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Bat Activity Survey Report - Final

**Bonhams, Hoe Lane, Flansham,
West Sussex, PO22 8NP**

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Report Summary

1. Bat activity surveys have been undertaken on land at Bonhams, Hoe Lane, Flansham to ascertain the use of the site by bats as there is a proposal for a residential development at this site. This was completed further to a Phase 1 Habitat survey completed by the Ecology Co-op in March 2017, which recommended 3 bat activity surveys, the deployment of bat loggers for a period of 5 days within two seasons and a single emergence survey on a mature beech tree and a wooden shed.
2. Three bat activity surveys have been undertaken and static bat loggers have been deployed twice, once during April and once during June. A bat emergence survey has been undertaken upon the shed with low-negligible bat roosting potential and upon a beech tree identified as having roosting potential for crevice dwelling bats.
3. The bat activity surveys were led by Paul Whitby and Dr. Ryan Walker and completed according to Bat Conservation Trust Guidelines.
4. No bats were seen to emerge from the shed at any time. As a result, based on the information gathered, no further surveys or mitigation is required upon this building.
5. The beech tree is concluded as supporting a common pipistrelle roost. This tree should be retained with a 10 meter no light zone created around it. In the event that this tree is to be felled a European Protected Species (EPS) license will need to be applied for and granted by Natural England in order to lawfully fell this tree.
6. Moderate species diversity was recorded during the bat activity surveys undertaken with five species; common pipistrelle, soprano pipistrelles, common noctule, serotines and *Myotis sp.* recorded. The deployment of static loggers identified an additional two species; nathusius pipistrelle and brown long-eared bat. By far the commonest bat recorded across the site is the common pipistrelle.
7. The nathusius pipistrelle bat was recorded by static loggers at two locations with a total of 9 recordings made. This is one of the less common bat species in the UK and has a scattered distribution, but is generally more common in the southeast and it is a species believed to be expanding, with greater records having been made in successive years.
8. A Mitigation Statement that details protection measures for important habitats for bats and enhancements measures for bats should support any future planning application. Outline mitigation is detailed within section 5.



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1 INTRODUCTION

1.1 Purpose of the Report

This report gives details of bat surveys conducted on Land at Bonhams, Hoe Lane, Flansham by The Ecology Co-op. These were led by Paul Whitby a full member of the Chartered Institute of Ecology and Environmental Management and licensed bat surveyor (class license WML – CL08) and Dr. Ryan Walker. The grid reference for this site is SU 96149 01172.

The objective of this survey work was to collect information relating to the use of the site by bats, including species, activity levels and important features across the site and where necessary prescribe further surveys and/or mitigation advice.

Three bat activity surveys have been undertaken and static bat loggers have been deployed twice, once during April and once during June. A single bat emergence survey has been undertaken upon the shed with low-negligible bat roosting potential and a beech tree identified as having roosting potential for crevice dwelling bats.

This survey and report was carried out and produced at the request of Pallant Homes Limited.

1.2 Background

The Ecology Co-op was instructed to undertake bat activity surveys on land at Bonhams, Hoe Lane, Flansham, following a Phase 1 habitat survey of the site conducted by The Ecology Co-op in March 2017 which concluded that the site has the potential to be used by foraging and commuting bats (see figure 1). In line with the bat conservation guidelines, 3 bat activity surveys were recommended with these to be timed across the three seasons; spring (May/April), summer (June/July) and autumn (August/September). In addition to this it was recommended that bat loggers are deployed at the site for a period of 5 days within two seasons.

It was also recommended that a single emergence survey is undertaken on a mature beech, identified as having moderate roosting potential for crevice dwelling bats, and the shed with low-negligible bat roosting.

Furthermore, biodiversity records requested from the Sussex Biodiversity Records Centre identified records for serotine (*Eptesicus serotinus*), whiskered (*Myotis mystacinus*), noctule (*Nyctalus noctula*), common pipistrelle (*Pipistrellus pipistrellus*) and brown Long-eared bats (*Plecotus auritus*) within 2km of the site. Records for western barbastelle bats (*Barbastella barbastellus*) from 2015 were also identified within the parish of Yapton and Barnham, with the exact location unspecified due to the sensitive nature of this information. However as detailed within the phase 1 habitat report the site is unlikely to be of any importance for this woodland associated species given that it supports only a small area of mixed scattered parkland trees.

The assessment was carried out further to a proposal to construct 34 residential properties at this site (see figure 2).



Figure 1. An aerial image showing the location of the site. The approximate site boundary is outlined in red.



Figure 2. Existing site plan with the site boundary shown in red.

1.3 Site Description

Land at Bonhams, Hoe Lane, Flansham, is situated just north of Flansham, West Sussex. The site is approximately 1.9 hectares in area and is split into two distinct areas. The first area comprises a field of poor semi-improved grassland with ruderal vegetation.

