



BAT MANAGEMENT PLAN (INCLUDING BAT SURVEY RESULTS)

Church of St Peter, Netherseal

18th October 2021

Ridgeway Ecology Ltd
36 Chichester Lane, Hampton Magna, Warwick,
Warwickshire, CV35 8TG, UK

Tel: 01926 259182

Mob: 07973445101

Email: enquiries@ridgewayecology.co.uk

Web: www.ridgewayecology.co.uk

Control Sheet

General Report Information	
Report title	Bat Management Plan
Client	Church of St Peter, Netherseal, Natural England, and the Bats in Churches Heritage Lottery Fund Project
Location	Church of St Peter, Netherseal
Prepared by	Dr Jon Russ
Issue date	18/10/2021
Document Reference	RE2021-131

Disclosure:

This document has been prepared by Ridgeway Ecology Ltd for the sole use of the commissioning client/s. It has been provided in accordance with the agreed scope and intended purpose. No other warranty is made as to the professional advice included in this document. It does not purport to give legal advice.

This report should not be copied or relied upon by any third party without the express prior written agreement of Ridgeway Ecology Ltd and the commissioning client/s.

The evidence gathered, and the opinions provided, have been prepared in accordance with the Chartered Institute of Ecology and Environmental Management Code of Professional Conduct.

Where any appraisal is based upon information provided by third parties, it is assumed that this information is relevant, correct and complete; there has been no independent verification of information obtained from third parties unless otherwise stated. Where field investigations have been carried out these have been appropriate to the agreed scope of works and carried out to a level of detail required to achieve the stated objectives

Contents

Executive Summary.....	4
1 Introduction	5
1.1 Background	5
1.2 Church Location	5
1.3 Church Description	6
1.4 Relevant Legislation	6
2 Statement of Heritage Significance.....	8
3 Survey	10
3.1 Methods.....	10
3.1.1 Desk study.....	10
3.1.2 Daytime Bat Roost Assessments and Inspections	10
3.1.3 Nocturnal Bat Surveys.....	11
3.1.4 Personnel	12
3.1.5 Equipment.....	12
3.1.6 Bat Detecting and Sound Analysis: Important General Considerations	13
3.2 Results.....	14
3.2.1 Desk study.....	14
3.2.2 Daytime Bat Roost Assessments and Inspections	14
3.2.3 Nocturnal bat surveys	17
3.2.4 Interpretation	22
4 Evaluation	24
4.1 Bat survey effort and expertise.....	24
4.2 Stakeholder consultation	24
4.3 Overall evaluation	25
5 Consideration of Bat Management Options	26
5.1 Option 1: Do Nothing	26
5.2 Option 2: Exclusion from the main parts of the church	27
6 Bat Management Objectives.....	28
6.1 Objectives	28
6.2 Achieving the Objectives.....	28
7 Prescribed Actions and Costings	33
7.1 Proposed Costings – 2021/2022	33
8 References	34

Executive Summary

- The Bats in Churches (BiC) project is a pioneering endeavour to empower church communities to co-exist with their resident bats. It is a unique cross-sectoral partnership of organisations with distinctive priorities, led by Natural England, and involving the Church of England, the Bat Conservation Trust, the Churches Conservation Trust and Historic England. Lasting five years (2019 – 2023), the project is largely funded by the National Lottery Heritage Fund after a successful development phase. The Church of St Peter, Netherseal was selected as one of the project churches.
- Bat surveys carried out in 2021 as part of the BiC project have confirmed that the Church of St Peter, Netherseal supports a maternity colony (5-11 bats in 2021) of adult female brown long-eared bats. The bats predominantly roost in the tenon and mortise joints in the tower but enter the main interior of the church (nave, chancel and aisles) to fly and occasionally perch before primarily emerging from the louvred windows of the tower ([see 3.2.4 and Figure 1 - Page 23](#)). A colony of common pipistrelles is also present in the tower but these rarely enter the church interior.
- Bat droppings and urine staining has caused damage and staining to pews, carpets, floor tiles and artefacts. There is a constant requirement to clean up droppings immediately before each service with all cleaning performed by volunteers.
- This Bat Management Plan provides practical advice on the potential to manipulate the way bats are using the church interior to restrict the impact they are having on the community and church heritage, or to exclude the bats from the interior without negatively affecting the Favourable Conservation Status of the population. The following is a summary of these measures which are also present in [Figure 2 - Page 31](#):
 - A European Protected Species (EPS) licence from Natural England will be sought for the reduction in available roosting space and the destruction of the access point at the top of the north wall.
 - The reduction of the roosting space and closing up of the access point will occur between 15th October and 15th April to minimise the impact upon the brown long-eared bat colony.
 - A polythene one-way valve to the access point at the top of the drainpipe in the north wall ([see Photograph 20](#)) for two weeks and then the hole will be permanently blocked.
 - The clock weight hatch will be closed ([Photographs 22 and 23](#)).
 - The hatch leading to the belfry will be restricted from closing fully to create a 200mm gap facilitating the movement of bats between the silence/clock chamber and the belfry ([Photograph 24](#)).
 - Two bat boxes will be erected in the belfry at the top of the east and west walls ([Photograph 25](#)).
 - A new access point will be created in the north louvred window. This will be achieved by cutting a 100mm x 30mm slot in the mesh to correspond with one of the openings and then extending the louvre with a piece of wood to provide a suitable landing platform ([Photograph 26](#)).
- Monitoring will be carried out to determine whether bats have responded favourably to the mitigation measures.
- Estimated costs are provided in Section 7.

1 Introduction

1.1 Background

This report presents the 2021-23 Bat Management Plan (BMP) for the Church of St Peter, Netherseal (also referred to hereafter as 'the church') as part of the Bats in Churches (BiC) Heritage Lottery Fund (HLF) Project led by Natural England.

The Church of St Peter, Netherseal supports a maternity colony of adult female brown long-eared bats which predominantly roost in the tenon and mortise joints in the tower but enter the main interior of the church (nave, chancel and aisles) to fly and occasionally perch before primarily emerging from the louvred windows of the tower. The management plan considers and prescribes bespoke measures intended to reduce the impacts of these bats inside the church while ensuring that there is no harm to the bats or the favourable conservation status of the local population to which they belong.

The strategy presented is based on the findings of a detailed suite of bat surveys of the Church of St Peter completed by Ridgeway Ecology Ltd in 2021, details of which are contained within this report, relevant recent research into mitigating the impacts of bats on churches, and ongoing consultation with stakeholders. The measures proposed will be implemented from 2021-23.

1.2 Church Location

The central Ordnance Survey Grid Reference (OSGR) of the Church of St Peter is SK 2887 1288. The postcode of the church is DE12 8DF and it is located here: <https://goo.gl/maps/mZCztxJf8VTtDoP27>. The church can be seen in Photograph 1.



Photograph 1. Church of St Peter, Netherseal (south elevation).

The church is located on Church Street, Netherseal, which is a small village and civil parish in the English county of Derbyshire, situated in the South Derbyshire district. Together with neighbouring Lullington, it is the southernmost village in the county. It is situated around 4.5 km south of the town of Swadlincote and around 8 km south-east of the town of Burton upon Trent.

1.3 Church Description

The Church of St Peter church is a Grade II* listed building (Listing Entry: 1334597). Both the church and its churchyard are important elements in the Netherseal Conservation Area. The churchyard southern boundary walls are separately listed Grade II.

The church was constructed in the 13th century and the tower in the 15th century. but was mostly rebuilt in 1877 by Arthur Blomfield. There is also an early 20th century north vestry. It is built of tooled ashlar and has plain tile roofs with crested ridge tiles and stone coped gables. There is also a ridge cross to the nave. It comprises a three-stage western tower, nave with north aisle, north vestry and south porch, and lower chancel. Inside the church is a four-bay 13th century north arcade with pointed double-chamfered arches. Most of the fittings in the church are simple; the chancel has a stone reredos with a mosaicked wall behind, and an ogee-headed piscina to the south, plus late 19th-century metal and wooden altar rails and late 19th-century timber choir stalls and organ. Across the chancel arch is a plain low stone screen and to the south in the nave is a late 19th century octagonal wooden pulpit with painted saints in trefoil-headed panels, on a stone base. The most interesting monument is the early 16th century moulded four-centred arched tomb niche to the north side of the chancel with re-set alabaster slab incised with illegible inscription and a figure, to Roger Doulton who died in 1500. The north aisle has an east window of 1899 commemorating Thomas Carter and a west window with re-set medieval glass to the top including a small heraldic device.

