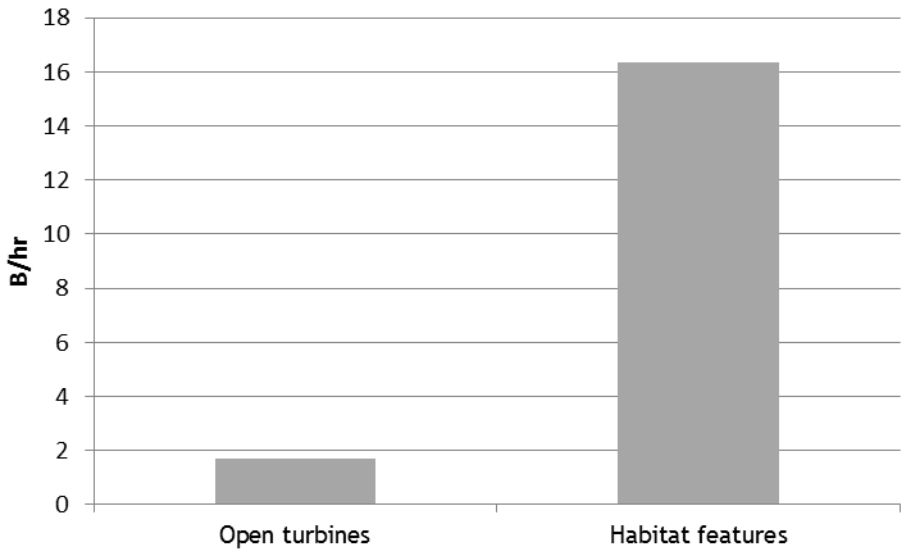
6.4.16 Overall there was a lower activity level over turbine locations situated in open areas (Groups 1 and 3: 0.1 B/h)) than other locations next to habitat features (Groups 1A and 2: 0.2 B/h). If R27A is removed then the relative activity levels would be 0.1 B/h for both (or one noctule recorded every ten hours).

Medium-sensitivity species

6.4.17 Common and soprano pipistrelles were recorded at all automated survey locations and the pipistrelle species were the most frequently recorded bats. The highest activity levels were recorded at five locations; 35/36 (25.1 B/h), 26A (17.4 B/h) and 27A (43.4 B/h) in SA1; 13A in SA3 (35.7 B/h); and 9A in SA4 (14.8 B/h), all on the edge of conifer plantation. The highest activity level recorded at open turbine locations (Groups 1 and 3) was from R43 (6.3 B/h) – all other locations recorded less than 4 B/h.

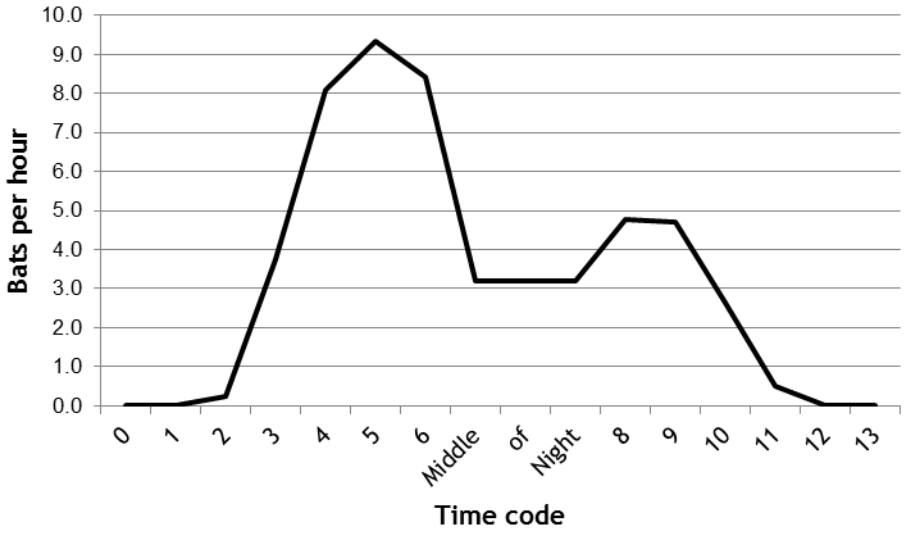
6.4.18 For common pipistrelle activity was highest in SA1 at R35-36 (14.2 B/h), R37 (12.8 B/h), R26A (10.5 B/h) and R27A (25.7 B/h). For soprano pipistrelle, activity peaks were recorded from R13A in SA3 (15.6 B/h) and R27A in SA1 (7.3 B/h). All of the peaks in activity were recorded on the edge of plantation woodland. Common pipistrelle activity at open turbine locations (0.5 B/h) was just 13% that at habitat features (4 B/h). The pattern was slightly more pronounced for soprano pipistrelle with activity at open turbine locations (0.6 B/h) just 8% of that at habitat features (7.1 B/h). The results presented in Figure 6.1 below allow a comparison of medium sensitivity bat activity between open turbine locations and habitat features, such as the edge of conifer plantation.

Figure 6.1: Relative activity (B/h) patterns for common and soprano pipistrelle during automated surveys at open turbine locations in comparison to habitat features.



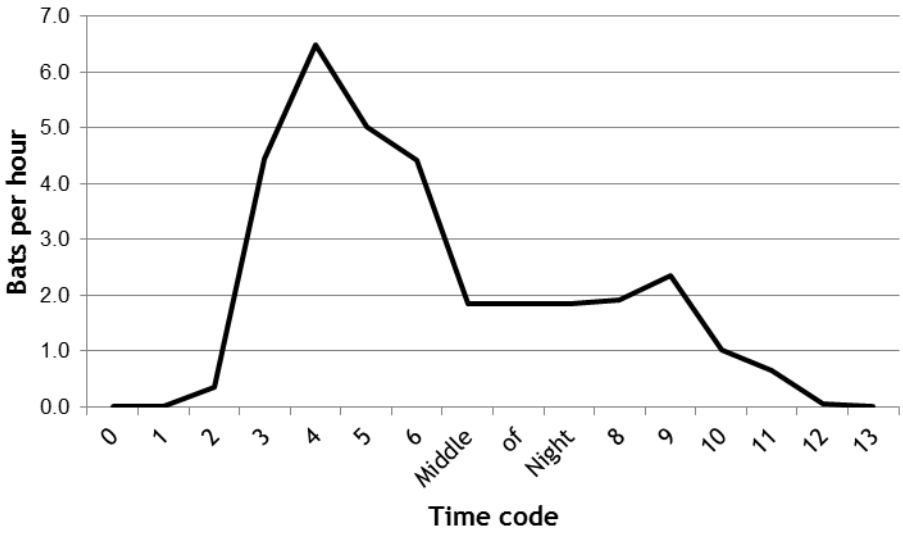
6.4.19 For common pipistrelle the earliest and latest passes were recorded at nine minutes after sunset and 46 minutes before sunrise respectively, with low numbers of passes within 30 minutes of sunset in general. The peak in activity was in the first two hours of the night and particularly between 80 and 100 minutes after sunset (TC5; 9.3 B/h) with a smaller secondary peak (TC8; 4.8 B/h) (see Figure 6.2).

