



ENVIRONMENTAL CONSULTANTS  
Unit 4, Langham Stables, Langham Lane, Lodsworth, Petworth, West Sussex, GU28 9BU

Tel: 01798 861800 - E-Mail: [info@ecologyco-op.co.uk](mailto:info@ecologyco-op.co.uk) - [www.ecologyco-op.co.uk](http://www.ecologyco-op.co.uk)

## **Preliminary Ecological Appraisal and Bat Scoping Survey**

**30 Lagoon Road, Pagham, West Sussex**

**Author: Dr Ryan Walker, CEnv, MCIEEM**

**Reviewed by: Paul Whitby, CEcol, MCIEEM**

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The Ecology Co-operation Ltd  
Registered Office: Greens Court, West Street, Midhurst, West Sussex, GU29 9NQ  
Company number: 8905527



## **Report Summary**

- 1. This report presents the results of a preliminary ecological appraisal (PEA) undertaken in March 2017. The survey was undertaken to establish if the site at 30 Lagoon Road, Pagham supports habitats with the potential to support EU and/or UK protected species. The site currently supports a small bungalow set in residential gardens. It is proposed that the bungalow is to be demolished and four trees are to be removed, to make way for a more modern residential property, proposed largely to be upon the same footprint.**
- 2. This survey work was carried out by Dr Ryan Walker, a full member of the Chartered Institute for Ecology and Environmental Management (CIEEM) and a Chartered Environmentalist, through the Society for the Environment.**
- 3. The site is situated to the east of Pagham Harbour SSSI, SPA and Ramsar site, within a high density residential area.**
- 4. The garden represents an area of moderate ecological value at a local scale, with the garden supporting habitat suitable for some species of reptiles and nesting birds.**
- 5. The bungalow proposed for demolition has a negligible potential to support roosting bats. All of the trees within the site, including the trees proposed for removal, have a negligible potential to support roosting bats.**
- 6. Removal of vegetation fringing the bungalow prior to demolition should be undertaken outside of the bird breeding season, as to not conflict with breeding birds.**
- 7. The vegetation and stony areas fringing the bungalow should be removed prior to demolition, by a suitably qualified ecologist, in an effort to translocate any reptiles or amphibians using these areas as refugia, to other parts of the garden.**
- 8. It is not expected that a proposed development of this scale will have any potential adverse impact upon the neighbouring designated area.**
- 9. A number of ecological enhancement recommendations are listed to improve the site for biodiversity conservation, including a wildlife sensitive external lighting plan.**

This report has been prepared by The Ecology Co-operation Ltd, with all reasonable skill, care and diligence

PEA - 30 Lagoon Road, Pagham



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## 1 **INTRODUCTION**

### 1.1 *Purpose of the Report*

This report details the results of a Preliminary Ecological Appraisal (PEA) and bat scoping survey for the footprint of a proposed demolition and rebuild of a residential property at 30 Lagoon Road, Pagham. The results establish the potential presence of protected species based upon the availability of suitable habitat and/or signs of the species themselves. These results will then guide any necessary further ecological surveys and/or mitigation in relation to the proposed development works for the site. In addition, a local biodiversity desk study was undertaken for a 2km radius of the site for records of protected species.

This survey was carried out by Dr Ryan Walker, a full member of the Chartered Institute for Ecology and Environmental Management (CIEEM) and a Chartered Environmentalist, through the Society for the Environment. Dr Walker also holds protected species survey licences for bats, dormice and great crested newts.

### 1.2 *Background*

The site; 30 Lagoon Road is situated to the south of Pagham and to the east of Pagham Lagoon (Fig. 1). Pagham Lagoon forms part of the Pagham Harbour Site of Special Scientific Interest (SSSI), Special Protection Area (SPA) and Ramsar Site. The wider area consists largely of high density residential properties to the east and north, lagoon and coastal wetland areas to the west and coastal environments to the south. It is proposed that the existing bungalow within the site will be demolished to make way for a more modern residential property, largely upon the same existing footprint (Fig. 2). It is proposed that four small to moderate sized trees and a row of non native conifer trees will also be removed. The bungalow is set within moderately large domestic gardens.