The second area comprises two residential properties (which will remain undisturbed by the proposals) and associated garden spaces and various outbuildings. Here, terrestrial habitats comprise amenity grassland, herbaceous flower beds, scattered parkland/broadleaved trees, species-poor hedgerow, bare ground, areas of hard-standing and bare ground tarmac, concrete and gravel.

Overall the site has low value for foraging bats with the mown amenity grassland, hard standing bare ground and semi improved rough grassland covering the majority of the site. The scattered parkland and broadleaved trees within the garden space of Bonhams has moderate value for foraging bats whilst the SUDS ponds located a few meters of the south-eastern site boundary has high value because it is

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likely to support a variety of invertebrate prey.

2 LEGAL PROTECTION

This section briefly describes the legal protection afforded to reptiles. It is for information only and is not intended to be comprehensive or to replace specialised legal advice. It is not intended to replace the text of the legislation, but summarises the salient points.

All species of bats within the UK are protected via The Conservation of Species and Habitats Regulations (2010) and also the Wildlife and Countryside Act (1981), as amended. Therefore, it is an offence to kill or injure a bat or interfere with any roosting or resting site. A bat roost is interpreted as "any structure or place used for shelter or protection by bats" whether or not bats are present at the time. Details of legislation and legal protection afforded to all species of British bats are given in Appendix 1.

The results of this survey will guide any necessary mitigation to ensure that no individuals or populations of bats and their roosting habitat are negatively affected by the proposed works, and therefore no offence is committed under UK and EU wildlife legislation.

3 METHODOLOGY

3.1 Bat Activity Surveys

Three bat activity survey has been undertaken on the 12th April, 12th June and 7th August 2017. This survey followed best practice techniques as outlined by the Bat Conservation Trust (BCT) (Collins, J 2016)¹. Corresponding weather conditions and details for the survey are detailed in the table below.

Table 1: Details of surveys undertaken on land at Bonhams, Hoe Lane, Flansham.

Date	Survey start time/end time	Temp. degrees centigrade, weather conditions throughout survey	Surveyors
12-04-17	19:44- 21:10 Sunset – 19:53	Max/Min temp: 12.5-8°C. 0% cloud cover and 0-5 mph wind.	Paul Whitby, BSc, MCIEEM, CEcol (Natural England bat licence no: 2015-15959-CLS-CLS). Briony Hill, BSc, GradCIEEM
12-06-17	21:02- 22:49 Sunset – 21:16	Max/Min temp: 15-14°C. 0% cloud cover and 0-5 mph wind.	Paul Whitby Hamish Muirden, BSc
7-08-17	20:10 – 22:30 Sunset – 20:34	Temp: 17°C. 50% cloud cover, 0-5 mph wind and 85% humidity	Dr. Ryan Walker (Natural England bat licence no: 2015-16736-CLS-CLS) Beth Walker

During the first survey on the 12th April 2017 one surveyor walked a transect encompassing the garden

¹ Collins, J. (ed.) (2016) Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edn).

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area of Bonhams which supports scattered trees. Another surveyor walked a second transect which encompassed the grassland field (see figure 3).

During the surveys on the 12th June and 7th August 2017 one surveyor walked a transect encompassing the entire site. On the 12th June the second surveyor undertook an emergence survey on the shed with low-negligible potential to support bats and on the 7th August the second surveyor undertook an emergence survey on the beech supporting multiple woodpecker holes (see figure 4).

All surveyors used Echometer Touch bat detectors to identify species through call frequencies and recorded all bat activity on and in close proximity to the site. Recordings were identified during the fieldwork where possible and, since all echolocations were recorded automatically, confirmed later where necessary using call frequency identification software.



Figure 3. Aerial photo of the site. The transect routes walked on the 12th April are shown with dashed lines with orange indicating the garden transect and yellow indicating the field transect. The sites boundaries are shown in red.



Figure 4. Aerial photo of the site. The transect route walked on the 12th July and 7th August is shown with a dashed yellow line. The location of the surveyor undertaking the emergence survey on the shed on the 12th July is indicated with a yellow dot. The location of the surveyor undertaking the emergence survey on the beech on the 7th August is indicated with an orange dot. The sites boundaries are shown in red.

3.2 Static Bat Logger Deployment

Two static bat loggers were deployed across land at Bonhams, Flansham on the 12th April 2017. A single logger was deployed on the 12th June 2017. Locations the loggers were set are shown in figure 5.

For all surveys a Peersonic detector and full spectrum recorder RPA2 enclosed within a Waterproof IP67 Enclosure was left in the field for at least 5 days, which is the maximum lifetime of the battery. The Peersonic detector is a passive recording device with real time full spectrum calls that can be viewed in detail once downloaded on Analysis software so that the species of bat making a call can (where possible) be identified.

By undertaking these surveys in April and June the data gathered has covered the most active periods for bats in accompaniment with the activity surveys undertaken. Whilst the data gathered from static loggers cannot be used to establish information of foraging and commuting by bats, it does provide information throughout the night, rather than the period immediately after bat emergence, which is observed during activity surveys.