Figure 6.2: Relative activity (B/h) patterns for common pipistrelle during automated surveys in relation to sunset and sunrise.



6.4.20 For soprano pipistrelle, bats generally arrived later on site with no records before 28 minutes after sunset then a rapid increase with a peak 60-80 minutes after sunset (TC4; 6.5 B/h). There was a smaller secondary peak in activity (TC9; 2.3 B/h) and the last record at 43 minutes before sunrise (see Figure 6.3).

Figure 6.3: Relative activity (B/h) patterns for soprano pipistrelle during automated surveys in relation to sunset and sunrise.



Low-sensitivity species

6.4.21 Low levels of *Myotis* sp. bat activity were recorded across the site (0.6 B/h) with activity at open turbine locations generally very low (0.3 B/h) except at Turbine R41 where higher activity was recorded (1.2 B/h). Overall activity at open turbine locations was 31% that at habitat features (1 B/h) with highest activity levels recorded at R27A in SA1 (2.1 B/h), at R4 (2 B/h) and R5 (2.1 B/h) in SA4. As with all species of bats activity increased significantly from Spring (0.1 B/h) to Summer (1.1 B/h). Nocturnal peaks in activity for *Myotis* bats occurred 100-120 minutes after sunset (TC6; 1.4 B/h) with very little activity recorded within an hour of sunset.

6.4.22 Just ten passes of long-eared bats were recorded from all detectors, which is a very low level of activity. Of these, seven passes were from SA4 (R9, R18, R32, and R39) with three passes from R13A in SA3. All passes were recorded in the Summer. Only one pass (at R32) was recorded at an open turbine location and no passes were recorded within an hour of sunset or sunrise.

Roost Survey

6.4.23 The four SAs were walked over in April 2013 and checked for any potential roosting habitat for bats. There are no buildings within 200m of turbine locations and the only mature trees are mainly planted non-native Sitka spruce *Picea sitchensis* which do not support any suitable roosting features for bats. No potential roosting habitat was located in the Survey Area.

6.5 Results of Offsite Highway Works Surveys

Driven Transect Survey

6.5.2 Details of transect surveys are included in Table 2.5 in Appendix 2. A map showing the driven transect route and transect stopping points is contained in Figure 11 with the number of passes and species recorded during each transect survey included in Figures 12-14. Results of the driven transects are summarised in Table 6.4.

6.5.3 The species recorded during the driven transects were the same as those recorded during the walked transect surveys, with no lesser horseshoe bats recorded. The activity levels of pipistrelle bats were higher during the driven transects (42.9 B/h) than the walked transects (16.6 B/h) with soprano pipistrelle the most frequently recorded species, rather than common pipistrelle. Activity levels of *Myotis* bats and noctule were similar. Only seven passes (all pipistrelle) were recorded during the May survey.

6.5.4 The distribution of bats along the route was relatively uniform with pipistrelle bats (of both species) recorded in most areas of the route and occaisonal scattered records of *Myotis* bats. The single pass of noctule was recorded from close to the north-east corner of SA4.

Table 6.4: Number of passes recorded (B) and relative activity (B/h) for each species during all driven transects.

Species	B	B/h
Soprano pipistrelle	175	20.3
Common pipistrelle	100	11.6
Common/soprano pipistrelle	94	10.9
Myotis sp.	6	0.7
Common/ Nathusius' pipistrelle	1	0.1
Noctule	1	0.1

Automated Bat Detector Survey

6.5.5 The survey found that there is only one potential severance point where there is no other available foraging/commuting habitat available (at Section 1.29). At all other areas where hedgerows or trees are to be removed/replanted there is alternative habitat available for bats to use. An SM2 bat detector was deployed at this point to monitor bat (and particularly lesser horseshoe bat) activity for five nights from 31 May to 5 June 2013 and from 19-23 July 2013, equating to 86.5 hours of survey. The SM2 was placed in the hedge, with an omnidirectional microphone attached via a cable and telescopic pole 0.5m above the hedge to record bat activity. The detector was configured to the same specification as those used for the automated detector work on site and analysed in the same way (see Appendix 1).

6.5.6 Results of the automated detector deployment at the hedge on the OHW route are recorded in Table 6.5. The species were the same as those recorded during the driven transect surveys, with no lesser horseshoe bats recorded. Activity levels were relatively low, with a combined average of 3.5 B/h for all species. The peak bat activity levels were recorded 60-80 minutes after sunset (TC5; 17.1 B/h) with only one pass (of noctule) within half an hour of sunset and 4 passes (three noctule and one common pipistrelle) within half an hour of sunrise. The pattern and frequency of activity suggests that the hedge is not of particular importance for commuting or foraging.

Table 6.5: Number of passes recorded (B) and relative activity (B/h) for each species during an automated detector survey of the OHW route.

Species	B	B/h
Soprano pipistrelle	165	1.9
Common/soprano pipistrelle	53	0.6
Common pipistrelle	41	0.5
Myotis sp.	31	0.4
Noctule	15	0.2
Common/ Nathusius' pipistrelle	1	<0.1

Inspection Survey

Tree Survey

6.5.7 One tree was surveyed that has features suitable to support roosting bats with all other trees being immature and lacking any potential roost features. A single mature ash tree located in Section 1.17 was surveyed from ground level using binoculars. The tree is c16m in height with a diameter at breast height of 1.4m. There were several potential roost features evident including two rot holes at eight and 12m height and a woodpecker hole at 8m. Images of the tree are shown in Appendix 2. The tree was assigned Category 1* status based on standard methods (Hundt, 2012) and given that several features are present that may potentially support larger roosts of bats.

Gosen Bridge

6.5.8 Images of the Gosen Bridge are shown in Appendix 2, showing the structure as well as some of the potential roost features. The bridge is located approximately 3.5km south west of the village of Llangadfan. It carries an unnamed single carriageway (local C2031 road) from northeast to southwest, crossing the Cledan River which flows to Afon Gam River to the northwest.