**Figure 1.** Aerial image of the site, which is outlined in red. Image orientated north to south.



**Figure 2.** (left) existing site plan with the bungalow and four trees and row of non native conifer trees to be removed depicted in red. (Right). Proposed new development and site layout.



## 2 ***SURVEY METHODOLOGY***

### 2.1 *Preliminary Ecological Appraisal*

A preliminary ecological appraisal was carried out on 18/03/17 to evaluate the site for habitats potentially suitable to support EU and UK protected species. The populations of the following species or taxonomic groups are often recorded within domestic garden settings similar to the site being surveyed; badgers (*Meles meles*), bats, dormice (*Muscardinus avellanarius*) nesting birds, great crested newt (*Triturus cristatus*), and the more widespread species of reptiles such as common lizard (*Zootoca vivipara*), slow worm (*Anguis fragilis*) and grass snake (*Natrix natrix*).

Methods detailed by the following authors were used in the assessment of either suitable habitat to support the above species or taxonomic groups or in some cases direct evidence that the species were present<sup>123457</sup>. The survey process also follows the Guideline for Preliminary Ecological Appraisal as outlined by CIEEM. Additionally, biodiversity records for significant species supporting legal protection, were collated from the Sussex Biodiversity Records Centre(SxBRC) based on a 2km radius from the centre of the site.

### 2.2 *Badgers*

An initial assessment was carried out to identify areas that might be used by badgers. Signs of badgers include setts, incidental foraging signs, runs and latrines.

### 2.3 *Bats*

Buildings and trees were assessed as part of a bat scoping survey to establish the potential to support roosting bats. Bats can use a variety of roost areas including trees with holes, splits, cracks, cavities, Ivy and loose bark. The table below describes the categories used for describing the potential for trees to be used by roosting bats.

Buildings can be used by roosting bats. Any voids or external crevices, such as loose fitting roof tiles, loose soffits or wooden cladding within buildings were assessed for their

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<sup>1</sup>Bright, B., Morris, P., Mitchell-Jones, A.J. and Mitchell-Jones, T (1997) *The Dormouse Conservation Handbook*. English Nature.

<sup>2</sup>English Nature (2001) *Great Crested Newt Mitigation Guidelines*. English Nature, Peterborough.

<sup>3</sup> Harris, S, Cresswell, P. and Jefferies, D. (1989) *Surveying Badgers*. Mammal Society.

Hundt, L (2012) *Bat Surveys: Good Practice Guidelines, 2nd edition*. Bat Conservation Trust.

<sup>4</sup> Oldham, R.S., Keeble, J., Swan, M.J.S. and Jeffcote, M. (2000) Evaluating the suitability of habitat for the great crested newt (*Triturus cristatus*). *Herpetological Journal* 10, 143-155.

<sup>5</sup>Hundt, L (2016) *Bat Surveys: Good Practice Guidelines, 2nd edition*. Bat Conservation Trust.



suitability to potentially support roosting bats. The general habitat was assessed for the potential for foraging habitat for bats.

| Category   | Description                                                                                                                                                                                                                           |
|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Negligible | A tree with negligible roosting habitat features likely to be used by bats.                                                                                                                                                           |
| Low        | A tree of sufficient size to potentially support roosting features, but with none seen from the ground or features identified of limited roosting potential.                                                                          |
| Medium     | A tree with one or more potential roost sites that could be used by bats due to their size, conditions and surrounding habitat, but unlikely to support a roost of high conservation status such as a maternity or hibernation roost. |
| High       | Trees with one or more potential roost sites that appear suitable for large numbers of bats or use as maternity or hibernation roosts.                                                                                                |

**Table 1.** Categories of trees in relation to bat roosting potential as described by the BCT<sup>5</sup>

## 2.4 *Breeding Bird Habitat*

Habitats were assessed for their suitability for supporting nesting birds. This could include ground nesting species, such as skylark (*Alauda arvensis*) and lapwing (*Vanellus vanellus*) or birds that favour more built environments. Where buildings were present, possible use by species such as starlings (*Sturnus vulgaris*) house sparrow (*Passer domesticus*), or barn owls (*Tyto alba*) were assessed.