1.4 Relevant Legislation

The information below is intended only as guidance to the legislation relating to these species. The Acts themselves should be referred to for the correct legal wording.

Annex IV of the EC Habitats Directive (Council Directive 92/43/EEC 1992 on the conservation of natural habitats and of wild fauna and flora) lists animal and plant species of Community interest in need of strict protection across member states, which includes all bat species (and their habitats). The EC Habitats Directive is transposed into law in England and Wales via the Conservation of Habitats and Species Regulations 2017, which are usually referred to as the 'Habitats Regulations'. As a result of this legislation, all UK bats are considered European Protected Species (EPS). In addition to EU regulations, however, all bats and their habitats are also protected by UK law under the Wildlife and Countryside Act 1981 (as amended), which was reinforced in England and Wales by the Countryside and Rights of Way Act 2000.

In combination, the above legislation makes it an offence to:

- Deliberately capture, injure or kill a bat;
- Deliberately disturb any bat; in particular, any disturbance which is likely to (i) impair a bats' ability to survive, breed, reproduce or to rear or nurture their young; or in the case of hibernating or migratory species, to hibernate or migrate; or (ii) to affect significantly the local distribution or abundance of the species to which they belong;
- To be in possession or control of any live or dead bat or any part of, or anything derived from a bat;
- Damage or destroy a breeding site or resting place of a bat;

- Intentionally or recklessly obstruct access to any place that a bat uses for shelter or protection; and
- Intentionally or recklessly disturb a bat while it is occupying a structure or place that it uses for shelter or protection.

Note that damaging or destroying a place used by a bat for breeding or resting anywhere in the UK is an absolute offence carrying strict liability under the Habitats Regulations. This means that no element of intent, reckless, or deliberate action needs to be evidenced to establish guilt; the prosecution only needs to demonstrate that the accused performed the prohibited act.

Also, note that the term 'roost' is not used in the above legislation, however, a site that a bat uses for breeding, resting, shelter or protection is called a roost in ecological terms. Bats tend to re-use the same roost sites and sometimes over many years but may not always be in residence. Current legal opinion is that a roost is protected irrespective of whether the bats are present.

As a result of the above legislation, where work will result in any destruction, damage or obstruction of any bat roost, whether occupied or not, or risks harming or disturbing bats then a European Protected Species derogation licence (often also called a development licence or a mitigation licence) is required from the Statutory Nature Conservation Body (e.g. Natural England) before such work can proceed.

In determining whether to grant such a licence Natural England must apply the requirements of Regulation 53 of the Habitats Regulations, and, in particular, apply the following three tests set out in sub-paragraphs (2)(e), (9)(a) and (9)(b):

1. Regulation 53(2)(e) states that: a licence can [only] be granted 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";
2. Regulation 53(9)(a) states that the appropriate authority (i.e. Natural England) shall not grant a licence unless they are satisfied "that there is no satisfactory alternative" to the proposed actions; and,
3. Regulation 53(9)(b) states that the appropriate authority shall not grant a licence unless they are satisfied "that the action authorised will not be detrimental to the maintenance of the population of the species concerned at a favourable conservation status in their natural range".

These three tests are commonly referred to as the 'purpose test', the 'NSA test' and the 'FCS test' respectively.

2 Statement of Heritage Significance

As part of the initial phases of the BiC Project, a Statement of Heritage Significance (SoHS) was prepared in respect of the heritage importance of each project church and the impact upon it from bat activity. The following comprises the relevant sections from the BiC SoHS for Church of St Peter, Netherseal which are largely taken from the listing entry:

Parish church. C13 with C15 tower, mostly rebuilt in 1877 by Arthur Blomfield, and with early C20 north vestry. Tooled ashlar with moulded stone plinth and plain tile roofs with crested ridge tiles and stone coped gables, topped by ridge cross to nave. Three stage western tower, nave with north aisle, north vestry and south porch, and lower chancel. Tower has full height stepped angle buttresses to all corners and a chamfered band between second and third stage. West elevation has pointed 3-light window with C19 Dec style tracery and hoodmould and clockface over to second stage. South elevation has small single light window to second stage and north elevation is blank. Above, the bell stage has narrow 2-light louvred panel traceried pointed bell openings in cavetto moulded surrounds with returned hoodmoulds to all sides, plus a clock face below eastern opening. Above again there is a coved stringcourse and embattled parapets, plus a metal weathervane. North aisle has a Y-tracery pointed C19 west window with carved head stops to the hoodmould, and a stepped angle buttress to west corner. North elevation of aisle has double gabled vestry to west end with pointed western door, pairs of adjoining lancets to each northern gable and a 2-light flat headed east window with cusped lights, also clasping buttresses to all corners. To east the aisle has three pointed C19 windows, each with stepped triple lancets plus quatrefoils in the spandrels, and stepped gabled buttresses between and to either end. East wall of aisle has pointed 2-light C19 geometric tracery window. Chancel has a continuous moulded sill band and deep buttresses between each window and to the corners. North elevation has two C19 pointed Y-tracery windows, east elevation has larger version of 3-light north aisle windows and south elevation has three more Y-tracery windows plus moulded pointed doorcase between western windows. South nave elevation has 3-light pointed C19 window with stepped lancets below pierced quatrefoils to east and Y-tracery window to west with gabled south porch beyond. This has a moulded pointed door with oval niche above carved with the Lamb of God. To either side the porch has trefoil headed lancets and inside there is a plain pointed door with a continuous outer moulding, and carved keys in trefoil niche above. Beyond to west there is another C19 Y-tracery window. To either end and between the windows there are stepped buttresses. All C19 openings have hoodmoulds with carved head stops. Interior has four bay C13 north arcade with pointed double chamfered arches dying into octagonal shafts over the capitals and octagonal piers and moulded capitals. Tower has tall continuous triple chamfered arch and chancel has C19 double chamfered arch on polygonal responds with moulded capitals. North aisle has roll moulded pointed arch with soffit on column corbels with stiff leaf capitals, into the north organ bay and chancel has similar arch to north, plus hoodmould with carved head stops. All north aisle and chancel windows have chamfered inner arches on attached colonnettes, and chancel also has hoods with carved head stops to all windows, plus a continuous sill stringcourse. Chancel roof has C19 scissor trusses, and nave and aisle have arched braced trusses. North aisle also has segment headed door into the vestry. Most of the fittings in the church are simple, the chancel has a stone reredos with mosaicked wall behind and an ogee headed piscina to south, plus late C19 metal and wooden altar rails and late C19 timber choir stalls and organ. Across the chancel arch is a plain low stone screen and to south in the nave is a late C19 octagonal wooden pulpit with painted saints in trefoil headed panels, on a stone base. North aisle has early C20 war memorial screen across eastern arch and late C19 bench pews. Similar pews in nave and similar date octagonal stone font to west end of nave with diaper panels to each side of the bowl. Across the tower arch is a mid C20 wooden screen. The most interesting monument is the early C16 moulded four-centred arched tomb niche to north side of the chancel with re-set alabaster slab

incised with illegible inscription and a figure, to Roger Doulton who died 1500. In the organ bay there are several early C19 slate and white marble wall memorials to members of the Gresley family and a classical aediculed white marble memorial of c1792 to Thomas and Elizabeth Gresley. Below this there are two re-set white marble slabs, one to Hannah Vincent c1772 and the other to Elizabeth Gresley c1759. North aisle has one ceramic and one enamelled brass wall plaque, the former c1872 to Mary Birch and the latter c1912 to Ruth Jeanette. It also has two painted charity boards of c1678 and 1669. The nave has a brass plaque of c1912 and the tower has several painted and embossed glass plaques recording the peals rung between 1909 and the present day. Much of the stained glass is commemorative. The east window and reredos commemorate John Woodhouse who died 1878, the south-east chancel window commemorates Isabella Robertson who died 1899 and central and western windows to south side of chancel are placed there in memory of Rev Gresley who died 1897. North east chancel window of c1914 is in memory of Constance Twiss and central south nave window has c1922 stained glass with inscription 'Virtus sola nobilitat'. North aisle has east window of 1899 commemorating Thomas Carter and west window with re-set medieval glass to the top including a small heraldic device.