6.5.9 The bridge is comprised of a single stone masonry arch with a clear span of 5.37m. Stone masonry abutments are 4.8m in length and approximately 2m in height and are founded on the bedrock. The Stone parapets are nominally 7.3m in length and 1m in height. There is a clear deck width of 3.88m to 3.94m over the length of the structure. The arch crown is approximately 3m below carriageway level.

6.5.10 The bridge supported a small number of potential roost features, including some small cracks in the stonework under the arch of the bridge and also between blocks on the southern elevation of the bridge, particularly where vegetation has opened up gaps between stone blocks. At one point several blocks are missing and there is a significant hole with smaller cracks leading away from it. On the western bank of the river on the southern elevation, some stones have collapsed exposing gaps between the remaining stonework that may provide limited opportunities for roosting bats.

6.5.11 Overall, the bridge is thought to be of moderate potential for roosting bats. It does not appear to have significant cavities in the stonework that could support larger roosts of bats but may provide roosting habitat for single (or very low numbers of) bats. It is possible that bats may use the bridge for hibernation but the cracks and crevices present do not appear to be deep enough to shelter bats throughout the winter.

Diosig Bridge

6.5.12 Images of the arch of the Diosig Bridge are shown in Appendix 2. It was not possible to gain access to the Diosig Bridge during May/June when it was decided that it would be necessary to widen the bridge as part of the OHW. As a result, emergence/re-entry surveys were commenced as a precaution before an inspection survey could be carried out once access was arranged, on 16 July 2013. During the survey water levels in the river were low, which allowed an inspection of the underside of the arch by walking along the river channel through the bridge. The bridge arch is small (approximately 2m high) and it was possible to inspect crevices using an endoscope and torch. The arch has recently been consolidated

with a small number of crevices remaining that might be suitable roosting features for one or two bats. No bats or evidence of previous use by bats was found during the inspection. Overall, the bridge is thought to be of low potential for bats due to the low number of potential roosting features.

Emergence and Re-entry Survey

6.5.13 A summary of the results of dusk emergence and dawn re-entry surveys is provided in Table 6.6 with further details of activity recorded provided in Table 2.6 in Appendix 2.

Table 6.6: Number of bats recorded during emergence/re-entry surveys on the OHW route.

Date	12/06	13/06		14/06	16/07	17/07
Survey Type	**Emergence**	**Re-entry**	**Emergence**	**Re-entry**	**Emergence**	**Re-entry**
Ash tree	0	0	No survey	No survey	0	0
Diosig Bridge	0	0	No survey	0	0	No survey
Gosen Bridge	No survey	0	21:50 1 Pp* 21:58 1 Pp	No survey	No survey	0

* Pp = common pipistrelle

6.5.14 The ash tree and two bridges have moderate potential for bats and two emergence and re-entry (dusk and dawn) surveys were carried out in June and in July 2013.

6.5.15 At the single ash tree, one surveyor was used. At Gosen Bridge three surveyors were used for the first survey, with two on the south side and one on the north side. It was found that adequate coverage could be achieved with two observers, one either side of the arch and this was followed for subsequent surveys. At Diosig bridge, two surveyors were used with one either side of and within 3m of the bridge arch.

6.5.16 Evidence of a small common pipistrelle bat roost was recorded at Gosen Bridge. Two bats were seen emerging from crevices under the arch on the north-east side of the bridge on 13 June 2013. No bats were seen emerging or re-entering either the single ash tree or Diosig Bridge.

6.5.17 In addition to bats recorded emerging from Gosen Bridge, activity from foraging/commuting bats was also recorded and this is summarised in Table 2.4 in Appendix 2. Four species of bats were recorded; common and soprano pipistrelle, *Myotis* sp. and noctule.

6.6 Future Baseline Conditions

6.6.1 It is difficult to predict future changes in the baseline conditions if the site is not constructed. The site is unlikely to be attractive to commercial development and the only variable that it would be reasonable to predict continuity in with any certainty would be land management. Assuming that the construction of the scheme did not take place and the farming regime remains unchanged, the baseline is unlikely to change significantly in the foreseeable future. If the farming regime changed, then an increase in the extent of pasture land, for example, might benefit noctule bats due to their apparent preferences for pasture habitat (Mackie & Racey, 2007). Other species may also benefit given that open moorland is not generally considered optimal habitat for bats due to lack of shelter, low temperatures and reduced foraging opportunities. Over time the plantation will be re-felled and stocked if it remains economically viable to do so.

7 NATURE CONSERVATION VALUE OF THE IDENTIFIED RESOURCES

7.1 Species Evaluations

Noctule

7.1.2 Noctule bats are listed on Appendix II of the Bonn Convention; Appendix II of the Bern Convention; Annexes II and IV of the EC Habitats & Species Directive; Schedule 5 of the Wildlife and Countryside Act 1981; and as a priority or Section 42[13] species.

7.1.3 Noctule was recorded in all years that surveys were carried out within the WFP area. In 2006, the species was recorded once on a transect survey in August. In 2011, noctule was recorded at two of the five static (automated) detectors that were deployed for 10 nights in August, with 2 passes recorded at A7 (near R39) and 76 passes recorded at A8 (near R14).

7.1.4 Similar levels of activity were also recorded within the OHW area, although automated data was only collected at one locality to compare relative activity.

7.1.5 In 2013, increased survey effort and coverage demonstrated that noctule activity over the site is low (0.2 B/h) during automated surveys, and was negligible during Spring (17 passes recorded). The activity level (during Summer) was skewed by prolonged foraging by (presumably) one bat at R27A over two nights in August, which constituted 45% of the total number of passes. Due to the large detectable range (see Appendix 1) of the echolocation call of this species, it is considered that calls recorded simultaneously from turbines and adjacent locations are likely to be from the same individual bat and that bats that commute over the site may be recorded from multiple locations. Both factors also tend to inflate activity levels for this species in comparison to other species.

7.1.6 The site does not appear to be of particular importance for foraging and/or commuting for this species. The habitat present on site is not likely to be optimal for noctule, with Mackie & Racey, (2007) finding that noctule bats at Horner Woods (Devon) preferred foraging above woodland, then pasture, followed by other habitats, arable and finally moorland. Noctules are also known to preferentially feed over open water early in the evening. Noctules, like many bats, are opportunistic predators and will exploit a wide range of prey resources, although larger prey, such as beetles, are preferred (Jones, 2009). The Survey Area is likely to be a peripheral foraging area that noctules visit during the Summer (July and August) when there is seasonal abundance of prey or when prey abundance is low at primary foraging areas, which are likely to be in nearby lowland valleys that contain abundant woodland and pasture habitats. Although radio-tracking studies of noctule are limited to one published study, this found that on average the mean maximum distance travelled from roosts was 6.3km (Mackie & Racey, 2007), which indicates that noctules recorded on the site may fly considerable distances to forage if necessary.

