



DARWIN ECOLOGY
integrating nature conservation

The Hopkiln Bury Court,
Bentley,
Farnham
GU10 5LZ

Email: info@darwin-ecology.co.uk
www.darwin-ecology.co.uk

Bat Emergence Surveys and Mitigation Report

17 St George's Avenue,
Warblington,
PO9 2RU

June 2023

Darwin Ecology Ltd
Registered Office: 8 Layton Lane, Shaftesbury, Dorset SP7 8EY
Company No. 07654823

Contents:

1.	EXECUTIVE SUMMARY	4
2.	INTRODUCTION AND BACKGROUND	5
3.	LEGISLATION & POLICY	6
4.	METHODOLOGY	10
	Phase 2 Bat Surveys	10
	Evaluating Bat Roosts	10
	Limitations	11
5.	SURVEY RESULTS	13
6.	IMPACT ASSESSMENT	15
7.	ENHANCEMENT RECOMMENDATIONS	16
	Bats	16
	Birds	16
	Wildlife Beneficial Landscaping Scheme	16
8.	REFERENCES	17
	APPENDICES	19

QUALITY CONTROL		
The information which we have prepared and provided is true, and has been prepared and provided in accordance with the Chartered Institute of Ecology and Environmental Management's Code of Professional Conduct.		
Prepared by	Abigail Harrington - Assistant Ecologist BSc (Hons)	05/06/23
Checked by	Olatz Gartzia - Principal Ecologist BSc MSc ACIEEM	06/06/23
Issue Number	1	
This report remains valid for 12 months from date of issue.		
Survey data are valid for 12-18 months from the date the survey was undertaken.		

Copyright Darwin Ecology Ltd.

This report is intended for the commissioning party only and should not be copied or reproduced in any way without prior written permission from Darwin Ecology Ltd.

This report has been prepared for the sole use of the client. Any third party referring to this report or relying on the information contained herein, does so entirely at their own risk.

Whilst every effort has been made to guarantee the accuracy of this report, it should be noted that living creatures are capable of migration and whilst protected species may not have been located during the survey duration, their presence may be found on site at a later date.

The views and opinions contained within the document are based on a reasonable timeframe between the completion of the survey and the commencement of any works. If there is any delay between the commencement of works that may conflict with timeframes laid out within this document, or have the potential to allow the ingress of protected species, a suitably qualified ecologist should be consulted.

It is the duty of care of the landowner/developer to act responsibly and comply with current environmental legislation if protected species are suspected or found prior to works.

1. EXECUTIVE SUMMARY

- 1.1. Darwin Ecology Ltd. was commissioned by Verity MacKenzie to undertake Phase 2 emergence/re-entry surveys at 17 St George's Avenue, Warblington, PO9 2RU. The surveys were required to support a planning application for alternations to the property.
- 1.2. A preliminary roost assessment was undertaken by Arbtech on 25th October 2022. During the survey the dwelling was found to offer a **moderate** suitability to support roosting bats.
- 1.3. In line with the Bat Conservation Trust (2016) guidelines, two emergence surveys were carried out in the 2023 survey season by Darwin Ecology Ltd.
- 1.4. During the emergence survey no bats were identified emerging from the property. The site was found to have a high level of activity including the commuting and foraging of bats.
- 1.5. Therefore, proposed plans will not directly impact any bat roosts and works can proceed without precautionary measures.
- 1.6. In the unlikely event that a bat is discovered during the works, all works must cease and a bat licence ecologist contacted for advice.
- 1.7. Recommendations for enhancements have also been made which include the installation of bat and bird boxes.

2. INTRODUCTION AND BACKGROUND

- 2.1. Darwin Ecology Ltd. was commissioned by Verity MacKenzie to undertake a Phase 2 emergence/re-entry surveys at 17 St George's Avenue, Warblington, PO9 2RU. The surveys were required to support a planning application for the alternations to the property.
- 2.2. The proposed drawings on which this assessment is based are provided in **Appendix 1 - Proposed Plans**.
- 2.3. The survey and report follow the Bat Conservation Trust (BCT) Good Practice Guidelines (2016).

Site Overview

- 2.4. The site is located within the residential area of Warblington, approximately 1.5km east of Havant and 2km west of Emsworth. The site is surrounded on all sides by residential properties.
- 2.5. The site comprises a detached residential dwelling with an associated amenity garden (see **Figure 1**).
- 2.6. The wider landscape comprises further residential properties as well as industrial properties, open green spaces and arable land. The A27 is located approximately 350m southeast (see **Figure 2**).