## 2.5 *Dormice*

Woodland and hedgerows on or adjacent to the site were assessed for their suitability to support potential dormice (*Muscardinus avellanarius*) habitat.

## 2.6 *Great Crested Newt*

The area was assessed for the occurrence of ponds or wet ditches that could be considered to be potential suitable breeding habitats for great crested newts (*Triturus cristatus*), on or within 500m of the site.

## 2.7 *Reptiles*

The site was assessed for potential reptile habitat, with particular attention paid to those features that provide suitable basking areas (e.g. south-facing slopes), hibernation sites (e.g. banks, walls, piles of rotting vegetation) and opportunities for foraging (rough grassland and scrub).



## 2.8 *Legal Protection*

Legal protection applying to relevant bird, mammal and herpetofauna species is briefly detailed in Appendix 1 of this report.

## 2.9 *Designated sites*

The online resource MAGIC was consulted<sup>6</sup>. The MAGIC website provides authoritative geographic information about the natural environment from across government. The information covers rural, urban, coastal and marine environments across Great Britain. It is presented in an interactive map which can be explored using various mapping tools that are included. Areas of biodiversity conservation significance from within 2km of the site are noted.

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<sup>6</sup> <http://www.magic.gov.uk/>



### 3 **RESULTS**

#### 3.1 *Dominant habitat types*



**Figure 3.** The approximate boundary within the red of the site at 30 Lagoon Road, Pagham. Image orientated from north to south.

The site is dominated by a bungalow within the centre of the site, a number of greenhouses and outbuildings and well maintained domestic gardens (Fig. 3). The garden supports a number of tightly mown lawns, raised beds, two garden ponds a number of walls, hard standing areas and decking areas (Figs 4-7). Most of the trees within the garden are non-native ornamental species. Broad habitats within the site are largely of moderate ecological value.

#### 3.2 *Badgers*

There were no signs of any badger activity recorded within the site.

SxBRC do not provide badger records due to the sensitive nature of this information.

#### 3.3 *Bats*

The site is on the edge of a suburban setting with extensive reed beds and coastal wetland areas to the west (Fig. 1). The wider landscape supports moderate foraging habitat for a number of the commoner species of bats (Fig. 1).

##### *Trees:*

There is a row of four mature non-native conifer trees to the north of the site (Fig. 2). It is proposed that these trees will be removed, in addition to a hawthorn (*Crataegus monogyna*), an ash (*Fraxinus excelsior*) a non native spruce and a non native bay tree



(T10, T11, T16 and T47; Fig. 2). All of these trees were scoped for potential bat roosting features. All of these trees were categorised as having a 'negligible' potential to support roosting bats.

#### *Buildings:*

The only building found upon the site is the detached bungalow (Figs. 4-6). The site also supports three wooden garden sheds and a green house. All of these structures are to be retained, with only the bungalow proposed for demolition.

The bungalow is a concrete structure, with wooden and glass lean too structures upon the north and south facing aspects (Figs. 4 & 5). There are no internal roof voids within the property. The bungalow supports a felt clad roof (Figs 4 & 5) and a single brick chimney stack. All external aspects of the bungalow appear to be tight-fitting and devoid of gaps that could be considered potentially suitable for supporting crevice roosting bats such as the pipistrelle species. The roofing material is also tight-fitting and devoid of gaps, as is the wooden barge board trim round the gable ends of the bungalow (Fig. 6). There is no evidence to suggest that bats could potentially be roosting within the external aspects of this property in any location and in its current condition, it has a negligible potential to support roosting bats.

Within the SxBRC dataset, there are records for the following four species of bats within 2km of the site during the last 10 years: noctule bat (*Nyctalus noctula*), common pipistrelle (*Pipistrellus pipistrellus*), soprano pipistrelle (*Pipistrellus pygmaeus*), brown long eared bat (*Plecotus auritus*).

### 3.4 *Reptiles*

The gardens could be considered suitable habitat to support some of the more common species of reptile such as slow worm, common lizard and grass snake. These species will often live within the structures of raised beds, under slabs or timber or in amongst areas of dense or rough vegetation as is characteristic of some part of the garden within the site (Figs 8-11).