Figure 5. Aerial photo of the site. Location of the two static bat loggers colour coded as yellow and orange, deployed on 12th April. Location of the static logger set out on the 12th June indicated with a blue dot. The sites boundaries are shown in red.

4 RESULTS

4.1 Bat Activity Surveys

12th April 2017

Garden Transect

Bat activity was recorded between 20:10 and 21:01 with a number of common pipistrelles and soprano pipistrelles recorded commuting and foraging throughout this time.

Regular foraging by common pipistrelles was recorded across parts of the garden space from 20:10 until 20:45 with bat activity trailing off after this time (see figure 6).

Activity was concentrated along the tree line to the south west of the garden space and within the area of scattered broad leaved trees at the eastern corner, with regular foraging by common pipistrelles recorded in these locations.



Figure 6. Bat activity recorded in the garden space on the 12th April, with blue representing common pipistrelle bats and orange representing soprano pipistrelle. Thicker lines represent greater activity observed.

Field Transect

Bat activity was recorded between 20:19 and 21:03 with a number of common pipistrelles recorded foraging and commuting and a single soprano pipistrelle being heard only. Social calling by common pipistrelles was also recorded on three occasions.

Activity was concentrated at the south-western corner of the site over the ruderal habitat and along the western boundary close to the tree line located beyond the fence at this boundary with regular foraging by common pipistrelles recorded (see figure 7).



Figure 7. Bat activity recorded within the field on the 12th April, with blue representing common pipistrelle bats and orange representing soprano pipistrelle. Thicker lines represent greater activity observed.

12th June 2017

Bat activity was recorded between 20:40 and 22:47 with a number of common pipistrelles and soprano pipistrelles recorded commuting and foraging throughout this time and a single serotine.

Regular foraging by common pipistrelles was recorded across the site throughout the survey period (see figure 8). A single serotine commuted overhead of the garden space of Bonhams at 21:42.

Activity was concentrated along the south-eastern boundary which is bordered by SUDS ponds, along the western tree line and within the area of scattered broadleaved trees at the eastern corner with regular foraging by common pipistrelles recorded in these locations.



Figure 8. Bat activity recorded across the site on the 12th June, with blue representing common pipistrelle bats, orange representing soprano pipistrelle and green representing serotine. Thicker lines represent greater activity observed.

7th August 2017

Bat activity was recorded between 20:42 and 22:15 with a number of common pipistrelles and soprano pipistrelles recorded commuting and foraging throughout this time and noctule, serotine and *Myotis* sp. also recorded.

Regular foraging by common pipistrelles was recorded across the site throughout the survey period.

Two serotine bats were recorded foraging over the garden space of Bonhams at 21:05 and heard but not seen at 22:06 and 22:09 within the garden space. Two *Myotis* sp. bats were heard only at 22:00 and 22:15 around the same location and a single common noctule at 21:54.

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Activity was concentrated along the western tree line and within the garden space of Bonhams.



Figure 9. Bat activity recorded across the site on the 7th August, with blue representing common pipistrelle bats, orange representing soprano pipistrelle, green representing serotine, red representing *Myotis* sp. and purple representing common noctules. Thicker lines represent greater activity observed.

4.2 Bat Emergence Surveys

No bats were seen to emerge from any part of the building at any time during the emergence survey of the shed on the 12th June.

A single common pipistrelle was recorded emerging from a woodpecker hole location in the crown of the beech during the emergence survey on the 7th August 2017.



4.3 Static Bat Logger Deployment

April bat logger data

Location 1

This detector was positioned along the north-eastern boundary of the site within the garden space of Bonhams. The detector was located within a tree line where it was felt that there was a high likelihood of detecting commuting and foraging bats. The detector recorded echolocation calls for five consecutive nights from the 12th April 2017 to the 16th April 2017.

A total of five species were recorded during the survey including common pipistrelle, soprano pipistrelle, brown long-eared bat, Nathusius's pipistrelle and serotine bat.

Common pipistrelle and soprano pipistrelle activity was recorded on all five nights.

A brown long-eared bat and Nathusius's pipistrelle was recorded on one of the five survey nights on the 12th April. Serotine activity was recorded during one of the five survey nights on the 16th April.

The peak count for common pipistrelle and soprano pipistrelle activity was recorded on the 12th April with a peak count of 621 common pipistrelle passes and 215 soprano pipistrelle passes. The peak count for brown long-eared and Nathusius's pipistrelle passes was recorded on the 12th April with a peak count of 1 brown long-eared bat pass and 1 Nathusius's pipistrelle pass. The peak count for serotine passes was on the 16th April with 2 passes recorded.

Table 1 shows the full results from the static logger deployment in location 1 during April 2017.

Date	<i>Eptesicus serotinus</i>	<i>Nyctalus noctula</i>	<i>Myotis sp.</i>	<i>Pipistrellus pipistrellus</i>	<i>Pipistrellus pygmaeus</i>	<i>Pipistrellus nathusii</i>	<i>Plecotus auritus</i>
12.04.17	0	0	0	627	215	1	1
13.04.17	0	0	0	227	74	0	0
14.04.17	0	0	0	336	22	0	0
15.04.17	0	0	0	621	65	0	0
16.04.17	2	0	0	308	7	0	0

Table 1: Species recorded and the total number of passes per day in Location 1 in April 2017.