Scope of Report

- 2.7. The aim of this report is to:
 - Determine the presence/absence of bats in the building(s) within the site;
 - Classify the roost type identified (e.g.day roost, maternity roost etc);
 - Carry out an impact assessment of the proposed works and how they will directly / indirectly affects the identified bat roost(s);
 - Outline the relevant legislation and protection afforded to bats; and
 - Provide avoidance, compensation, mitigation and enhancement measures recommended to avoid harm/injury to roosting bats.



Figure 1: Site location within the local landscape (Copyright Google Earth Pro, 2023). Site boundary is outlined in red and the building to be surveyed is highlighted in orange.



Figure 2: Site location within the wider landscape (Copyright Google Earth Pro, 2023).

3. LEGISLATION & POLICY

Bat Legislation

- 3.1. In England and Wales, all bat species and their roosts are legally protected under the European *Habitats Directive* (1992); the *Conservation of Habitats and Species Regulations* (2017); the *Wildlife and Countryside Act* (1981) (as amended); the *Countryside and Rights of Way Act, 2000*; and the *Natural Environment and Rural Communities Act* (NERC, 2006).
- 3.2. Barbastelle (*Barbastella barbastellus*), Bechstein's (*Myotis bechsteinii*), greater horseshoe (*Rhinolophus ferrumequinum*), lesser horseshoe (*Rhinolophus hipposideros*), brown long-eared, soprano pipistrelle (*Pipistrellus pygmaeus*), and noctule (*Nyctalus noctula*) bats are all species of principal importance in England under *Section 41* of the *Natural Environment and Rural Communities Act 2006*.
- 3.3. You will be committing a criminal offence if you:
- Deliberately capture, injure or kill a bat;
 - Intentionally or recklessly disturb a bat in its roost or deliberately disturb a group of bats;
 - Damage or destroy a bat roosting place (even if bats are not occupying the roost at the time);
 - Possess or advertise/sell/exchange a bat (dead or alive) or any part of a bat; or
 - Intentionally or recklessly obstruct access to a bat roost.
- 3.4. The government's statutory conservation advisory organisation, Natural England, is responsible for administering EPS licenses that permit activities that would otherwise lead to an offence.
- 3.5. A licence can be obtained if the following three tests have been met:
- Regulation 53(9)(a) - there is "no satisfactory alternative" to the derogation, and;
 - Regulation 53(9)(b) - the derogation "will not be detrimental to the maintenance of the population of the species concerned at a favourable conservation status in their natural range" and;
 - Regulation 53(2)(e) - the derogation is for the purposes of "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".

National Planning Policy

- 3.1. The *National Planning Policy Framework (2021)* aims to minimise impacts on biodiversity and provide net gains in biodiversity where possible, contributing to the Government's commitment to halt the overall decline in biodiversity. Chapter 15 'Conserving and enhancing the natural environment' details what local planning policies should seek to consider with regard to planning applications.
- 3.2. Planning policies and decisions should contribute to and enhance the natural and local environment by:

174 a) Protecting and enhancing valued landscapes, sites of biodiversity or geological value and soils (in a manner commensurate with their statutory status or identified quality in the development plan);

174 b) Recognising the intrinsic character and beauty of the countryside, and the wider benefits from natural capital and ecosystem services – including the economic and other benefits of the best and most versatile agricultural land, and of trees and woodland;

174 d) Minimising impacts on and providing net gains for biodiversity, including by establishing coherent ecological networks that are more resilient to current and future pressures;

175) Plans should: distinguish between the hierarchy of international, national and local designated sites; allocate land with the least environmental or amenity value, where consistent with other policies in this Framework; take a strategic approach to maintaining and enhancing networks of habitats and green infrastructure; and plan for the enhancement of natural capital at a catchment or landscape scale across local authority boundaries;

176) Great weight should be given to conserving and enhancing landscape and scenic beauty in National Parks, the Broads and Areas of Outstanding Natural beauty which have the highest status of protection in relation to these issues. The conservation and enhancement of wildlife and cultural heritage are also important considerations in these areas, and should be given great weight in National Parks and Broads. The scale and extent of development within all these designated areas should be limited, while development within their settings should be sensitively located and designed to avoid or minimize adverse impacts on the designated area.