The SxBRC has recorded adders, common lizards slow worm and grass snakes within 2km of the site during the last 10 years.

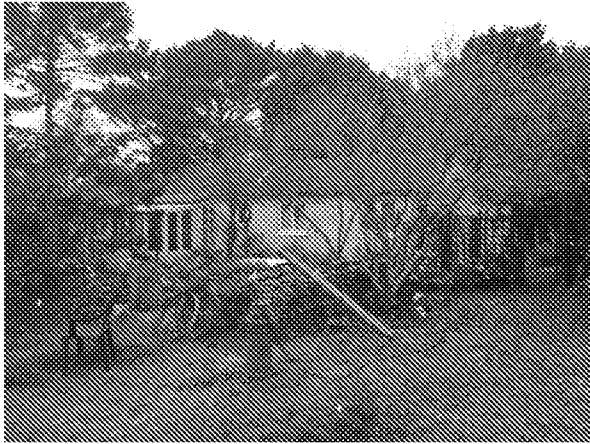


**Figure 4.** The south facing aspect of the bungalow, set in moderate sized gardens at 30 Lagoon Road.

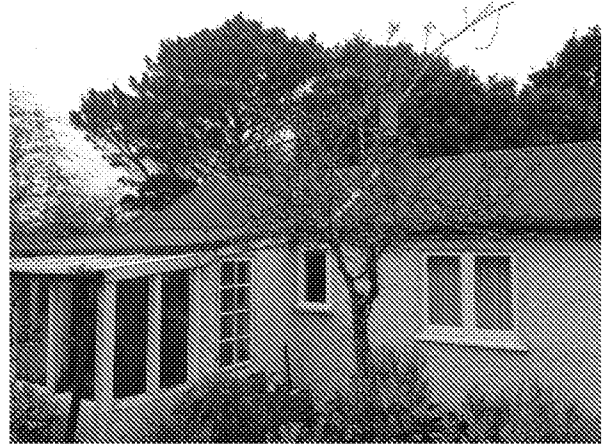


**Figure 5.** The south facing aspect of the bungalow at 30 Lagoon Road, with a felt lined roof at 30 Lagoon Road.



**Figure 6.** East facing aspect of the bungalow at 30 Lagoon Road showing the tight-fitting barge boarding, fringing the roof.

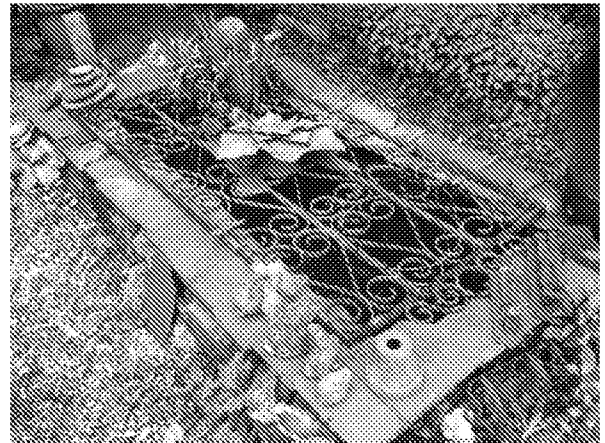


**Figure 7.** The ornamental pond to the east of the garden at 30 Lagoon Road.



**Figure 8.** The concrete lined pond to the south of the garden at 30 Lagoon Road.



**Figure 9.** The western section of the garden at 30 Lagoon Road.

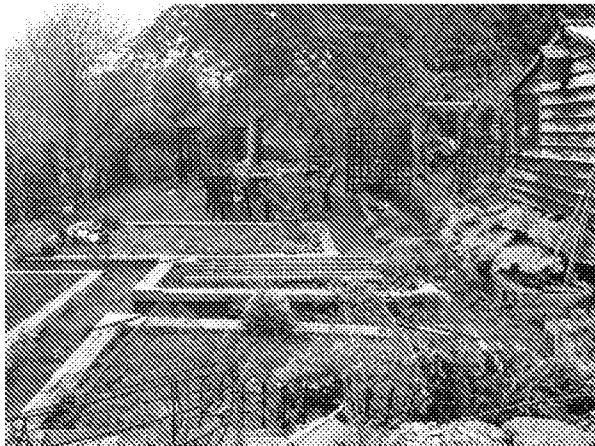


**Figure 10.** The southwest area of the garden with two wooden garden sheds within 30 Lagoon Road.



**Figure 11.** Views from the west of the garden across Pagham Harbour SSSI, SPA and Ramsar Site.

### 3.5 *Breeding Bird Habitat*

Habitat suitable for nesting garden birds is present throughout the site, within the larger trees, herbaceous shrubs and around the sheds.