Location 2

This detector was positioned along the south-eastern boundary of the site. The detector was located on a fence line with a SUDS pond located beyond the sites boundary. The detector recorded echolocation calls for five consecutive nights from the 12th April 2017 to the 16th April 2017.

Significantly less bat calls were recorded. A total of four species were recorded during the survey including common pipistrelle, soprano pipistrelle, Nathusius' pipistrelle and serotine bat. A total of 21 common pipistrelle passes, 1 soprano pipistrelle pass, 1 Nathusius' pipistrelle pass and 1 serotine pass were recorded.

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On review, it was decided that the sensitivity setting of the microphone on this logger may have impaired the detectability of bat calls, owing to the very low number of recordings made.

June bat logger data

Location 3

This detector was positioned along the southern corner of the site. The detector was located between earth mound supporting ruderal habitat. SUDS ponds situated beyond the sites boundaries are located in close proximity. The detector recorded echolocation calls for five consecutive nights from the 12th June 2017 to the 16th June 2017.

A total of seven species were recorded during the survey including common pipistrelle, soprano pipistrelle, Nathusius' pipistrelle, brown long-eared bat, serotine bat, common noctule and *Myotis sp.*

Common pipistrelle activity was recorded on all five nights whilst soprano pipistrelles were recorded during three of the five survey nights on the 14th, 15th and 16th June. Serotine and Nathusius's pipistrelle activity was recorded during four of the five survey nights on the 12th, 13th, 15th and 16th June. Noctule bats were recorded on two of the five survey nights on the 15th and 16th June. Brown long-eared bat activity was recorded during two nights on the 12th and 15th June. A *Myotis sp.* was recorded on the 15th June.

The peak count for common pipistrelle and soprano pipistrelle activity was recorded on the 16th April with a peak count of 1258 common pipistrelle passes and 9 soprano pipistrelle passes. The peak count for brown long-eared and *Myotis sp.* passes was recorded on the 15th April with a peak count of 1 pass each. The peak count of 3 Nathusius's pipistrelle passes was recorded on the 16th June. The peak count of 3 serotine passes and 2 common noctule passes was recorded on the 15th April.

Date	<i>Eptesicus serotinus</i>	<i>Nyctalus noctula</i>	<i>Myotis sp.</i>	<i>Pipistrellus pipistrellus</i>	<i>Pipistrellus pygmaeus</i>	<i>Pipistrellus nathusii</i>	<i>Plecotus auritus</i>
12.06.17	2	0	0	135	0	2	1
13.06.17	1	0	0	190	0	2	0
14.06.17	0	0	0	203	4	0	0
15.06.17	3	2	1	415	2	1	1
16.06.17	2	1	0	1258	9	3	0

Table 2. shows the full results from the static logger deployment in location 3 during June 2017.

4.4 Constraints/Limitations

Despite the temperature being 10°C at the start of the activity survey undertaken on the 12th April this dropped to 8°C at 21:00. This coincided with a drop in bat activity at this time leading to the survey being cut short. Subsequent surveys will be undertaken in optimal conditions later in the year which will improve the confidence in the assessment.

No constraints or limitations were identified during the second survey. The survey was completed within the allocated temperature range and without the influence of rain and was deemed to be suitable.



5 DISCUSSION AND RECOMMENDATIONS

The beech tree with woodpecker holes within the crown supports a common pipistrelle bat roost with an individual recorded emerging during a survey on the 7th August. The location of the tree is shown in figure 10 and is coded as T47 within the tree constraints plan produced by Broad Oak Tree Consultants Ltd. The plan is to retain this tree and therefore a no light zone must be created around it where no lights will be directed towards this tree or within a 10 meter radius of it.

In the event that plans change and this tree is proposed to be felled a European Protected Species (EPS) license will need to be applied for and granted by Natural England to permit the work which will result in the loss of a bat roost. The license document would detail all necessary mitigation which would include:

- A climbed inspection of the bat roosting features on the beech tree by a licensed ecologist with aerial rescue certification for detailed inspection using a endoscope prior to felling to be undertaken. Where any bat identified within the woodpecker holes are removed safely by hand and placed within a bat box, such as a 2F Schwegler bat box, which will be made available.
- The works must be timed between mid March and end October to avoid the hibernation period when bats are most vulnerable to disturbance.