- 3.3. Specific policies regarding habitats and biodiversity comprise:

179) To protect and enhance biodiversity and geodiversity, plans should:

- a) identify, map and safeguard components of local wildlife-rich habitats and wider ecological networks, including the hierarchy of international, national and locally designated sites of importance for biodiversity, wildlife corridors and stepping stones that connect them; and areas identified by national and local partnerships for habitat management, enhancement, restoration or creation and
- b) promote the conservation, restoration and enhancement of priority habitats, ecological networks and the protection and recovery of priority species and identify and pursue opportunities for securing measurable net gains for biodiversity.

180) When determining planning applications, local planning authorities should apply the following principles:

- a) if significant harm to biodiversity resulting from a development cannot be avoid (through locating on an alternative site with less harmful impacts), adequately mitigated, or, as a last resort, compensated for, then planning permission should be refused;
- b) development on land within or outside of Sites of Special Scientific Interest, and which is likely to have an adverse effect on it (either individually or in combination with other developments), should not normally be permitted. The only exception is where the benefits of the development in the location proposed clearly outweigh both its likely impact on the feature of the site that make it of special scientific interest, and any broader impacts on the national network of Sites of Special Scientific Interest;
- c) development resulting in the loss or deterioration of irreplaceable habitats (such as ancient woodland and ancient or veteran trees) should be refused, unless there are wholly exceptional reasons and a suitable compensation strategy exists; and
- d) development whose primary objective is to conserve or enhance biodiversity should be supported; while opportunities to improve biodiversity in and around development should be integrated as part of their design, especially where this can secure measurable net gains for biodiversity or enhance public access to nature where this is appropriate.

4. METHODOLOGY

Phase 2 Bat Surveys

- 4.1. Two dusk emergence surveys were conducted during the 2023 survey season. Surveys were undertaken in line with Bat Conservation Trust (BCT) Good Practice Guidelines (2016), with any limitations outlined below.
- 4.2. The surveys were conducted by the following surveyors:
- Abigail Harrington
 - Jenny Denny
 - George Ridgway
- 4.3. Surveyors were positioned strategically around the building(s) in order to provide adequate coverage of all elevations. Surveyors focused on any features identified during the Preliminary Roost Assessment (PRA) as having potential to be used as bat access points. The location of the surveyors and building are shown on **Figure 3, Bat Survey Results**.
- 4.4. Dusk surveys began 15 minutes prior to sunset and lasted 1.5 hours after sunset. Surveyors recorded bat activity using hand-held Echometer Touch detectors connected to Android or iPhone devices. Analysis of recordings was undertaken after the surveys to confirm species identification. Observations recorded during surveys included bat access points, bat species, time, and type of activity (e.g. emergence, re-entry, commuting, foraging, etc.). Incidental records of bats within the vicinity of the building (but not necessarily roosting) were also recorded.
- 4.5. A summary of the survey dates and weather conditions are provided in **Table 1**.

Table 1: Emergence survey dates and weather conditions

Date	Survey type	Sunset time	Start weather conditions	End weather conditions	Surveyors
11/05/23	Dusk	20:40	Rain: 0 Wind: 0 Cloud cover: 100% Temperature: 13°C	Rain: 0 Wind: 1 Cloud cover: 80% Temperature: 12°C	Abigail Harrington Jenny Denny
31/05/23	Dusk	21.07	Rain: 0 Wind: 2 Cloud cover: 0% Temperature: 15°C	Rain: 0 Wind: 2 Cloud cover: 0% Temperature: 14°C	Abigail Harrington George Ridgway

Evaluating Bat Roosts

- 4.6. The value of the bat roosts on site was assessed in accordance with the article published in the Chartered Institute of Ecology and Environmental Management (CIEEM), In Practice Magazine - *Valuing Bats in Ecological Impact Assessment* (Wray, et al., 2010).

- 4.7. Roosts are assigned a relative ecological value based on the rarity of the species (**Table 2**) and categorisation of roost type (**Table 3**), informed by survey results. Once a value has been calculated, robust mitigation for any impacts identified from the proposed development can be determined.