[13] Species or habitats referred to within The Natural Environment and Rural Communities Act 2006 (NERC 2006) as of principal importance for the conservation of biodiversity in Wales which are listed on the Natural Resources Wales website. The government must take steps to "further the conservation" of these species/habitats under Section 42 of the NERC ACT 2006.

7.1.7 The noctule activity suggests that although noctules use the site regularly they do so infrequently, probably do not roost nearby and do not use the site as an area of primary foraging importance. This difference in activity between open turbine locations and habitat features is not as pronounced as with other species (see below) and this is likely to reflect the typical behaviour of this species to commute and forage at height over a landscape rather than staying close to habitat features that most other species of bats associate with. Given this, it is likely that small numbers of noctules use the site regularly (but infrequently) and range widely over a large area.

7.1.8 Noctule is a species of bat which is difficult to survey due to its habit of roosting almost entirely in tree roosts. It has been described as generally uncommon, although more numerous in wooded areas, with a Welsh population of around 4,750 which seems to be stable (Battersby, 2005). There is very little colony size data for noctule in the UK due to the deifficulty in finding tree (rather than building) roosts of bats which may lead to low confidence in population estimates[14]. In recent years, there is evidence of an increasing population trend for noctule in the UK from National Bat Monitoring Programme (NBMP) data (BCT, 2012), with a 23% population increase inferred from field (rather than roost) records during 1998-2011. Noctule is highly migratory in Europe with some migrations recorded of over 1,000km (Hutterer *et al.*, 2005). However, it is currently not known to move out of England in winter and hibernating bats have been found in even very severe winters (Mackie & Racey, 2008).

7.1.9 Given that low noctule activity levels have been recorded, of a bat that is generally easy to detect at distance (see Appendix 1), and that noctule is widespread in Wales, the WFP area and the OHW area are both considered to be of local importance for this species.

Common Pipistrelle

7.1.10 Common pipistrelle bats are listed on Appendix II of the Bonn Convention; Appendix II of the Bern Convention; Annexe IV of the EC Habitats & Species Directive; Schedule 5 of the Wildlife and Countryside Act 1981; and as a Priority Species under the Powys LBAP[15]

7.1.11 Nathusius' pipistrelle is not considered to be present and is not ascribed a nature conservation value (see Section 6.4.5).

7.1.12 This is the most frequently recorded bat within the WFP area with bats recorded in all areas of the site. This species was recorded from all automated detector locations, with low to moderate levels of activity recorded from locations on habitat features, such as coniferous plantation edge and low levels of activity over turbine locations.

7.1.13 Slightly higher levels of activity were recorded during driven transect surveys in the OHW area. A roost of two individuals was found in the Gosen Bridge during emergence/re-entry surveys.

7.1.14 Common pipistrelle is the most abundant species of bat across the UK with a UK population of around 2,430,000 (Battersby, 2005; breakdowns by country are not available). The species is thought to have undergone declines of around 55% since the 1960s although there

[14] The authors suggest that the majority of population estimates contained therein should be viewed with caution and are presented to provide comparative information on general population size for each species.
[15] Those for which Species Action Plans (SAP) are prepared under the Local Biodiversity Action Plans for Powys.

is evidence of populations becoming stable or possibly increasing within the last ten years (Battersby, 2005). BCT field data indicates that populations may have increased by 65% during 1998-2011 (BCT, 2012). There are no population figures for the combined Powys SAP for pipistrelle bats but mid-Wales is thought to have "particularly strong populations of pipistrelle bats"16.

7.1.15 Given the abundance of the species in the UK, the population within the WFP area and the OHW area are both considered to be of a value no greater than the level of the site for this species. This valuation includes the Gosen Bridge where a small roost of this species was found.

[16] http://www.powys.gov.uk/uploads/media/pipstrelle_bat_bi.pdf

Soprano Pipistrelle

7.1.16 Soprano pipistrelle bats are listed on Appendix II of the Bonn Convention; Appendix II of the Bern Convention; Annexe IV of the EC Habitats & Species Directive; Schedule 5 of the Wildlife and Countryside Act 1981; and as a Priority or Section 42 species.

7.1.17 This is the second most frequently recorded bat within the WFP area with bats recorded in all areas of the site. This species was recorded from all automated detector locations, with low to moderate levels of activity recorded from locations on habitat features, such as coniferous plantation edge and low levels of activity over turbine locations.

7.1.18 Higher levels of activity were recorded during driven transect surveys in the OHW area, with this species recorded more frequently than common pipistrelle in this area.

7.1.19 Soprano pipistrelle is the second most common species of bat in the UK with a UK population of around 1,300,000. Historic population trends do not exist for this species as it was not described until 1997 although recent work suggests the population is stable or increasing (Battersby, 2005) with an upward trend of 34% during 1998-2011 from BCT data (BCT, 2012).

7.1.20 The WFP area and the OHW area are likely to be of no greater importance than the level of the site for this species, due to the local abundance of this species within the general population context and the fairly typical activity levels recorded for this species within the site.

Myotis Bats

7.1.21 All *Myotis* species are listed on Appendix II of the Bonn Convention; Appendix II of the Bern Convention; Annexe IV of the EC Habitats & Species Directive; and Schedule 5 of the Wildlife and Countryside Act 1981. In addition Bechstein's bat *Myotis* bechsteinii is listed as a Priority Species under the UK Biodiversity Action Plan; Annexe II of the EC Habitats & Species Directive; and as 'Near threatened' under the IUCN Red List of Threatened Animals.

7.1.22 Low levels of *Myotis* bat activity were recorded in the WFP and OHW areas with some areas of higher activity along plantation edges in the WFP area.

It is difficult to generalise on the population status of *Myotis* bats. Table 7.1 (below) lists the UK population status and Welsh population size (from Battersby, 2005) for each *Myotis* species which may be found within the area of the site.

Table 7.1: Population status of *Myotis* bat species which may be found at the Site.

Common Name	Scientific Name	UK population status	Welsh population
Whiskered bat	*Myotis mystacinus*	Local	8,000
Brandt's bat	*Myotis brandtii*	Common in north and west, rare or absent elsewhere	22,500
Natterer's bat	*Myotis nattereri*	Fairly common throughout much of the UK	70,000

Daubenton's Bat	*Myotis daubentonii*	Common throughout much of the UK	95,000
Bechstein's bat	*Myotis bechsteinii*	Very rare	1,500

7.1.23 It is likely that the most frequently recorded species was Natterer's bat, and most calls fitted the parameters associated with this species. It is also possible that whiskered or Brandt's bat could be present given that records of this species were returned from the desk study. It is considered unlikely that Bechstein's bats is present due its rarity. It is assumed that no rare species occur on site and the site is likely to be of local importance for *Myotis* species of bats.