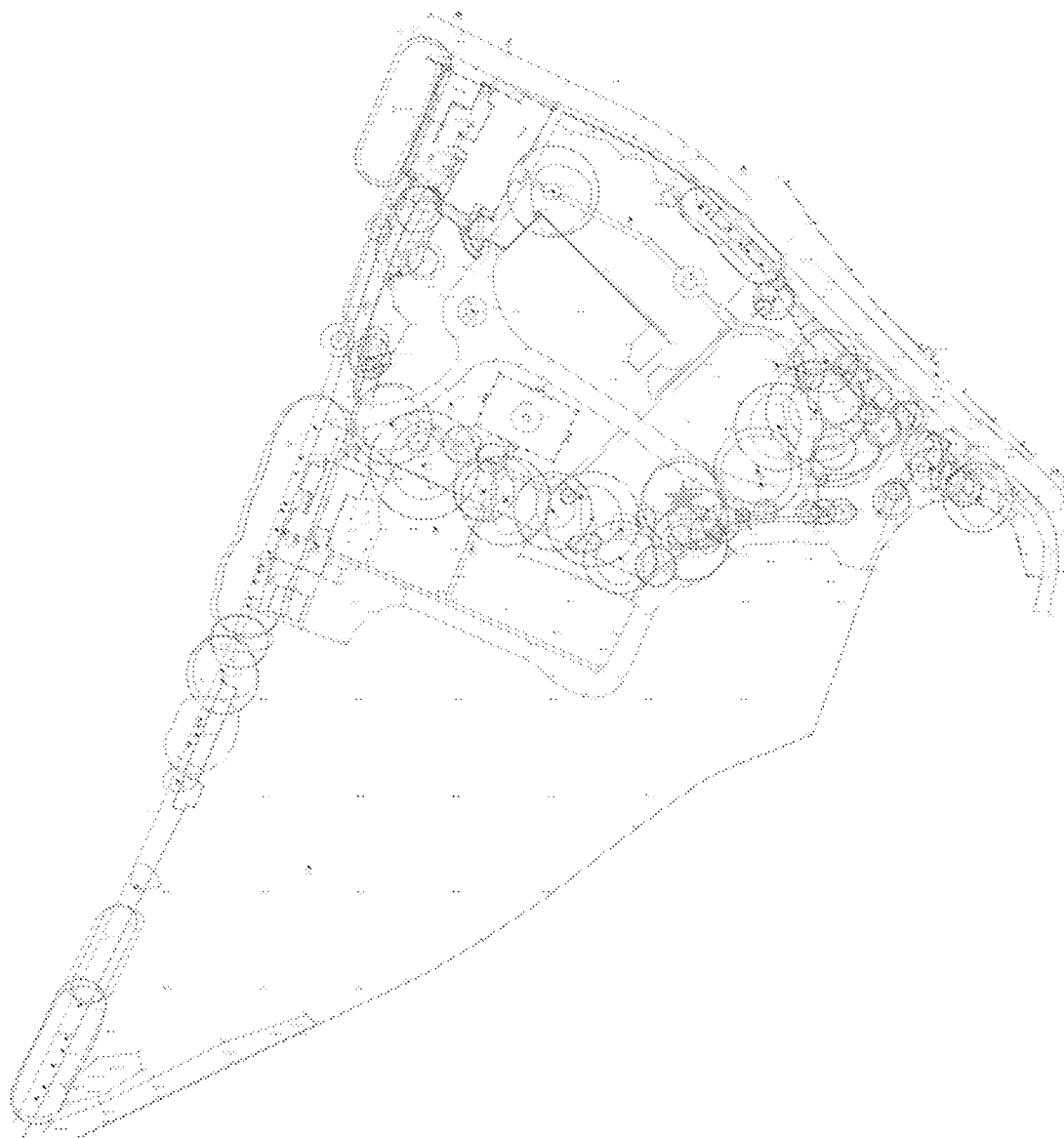


Figure 10: Tree constraints plan produced by Broad Oak Tree Consultants Ltd with the tree supporting a common pipistrelle bat roost shown with a yellow star.

No bats were seen to emerge from the shed at any time. As a result, based on the information gathered, no further surveys or mitigation is required upon this building.

The results of the bat activity surveys indicate that bat activity is concentrated along the tree line to the south west of the garden space, within the area of scattered broadleaved trees, at the south-western corner of the site overhead of the ruderal habitat and along the western site boundary.

Moderate species diversity has been recorded during the bat activity surveys undertaken with five species; common pipistrelle, soprano pipistrelles, common noctule, serotine and *Myotis sp.* recorded, whilst two additional species; nathusius pipistrelle and brown long-eared bat were detected through the deployment of static loggers. By far the commonest bat recorded is the common pipistrelle, with just over 98% of calls recorded at location 3 made by this species.



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The nathusius pipistrelle bat was recorded at Location 1 and 3, with a total of 9 recordings made. This is one of the less common bat species in the UK, with an estimated population of 16,000 individuals according to the Bat Conservation Trust website. The species has a scattered distribution in the UK, but is generally more common in the southeast and it is a species believed to be expanding, with greater records having been made in successive years.