Table 2: Categorising bat species by distribution and rarity

Rarest	Rare	Common
Greater horseshoe Bechstein's Alcathoe Greater mouse-eared Grey long-eared Barbastelle	Lesser horseshoe Whiskered Brandt's Daubenton's Natterer's Leisler's Noctule Nathusius' pipistrelle Serotine	Common pipistrelle Soprano pipistrelle Brown long-eared

Table 3: Valuing bat roosts

Geographic Frame of Reference	Roost Type
District, Local or Parish	Feeding perches (common species) Individual bats (common species) Small numbers of non-breeding bats (common species) Mating sites (common species)
County	Maternity sites (common species) Small number of hibernating bats (common and rarer species) Feeding perches (rarer/rarest species) Individual bats (rarer/rarest species) Small numbers of non-breeding bats (rarer/rarest species)
Regional	Mating sites (rarer/rarest species) including well-used swarming sites Maternity roosts (rarer species) Hibernation sites (rarest species) Significant hibernation sites for rarer/rarest species or all species assemblages
National/UK	Maternity sites (rarest species) Sites meeting Sites of Special Scientific Interest (SSSI) guidelines
International	Special Areas of conservation (SAC) sites

Limitations

- 4.8. The surveys were undertaken in accordance with the best practice guidelines within the peak bat activity period (May to September inclusive). The results are therefore considered to be an accurate representation of the general use of the building(s) by roosting bats.

- 4.9. Nevertheless, bats may use roosting features intermittently throughout the year and may be present in larger or smaller numbers depending on their breeding cycle, weather conditions and in response to disturbance. Bats may be present at other times of the year and the results in this report should therefore be viewed in the context intended.

5. SURVEY RESULTS

- 5.1. The surveys were conducted in suitable weather conditions on 11th and 31st May 2023. No bats were recorded emerging from the building during the surveys.
- 5.2. Overall, during the emergence survey on 11th May 2023, a moderate to high level of activity was recorded around the site. Species recorded included common pipistrelle (*Pipistrellus pipistrellus*), soprano pipistrelle, and noctule.
- 5.3. Common pipistrelle and soprano pipistrelle were seen regularly foraging around the front and back gardens of the site and flight pathways connecting these locations, over the location of the proposed extension and over the eastern hipped end of the building were used frequently in both directions.
- 5.4. During the emergence survey on 31st May 2023, there was a low level of bat activity with a few passes by common pipistrelle and soprano pipistrelle and some foraging by these species.
- 5.5. **Figure 3** shows the location of the surveyors and the bat activity.



*NOTE Areas are indicative and are not shown to exact scale.

-  Building surveyed
-  Surveyor Location
-  Bat Emergence/ Re-entry Location and Flight Path (coloured by species)
-  Area of Continuous Bat Activity (coloured by species)

- Bat Species*
-  Multiple species (including common pipistrelle and soprano pipistrelle)
 -  Noctule

6. DISCUSSION, RECOMMENDATIONS AND MITIGATION

Bats

- 6.1. No bats emerged from the building during the emergence surveys. Therefore, based on these results, the building at 17 St George's Avenue does not support roosting bats.
- 6.2. The site was found to be used for several species of commuting and foraging bats.
- 6.3. The proposed works will not result in the destruction of a bat roost, and therefore, works can proceed without any requirement of a protected species licence or further surveys.
- 6.4. No precautionary measures are recommended in this instance.
- 6.5. **In the unlikely event that a bat is discovered during the works, all works must cease and a bat licensed ecologist contacted for advice.**
- 6.6. *Lighting:* The installation of additional lighting on site should be avoided. If any new external lighting is installed, this must be directed to avoid light spillage onto vegetation. Bats are sensitive to light and could potentially avoid the area if access points or the surrounding areas become lit. Minimising the periods of lighting and using motion sensors is strongly recommended, using a short timer to reduce the duration of lighting and reduce disturbance to bats. It is important to direct the light only where it is needed and avoid light spillage onto vegetated margins. Upward lighting can be minimised by fitting lights with downward facing baffles to avoid light pollution. Preventing light spillage above an angle of 70 degrees can be achieved by using fixtures that shield the bulb and direct the light downward. Warm white LEDs are less harmful to bats than bright white LEDs. If appropriate measures are taken to reduce light spillage from the development, it is likely that there will be no negative impacts on local bat populations.
- 6.7. See the Appendix for further information on designing lighting to minimise impacts on bats.
- 6.8. *Habitats:* The proposals do not result in significant loss of foraging habitat for bats, however, a wildlife friendly landscaping scheme is recommended to enhance the site for bats and other wildlife.