### 3.6 *Dormice*

Dormice often favour woodland with dense understory and mixed species hedges. There is no habitat within the site that could be considered suitable for supporting populations of dormice. Dormice have not been recorded within 2km of the site by SxBRC during the last 10 years.

### 3.7 *Great Crested Newts*

The garden supports two ponds; the ornamental fish pond to the east of the bungalow (Fig. 6) and the concrete lined pond to the southwest of the garden (Fig. 8). The ornamental pond is most likely unsuitable aquatic habitat for most species of amphibian, as the pond supports a number of large ornamental carp, that would most likely predate any amphibians and their eggs. The concrete lined pond currently supports frog spawn. This pond was subjected to a great crested newt habitat suitability index survey<sup>4</sup>. This pond secured a score of 0.44 resulting in it being classified as 'poor' in relation to its suitability to support great crested newts. The habitat to the west (Pagham Harbour SSSI) represents brackish, lagoon habitat that would be unsuitable habitat to support breeding habitat for amphibians.

Great crested newts have not been recorded within 2km of the by SxBRC during the last 10 years.



### 3.8 *Constraints/Limitations*

An initial site assessment such as this is only able to act like a 'snapshot' to record any flora or fauna that is present at the time of the survey. Habitats are assessed for their potential to support some species, even where no direct evidence (such as droppings) have been found.

### 3.9 *Designated sites*

One of the eastern boundaries of Pagham Harbour SSSI, SPA and Ramsar Site is directly to the east of the garden at the site of 30 Lagoon Road (Fig. 11). Bognor Reef SSSI is less than 1km to the southeast of the site. Given that the proposed development will largely be encompassing the same footprint of the existing bungalow, it is unlikely that the proposed development will have any effect upon these sites.

### 3.10 *Assessment of Controlled Weed Species*

There were no species of controlled weed recorded within the site.

### 3.11 *Other notable protected species*

A number of marine mammal species have been recorded within 2km of the site within the last 10 years, however there is no suitable habitat to support these species within the site and the development is extremely unlikely to have any impact upon any marine species.



## 4 ***DISCUSSION AND RECOMMENDATIONS***

### 4.1 *Preliminary Ecological Appraisal*

The habitats within the site are largely of moderate ecological value at the local scale. Garden habitats can be important habitats for some species such as hedgehogs, reptiles and amphibians, that have become increasingly more scarce at a national scale. The concrete lined pond is most likely one of the most valuable features to wildlife, within the context of the garden. The proposed plan to remove the existing bungalow and replace it largely upon the main footprint will have minimal ecological impact to the site in the long term. However, the following potential impacts need to be mitigated as a result of the proposed works;

- The vegetation fringing the bungalow has the potential to support a number of species of garden birds during the bird breeding season (April-September). This needs to be considered with regards to timing for the potential demolition of the existing bungalow.
- The vegetation and the stonework fringing the bungalow has the potential to support refugia for reptiles and amphibians such as the common frogs using the garden. This needs to be considered with regards to timing for the potential demolition of the existing bungalow.

Specific mitigation and a number of ecological enhancements are suggested below.

### 4.2 *Badgers*

This assessment did not identify the presence of any badger setts or any badger activity that may have suggested the presence of a badger sett nearby.

No further surveys or mitigation in relation to badgers are considered necessary.