The churchyard is bordered to the north and north west by a Cheshire Home which enjoys the benefit of access through the northern boundary of the churchyard. To the east of the churchyard is residential property, and to the south west is the village green.

The tall brick wall between the village green to the south west of the church and the adjoining area of churchyard is a dominant feature within this part of the village.

The SoHS does not provide an assessment of the impacts of bats and the priorities for bat mitigation. However, the Light Tough Survey undertaken by Jan Skuriat (RSK, Midlands) states:

St Peters has a problem with a lot of bat droppings and urine stains on pews and on a new expensive tiled floor. Bats flying inside the church is a major issue; urine is splashed on surfaces and there is an ammonia smell. There is probably a breeding colony of Brown Long-Eared bats in the tower. There is evidence in the tower base (including a dead baby BLE) as well as against walls, and there are also roosting sites next to the tower. A single Brown Long-Eared bat was found roosting during the visit.

Bat droppings and urine staining present throughout church causing damage and staining to pews, carpets, floor tiles and artefacts between May and October. Constant requirement to clean up droppings immediately prior to each service. All cleaning performed by volunteers and has a significant strain on volunteer resources.

3 Survey

3.1 Methods

3.1.1 Desk study

An initial desk study for relevant information about bats at the Church of St Peter, Netherseal was undertaken in April 2021, and this was revisited in October 2021 prior to issuing this report. The desk study comprised a review of all prior bat survey and assessment reports made available to Ridgeway Ecology Ltd by Natural England or by the church, namely:

- Bats in Churches Bat Roost Visit Report Form completed by Jan Skuriat (RSK, Midlands) following a visit to the church on 11th August 2017

A search of the Natural England Multi-Agency Geographic Information for the Countryside (MAGIC) web portal was also undertaken for:

- Any statutory designated sites of nature conservation importance where bats are mentioned in their citations or qualifying criteria within a 5 km radius of the church i.e. Sites of Special Scientific Interest, Local or National Nature Reserves, or Special Areas of Conservation; and,
- Any EPS development licences issued for bats within 2 km of the church since 2008.

In addition to the above, Derbyshire Bat Group (DBG) were consulted for any relevant information pertaining to bats at the church. In view of this consultation records of bats in the area surrounding the site were not then also requested from Derbyshire Biological Records Centre for this study.

Aerial images (Google Earth) and Ordnance Survey maps were also consulted as part of the desk study, to assess the potential value of the habitat surrounding the church for roosting, foraging and commuting bats.

3.1.2 Daytime Bat Roost Assessments and Inspections

The suite of field surveys completed at the church was undertaken in accordance with the minimum survey standards required to register the church with Natural England to implement suitable mitigation measures under a European Protected Species Licence. All field surveys were led and undertaken by Dr Jon Russ CEnv MCIEEM, who is an experienced Natural England licensed bat ecologist.

An initial bat roost assessment and inspection of the church was completed on 19th April 2021. The principle aims of this initial site visit were to assess the suitability of the various construction features within the church for roosting and hibernating bats, and to undertake a search for evidence of bat presence, typically indicated by bat droppings, the remains of prey (such as discarded moth wings), characteristic staining from urine or fur, or the presence of live or dead bats. This site visit was also intended to provide a platform for designing a suitable nocturnal survey strategy for the summer of 2021.

Following on from the initial daytime appraisal completed on 19th April 2021, further comparative assessment and inspection of bat activity inside the church were also undertaken before three dusk emergence surveys (see below) and before a meeting on 22nd September 2021.

3.1.3 Nocturnal Bat Surveys

Four nocturnal bat surveys – three dusk emergence surveys and one pre-dawn re-entry survey - were undertaken at the church in the summer of 2021. The main aims of these bat activity surveys were to determine the current status of the bat roosts that had previously been identified at the church and to establish if any further bat roosts were present, along with relevant information on their status if they were.

The nocturnal surveys were all undertaken within the optimum period for bat activity as stated in Collins (2016). They were also undertaken within each of the required periods according to Natural England EPS licence criteria.

Table 1 shows the dates and timings for each of the nocturnal surveys undertaken at the church in the summer of 2021. Table 2 shows the weather conditions for these surveys.

Table 1. Timings of nocturnal surveys

Survey Date	Survey Start Time	Survey End Time	Sunset/(Sunrise)
24/05/2021	20:35	22:41	21:01
25/05/2021	03:00	05:00	(04:44)
20/07/2021	21:00	23:30	21:30
31/08/2021	19:40	22:15	20:00

Table 2. Weather conditions during the nocturnal surveys

Survey Date	Temperature at Start of Survey (°C)	Temperature at End of Survey (°C)	Cloud Cover (%)	Wind (Beaufort Scale)	Precipitation
24/05/2021	10	9	50-12.5	0-1	None
25/05/2021	9	9	75-87.5	0	None
20/07/2021	23	20	63-40	0	None
31/08/2021	17	17	80	0	None

The emergence surveys all commenced at least 20 minutes before dusk and extended for at least two hours post-sunset, and the re-entry survey commenced at least two hours before dawn and extended until sunrise. Surveyors recorded key information regarding possible bat roosts in the church, such as exit or entry points and/or roosting locations (suspected or confirmed), key flight-lines and times of bat activity, and the bat species concerned. Where bat activity could not be confirmed to species level, i.e. for the cryptic *Myotis* bats (*Myotis* spp.), it was instead attributed to the appropriate genus - see Section 3.1.6.

Each emergence and re-entry survey involved at least four suitably experienced surveyors watching and listening with bat detectors for any bats exiting from or entering the church, including at least one stationed inside the church. On all nocturnal surveys two high-specification wide-angle infrared cameras (alongside high specification infrared illuminators) were used, with a thermal scope being used on the final survey.

3.1.4 Personnel

Field surveys were led by Dr Jon Russ CEnv, MIEEM (Natural England Class 3 & 4 Bat Licences CLS2294). Jon is a terrestrial and behavioural ecologist with a specialist interest in bats. As Director of his successful consultancy firm (Ridgeway Ecology Ltd), and through his academic research and work with the Bat Conservation Trust, he has managed, designed and carried out large and small scale bat surveys and bat monitoring programmes in the UK and the tropics. He has extensive experience of the United Kingdom and European Union legislation regarding bats and has been a fully licensed bat worker for over 20 years, holding bat conservation, education and scientific licences for radio-tracking, mist-netting, ringing, harp-trapping, ultrasonic playback and DNA sampling. His publication record includes a large number of articles in scientific journals as well as other publications including the widely used book, “The Bats of Britain and Ireland: Echolocation, Sound Analysis, and Species Identification”, “Review of ASSI designation for bats in Northern Ireland”, “The Northern Ireland Bat Action Plans” which he coordinated and delivered, “British Bat Calls: A Guide to Species Identification” and more recently “Bat Calls of Britain & Europe” published in August 2021. He is currently Warwickshire Bat Group Treasurer and Project Officer. Jon holds Natural England Class 3 & 4 Licences, Bat Low Impact Class Licence, HS2 Bat Low Impact Class Licence for Trees, HS2 Bat Low Impact Class Licence for Buildings and has been named ecologist on over 120 EPSL’s, including 10 historic buildings and has successfully registered 70 BLICL’s of which 15 have been historic and/or listed buildings. Jon has personally surveyed 30 churches and assisted with the mitigation measures required during remedial work.