7. ENHANCEMENT RECOMMENDATIONS

- 7.1. National planning policy states that all developments should seek to enhance onsite biodiversity whether impacts on protected species are recorded or not. Incorporating enhancement features into new or renovated buildings should be carefully considered. These features can be simple and inexpensive, please see below for specific recommendations.

Bats

- 7.2. To enhance the site for crevice dwelling bats such as pipistrelle and myotis species, an integrated bat box should be installed on the new extension. Additionally, two gaps under the ridge tiles can be created to provide access for bats.

Birds

- 7.3. Bird boxes can also be installed on the proposed extension or on retained trees. Bird boxes should be installed at least 4m from ground level with unobstructed air space in front. See the **Appendix** for further information on bird boxes.

Wildlife Beneficial Landscaping Scheme

- 7.4. Wildlife friendly landscape planting seeks to enhance biodiversity, improve connectivity to the surrounding habitats and provide food and shelter for a wide range of wildlife. All amenity planting and formally landscaped areas should be designed using a variety of plant species beneficial for wildlife. These do not necessarily have to be native but should be chosen for their ability to provide nectar or fruit and should be non-invasive species. There are a number of specialist seed mixes available specific to certain soil types, growing conditions and designed to benefit different groups of species such as bees or butterflies and moths.
- 7.5. All habitats should be managed in a suitable way to encourage a wide variety of insects and other wildlife to use the site.
- 7.6. Further information regarding habitat creation, enhancement and management can be provided on request.

8. REFERENCES

- Arbtech (2022) - Preliminary Roost Assessment - 17 St George's Avenue
- CIEEM (2012) Guidelines for Preliminary Ecological Appraisal. *Technical Guidance Series*.
- Collins, J. (2016) *Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd Edition)* The Bat Conservation Trust, London.
- Mitchell-Jones, A.J., (2002). *Bat Mitigation Guidelines*. English Nature, Peterborough.
- Mitchell-Jones, A. J. & McLeish, A. P. (2004). *Bat Workers' Manual (3rd Edition)*. JNCC, Peterborough.
- Ordnance Survey Maps [online] www.osmaps.ordnancesurvey.co.uk [June 2023].
- Schofield, H. W. & Mitchell-Jones, A.J. (2004). *The Bats of Britain and Ireland*. Vincent Wildlife Trust, Ledbury.
- UK Government's Countryside Geographic Information Website [online] www.magic.gov.uk [June 2023].
- Wray, S., Wells, D., Long, E. & Mitchell-Jones, T. (2010) Valuing Bats in Ecological Impact Assessment. In Practice, No. 70.

Legislation and Policy

- Council of the European Communities (1992) *Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (EN)*. Official Journal of the European Communities [online] www.eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ:L:1992:206:TOC [June 2023].
- Council of the European Communities (2009) *Council Directive 2009/147/EC of 30 November 2009 on the conservation of wild birds (EN)*. Official Journal of the European Union [online] eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:020:0007:0025:EN:PDF [June 2023].
- Department for Environment, Food and Rural Affairs (2011) *Biodiversity 2020: A Strategy for England's Wildlife and Ecosystem Services* [online] www.gov.uk/government/uploads/system/uploads/attachment_data/file/69446/pb13583-biodiversity-strategy-2020-111111.pdf [June 2023].
- Ministry of Housing, Communities & Local Governments (2021) National Planning Policy [online] assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1005759/NPPF_July_2021.pdf [June 2023].

Natural Environment and Rural Communities Act 2006 (UK Parliament). *The National Archives* [online] www.legislation.gov.uk/ukpga/2006/16/contents [June 2023].

Office of the Deputy Prime Minister Circular (2005) *Government Circular: Biodiversity and Geological Conservation – Statutory Obligations and their Impact within the Planning System* [online] www.gov.uk/government/uploads/system/uploads/attachment_data/file/7692/147570.pdf [June 2023].

The Conservation of Habitats and Species (Amendment) Regulations 2017 (UK Parliament). *The National Archives* [online] www.legislation.gov.uk/uksi/2017/1927/contents/made [June 2023].

The Hunting Act (2004) *The National Archives* [online] www.legislation.gov.uk/uksi/2012/1927/contents/made [June 2023].