Brown Long-eared Bat

7.1.24 Brown long-eared bat is listed on Appendix II of the Bonn Convention; Appendix II of the Bern Convention; Annexe IV of the EC Habitats & Species Directive; Schedule 5 of the Wildlife and Countryside Act 1981; and as a Priority or Section 42 species.

7.1.25 All records of long-eared bats are assumed to refer to brown long-eared bats (see Appendix 1). This species was recorded very infrequently within the WFP site with a total of ten passes recorded. It was not recorded during the OHW surveys.

7.1.26 Brown long-eared bat is a common species of bat with an Welsh population of around 17,500. Historic population trends indicate a long-term decline in the UK population (Battersby, 2005), although NBMP data indicate that the population is stable (BCT, 2012). The WFP site is likely to be of value at no more than the level of the site for this species, due to the local abundance of this species within the general population context and the very low activity levels recorded for this species within the WFP site.

7.2 Sensitivity of the Valued Resources

7.2.1 BCT (Hundt, 2012) and NE (2012) guidance both identify species that are considered to be more susceptible to wind farm developments than others, through their categorisation of species as high, medium or low risk. In this assessment, sensitivity is taken as a proxy for risk. As a result, noctule would be considered the most sensitive species (both individuals and populations), followed by the two pipistrelles considered sensitive to direct effects on individuals but not sensitive at the population level. *Myotis* and long-eared bats are considered low sensitivity in both respects.

7.2.2 These categories are not based on data that has been collected in the UK and there is currently a paucity of robust evidence to show if and why impacts on UK bats occur from the operation of wind turbines. The impact assessment explores the current evidence base further and shows how UK impact assessments must largely rely on data from other European countries and generally adopt a precautionary approach to fill the evidence gap.

8 IMPACT ASSESSMENT

8.1.1 This section assesses the effects on ecology and nature conservation that would result during the construction, operation and decommissioning phases of the development without mitigation in place.

8.2 Structure of the Impact Assessment

8.2.1 Direct and indirect environmental effects of the construction and operational and decommissioning phases of the WFP, based on the project description in Chapter 3 of the SEI 2013, are evaluated for each species of bat considered of medium or high sensitivity – noctule, common pipistrelle and soprano pipistrelle. *Myotis* and long-eared bats are not considered further as they are considered low sensitivity and unlikey to be effected.

8.2.2 For the OHW, effects on all species of bats are considered.

8.2.3 Mitigation for identified negative effects is presented below, along with proposals to enhance the value of the WFP and OHW for bats.

8.3 Proposed Site Layout

8.3.1 Following an analysis of ecological and other constraints, a final site layout minimising potential environmental impacts was produced as shown in the 2013 SEI (Figure 3.6, Volume III) with the development of this layout described in Chapter 3 Section 3.3 of the 2013 SEI.

8.3.2 The project has been designed so that land take is restricted to the minimum required for the construction and operation of the wind farm. This approach will minimise habitat losses and will help prevent the need for agricultural intensification to offset land lost to grazing.

8.3.3 The track network has been designed so that where it is possible to upgrade existing tracks, rather than construct new tracks, and for new tracks to follow exisiting field boundaries, these opportunities have been taken.

8.3.4 The total permanent land take from new access tracks, turbine foundations, crane hardstandings, met mast, substation and welfare buildings would be approximately 16.5ha; roughly equivalent to 1.00% of the total site area.

8.4 Potential Effects on Bats

8.4.1 The most commonly documented direct impact is considered to be mortality through direct collision with turbine blades. Some studies had concluded that barotrauma[17] accounted for up to 60% of documented fatalities (e.g. Baerwald, 2008); however, a recent study found that most cases of barotrauma had probably been misdiagnosed and that at most 6% of bats found at wind farm sites may show signs of barotrauma with traumatic injury (caused by direct collision) by far the major cause of mortality (Rollins *et al.*, 2012).

8.4.2 Other possible impacts include:

[17] Mortality due to damage to bats' lungs caused by sudden change in air pressure close to the turbine blade.

- Loss of foraging habitat (directly due to wind farm construction or indirectly because bats avoid the wind farm area); and
- Fragmentation of habitat (indirectly because wind farms form barriers to commuting or seasonal movements, and due to severance of foraging habitat).

8.4.3 BSG Ecology is not aware of any robust published studies concerning fatality monitoring for bats in the UK and data from studies in continental Europe may not be entirely comparable to patterns of fatality in the UK. Nonetheless, in the absence of such published information a precautionary approach has been taken and this assessment takes into account findings from elsewhere (as detailed below) with the assumption that impacts on bats, may potentially occur.

8.5 Predicted Effects During Construction

Wind Farm Proposal

8.5.1 There are limited potential effects on bats during the construction phase of the development. There is a potential for disturbance of active bats from construction works. However, all work would be undertaken during the day during the active period (7.00am to 7.00pm) so disturbance would be unlikely. There is also some potential for disturbance of roosting bats through felling of coniferous plantation areas; however, no roosting habitat has been identified within these areas and it is very unlikely that an effect will occur.

8.5.2 Although it could be argued that loss of habitat is a construction effect as well as an operational effect this effect will be dealt with under operational effects given that the full extent of habitat loss will be during this period of the development.

8.5.3 It is considered that the construction phase would not result in a significant impact on bats. This assessment is made with a high level of confidence.

Offsite Highways Works

8.5.4 There are two potential impacts on bats during the construction phase of the OHW. The first is the short term severance of foraging areas and commuting routes through the loss of sections of hedgerows and small trees during widening of stretches of the OHW route. However, there is only one potential severance point where there is no other available foraging/commuting habitat available for bats (on the other side of the road) and where potential impacts on lesser horseshoe bat might be anticipated, given their apparent preference for continuous habitat features for foraging and commuting. This location was surveyed with an automated detector and no lesser horseshoe bats were recorded. In addition, only low levels of activity from four other species was recorded (noctule, common and soprano pipistrelle and *Myotis* sp.). None of these species are likely to be significantly affected by the temporary removal of the hedgerow (all hedgerows will be moved or re-planted nearby). This assessment is made with a high level of confidence.