Avoidance, mitigation and compensation measures for the potential impacts to foraging and roosting habitat as a result of the development will need to be incorporated into the development. Measures will be detailed in full within the Mitigation Statement. Such measures could include:

- Retention of existing trees and shrubs wherever possible to maintain existing foraging and commuting routes.
- Sensitive lighting plan that maintains dark areas of suitable foraging and commuting habitat in accordance with guidance provided by the Bat Conservation Trust (see appendix 2).
- New roosting opportunities for bats incorporated into the fabric of buildings close to the boundaries of the site e.g. 1FR Schwegler bat tubes, 2FE Schwegler wall mounted bat shelters and 1MF bat boxes which can easily be incorporated into the build or onto external faces of properties to provide net gain in bat roosting habitat. These features will be suitable for all pipistrelle bat species, including the least common nathusius pipistrelle.
- The instillation of at least three Schwegler woodcrete bat boxes such as 2F and 2FN Schwegler bat boxes on suitable mature trees away from sources of artificial light.
- Soft landscape planting scheme using native species that encourage invertebrate prey which should include the enhancement of the western site boundary for foraging and commuting bats through the planting of native species rich hedgerow to complement the existing SUDS ponds.

Should you need any further advice on the information provided above, please do not hesitate to contact The Ecology Co-op.



6 APPENDIX 1 – LEGISLATION AND POLICY

Bats

All species of British bat are fully protected under the Wildlife and Countryside Act 1981 as amended through inclusion in Schedule V. All bat species in the UK are also included in Schedule II of the Habitats Regulations 2010 which transpose Annex II of the Council Directive 92/43/EEC 1992 on the Conservation of Natural Habitats and of Wild Fauna and Flora ("EC Habitats Directive") which defines European protected species of animals.

Bat species are afforded further protection by the Countryside and Rights of Way (CROW) Act 2000; and the Natural Environment and Rural Communities Act 2006.

Under the above legislation it is an offence to:

- kill, injure or take an individual;
- possess any part of an individual either alive or dead;
- intentionally or recklessly damage, destroy or obstruct access to any place or structure used by these species for shelter, rest, protection or breeding;
- intentionally or recklessly disturb these species whilst using any place of shelter or protection; or
- deliberate disturbance in such a way as to be likely to impair their ability to:
 - survive, to breed or reproduce, or to rear or nurture their young; or
 - in the case of animals of a hibernating or migratory species, to hibernate or migrate; or
 - to affect significantly the local distribution or abundance of the species to which they belong;
- keep (possess), transport, sell or exchange, or offer for sale or exchange, any live or dead bat, or any part of, or anything derived from a bat.

It is also an offence to set and use articles capable of catching, injuring or killing bats (for example a trap or poison), or knowingly cause or permit such an action. In the case all species of British bat there is also protection under Schedule 6 of The Wildlife and Countryside Act 1981 (as amended) relating specifically to trapping and direct pursuit of these species.

A European Protected Species License (EPSL) in relation to bats is required from Natural England for any work that would result in an otherwise unlawful activity (e.g. damage to a bat roost). A license can only be issued to permit otherwise prohibited acts if Natural England are satisfied that all of the following three tests are met:

- The proposal is for 'preserving public health or public safety or other imperative reasons of overriding public interest including those of a social or economic nature and beneficial consequences of primary importance for the environment';
- There is no satisfactory alternative; and
- The action authorised by the license will not be detrimental to the maintenance of bat populations at a favourable conservation status in their natural range.

A bat roost is defined by the Bat Conservation Trust publication Bat Surveys—Good Practice Guidelines



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2nd Edition as “the resting place of a bat”¹. Generally, however, the word roost is interpreted as “any structure or place, which any wild bat uses for shelter or protection.”

Bats tend to re-use the same roosts; therefore legal opinion is guided by recent case law precedents, that a roost is protected whether or not the bats are present at the time. This can include for summer roosts, used for breeding; or winter roosts, used for hibernating.



7 APPENDIX 2 – ARTIFICIAL LIGHTING AND WILDLIFE

Interim Guidance: Recommendations to help minimise the impact of artificial lighting – produced by The Bat Conservation Trust.

Wherever human habitation spreads, so does artificial lighting. This increase in lighting has been shown to have an adverse effect on our native wildlife, particularly on those species that have evolved to be active during the hours of darkness. Consequently, development needs to carefully consider what lighting is necessary and reduce any unnecessary lighting, both temporally and spatially. When the impacts on different species groups are reviewed, the solutions proposed have commonalities that form the basis of good practice. These are outlined in the following document.

Overview of impacts

Invertebrates

Artificial light significantly disrupts natural patterns of light and dark, disturbing invertebrate feeding, breeding and movement, which may reduce and fragment populations. Some invertebrates, such as moths, are attracted to artificial lights at night. It is estimated that as many as a third of flying insects that are attracted to external lights will die as a result of their encounter.¹ Insects can become disoriented and exhausted making them more susceptible to predation. In addition, the polarisation of light by shiny surfaces attracts insects, particularly egg laying females away from water. Reflected light has the potential to attract pollinators and impact on their populations, predators and pollination rates. Many invertebrates natural rhythms depend upon day-night and seasonal and lunar changes which can be adversely affected by artificial lighting levels.