The Wildlife and Countryside Act 1981 (England and Wales) (Amendment) Regulations 2004 (UK Parliament). *The National Archives* [online] www.legislation.gov.uk/ukpga/1991/39/contents *Countryside and Rights of Way Act, 2000* [June 2023].

APPENDICES

E-03 ▼



0
-

17

▲ E

GFL-Proposed Site Plan (partial) and Ground Floor Level Plan
1:50

1

A diagram of a circular pond with a diameter of 2m. A north arrow points upwards, labeled 'N'. A scale bar below the pond shows a distance of 2m, with a midpoint marked at 1m. The pond is divided into four quadrants by a vertical and a horizontal line.

RevID | CID | Transmittal Set Name

11

☐ preliminary ☒ planning ☐ building regulations

☐ production ☐ tender ☐ construction ☐ as built ☐ other

The Steven Barlow Partnership
The Studio, 81 Minor Road

The second, Dr Ian H. Ross,
Portsmouth, Hampshire. PO1 5LB.
United Kingdom.

+44 (0) 800 756 9726

tsbp-architecture.co.uk
tsbp-architecture.co.uk

This drawing is protected by copyright of THE STEVEN BARLOW PARTNERSHIP under The Copyright, Design and Patents Act 1988 and the reproduction or use in any form without prior written consent from

Only the original drawing should be relied on. Plans are liable to distortion in transmission to the web. Do not

scale of this drawing is for general information only. For planning and construction purposes, please refer to the project drawings. For more information, please contact the project architect.

This drawing is to be read and understood in conjunction with structural, mechanical, electrical and/or

any other contractual documentation as may be applicable to the project prior to the commencement of work and its duration.

© Copyright 2011. The American Institute of Architects. (AIA) Architects and

Chartered Institute of Architectural Technologists Chartered Practice
Principal - Steven V. Barlow FCIT

17 St Georges Avenue, Warblington. PO9 2RU.

APPENDIX 2 - SURVEY AND REPORTING LIMITATIONS AND EXCEPTIONS

This report and its survey results should be considered in conjunction with the terms and conditions proposed and scope of works agreed between Darwin Ecology Ltd and the client.

This report has been produced in the context of the proposals stated in the Introduction & Background section of this report (Section 2) and should not be used in any other context.

Darwin Ecology Ltd have endeavoured to identify the likely presence / absence of protected species wherever possible on site, where this falls within the agreed scope of works. Current standard methodologies have been used, which are accepted by Natural England and other statutory conservation bodies. No responsibility can be accepted where these methodologies fail to identify all species or significant species on site.

Extended Phase 1 and Preliminary Ecological survey techniques provide a preliminary assessment of the likelihood of protected species occurring on the development site, based on the suitability of the habitats and any field signs found during the site visit. A Phase 1 survey should not be taken as providing a full and definitive survey of any protected species group.

Extended Phase 1 and Preliminary Ecological Appraisals represent a snapshot of conditions at the time of survey and are limited by factors which affect the presence of plants and animals such as the time of year, migration patterns and behaviour. Surveys should therefore not be considered a comprehensive list of all plant species or as conclusive proof that certain protected species are not present or will not be present in the future.

Where the presence/absence of a certain species is in question our ecologists must apply a precautionary approach until further survey data can be sought to better inform the decision.

Darwin Ecology Ltd will advise on the optimum survey season for a particular habitat or protected species prior to undertaking the survey work. Darwin Ecology Ltd cannot accept responsibility for the accuracy of surveys undertaken outside this period.

The potential impacts, mitigation and enhancement sections of the report provide an overview and is for guidance only. This section should not be solely relied upon, but should be considered in the context of the whole report.

Interpretations of survey results and recommendations outlined in the report represent our professional opinions, expressed in accordance with recognised industry practices and current legislation at the time of reporting. The results of survey work undertaken by Darwin Ecology Ltd are representative at the time of surveying.

Where the client had supplied us with data from previous reports, it has been assumed that this information is valid. No responsibility can be accepted by Darwin Ecology Ltd for inaccuracies within any previous data supplied.

The copyright in this report, plans and other associated documents prepared by Darwin Ecology Ltd is owned by them and no such report, plans and other associated documents may be reproduced without their written consent.

Amendments to this report after its submission may be necessary in light of new, relevant information and / or legislation. This report should be referred to us for re-assessment if any such amendments are necessary or after the expiry of one year from the date of the report.