8.5.5 Secondly, there is a potential for disturbance of bats from construction works. Although most OHW work will be undertaken during the day, when foraging areas and commuting routes of bats will not be effected, the Traffic Management Plan (TMP) acknowledges that temporary road closures may need to be put in place for some works and these would be during periods of lowest traffic flow, at 09:30-15:30 or at night during 20:00-06:00. If such

works take place at night during the active season there is some potential for very localised disturbance of bats on occasional nights. This is unlikely to lead to significant disturbance of any bat species and this assessment is made with a high level of confidence.

8.5.6 Where there is a potential for roosting bats to be disturbed, bat surveys have been carried out on two bridges that are due to be widened (Gosen and Diosig) and at a single mature ash tree that will be removed where the road will be widened. The surveys indicate that the Gosen bridge is used by small numbers of roosting common pipistrelle bats and that the other features were not used by roosting bats. Without mitigation (proposed mitigation is set out in Section 8.8 below), there is potential for an effect on the bats that roost at the Gosen Bridge through bridge-widening works that may lead to the roost being damaged or destroyed or individual bats being injured or killed. Such an effect would be adverse and significant at the level of the site. This assessment is made with a high level of confidence.

8.6 Predicted Effects During Operation

Collision with Turbine Blades (and Barotrauma)

8.6.1 This potential effect is only considered for the WFP, not the OHW.

Background

8.6.2 Studies from Europe, Australia and North America have highlighted a number of cases where fatalities have occurred as a result of collision/barotrauma. Results from European studies are discussed below.

8.6.3 Noctule bats are considered to be at high risk of collision/barotrauma due to their 'hawking' feeding strategy. Hotker *et al*. (2006) reviewed studies from 13 wind farm sites in Germany where monitoring for bat fatalities had taken place. At these sites noctule bat was the species most affected with 120 deaths recorded at six of the wind farm sites studied. The same study reported that the second most affected species was the common pipistrelle with 44 bat fatalities recorded at the same sites. Latest fatality figures from the Brandenburg Institute in Germany18 have reported a total of 696 noctule fatalities across Europe. However, several other bat species have been killed in high numbers by wind turbines and include species that were recorded during surveys at this site: common pipistrelle (1054), soprano pipistrelle (154) and much lower totals for brown long-eared bat (3) and for four species of UK *Myotis* bats (16 in total). If it is assumed that bats are unlikely to be displaced by operating wind turbines and continue to commute in those areas where they have previously been recorded, mortality through collision/barotrauma is a possibility. Many recent studies have indicated that there are a number of reasons why bats may be attracted to wind turbines and subsequently killed as a result. Although many of these are currently unproven hypotheses, the list below includes the most plausible current explanations which have been adapted from a review by Jones *et al*. (2009):

- Attraction to tall tree-like objects. This may be due to bats looking for somewhere to roost or the 'tallest tree' hypothesis where males which establish and defend mating territories may attempt to mate with females around the tallest structure available;

[18] Data from the central register of the State Fund Ornithological Station in State Office for Environment, Health and Consumer Protection of Brandenburg (2012).

- Prey concentration around 'warm' wind turbine nacelles may attract bats to forage close to the rotor swept zone;
- Increases in flight height and changes in aerial behaviour during migration periods; and
- Bats may investigate wind turbines as potential roost sites.

8.6.4 However a more recent review by Rydell *et al*. in two separate research papers (2010; 2010a) concluded that there is little evidence for any of these hypotheses from studies in Europe and that the most likely reason for bats to be attracted to turbines is high altitude feeding on migrating insects that accumulate at turbine towers. This hypothesis explains why there are such seasonal peaks in bat mortality (August-September and May-June) in Europe, and why high mortality generally occurs in weather conditions associated with large-scale migratory movements of insects. It has been previously documented that insects may gather around turbines in such numbers that dead insects on turbine blades may even impede their operation (Corten & Veldkamp, 2001).

Impacts on High Sensitivity Species – Noctule Bat

8.6.5 Noctule is listed as being of high sensitivity to collision/barotrauma and the threat to the status of its UK populations posed by wind farms is thought to be high (NE, 2009; Hundt, 2012).

8.6.6 Noctule activity on the site was low. During the walked transects, only eight passes by noctules were recorded during the 2013 survey programme. Of the bat passes recorded by automated detectors, 1.6% of the total was of noctules, with nearly half of those coming from one detector (and probably one bat) over two nights of prolonged foraging activity. Therefore, although adverse effects resulting from the operation of the wind turbines cannot be ruled out, effects are likely to be low.

8.6.7 If an effect occurs it would be adverse and is likely to be significant at no more than the level of the site, given that it is unlikely that the entire local population of noctules is killed by the turbines. There is a medium level of confidence in this assessment due to the difficulty in predicting whether individual bats are likely to be struck by wind turbine blades, and of predicting the level of fatalities that are likely to occur.

Impacts on Medium Sensitivity Species – Common and Soprano Pipistrelle Bat

8.6.8 Both species are listed as being at medium sensitivity to collision/barotrauma and the threat to the status of the UK populations of both species posed by wind farms is thought to be low (NE, 2009; Hundt, 2012).

8.6.9 Given that low-moderate[19] levels of activity were recorded for pipistrelle species on the site, and the fact that regular pipistrelle fatalities have been recorded at wind farms in Europe (see Appendix 8.4, Volume 4 for more detail), it is possible that collision/barotrauma impacts could occur for these two species of bats.

8.6.10 The locations of the turbines have been moved away from plantation edges, where most pipistrelle activity has been recorded, in line with NE guidance (2012). Although a small number will be within 100m of plantation edge, most turbine locations will be beyond this distance. This is likely to reduce potential effects on pipistrelle bats significantly given that

[19] Based on results from similar surveys carried out by BSG at many locations in Wales and the UK.

pipistrelle bats are unlikely to be flying over open moorland unless there are significant concentrations of prey items, such as midges. Studies on midges have shown that they usually do not fly unless wind speeds are below 3 ms-1 (Hendry, 1989) which is below the typical cut-in speeds for wind turbines at 3 to 4 ms-1. It was notable that pipistrelle activity notably increased across the site in July and August during the onset of an unusually prolonged July heatwave which coincided with a very pronounced emergence of midges, particularly in SA1. It is likely that pipistrelle bats do not use the high moorland habitats during a large proportion of the year and also that activity would be lower in a typical summer with lower temperatures than 2013.

8.6.11 The effect on common pipistrelle is not likely to be significant at any geographic level due to their general abundance and the low likelihood of fatalities occuring on a regular enough basis to have any effect on the local population status of the species. The effect on soprano pipistrelle is also not likely to be significant for the reasons given above for common pipistrelle. There is a medium level of confidence in this assessment due to the difficulty in predicting whether individual bats are likely to be struck by wind turbine blades, and of predicting the level of fatalities that are likely to occur.