It is not always easy to disentangle the effects of lighting on moths from other impacts of urbanisation. However, it is known that UV and green and blue light, which have short wavelengths and high frequencies, are seen by most insects and are highly attractive to them. Where a light source has a UV component, male moths in particular will be drawn to it. Most light-induced changes in physiology and behaviour are likely to be detrimental. They discern it to be 'light', so they do not fly to feed or mate.²

Birds

There are several aspects of changes to bird behaviour to take into account. The phenomenon of robins and other birds singing by the light of a street light or other external lighting installations is well known, and research has shown that singing did not have a significant effect on the bird's body mass regulation. However, it was felt that the continual lack of sleep was likely to be detrimental to the birds' survival and could disrupt the long-term circadian rhythm that dictates the onset of the breeding season³. Many species of bird migrate at night and there are well-documented cases of the mass mortality of nocturnal migrating birds as they strike tall lit buildings. Other UK bird species that are particularly sensitive to artificial lighting are long-eared owls, black-tailed godwit and stone curlew.⁴

Mammals

A number of our British mammals are nocturnal and have adapted their lifestyle so that they are active in the dark in order to avoid predators. Artificial illumination of the areas in which these mammals are active and foraging is likely to be disturbing to their normal activities and their foraging areas could be

¹Bruce-White C and Shardlow M (2011) A Review of the Impact of Artificial Light on Invertebrates - See more at: <http://www.buglife.org.uk/advice-and-publications/publications/campaigns-and-reports/review-impact-artificial-light/#sthash.s7GPA1vL.dpuf>

²As above

³Pollard A. (2009) Visual constraints on bird behaviour. University of Cardiff

⁴Rodriguez A., Garcia A.M., Cervera F. and Palacios V. (2006) Landscape and anti-predation determinants of nest site selection, nest distribution and productivity in Mediterranean population of Long-eared Owls, *Asio otus*. *Ibis*, 148(1), pp.133-145

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lost in this way. It is thought that the most pronounced effect is likely to be on small mammals due to their need to avoid predators. However, this in itself has a knock-on effect on those predators.

The detrimental effect of artificial lighting is most clearly seen in bats. Our resident bat species have all suffered dramatic reductions in their numbers in the past century. Light falling on a bat roost exit point, regardless of species, will at least delay bats from emerging, which shortens the amount of time available to them for foraging. As the main peak of nocturnal insect abundance occurs at and soon after dusk, a delay in emergence means this vital time for feeding is missed. At worst, the bats may feel compelled to abandon the roost. Bats are faithful to their roosts over many years and disturbance of this sort can have a significant effect on the future of the colony. It is likely to be deemed a breach of the national and European legislation that protects British bats and their roosts.

In addition to causing disturbance to bats at the roost, artificial lighting can also affect the feeding behaviour of bats and their use of commuting routes. There are two aspects to this: one is the attraction that short wave length light (UV and blue light) has to a range of insects; the other is the presence of lit conditions.

As mentioned, many night-flying species of insect are attracted to lamps that emit short wavelength component. Studies have shown that, although noctules, serotines, pipistrelle and Leisler's bats, take advantage of the concentration of insects around white street lights as a source of prey, this behaviour is not true for all bat species. The slower flying, broad-winged species, such as long-eared bats, barbastelle, greater and lesser horseshoe bats and the *Myotis* species (which include Brandt's, whiskered, Daubenton's, Natterer's and Bechstein's bats) generally avoid external lights.

Lighting can be particularly harmful if it illuminates important foraging habitats such as river corridors, woodland edges and hedgerows used by bats. Studies have shown that continuous lighting along roads creates barriers which some bat species cannot cross⁵. It is also known that insects are attracted to lit areas from further afield. This could result in adjacent habitats supporting reduced numbers of insects, causing a further impact on the ability of light-avoiding bats to feed.

These are just a few examples of the effects of artificial lighting on British wildlife, with migratory fish, amphibians, some flowering plants, a number of bird species, glow worms and a range of other invertebrates all exhibiting changes in their behaviour as a result of this unnatural lighting.

Recommendations

Survey and Planning

The potential impacts of obtrusive light on wildlife should be a routine consideration in the Environmental Impact Assessment (EIA) process⁶. Risks should be eliminated or minimised wherever possible. Some locations are particularly sensitive to obtrusive light and lighting schemes in these areas should be carefully planned.

In August 2013, Planning Minister Nick Boles launched the new National Online Planning Guidance Resource aimed at providing clearer protection for our natural and historic environment. The guidance looks at when lighting pollution concerns should be considered and is covered within one of the on line planning practice guides⁷. The guide provides an overview for planners with links to documents that aim to give planners an overview of the subject through the following discussion points:

⁵Stone E. L., Jones G and Harriss (2009) Street lighting disturbs commuting bats. *Current Biology*, 19, pp 1-5

⁶See also: Institution of Lighting Professionals – Professional Lighting Guide (PLG 04) Guidance on undertaking lighting environmental impact assessments)



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- 1.2 When is obtrusive light / light pollution relevant to planning?
- 1.3 What factors should be considered when assessing whether a development proposal might have implications for obtrusive lighting / light pollution?
- 1.4 What factors are relevant when considering where light shines?
- 1.5 What factors are relevant when considering how much the light shines?
- 1.6 What factors are relevant when considering possible ecological impact?