### 4.3 *Bats*

The bungalow proposed for demolition has a negligible potential to support roosting bats. No further surveys are required in relation to bats, however a sympathetic lighting scheme should be considered for the proposed development as the garden is most likely used by foraging bats. To ensure that the site is not devalued in terms of value to wildlife, the following lighting scheme should be undertaken, in accordance with Bat Conservation Trust Guideline (Appendix 2):

- The velux windows within the roof of the proposed development should have blinds fitted to reduce light spill in an upwards direction from the roof of the house.
- External lighting should only use low level lighting, with downward facing baffles, that does not illuminate the rest of the garden trees.
- LED lighting should be used for all external lights.



- Timers and/or motion sensors should be used on all external lighting in an effort to only illuminate the garden when necessary.

#### 4.4 *Reptiles*

The site supports habitat that could be considered suitable for potentially supporting some of the commoner species of reptile, that are often found in garden environments. The proposed development will largely not impact the garden within the site. However, the vegetation and stony areas fringing the house have the potential to support refugia that could be used by reptiles and amphibians. This must be considered during the demolition process and it is therefore suggested that these areas are removed by hand under the supervision of a suitably qualified ecologist and any reptiles or amphibians found are removed and relocated to another area of the garden.

#### 4.5 *Breeding Bird Habitat*

Most of the vegetated areas within the site could potentially support nesting birds, including the vegetation fringing the edge of the existing bungalow. As a precautionary measure the vegetation fringing the bungalow should be removed during the winter months (October - March), outside of the bird breeding season, to discourage any birds from nesting close to the house prior to demolition.

#### 4.6 *Dormice*

The site has a negligible potential to support populations of dormice. No further surveys or mitigation are considered necessary.

#### 4.7 *Great Crested Newts*

The site has a negligible potential to support populations of great crested newts, which are not recorded within 2km of the site. No further surveys or mitigation are considered necessary.

#### 4.8 *Designated areas*

The Pagham Harbour SSSI, SPA and Ramsar Site, neighbouring the property is unlikely to suffer any adverse impacts from the proposed development.

The new proposed property is planned to largely encompass the original footprint of the existing bungalow. Impacts stemming from housing developments to sensitive areas designated for their wildlife interest, normally result from impacts to wildlife from disturbance due to increased visitor pressure, increased impacts from dog walking or predation risk to wildlife from other domestic animals such as cats. However, these pressures normally



result from large, multi plot housing developments that are planned for green field or brown field sites that neighbour designated areas. None of these potential impacts will likely exist for a simple demo-rebuild of a single, small domestic property, supporting one family.

#### 4.9 *Suggested Ecological Enhancements*

Under the UK Governments National Planning Policy Framework (NPPF), planning policy aims to achieve sustainable development through three dimensions; economic, social and environmental<sup>7</sup>. The environmental role can be achieved through undertaking steps to improve biodiversity. The following ecological enhancements are suggested for the proposed development:

- The wider area supports ideal foraging habitat for bats. Artificial bat roosting habitat can be created through the provision of bat boxes. Two 2F general purpose bat boxes (<http://www.nhbs.com/title/158629/2f-schwegler-bat-box-general-purpose>) can be sited within trees within the site. The boxes should be sited upon trees as high as possible, preferably by a suitably qualified ecologist using tree access climbing gear.
- Six artificial house martin nests (<http://www.nhbs.com/title/195378/house-martin-nests>) could be fitted to the eaves of the new proposed development to improve the nesting habitat for this species.
- An area of wildflower meadow within the garden will enhance the area for general biodiversity and provide a positive visual impact during the summer months. The following link provides a simple step by step guide (<https://www2.rspb.org.uk/makeahomeforwildlife/givenatureahomeinyourgarden/gardenactivities/startawildflowermeadow/>).
- A wildlife friendly lighting scheme should be included for any external lighting upon the proposed new development. Nocturnal animals such as bats are sensitive to artificial light. This is particularly important within the vicinity of the trees to the southeast of plot 4. External lights should be on timers, lighting should be directed downwards or at a low level. see Appendix 2 for details or ([http://www.bats.org.uk/pages/bats\\_and\\_lighting.html](http://www.bats.org.uk/pages/bats_and_lighting.html)).

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<sup>7</sup>[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/6077/2116950.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/6077/2116950.pdf)



## 5 **APPENDIX 1 - LEGISLATION AND POLICY**

### 5.1 *General*

This section briefly describes the legal protection afforded to protected species. 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.