Disturbance or Loss of Foraging Habitat or Commuting Routes

Wind Farm Proposal

8.6.12 There is no evidence that the WFP area contains an important commuting route for bats and effects on commuting routes are characterised as for foraging areas.

8.6.13 With regard to habitat loss caused by installation of turbines and associated ancillary infrastructure, a very small area would be taken up by the turbine bases and access tracks (see SEI 2013, Chapter 3). Due to careful selection of the routes of access tracks and turbine locations the WFP ensures that effects on bats through habitat loss would not be significant with a high level of confidence.

8.6.14 Loss of habitat through forest felling associated with the development would affect species of bats, particularly pipistrelle species, that surveys have shown to forage preferentially along the edges of these habitats. The loss of some of the forestry plantation is likely to have an adverse effect on common pipistrelle and be significant at less than the level of the site. For soprano pipistrelle, the efffect would be adverse and would be significant at no more than the level of the site, given that much of the existing foraging habitat would remain. There is a high level of confidence in this assessment.

Offsite Highways Works

8.6.15 Temporary loss of hedgerows and trees has been assessed under construction stage effects. Once these habitats are re-instated it is unlikely that there will be a significant effect on any species of bat that has been recorded using the OHW route.

8.7 Predicted Effects During Decommissioning

8.7.1 Effects during decommissioning have only been considered for the WFP, not the OHW.

8.7.2 Given that decommissioning activity is unlikely to take place within the timeframe considered by this SEI it would be inappropriate to comment on this phase in much detail

i.e. the ecology of the Site has the potential to change considerably in the time period leading up to decommissioning.

8.7.3 The effects of the decommissioning phase are likely to be comparable to those considered during the construction phase, although of lesser magnitude, as decommissioning would take less time and be potentially less damaging due the presence of an existing track network. It would be possible to restrict vehicles and machinery to these tracks during much of the decommissioning phase.

8.7.4 Decommissioning works would be planned with care so as to minimise the potential for ecological effects.

8.7.5 There is some risk of disturbance of bats from decommissioning works. However, provided all work is undertaken during the day, disturbance would be kept to a minimum. It is considered that impacts on bats through the decommissioning of the proposed development would be negligible in the short term and not significant. This assessment is made with a high level of confidence.

8.8 Mitigation and Enhancement Measures

8.8.1 The following mitigation and enhancement measures would be implemented as part of the development to ensure that significant impacts resulting from construction, operation and decommissioning would be reduced as far as reasonably practicable. The measures have been developed in conjunction with the engineering design to maximise opportunities for mitigation and enhancement.

8.8.2 Best practice and associated guidance from statutory consultees would be secured through agreement on a Construction Method Statement and Construction Environmental Management Plan as well as agreement over the content of the Habitat Management Plan (HMP).

Constraints and Design Evolution

8.8.3 A constraint to the layout was identified as a result of consultation with CCW (now NRW) and emerging guidance. This was used to inform the final layout of the development to minimise its impact on bats.

8.8.4 Turbines will be located such that their turbine blade tips will be at least 50m from habitat features (specifically plantation edge and stream gullies) following published guidance from NE (2009). In some instances this will be carried out by micro-siting the turbines, especially turbines R2, R3 and R9 which are shown to be close to 50m from the plantation edge.

Construction

Wind Farm Proposal

8.8.5 Designated working areas, storage areas and access routes would be identified at the commencement of the construction phase. The proposed works would be phased so that access tracks are constructed first. Vehicular access would be restricted to designated routes throughout construction and operation as far as possible, thereby minimising potential disturbance of wildlife. Night working will not be carried out therefore minimising disturbance effects on bats.

8.8.6 As mentioned above the roost survey carried out in 2013 indicates that the plantation forestry is likely to provide no roosting features for bats and a brief walkover survey is all that is required, prior to felling of selected forestry areas, to make sure that such features have not developed in the intervening period. If any were found then further surveys would have to be undertaken to inform whether felling could continue (with or without a European Protected Species Licence ('EPS Licence').

Offsite Highways Works

8.8.7 Assuming that more than two years have passed since the 2013 surveys of the Diosig and Gosen Bridges and the single mature ash tree on the OHW route, it will be necessary to update bat activity surveys to show whether bats are using these structures prior to widening of the bridges and felling of the ash tree. If bats are found to be roosting then then NRW should be contacted prior to this work taking place to discuss the requirement or otherwise to carry out the mitigation measures under an EPS Licence.

8.8.8 It is considered that if these measures are in place the significance of any residual effect on roosting bats will be negligible and this assessment is made with a high level of confidence.

Operation

8.8.9 No mitigation during the operational phase is considered necessary, given the design mitigation that has been implemented to reduce the potential effects on bat species discussed above.

8.8.10 There is only limited scope for mitigation during the operational phase and residual effects on bats that may persist through the operational phase of the wind farm are perhaps better addressed through enhancement measures (see below) rather than mitigation.

8.8.11 Where reasonable opportunities exist for enhancing the wildlife value of the Site then these have been taken. Following further discussions with consultees, a HMP has been developed for the Site. The detailed HMP is presented in Appendix 5.2 of the SEI 2013. This will cover the life of the development. Key points in the plan that will result in enhancements for bats include a number of management practices that will improve invertebrate density and diversity for foraging bats:

- Streamside planting of elder / alder will create commuting and foraging habitat for bats;
- Management of unimproved pastures for curlew;
- Maintenance of wet flushes, boggy areas and damp, rough grassland;
- Retention and restoration of unimproved grassland;

8.8.12 If the HMP and the enhancement measures provided therein for bats are taken into account it is likely that the loss of forestry habitat will be balanced by the gain in new or improved foraging and commuting habitats. As a result the effect on bats will be neutral, or may lead to a beneficial long-term effect at the level of the site for all bat species, and particularly pipistrelles. There is a high level of confidence in this assessment.

Decommissioning

8.8.13 In order to ensure that none of the decommissioning effects on the Site's bat interest are significant, similar mitigation measures will be implemented as for the construction phase of the development.

8.9 Residual Effects

Wind Farm Proposal

8.9.2 Adverse effects significant at the site level may occur as a result of the operation of the WFP through the potential for a small number of noctule bats to be killed by collision with turbine blades (or possibly barotrauma). No further residual effects have been identified and no further mitigation measures are proposed.