This can help planners reach the right design through the setting of appropriate conditions relating to performance and mitigation measures at the planning stage.

The Institution of Lighting Professionals (ILP) recommends that Local Planning Authorities specify internationally recognised environmental zones for exterior lighting control within their Development Plans⁸. In instances lacking classification, it may be necessary to request a Baseline Lighting Assessment/Survey conducted by a Lighting Professional in order to inform the classification of areas, particularly for large-scale schemes and major infrastructure projects.

When assessing or commissioning projects that include the installation of lighting schemes, particularly those subject to the EIA process, the following should be considered and relayed to applicants:

- **Ecological consultants should confirm the presence of any sensitive fauna and flora**, advising the lighting designers of bat routes and roosts and other areas of importance in order to ensure that reports correspond with each other.
- **Ecological consultants should consider the need for quantitative lighting measurements**. In some instances it may be necessary for further lighting measurements to be taken. For example, outside an important bat roost. These should follow best practice guidance from the ILP and would ideally be conducted by a Lighting Professional.
- **Where appropriate, professional lighting designers should be consulted** to design and model appropriate installations that achieve the task but mitigate the impacts. This should be done at the earliest opportunity. Early decisions can play a key role in mitigating the impact from lighting.
- **Reports submitted should outline the impacts of lighting in relation to ecology**, making clear reference to the ecological findings, highlighting any sensitive areas and detail proposed mitigation. Consideration should also be given to internal lighting where appropriate.
- **Post –installation checks and sign off upon commissioning should be carried out** by the lighting designer to ensure that the lighting installation has been installed in accordance with the design, that predictions were accurate and mitigation methods have been successful.

Principles and design considerations

Do not

- **provide excessive lighting**. Use only the minimum amount of light needed for the task.
- **directly illuminate bat roosts** or important areas for nesting birds

Avoid

- **installing lighting in ecologically sensitive areas** such as: near ponds, lakes, rivers, areas of high conservation value; sites supporting particularly light-sensitive species of conservation significance (e.g. glow worms, rare moths, slow-flying bats) and habitat used by protected species.
- **using reflective surfaces under lights**.

Do

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- **consider employing a competent lighting designer** who will apply the principals of providing the right light, in the right place, at the right time and controlled by the right system.
- **minimise the spread of light** to at, or near horizontal and ensure that only the task area is lit. Flat cut-off lanterns or accessories should be used to shield or direct light to where it is required.
- **consider the height of lighting columns.** It should be noted that a lower mounting height is not always better. A lower mounting height can create more light spill or require more columns. Column height
- **consider no lighting solutions where possible** such as white lining, good signage and LED cats eyes. These options can also be effective. For example, light only high-risk stretches of roads, such as crossings and junctions, allowing headlights to provide any necessary illumination at other times.
- **use temporary close-boarded fencing until vegetation matures,** to shield sensitive areas from lighting.
- **limit the times that lights are on to provide some dark periods.** The task being lit often varies, for example roads are less used after 23.00hrs and car parks are empty. A lighting designer can vary the lighting levels as the use of the area changes reducing lighting levels or perhaps even switching installations off after certain times. This use of adaptive lighting can tailor the installation to suit human health and safety as well as wildlife needs.

Technological specifications

Research from the Netherlands has shown that spectral composition does impact biodiversity.

- **Use narrow spectrum light sources** to lower the range of species affected by lighting.
- **Use light sources that emit minimal ultra-violet light**
- **Lights should peak higher than 550 nm**
- **Avoid white and blue wavelengths of the light spectrum** to reduce insect attraction and where white light sources are required in order to manage the blue short wave length content they should be of a warm / neutral colour temperature <4,200 kelvin.

Further guidance on the spectral composition of artificial lighting will be made available following the publication of research from the Netherlands.

Further reading:

- A review of the impact of artificial light on invertebrates. Buglife. 2011
- Royal Commission on Environmental Pollution. 2009. Artificial light in the environment. London, HMSO
- The Ecological Consequences of Artificial Night Lighting" edited by Longcore and Rich
- Shedding Light: A survey of local authority approaches to lighting in England. CPRE 2014

<http://planningguidance.planningportal.gov.uk/blog/guidance/light-pollution/when-is-light-pollution-relevant-to-planning/> <http://planningguidance.planningportal.gov.uk/blog/guidance/light-pollution/when-is-light-pollution-relevant-to-planning/>

⁸ Institution of Lighting Professionals (2011) Guidance Notes for the Reduction of Obtrusive Light GN01:2011