For the nocturnal surveys Jon was assisted by the following people, who are all professionally experienced in undertaking nocturnal bat emergence and re-entry surveys:

James Whiteford MSc Cocol	Natural England Level 2 Class Licence (2015-14621-CLS- CLS), c.12 years’ relevant professional experience.
Jackie Underhill PhD CIEEM	Natural England Level 2 Class Licence (2015-14790-CLS-CLS), c.15 years’ relevant experience.
Amy Trewick BSc ACIEEM	Natural England Level 2 Class Licence (2018-37960-CLS-CLS), c.9 years’ relevant professional experience.
Zoe Jackson MSc ACIEEM	c. 12 years’ experience
Katie Warren MSc	Natural England Level 1 Class Licence (2021-52120-CLS-CLS), c.5 years’ relevant experience.

In addition to the professional surveyors, several volunteer bat workers from the Derbyshire Bat Group attended all of the surveys.

3.1.5 Equipment

Equipment used for the daytime assessments and inspections comprised a combination of the following: a 450 lumen Lenser P7 LED hand-torch, close-focusing Nikon binoculars, a Ridgid Seesnake CA-300 endoscope, and a Canon Powershot SX540 HS digital camera for photographs.

Equipment used by the surveyors on the nocturnal surveys comprised combinations of the following bat detectors: Pettersson D980, Peersonic RPA3, Pettersson M500-384, Elekon Batlogger M, Wildlife Acoustics Echometer Touch 2 Pro and Pettersson D240x. Bat call analysis software used comprised Anabat Insight, Sonobat and BatSound.

Professional-standard infrared recording equipment supported by high-specification infrared illuminators were integral to the efficacy of the nocturnal surveys. These units comprised Sony HDR-SR12, Sony HDR-SR11 and Sony HDR-SR0 and Canon XA2 cameras with various infrared floodlights. In addition, a Guide TrackIR Pro 19 thermal scope was used on the final survey.

3.1.6 Bat Detecting and Sound Analysis: Important General Considerations

Bat echolocation calls were identified to species level via sound analyses wherever possible. It is important to note, however, that confident identification to species level is not always possible because the calls of some bats and bat species are cryptic and/or difficult to detect, and in some genera, even the most characteristic calls cannot readily be assigned to a single species. This appraisal considers the following criteria as appropriate for this study:

- The UK *Myotis* bat species *Myotis* spp. cannot be separated from each other with certainty because of the short duration, frequency-modulated echolocation calls that are characteristic of all UK bats in this genus. As such, where a *Myotis* bat species has been recorded during these surveys it is considered at the genus level only as a 'Myotis bat'. Two of the six *Myotis* bat species that breed in the UK, Bechstein's bat *M. bechsteinii* and Alcaholic bat *M. alcathoe*, are not currently known to reside in the East Midlands. For this study, unless specified otherwise, a 'Myotis bat' is therefore considered to be one or more of the following: Natterer's bat *M. nattereri*, Daubenton's bat *M. daubentonii*, whiskered bat *M. mystacinus* and/or Brandt's bat *M. brandtii*.
- It can also be difficult to separate the calls of the two *Plecotus* bat species *Plecotus* spp. that breed in the UK: the grey long-eared bat *P. austriacus* and the brown long-eared bat *P. auritus*. The grey long-eared bat is not currently considered to be resident in the East Midlands, however, and therefore any *Plecotus* bat referred to in this report is considered a brown long-eared bat by default.
- There are three pipistrelle species *Pipistrellus* spp. of bat resident in the East Midlands: common pipistrelle *P. pipistrellus*, soprano pipistrelle *P. pymaeus*, and the uncommon Nathusius' pipistrelle *P. nathusii*. Usually, these species are readily distinguishable by their echolocation calls. However, it should be noted that where common pipistrelle calls have a frequency of maximum energy (FMaxE) at 48 Khz or above these can overlap with atypically low soprano pipistrelle calls, and where common pipistrelle calls have an FMaxE of below 41 Khz these can overlap with high Nathusius' pipistrelle calls. Therefore, where a pipistrelle call exhibits the above or where it cannot reliably be identified to species level (e.g. because it is faint or very brief) it has been assigned to the parent *Pipistrellus* genus.
- It can also occasionally be problematic to distinguish between the echolocation calls of the two bats in the *Nyctalus* genus *Nyctalus* spp., noctule *N. noctula* and Leisler's bat *N. leisleri*, and sometimes serotine *Eptesicus serotinus* as well; for example, where these large bats are recorded in cluttered surroundings or where multiple bats are present. Therefore, where one of these difficult-to-identify 'big bat' calls cannot reliably be identified to species level it has been labelled as such.

It is also important to note that in almost any acoustic study of bats several variables affect the 'detectability' of a bat; ranging from its biology and ecology; to the environmental conditions and the condition of the acoustic survey equipment; to the type of bat detector and microphone used. These

variables mean that there can be biases in the data gathered from acoustic bat surveys, particularly those that involve only automated units deployed remotely. As such, any conclusions drawn from such surveys alone should consider these biases.

3.2 Results

3.2.1 Desk study

A Light Touch Survey carried out by Jan Skuriat of RSK on 11th August 2017 revealed the presence of a brown long-eared bat maternity roost and hibernation roost plus pipistrelle roosts:

Total c. 1000, mainly Brown Long-Eared, but also Pipistrelle spp. and possibly Myotis droppings (most likely Natterer's Bats) scattered throughout nave, transept and vestry, with distinct concentrations present below favoured roost in roof timber, at the base of the tower, and at locations associated with possible access points. The church is cleaned frequently – but not too recently so evidence was apparent – very few droppings were older. Urine pitting/ staining was very widespread on all surfaces including pews, brass work and the new tiled floor.

3.2.2 Daytime Bat Roost Assessments and Inspections

Four daytime roost inspections produced fairly consistent results with those of the Light Touch Survey:

- At the north-west corner of the silence/clock chamber, there was a large accumulation of brown long-eared bat droppings under a crevice between the timber frame and the wall of the clock mechanism (Photographs 2 and 3). No fresh droppings appeared until July (and were also obvious in August) demonstrating that the roost was not in use prior to this month.
- Smaller accumulations of brown long-eared bat droppings were also located under tenon and mortise joints in the silence/clock chamber (e.g. Photographs 4-6). Again, fresh droppings were not identified until July.
- In the belfry, there were scattered brown long-eared bat droppings on the bells and bell frame as well as on the floor and ledges under the exposed timbers of the roof (e.g. Photographs 7-9).
- Brown long-eared bat droppings were present on the walls at the north-west corner of the vestry/organ room as well as on the organ itself (Photographs 10 and 11). None of these appeared to have been produced in 2021.
- In the nave and north aisle during each survey visit there were very small numbers of widely scattered brown long-eared bat droppings, as well as urine splashes, with no obvious accumulations (e.g. Photographs 12-13).
- Within the tower, particularly on the ledge under the south-facing louvred window, there were dozens of small-sized bat droppings which were produced by pipistrelle bats (Photograph 14). Although old droppings were present during the April and May surveys it was not until July that fresh droppings began to appear.

In addition to the features that are known to be used by bats from surveys at the church, there are several other features that may be important to roosting and / or hibernating bats. Principally, these features comprise apertures, gaps, cavities and crevices in the following locations:

- At the apex of the roofs along the ridge;

- On wall tops, below the wall plate;
- Among and between other structural roof timbers;
- Where the structural roof timbers abut internal walls; and,
- Within stonework, particularly below the eaves alongside protruding rafters.



Photograph 2. Large accumulation of bat dropping to the right of the clock mechanism in the north-west corner of the silence/clock chamber



Photograph 3. Opening between the timber frame and the wall above the droppings shown in Photograph 2.