THE IMPACT OF LIGHTING ON BATS

Bats favour a dark environment for both roosting and foraging as they are adapted to low-light conditions. Artificial lighting will disturb bats if the lighting covers roost access points, flight paths or foraging habitats.

The main peak of nocturnal insect abundance occurs at dusk and a delay in emergence results in a lower foraging rate for bats.

Artificial lighting creates a 'vacuum effect' for nocturnal insects. During the night nocturnal insects use the light of the moon* to navigate. However, artificial lighting and even sky glow above cities obscures the natural moonlight as it is closer

and radiates light in multiple directions.

Some species of bats have been recorded foraging around street lights such as *Pipistrellus* species and *Nyctalus* species. However, species that are less tolerant of artificial light are at a disadvantage when foraging as insects are drawn away from these species usual foraging grounds into the zones of artificial light.

Lighting must be considered in context to any development as increased lighting may cause roost abandonment, reduced reproductive success, and reduced foraging. Mitigation to reduce the impacts of lighting for bats is therefore of great importance in bat conservation.

Table 1: Summary of predicted impact of lighting for each species/genus

Impact	High	Medium	Low
Behaviour			
Maternity roost	All species	-	-
Night roost	<i>Rhinolophus hipposideros</i> <i>Rhinolophus ferrumequinum</i> <i>Myotis</i> spp. <i>Plecotus</i> spp.	<i>Pipistrellus</i> spp. <i>Nyctalus</i> spp. <i>Eptesicus serotinus</i> <i>Barbastella barbastellus</i>	-
Emergence	All species	-	-
Foraging	<i>Rhinolophus hipposideros</i> <i>Rhinolophus ferrumequinum</i> <i>Myotis</i> spp. <i>Plecotus</i> spp.	-	<i>Pipistrellus</i> spp. <i>Nyctalus</i> spp. <i>Eptesicus serotinus</i> <i>Barbastella barbastellus</i>
Commuting	<i>Rhinolophus hipposideros</i> <i>Rhinolophus ferrumequinum</i> <i>Myotis</i> spp. <i>Plecotus</i> spp.	-	<i>Pipistrellus</i> spp. <i>Nyctalus</i> spp. <i>Eptesicus serotinus</i> <i>Barbastella barbastellus</i>
Swarming	All species	-	-
Hibernation	All species	-	-

*For more information see Warrant, E., and Dacke, M. (2016) Visual Navigation in Nocturnal insects. *Physiology*, 31, 182-196.

Sources of light that can disturb bats include; light spill via windows, sport floodlighting, car headlights, roadside lighting, security lighting, aesthetic lighting of waterways, and aesthetic illumination of buildings. Glare will affect bats over greater distance than the target area directly illuminated.

Avoidance is the most effective method, but if this is not possible the following measures should be considered.

What lighting should I use?

- Low pressure sodium lights or 'warm' LEDs
- Wavelength above 540nm
- Colour temperature below 2700K
- Shielded lights that prevent light spill above a 70 degree angle
- Passive infrared (PIR) motion sensors



What to avoid:

- Lighting roost entrances, flightpaths, and foraging or commuting routes
- Reflective surfaces beneath lighting
- High level lights
- Non-directional lighting

Lighting should be considered at an early stage allowing impacts to be minimised through the design of the site.

Key Points

- Keep lighting intensity to the minimum level required
- Limit the times that lights are on to provide some dark periods (e.g. switching installations off between midnight and 5am)
- Dim lighting according to demand
- As an alternative to lighting pathways use paving materials that reflect moonlight
- Low level lighting allows darkness to be retained within higher vegetation
- Set dark habitat buffers - lighting should always be a minimum of 25m from vegetated margins and 40m from waterbodies
- Incorporate dark corridors within the site
- Compensate for the loss of dark areas by enhancing other dark areas
- Consider building design - install internal lighting away from windows



How to Install



Integrated bat boxes can be installed into the brickwork of buildings to provide a roosting spot for bat species.

Being embedded in the masonry of a building, they do not impact the exterior seal of structure and are commonly integrated in new builds.

With some modification or bespoke design, integrated bat boxes can be installed in such a way that it does not interfere with a building's exterior facade.

The 1FR bat tube has a 45 degree angle for bats to land on and crawl upwards into the bat tube. It has been designed to be installed within or adjacent to the the external skin of the block work or brickwork.