### 5.2 *Badger*

Badger is protected in Britain under the Protection of Badgers Act 1992 and Schedule 6 of the Wildlife and Countryside Act 1981 (as amended).

The legislation affords protection to Badger and Badger setts, and makes it a criminal offence to:

- wilfully kill, injure, take, possess or cruelly ill-treat a Badger, or to attempt to do so;
- interfere with a sett by damaging or destroying it;
- to obstruct access to, or any entrance of, a Badger sett; or
- to disturb a Badger when it is occupying a sett.

### 5.3 *Bats, Dormouse and Great Crested Newt*

Dormouse (*Muscardinusavellanarius*), Great Crested Newt (*Triturus cristatus*), and all species of British bat (*Vespertilionidae* and *Rhinolophidae*) are listed on *Schedule 5* of the *Wildlife and Countryside Act 1981* (as amended), and receive full protection under *Section 9*. These species are also all listed as European Protected Species on *Schedule 2* of the *Conservation (Natural Habitats, etc.) Regulations 1994* which gives them full protection under *Regulation 39*. Protection was extended by the *Countryside and Rights of Way Act 2000* (the CRoW Act). 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
- sell or attempt to sell any individual.

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 of Dormouse and 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.

Dormouse, Great Crested Newt and all species of British bat are included as priority species in the *UK Biodiversity Action Plan* and as species of principal importance for the conservation of biological diversity in England under *Section 74* of the *Countryside and Rights of Way (CROW) Act 2000*.

## 5.4 *Reptiles*

Common Lizard (*Lacerta vivipara*), Grass Snake (*Natrix natrix*), Slow-worm (*Anguis fragilis*), and Adder (*Vipera berus*) are listed under *Schedule 5* of the *Wildlife and Countryside Act 1981* (as amended), in respect of *Section 9(5)* and part of *Section 9(1)*. This protection was extended by the *Countryside and Rights of Way (CROW) Act 2000*. Under the legislation it is an offence to:

- intentionally or deliberately kill or injure any individual of these species; or
- sell or attempt to sell any part of these species either alive or dead.

## 5.5 *Breeding bird habitat*

All species of bird are protected under *Section 1* of the *Wildlife and Countryside Act 1981* (as amended). Protection was extended by the *Countryside and Rights of Way (CROW) Act 2000*. Under the above legislation it is an offence to intentionally:

- kill, injure or take any wild bird;
- take, damage or destroy the nest of any wild bird while that nest is in use or being built; or
- take or destroy an egg of any wild bird.

Certain species are listed on *Schedule 1* of the *Wildlife and Countryside Act 1981* (as amended) and receive protection under *Sections 1(4)* and *1(5)*. The protection was extended by the *Countryside and Rights of Way (CROW) Act 2000*. There are special penalties where the offences listed above are committed for any *Schedule 1* species and it is also an offence to intentionally or recklessly:

- disturb any such bird when it is building its nest or while it is in or near a nest containing dependant young; or
- disturb the dependant young of any such bird.



## 6 **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.<sup>1</sup> 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.<sup>2</sup>

#### **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 season<sup>3</sup>. 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.<sup>4</sup>

#### **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

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<sup>1</sup>Bruce-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

<sup>2</sup>As above

<sup>3</sup>Pollard A. (2009) Visual constraints on bird behaviour. University of Cardiff

<sup>4</sup>Rodriguez 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

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 cross<sup>5</sup>. 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) process<sup>6</sup>. 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 guides<sup>7</sup>. 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:

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<sup>5</sup>Stone E. L., Jones G and Harriss (2009) Street lighting disturbs commuting bats. *Current Biology*,



19, pp 1-5

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

1. When is obtrusive light / light pollution relevant to planning?
2. What factors should be considered when assessing whether a development proposal might have implications for obtrusive lighting / light pollution?
3. What factors are relevant when considering where light shines?
4. What factors are relevant when considering how much the light shines?
5. 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 Plans<sup>8</sup>. 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

- ☐ **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

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<http://planningguidance.planningportal.gov.uk/blog/guidance/light-pollution/when-is-light-pollution-relevant-to-planning/>7<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