Photograph 4. Accumulation of droppings on the floor at the south-east corner of the silence/clock chamber



Photograph 5. Crevice in the tenon and mortise joint above the droppings shown in Photograph 4



Photograph 6. Crevices in tenon and mortise joints above bat droppings in the silence/clock chamber



Photograph 7. Example of bat droppings on the metal frame supporting the bells



Photograph 8. Example of bat droppings on a bell



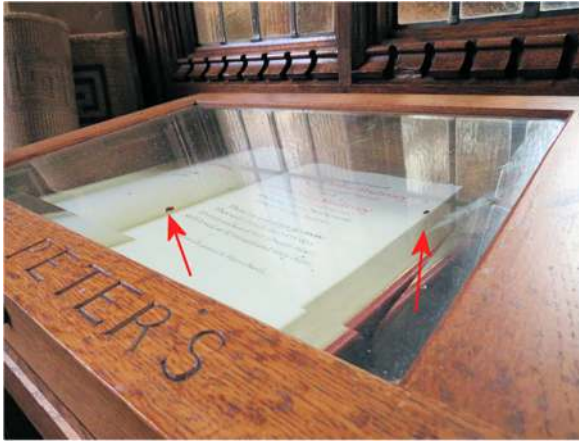
Photograph 9. The underside of the roof within the belfry



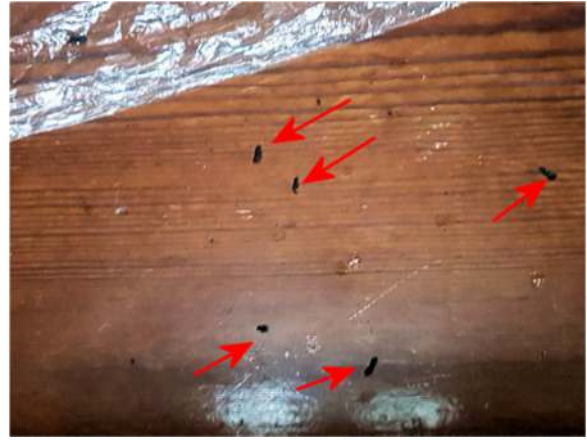
Photograph 10. Bat droppings adhered to the walls at the north-west corner of the vestry/organ room



Photograph 11. Bat droppings on the organ



Photograph 12. Bat droppings and urine splashes on a display case at the western end of the nave



Photograph 13. Bat droppings on stored seats at the western end of the north aisle



Photograph 14. Bat droppings on a ledge under the south-facing louvred window in the belfry

3.2.3 Nocturnal bat surveys

24th May 2021 – Dusk survey

No bats were observed flying within or emerging from the church. Common pipistrelles were recorded flying and foraging in the vicinity of the church from 21:20 to 22:08 and a noctule occasionally flew along the southern side of the church (21:43, 21:45 and 22:30), flying from the west. In addition, a single *Myotis* sp. was heard at 22:03 along the western side of the church.

25th May 2021 – Dawn survey

No bats were observed flying within or entering the church. Common pipistrelles were very occasionally recorded flying in the church grounds from 03:52 to 04:27 and noctules were observed flying overhead at 21:45 and 22:30. At 03:50 a single *Myotis* sp., probably a Daubenton's bat, was recorded flying to the west of the tower.

20th July 2021 – Dusk survey

Generally, activity was quite low: an infrared camera placed in the silence/clock chamber recorded the first brown long-eared bat at 21:36 with activity continuing until 22:33 when presumably all bats had left the church. The most bats observed within a single frame was two individuals but it is estimated that 5 bats in total were present (Photograph 15). Bats were recorded flying in the church nave at

21:38 and 21:43, again with the most bats recorded in a single frame being two. At 21:55 two brown long-eared bats were observed emerging from the east-facing louvred window in the belfry and flying northwards. Brown long-eared bats were also recorded flying outside the church at 22:07, 22:09 and 22:26 (Photograph 16).

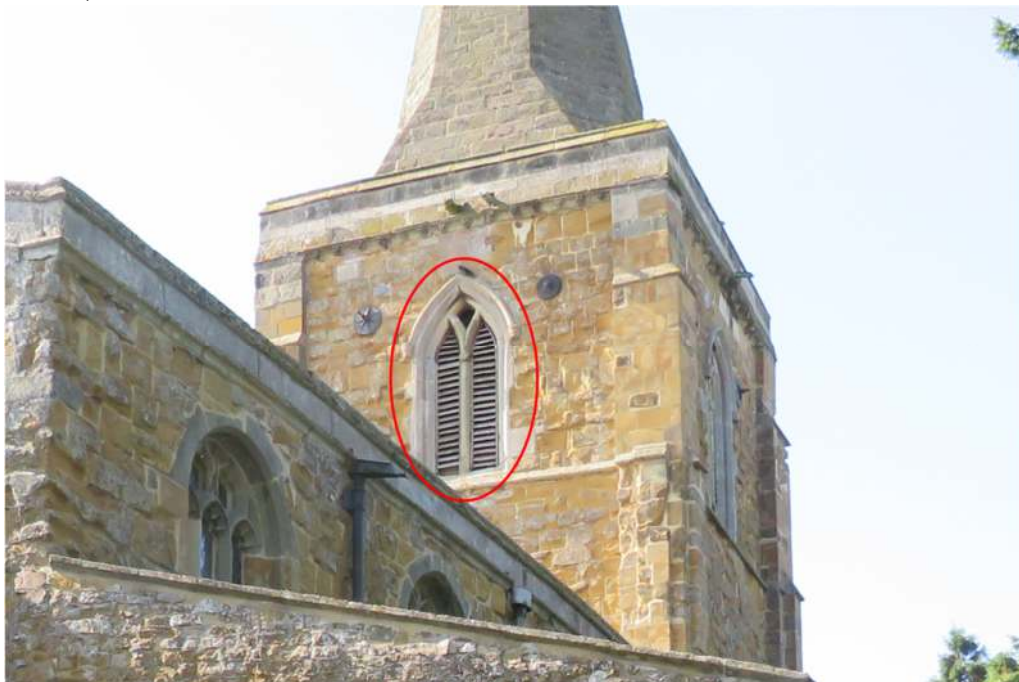
An infrared camera placed in the vestry/organ room did not record any bats.

At 21:22 a single common pipistrelle was observed emerging from the louvred window on the western side of the tower.

Common pipistrelles and noctules were regularly recorded flying and foraging in the vicinity of the church for the duration of the survey with common pipistrelles first appearing at 21:38 and noctules at 21:30. A soprano pipistrelle was also recorded to the east of the church at 21:46.



Photograph 15. Example of a brown long-eared bat captured using an infrared camera in the silence/clock chamber.



Photograph 16. East-facing louvred window – brown long-eared bat access point

31st August 2021 – Dusk Survey

Brown long-eared bats began to emerge from the silence/clock chamber at 19:59 into the lower part of the tower and then into the nave (Photograph 17). Eleven bats were observed emerging in total, the last one emerging at 20:28. Bats frequently flew into and out of the silence/clock chamber during this period.

At 20:27 a single bat was recorded flying within the interior of the vestry/organ room and at 20:17 and 20:41 two bats were observed entering between the rafter tails above the wall to depart the church (Photographs 18-20).

From 20:25 to the end of the survey at 22:15 up to nine bats were observed perching along the ridge in the nave and flying within the interior of the nave and north aisle (Photograph 21). Social activity was very high with social calls being heard frequently for the duration of the survey.

At 20:15, nine bats were still present within the church interior.



Photograph 17. Example of a brown long-eared bat emerging from the silence/clock chamber into the lower part of the tower



Photograph 18. Brown long-eared bat departing from the church via a gap between the rafter tails and wall (infrared camera)



Photograph 19. Access point at top of drainpipe on the northern side of the church (see Photograph 18)



Photograph 20. Access point at top of drainpipe (see Photograph 18)



Photograph 21. Brown long-eared bats in the nave (thermal camera). Bats in flight are circled, the others are stationary.

3.2.4 Interpretation

- A small maternity colony of brown long-eared bats (5-11 bats observed) is roosting within the silence/clock chamber in the church (Figure 1).
- The bats emerge from the silence/clock tower into the lower part of the tower and then into the nave and north aisle.
- Bats either emerge from the east-facing louvred window of the belfry or between the rafter tails and wall at the top of the drainpipe on the north-facing wall of the vestry/organ room.
- In 2021 the bats did not appear to use the church in early May with only 5 bats occupying the building in July. Numbers increased to 11 during late August and during this time social activity was high. It is likely that the church is used as a mating site during this period.
- Common pipistrelles roost above the west-facing louvred window of the belfry. Only a single bat was observed emerging in July but the droppings indicate that a larger population is present, probably 5+ individuals.