For a rendered finish, the 1FR bat tube can be built into the external skin of breeze blocks (acting as a block) and be rendered over (ensuring the access point is left clear). Ridges should be created in the render immediately below the access point, which will aid the bats when crawling into the bat tube.

For a brickwork finish, the 1FR bat tube should be installed within the brickwork, set back slightly to allow the front to either be rendered over or for a continuity of brick slips to be mortared over the top of the tube. The upper brick slip should overlap the access point and the lower brick slip should be in line with the 45 degree angle of the bat tube.

Alternatively, **Habibat** bat tubes can be purchased that are designed for brickwork design and can be custom made.





Gable end cavity wall feature



A small section of the cavity wall at the apex of a gable end will be left free from insulation to create a cavity approximately 1 m high. The base of this cavity is blocked to ensure that bat access is limited to an enclosed area.

Sections of scored insulation board are installed in the cavity to provide surfaces for bats to roost on and create .

An Ecologist will be on site to work with contractors while this feature is being created to ensure it is suitable for roosting bats.

An integrated bat box is built into the apex of the gable end wall to provide access into the cavity for bats while the sloping entrance and lack of a ledge prevents birds from entering or nesting.

Alternative bespoke access points may also be recommended according to the building design and materials used.



Creating this space within the cavity wall itself, and installing access suitable for bats is simple and effective way to provide a small cavity feature capable of supporting a range of bat species including serotine, brown long-eared and maternity colonies of pipistrelle bats.

Access for summer maternity roosts should be placed on southerly or westerly aspects.

Cavity Wall Feature



TYPES OF BIRD BOXES



Vivar Pro Seville 32mm WoodStone Nest Box

- Manufactured from woodstone - increases longevity and provides a consistent internal temperature
- The nest box compensates for the lack of natural cavities that are found in trees
- Suitable for blue tits, tree sparrows, house sparrows, great tits, crested tits, nuthatches, coal tits and pied flycatchers
- Should be installed between 1.5m and 3m high



House Martin Nest Cups



Swallow Nest Bowl

- Suitable nest building mud is difficult for house martins and swallows to find
- Alterations to house construction and roof design have resulted in a decrease of suitable nesting sites
- Install swallow nest bowls within an outbuilding or garage that has flight access - 6cm below the ceiling
- Install house martin nest cups under the eaves of a house - minimum of 2m high



Swift Nest Box

- Swift numbers are declining partly due to a loss of nesting sites
- The entrance hole discourages other birds such as starlings and sparrows
- Install a minimum of 5m high with unobstructed airspace in front of the nest
- Integrated models of swift nest boxes are also available



5KL Schwegler Nuthatch Nest Box

- Manufactured from woodcrete
- Nuthatches prefer nest boxes with larger cavities. They will often occupy owl nest boxes and fill the entrance hole with mud reducing the size to approximately 32mm
- Nuthatches plaster mud on the internal walls of the cavity and line the floor with wood chipping and leaves to nest
- To discourage nuthatches from using owl nest boxes try installing the 5KL immediately adjacent



Open-fronted Nest Box

- Manufactured from woodstone - lifetime of 20-25 years
- Suitable for robin, wren, spotted flycatchers, and black redstart
- Best installed hidden from view on the wall of a building or hidden within ivy/honeysuckle as the boxes open-front may attract predators
- Install at a height of 1-3m



Sparrow Terrace Next Box

- Sparrow populations are decreasing due to a lack of nesting sites
- Sparrows are a sociable species and prefer to nest in a colony
- Likelihood of uptake is increased if more nesting chambers are available (the example nest box shown contains three nesting chambers)
- Various other nest box designs are available
- Install at a minimum of 2m high



Tawny Owl Nest Box

- Install on a mature tree within a woodland (not on the outskirts)
- Install a minimum of 3m high
- Face the box entrance away from prevailing wind (generally avoiding west/south-west)



Little Owl Nest Box

- Prefer areas of mixed farmland and orchards
- Essential features; small entrance hole (70mm), narrow tunnel, and a dark nesting chamber
- Install on a horizontal tree branch/wall top or beam so that owlets can walk in/out prior to fledging
- Can be installed on any tree species apart from cherry - the cherry harvest coincides with the little owl breeding season
- Entrance hole should face the tree trunk
- Install at a minimum height of 3m