Offsite Highway Works

8.9.3 No residual effects on bats from the OHW have been identified.

8.10 Cumulative Effects

8.10.1 It is necessary to undertake a cumulative assessment in relation to bats due to their mobile nature and their ability to potentially exploit resources over a wide area. Given that the likely maximum foraging/commuting range known for noctule from one study is 6.3km (Mackie & Racey, 2007) we have taken a precautionary approach and assumed that the zone of influence of the development for noctule bats (the only high-sensitivity species recorded) is 10km. In addition, the BCT guidance (2012) advises that a desk-study should include records of high-risk species within 10km, which coincides with the anticipated zone of influence.

8.10.2 The typical flying ranges of the bat species identified on site are summarised in Table 8.1.

Table 8.1: Typical Bat Ranging Distances, adapted from (Hundt, 2012)

Bat species	Flying range
Noctule	Migratory – can fly 1000s of km when migrating in Europe. Only anecdotal evidence of migration in UK. Mean maximum distances to foraging grounds recorded as 6.3km (Mackie & Racey, 2007)
Common and soprano pipistrelle	Foraging areas up 3-4km from roosts.
Myotis sp.	Varies per species – but can be up to 10km for Daubenton's bat and usually around 3km for Natterer's bat.
Plecotus sp.	Generally feeds within 1-2km of roosts.

8.10.3 The assessment includes all existing and proposed wind farms (for which planning applications have been submitted) within 10km of the WFP site boundary.

8.10.4 Of these projects, nine have been selected for the consideration of cumulative effects on bats. Table 8.2 lists the other developments that have been considered as well as the likely significant effect of each on bats. Of the developments listed in Table 6-16, the environmental statements (and other relevant documents) were reviewed, where available, to identify the likely significant effect of each development on bats.

Table 8.2: cumulative effects on bats from other developments within 10km.

Development	Status	Distance from Application Boundary (km)	No. of Turbines	Significance of Effects on Bats
Carnedd Wen	Public Inquiry	0-4	50	Not significant (RWE, 2008)
Carno I and II	Operational	6-7	68	No data available
Carno III	Application submitted	8-10	18	No data available
Cemmaes II	Operational	5	18	No data available
Cemmaes III	Application	5	12	Not significant

	submitted			(Acciona, 2008)
Dyfnant Forest	Pre-application	6-7	32	Not significant (Scottish Power Renewables, 2013)
Mynydd Clogau I	Operational	10	17	No data available
Mynydd Clogau II	Application submitted	10	19	Not significant (Arcus, 2008)
Mynydd Wawn Fawr	Application submitted	1-6	38	Not significant (Entec, 2007)
Esgair Cwmowen	Application submitted	7	17	No data available
Tir Gwynt	Approved	4-7	12	Not significant (West Coast Energy, 2007)

8.10.5 Information on the predicted ecological effects of these developments was available for just six of these, but none were considered likely to have significant effects on bats. All of these sites are similar upland habitats that provide sub-optimal habitat for bats and would be identified as low-sensitivity for bats. Most of the relevant assessments also acknowledge that the adjacent lowland areas are or are likely to be more suitable for bats. As a consequence, for these developments there is no or very limited potential for significant cumulative effects. Although information is not available in relation to bats for the other developments, it is considered unlikely, given their distance from the proposed Development, their scale, and the poor quality of the habitat present for bats that effects associated with them would lead to any cumulative effects on bats. Although it is possible

that that there may be some cumulative bat mortality from any of these sites, it is unlikely that this additional effect would be significant in terms of affecting the local population status of any species of bat. There is a high level of confidence in this assessment.

8.11 Monitoring

8.11.1 There is no detailed, or prescriptive guidance currently available on monitoring effects on bats at UK wind farms, although there is an ongoing study by Exeter University (and funded by Defra) to determine whether British bat species are at risk from onshore wind turbines. which has yet to report its results and conclusions.

8.11.2 Guidance from NE (2012) suggests that:

"Standardised surveying/monitoring pre and post installation should be required in most high risk situations and welcomed everywhere. Detailed monitoring is required on sites where impacts are predicted. Such methods could include installation of remote detectors at height to record activity, and corpse searching. Such data can make a valuable contribution to the evidence base and help set the risk in context".

8.11.3 The WFP has been identified as a low, rather than high, sensitivity site, and a significant impact has not been predicted for any population of bat, although there is a possibility of individual bats being killed by turbines. As such, there is not a clear justification for carrying out post-construction monitoring surveys for bats at the WFP. Nonetheless, RES have discussed the likely requirement for monitoring surveys for bats with NRW on several occasions and have agreed to discuss this requirement further if the WFP is consented.

8.11.4 If agreement is reached that monitoring surveys for bats are required post-construction then it is considered that the 2013 surveys will provide a baseline for post-construction monitoring that may be able to indicate differences between relative bat activity at near-ground level between the pre-construction and post-construction periods. However, the baseline surveys are not sufficiently detailed or carried out for a long enough period to detect whether a significant change in activity patterns would be caused by the operation of the wind farm or by some other external factor (such as weather conditions) If fatality searches and other bat survey methods that rely on the presence of turbines (e.g. activity surveys at the nacelle of the turbine) are to be employed post-construction then the baseline will have to assume no bat mortality from turbine collision/interaction and no bat activity around turbines, given that the turbines will be erected during construction.

8.11.5 The objective of any monitoring surveys would be to focus on those species present on the WFP site that are considered to be most sensitive to development of this nature. The monitoring work should focus on the following elements:

- Bat activity in the vicinity of turbines (in particular noctule bat activity);
- Fatality searches for bats. It is likely to be necessary to use dogs for this given the difficult terrain for locating dead bats.

8.11.6 The nature and scope of post-construction monitoring should be made the subject of a planning condition or planning agreement, which should be agreed in consultation with NRW. The results of the proposed monitoring should be assessed in terms of the significance of any effects on bats.

8.12 Conclusions and Statement of Significance

8.12.1 The assessment of the potential residual effects of the proposed wind farm on bats is summarised in Section 8.9.

8.12.2 The WFP does not involve significant land take and, with habitat management to increase insect diversity and densities, no significant effects on foraging habitats for bats are predicted from felling of plantation and there should be a neutral or slighly benficial net gain from the proposed habitat enhancement measures.

8.12.3 The OHW will involve the temporary removal and re-planting of hedgerows and small trees that is not likely to lead to a significant effect on foraging and commuting bats. Any effects on roosting habitat for bats at the Gosen Bridge will be temporary, small in scale and mitigated for under an EPS licence (if necessary).

8.12.4 There is a small risk of mortality from collisions with turbine blades (or barotrauma), particularly for noctule bats, although this unlikely to have a significant effect on any species population.

8.12.5 It is concluded that the Proposal would comply with relevant planning policies in relation to bats. Overall, no impacts on bats are likely to occur as a result of the WP or OHW that would be considered significant under the EIA Regulations.

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