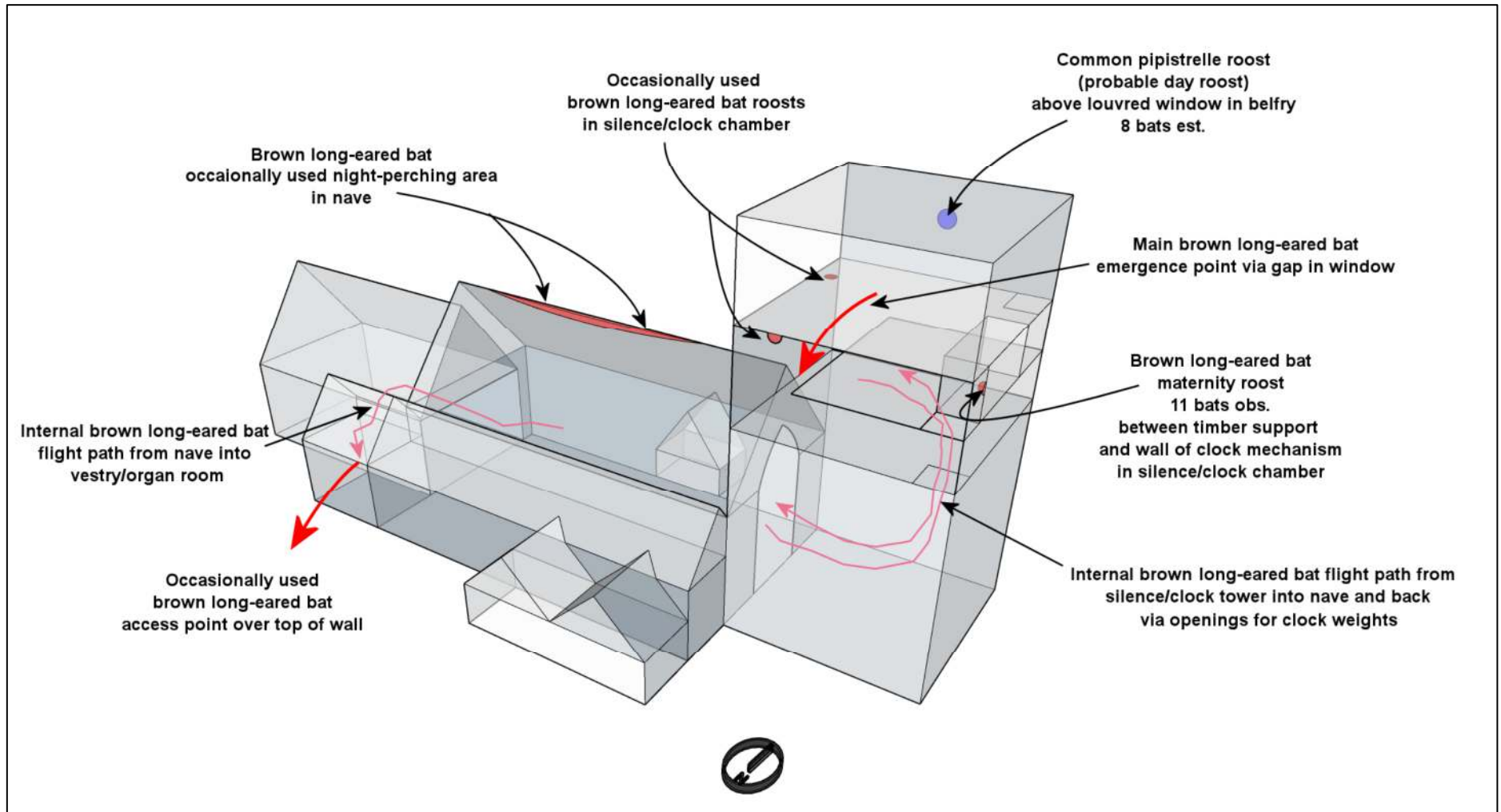


Figure 1. Plan of the church showing the location of the identified roosts, internal flight paths and access points

4 Evaluation

4.1 Bat survey effort and expertise

The suite of bat surveys undertaken at the Church of St Peter was completed in accordance with current best practice guidance in respect of professional bat surveys and churches – see Collins (2016).

This management plan has been authored by Jon Russ PhD BSc (Hons) CEnv MCIEEM who also led all of the 2021 field surveys at the church (see 3.1.4).

4.2 Stakeholder consultation

The following provides a timeline of formal consultations with the representatives of the Church of St Peter within the scope of the BiC Project:

11th August 2017 - Within round one of the BiC Project Jan Skuriat of RSK, Midlands met with Carolyn Coxon, Church Warden to undertake an initial Light Touch Survey (LTS). The BiC LTS requires a suitably experienced ecologist to collect physical and social information about the church; the names and roles of its representatives and architect; information about the bat species present and how bats use the church; the social and physical impacts caused by bats; and recommendations for solving the problems. This information was then collated and presented to the BiC Project team in a standardised LTS report form intended to help them construct their round two funding application to the HLF in 2018.

19th April 2021 – Within round two of the BiC Project Dr Jon Russ of Ridgeway Ecology Ltd met onsite with the churchwarden, Carolyn Coxon, the architect Richard Smith, the Bats in Churches Project Engagement Officer, Rose Riddell, and the Bats in Churches Heritage Advisor, Rachel Arnold to get an update on bat issues at the church and the desired outcomes from the project.

22nd September 2021 – Following the successful completion of the summer bat surveys of the church a progress meeting between the church representatives and the Bat Ecologist was held onsite. The BiC Engagement Officer and BiC Heritage Advisor were also present. The architect was also invited but was unable to attend. The proposed bat mitigation measures, and the next steps regarding these, were discussed and agreed upon at this meeting.

Records of the above can be provided by the BiC Project team and/or Ridgeway Ecology Ltd upon request.

In addition to the above formal consultations, informal discussions regarding the bat impacts and proposed mitigation have been ongoing (via email and onsite) between Jon Russ, Carolyn Coxon.

4.3 Overall evaluation

Based on the above, it is considered that the level of bat survey effort and expertise and stakeholder consultation involved at St Peter, Netherseal provides a robust platform for the recommendations contained within this report. Every effort has been made to provide a comprehensive ecological appraisal and appropriate recommendations in the context of the commissioned scope of works and the overall aims of the BiC Project.

Notwithstanding the above, however, it remains important to note that it is impossible to completely characterise or predict the natural environment as wild animals are inherently unpredictable, all habitats are subject to change, and species may colonise or vacate areas for a variety of reasons after surveys have taken place or mitigation has been implemented.

5 Consideration of Bat Management Options

The focus of the proposed mitigation for the Church of St Peter is the brown long-eared bat maternity roost containing 5-11 bats. This maternity colony is responsible for the majority of the negative impacts on the church. In 2021 the population was quite small but it is clear from talking to the churchwarden and from the LTS that the issue has been a lot worse in the past and therefore it is likely that the number of bats present within the church has been higher in previous years. These impacts comprise bat droppings and urine stains throughout the nave, chancel, vestry/organ room and north aisle of the church.

Investigations at the Church of St Peter to date have not revealed a significant impact on the church from the colony of common pipistrelles which roost and emerge from the tower. The mitigation measures discussed hereafter will therefore aim not to have any significant effects on these animals.

The bat management option considered hereafter proposes to retain the bat maternity roost of brown long-eared bats within the church. The principle reason for not excluding the bat colony from the church is because the Favourable Conservation Status (FCS) of the local populations of the two bat species concerned could be adversely affected by such an action. In this scenario Regulation 53(9)(b) of the Habitats Regulations, 2017 (see 1.4) states that the appropriate authority (Natural England) cannot grant a licence for any activity affecting bats (as EPS) unless they are satisfied “that the action authorised will not be detrimental to the maintenance of the population of the species concerned at a favourable conservation status in their natural range”.

In addition to the risks that exclusion would pose to the welfare and FCS of the protected bat species it is unwarranted when other less harmful and potentially more effective options are currently available at the church - see below. The church’s representatives also have no desire to exclude the bats. Furthermore, exclusion would be against the spirit of the BIC Project and its principle aim “to transform support for church communities with nationally important historic churches with protected bat roosts to create a sustainable partnership that will safeguard a future for bats, historic places of worship and for the people who use them”.

Based on the above, the following option (sections 5.2) was considered as the only potential solution to mitigate and reduce the impacts from the brown long-eared bats at the church while allowing the bat roosts that reside within the fabric of the church to continue to do so. This option has been considered within the context of the suite of bat surveys undertaken at the church in 2021, ongoing stakeholder consultation, and relevant research.

5.1 Option 1: Do Nothing

Balancing the need to protect churches and bats - our cultural and our natural heritage - is very challenging. Conserving the bat colonies that occupy churches is important because the bats may not have any alternative suitable roost sites and the loss of an important roost could significantly harm bat populations that are already threatened. At the same time however, churches are often very important buildings historically and communally, and they can suffer significant negative effects from large colonies of bats. The Church of St Peter comprises one of the main community centres in Netherseal. The upkeep of an old church is difficult, and the mess left by the colony of brown long-eared bats places an added burden on those that use it.

The Executive Summary from the 2017 BiC SoS (Skuriat, 2017) for St Peter’s made the following statement regarding the impacts from bats on this building:

“The situation got worse 6 years ago. No obvious reason why. Droppings and urine staining scattered throughout church. Plastic covers over lectern and brasses etc. LTS says concentration is in bell tower. Couple of years ago PCC talked about hanging curtains/polythene sheeting between bell tower and nave as a temporary measure to see if it reduced bats inside the nave and chancel., with droppings scattered throughout the nave, transept and vestry. Urine pitting and staining is widespread on all surfaces including pews, brasswork and the relatively newly tiled floor.”.

Based on the solutions and outcomes preferred by the church’s representatives (BiC LTS, 2017), and the wider context and principle aim of the BiC Project as described above, it is not appropriate to ‘do nothing’ at St Peter’s in respect of the impacts from the bats. As such, this option was rejected at an early stage.

5.2 Option 2: Exclusion from the main parts of the church

As the brown long-eared bat colony is roosting within the tower and as one of their access points is via the east louvred window in the belfry the option that is most likely to result in a successful outcome is to exclude the bats from emerging from the tower into the church. Brown long-eared bats are relatively resilient to change, particularly when their original roosting habitat is maintained in situ.

The main area of the church is used as a pre-emergence flight area by the colony. However, this activity also occurs around the roosting sites in the silence/clock chamber as well as in the belfry and the size of these areas combined is considered to be large enough for bats to continue to use the site.

The access point between the rafter tails and the wall on the northern side of the church will need to be blocked up. However, as bats are also emerging from the louvred window in the belfry this should not deter bats from accessing the church. Additional access should be incorporated into the tower.

Excluding bats from the main body of the church will result in the loss of night-perching sites within the nave. These areas may be important during the breeding season. Alternative sites should be incorporated into the belfry.

6 Bat Management Objectives

6.1 Objectives

The overall aim of the management plan and bat mitigation strategy for the Church of St Peter is to reduce the negative impacts from the resident bats while maintaining the FCS of both the brown long-eared bat and common pipistrelle colonies.

Based on the information that has been gathered at the Church of St Peter there are three key bat management objectives for 2021 to 2023 within the scope of the BiC Project; these are provided below. The success (or otherwise) of this bat management plan can be measured against these objectives.

Objective 1

To restrict the bats to an area of the church as well as providing artificial roosts additional and enhanced and monitor its use.

Objective 2

To reduce the usage of the church interior by the brown long-eared bat maternity colony to a level that is acceptable to the church users, including diminishing or eliminating the depositions of droppings and urine on important wall paintings, fittings and memorials.

Objective 3

To monitor and maintain the status of the brown long-eared bat and common pipistrelle roosts within the church, and thereby ensure that the FCS of the local populations of these two species is also maintained.

6.2 Achieving the Objectives

Objective 1 – see Figure 2.

- As all bat roosts (places that bats use for shelter or protection) are protected under current legislation (whether bats are present or not) a European Protected Species (EPS) licence from Natural England will be sought for the reduction in available roosting space and the destruction of the access point at the top of the north wall.
- The reduction of the roosting space and closing up of the access point will only occur between 15th October and 15th April to minimise the impact upon the brown long-eared bat maternity colony.
- The named ecologist will initially fix a polythene one-way valve to the access point at the top of the drainpipe in the north wall (see Photograph 20). Once this has been in place for 2-3 weeks it will be removed and the ecologist will block the hole using steel wool in the first instance. This will eventually be replaced with lime mortar.
- The clock weight hatch will be closed (Photographs 22 and 23). Fortunately, the mechanical winder is being replaced during winter 2021 with an electrical winder and therefore the weights can be lifted above the height of the hatch.
- The hatch leading to the belfry will be restricted from closing fully to create a 200mm gap facilitating the movement of bats between the silence/clock chamber and the belfry (Photograph 24). This will be achieved by fixing a 200mm wooden batten on either side of

the opening. A sign will be attached to the hatch stating “Please keep the hatch open for the protected bats roosting in the tower” or similar.

- Two bat boxes will be erected in the belfry at the top of the east and west walls (Photograph 25).
- A new access point will be created in the north louvred window. This will be achieved by cutting a 100mm x 30mm slot in the mesh to correspond with one of the openings and then extending the louvre with a piece of wood to provide a suitable landing platform (Photograph 26).



Photograph 22. The clock weight hatch (from inside the silence/clock chamber)



Photograph 23. The clock weight hatch (from the base of the tower)



Photograph 24. The access hatch to the belfry showing 200mm gap



Photograph 25. Greenwood's EcoHabitats medium hollow box



Photograph 26. Slot cut into mesh on the louvred window to create access

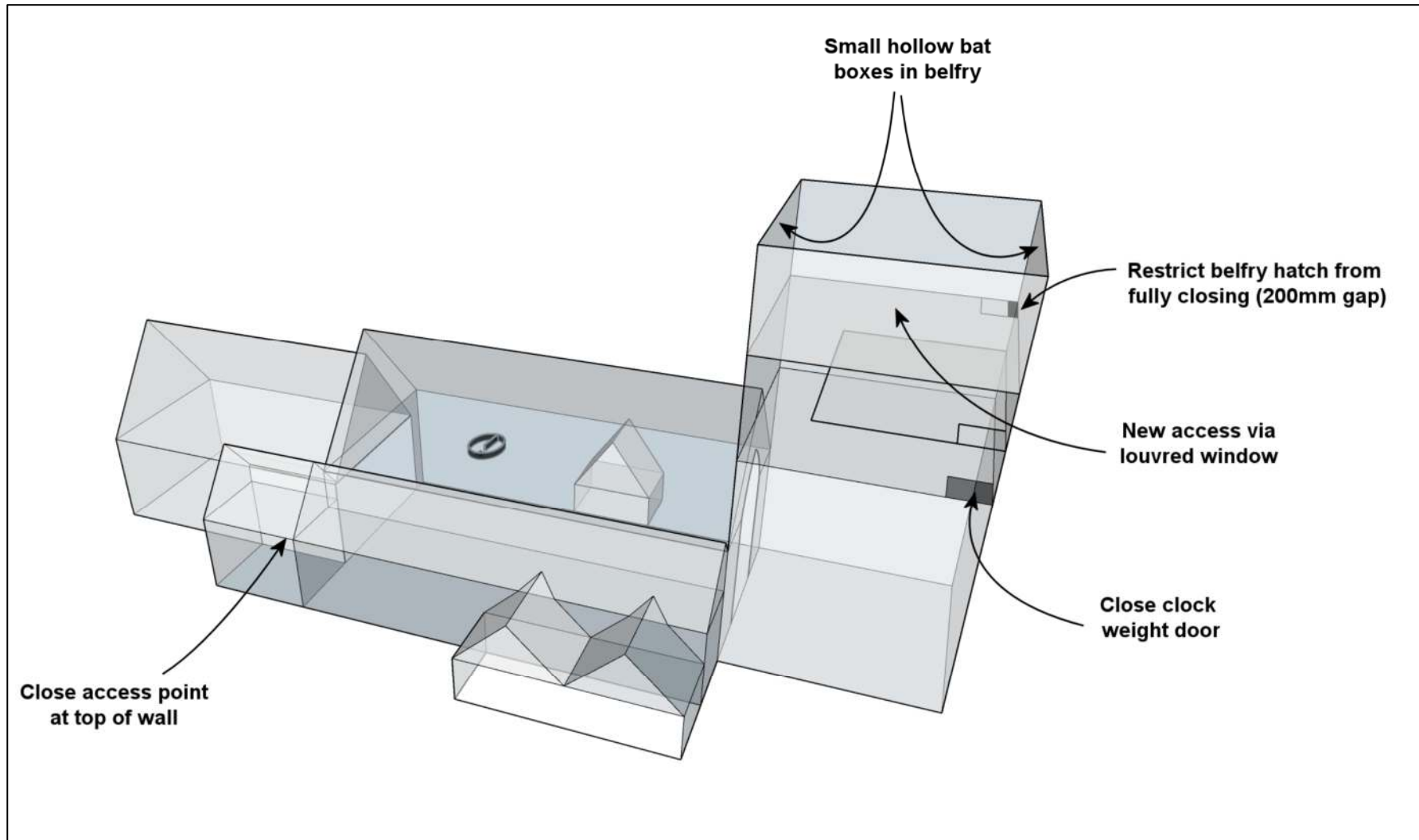


Figure 2. Plan of the church showing the measures to restrict the bats to the tower and enhance the existing roosting habitat in this area

Objective 2

The proposed restriction of the bats to the tower should eliminate the droppings and urine within the main church interior.

The success or otherwise of the proposed bat mitigation strategy in meeting Objective 2 will be formally evaluated in consultation with the regular church users at the end of each summer from 2020 to 2023, for example by annually revisiting and updating the 2019 LTS findings.

More information on the actions and expenditures required to achieve Objective 2 are provided in Section 7 below.

Objective 3

In the first instance, monitoring is required during the early stages of implementing the bat management plan at the Church of St Peter to ensure that no bats are harmed, and to inform any remedial actions if the risks to bat welfare are higher than anticipated. In such a scenario, if monitoring confirms that the colonies brown long-eared bat has not responded as predicted to the proposed activities, and risks to the bats have increased, an adaptive management plan will need to be devised and agreed with Natural England as a matter of urgency.

Beyond this, monitoring is also critical at the Church of St Peter to allow a comprehensive appraisal of the success or otherwise of the proposed bat mitigation strategy, and to establish whether the FCS of the local populations of brown long-eared bats are being maintained. Establishing this is imperative because the law that usually protects the bats and their roosts has been derogated on this basis.

To achieve Objective 3 the proposed bat mitigation measures must ensure that the primary ecological function of the Church of St Peter for the local populations of brown long-eared bats is maintained. The current primary ecological function of the church for the species is to provide suitable conditions for the maternity roost of adult female bats (c.11) and their young.

The actions that are prescribed to accompany the above objectives at St Peter's Church are provided in Section 7 along with the associated costs. The following criteria will be used to evaluate whether Objective 3 has been achieved:

An initial favourable outcome will comprise the continual usage of the tower by brown long-eared bats in 2022.

7 Prescribed Actions and Costings

7.1 Proposed Costings – 2021/2022

The costs below are estimated to implement and monitor the bat mitigation strategy at the Church of St Peter in 2021/22 as described above. All costs stated include VAT.

Bat Boxes – 2021/2022

The prices provided in Table 3 have been taken from <https://www.greenwoodsecohabitats.co.uk/shop> and include VAT.

Table 3: Costs of the bat boxes for the Church of St Peter in 2021/22

Bat Boxes – 2020 / 2021				
<u>Item</u>	<u>Box Manufacturer and Design</u>	<u>Price Per Unit</u>	<u>No. Required</u>	<u>Total Cost</u>
1	Greenwoods Ecohabitats Small Hollow	£42	2	£84
2	Delivery			£15
	<u>Total (incl. VAT)</u>			<u>£99</u>

Consultant Fees and Bat Monitoring Costs – 2021/2022

The proposed costs for bat consultancy and monitoring at St Peter’s Church in 2020 are provided in Table 4. These are based on the rates and fees provided by Ridgeway Ecology Ltd to Natural England when tendering for Phase 1 of the work at this church and include travel expenses.

Table 4: BiCCL RC fees and bat monitoring costs for the Church of St Peter in 2021/22

RC Fees and Bat Monitoring Costs – 2021 - 2022			
<u>Item</u>	<u>Description</u>	<u>Timescale</u>	<u>Fees</u>
1	European Protected Species Licence application	Dec 2021	£500
2	Site visit to inspect roosts and close hatch and access point	March 2022	£250
3	Early-season inspection	May 2022	£150
4	Late-season inspection	August 2022	£150
	<u>Total (incl. VAT)</u>		<u>£1050</u>

8 References

- Altringham, J. (2003). *British Bats*. HarperCollins Publishers.
- Barratt, E. M., Deaville, R., Burland, T. M., Bruford, M. W., Jones, G., Racey, P.A. & Wayne, R.K. 1997. DNA answers the call of pipistrelle bat species. *Nature* 387: 138-139.
- Blake, D., Hutson, A. M., Racey, P. A., Rydell, J. & Speakman, J. R., 1994 Use of lamplit roads by foraging bats in Southern England. *J. Zool. Lond.* 234: 453 - 462.
- Battersby, J. (2005) *UK Mammals: Species Status and Population Trends*. JNCC/Tracking Mammals Partnership 2005.
- Collins, J. (ed.) 2016 *Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edition)*. The Bat Conservation Trust, London.
- Elliot, P. (2005). *Warwickshire, Coventry & Solihull Local Biodiversity Action Plan: Bats*. Warwickshire County Council.
- Entwistle, A.C., Harris, S., Hutson, A., Racey, P.A., Walsh, A., Gibson, S.D., Hepburn, I. & Johnston, J. (2001). *Habitat management for bats. A guide for land managers, land owners and their advisors*. Joint Nature Conservation Committee, UK.
- IEEM. 2005. *Guidelines for Ecological Impact Assessment. Consultation Draft*. Institute of Ecology & Environmental Management, UK.
- Joint Nature Conservation Committee (2007). *UK Biodiversity Action Plan*. www.ukbap.org.uk
- Mitchell-Jones, A. J. (2004) *Bat Mitigation Guidelines*. English Nature, Peterborough.
- Mitchell-Jones, A.J. & McLeish, A.P. 2004. *The Bat Workers Manual (3rd ed.)*. JNCC, Peterborough.
- Office of the Deputy Prime Minister, under licence from the Controller of Her Majesty's Stationery Office (2005). *Planning Policy Statement 9: Biological and Geological Conservation*.
- Russ, J. M. (1999). *The Bats of Britain and Ireland: Echolocation calls, sound analysis and species identification*. Alana Books, Powys, UK.
- Rydell, J. 1992 Exploitation of insects around street lamps by bats in Sweden. *Functional Ecol.* 6: 744 - 750.
- Simpson, P. 2007. New species protection legislation: opportunities and risks for consultant ecologists. In: *In Practice. Bulletin of the Institute of Ecology and Environmental Management*. 58, 24-27.
- Simpson, P. 2009. Ecology legal update. In: *In Practice. Bulletin of the Institute of Ecology and Environmental Management*. 66, 36-38.

END OF REPORT



www.ridgewayecology.co.uk | enquiries@ridgewayecology.co.uk | 01926 259182