

Wild Wings Ecology



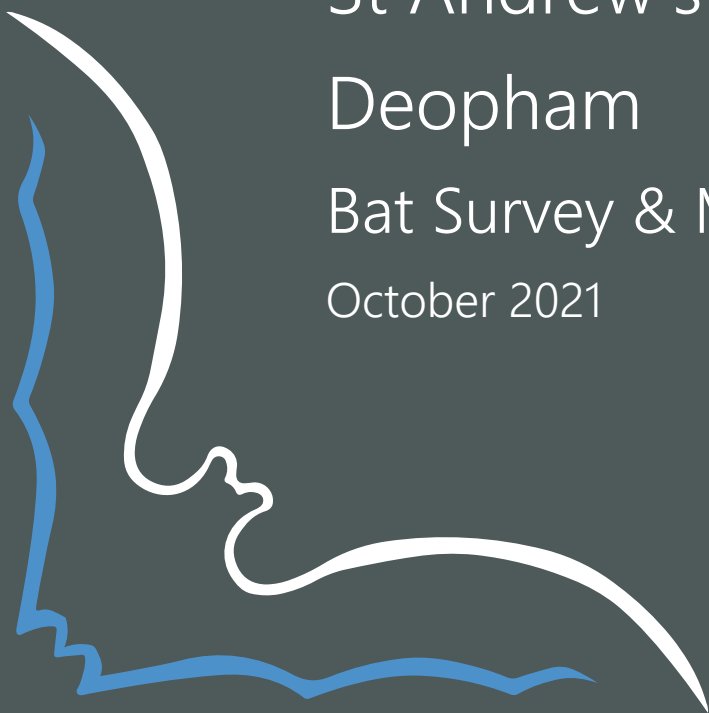
Bats in Churches Project:

St Andrew's Church

Deopham

Bat Survey & Management Plan Report

October 2021



This report was produced for Natural England by Wild Wings Ecology Ltd. The intellectual property rights rest with Natural England. The report content relies on Wild Wings Ecology’s expertise and they are responsible for the content. Consequently, the report content must not be edited in any way without the explicit consent of the report author/Wild Wings Ecology Ltd.

Company Registered in England and Wales No. 11682642
 VAT Registration No. 309464984

Quality Assurance: This report and the data it contains have been collected and compiled in accordance with the Chartered Institute for Ecology and Environmental Management’s (CIEEM) Code of Professional Conduct and the report has been prepared in accordance with CIEEM’s Guidelines for Ecological Report Writing.

Document type	Bats in Churches Project – Bat Survey & Management Plan Report
Version	1.0
Author	Dr Charlotte Packman PhD CEcol MCIEEM
Client	Natural England
Site address	St Andrew’s Church, Church Road, Deopham, Wymondham, Norfolk, NR18 9DG.
Site grid reference	TG 04991 00477
Survey period	May – August 2021
Report date	04/10/2021

Wild Wings Ecology Ltd,
 The Enterprise Centre,
 University of East Anglia,
 Norwich Research Park,
 Norwich,
 Norfolk, NR4 7TJ.



Email: info@wildwingsecology.co.uk
 Phone: 01603 339 043
 Website: www.wildwingsecology.co.uk

Contents

Figures & tables.....	4
1. Summary.....	5
2. Introduction.....	6
2.1. Purpose.....	6
2.2. St Andrew’s Church, Deopham.....	6
2.2.1. Location.....	6
2.2.2. Statement of Significance.....	6
2.2.3. History of bat use/previous bat survey work.....	9
3. Methodology.....	12
3.1. Visual inspection.....	12
3.2. Bat activity surveys.....	12
4. Results.....	16
4.1. Visual inspection.....	16
4.2. Bat activity surveys.....	18
5. Discussion.....	21
5.1. Proposed management plan.....	21
6. References.....	28
Appendix 1: Bat Roost Visit Report Form, Sept 2017.....	29
Appendix 2: Bats in Churches Class Licence Survey Criteria.....	29
Appendix 3: Photographs (general).....	31
Appendix 4: Budget/estimated costs.....	37

Figures & tables

Table of figures

Figure #	Figure description	Page #
1.	Location (at landscape scale) of St Andrew's Church, Deopham with bat Core Sustainance Zones	8
2.	Location of St Andrew's Church, Deopham and surrounding habitats	9
3.	Visual inspection results	17
4.	Results from 2021 bat activity surveys	19
5.	Annotated infrared photos taken during activity surveys showing interior roost locations and access points	20
6.	Annotated church plan showing locations of proposed management interventions	26

Table of tables

Table #	Table description	Page #
1.	Surveyor details	14
2.	Bat activity survey details	15

1. Summary

St Andrew's Church, Deopham underwent bat surveys in summer 2021 to inform a proposal for managing the impacts of the bats on the church whilst protecting the church bat population. This work was undertaken as part of Natural England's Bats in Churches Project (funded by the Heritage Lottery Fund).

St Andrew's Church is home to a medium-sized maternity colony of Natterer's bats, probable small maternity colony of common pipistrelles and small numbers of day roosting soprano pipistrelles. The church has experienced long-term negative impacts from the presence of bats in the church interior, with staining (from droppings and urine) on floors, walls, pews, ledger stones, memorials and organ pipes.

Management options were discussed with church representatives and the architect and include:

- Opening-up of exterior putlog holes to create suitable roost cavities for Natterer's bats.
- Construction of rafter bat boxes, suitable for Natterer's bat maternity use, at their main access point on the south side of the nave.
- Subsequent closing-up of the Natterer's bat access point at the north-west corner of the chancel.
- Creation of a suitable maternity colony box for common pipistrelles behind the tower door access point, with false doors added on the interior side to create a contained roost space.
- Stone-coloured 'ecostyrene' bat boxes to be erected at several locations along the south aisle.
- 'Deflector board'/'hood' to be positioned over the top of the decalog boards to reduce bat dropping and urine deposition.
- 'Deflector board'/'hood'/covering for rood screen sections (to be assembled together).

Some Natterer's bat colonies at churches in Norfolk appear to have declined in recent years (although the population at Deopham appears stable currently). Careful monitoring will be needed to assess if measures are effective in reducing the impact of bats on the church, assess how bats respond to the measures and ensure no adverse impacts on the bat populations. Monitoring is also a requirement for licensed works and is essential to inform future best practice. Monitoring proposed includes: visual inspections, bat activity surveys and use of roost cameras for the pipistrelle maternity box and Natterer's rafter bat boxes.

Adoption of new/artificial roosts takes time but it is hoped that over time the bats will begin to use the new roosts, helping to alleviate the impacts of bat presence inside the church.

2. Introduction

2.1. Purpose

Wild Wings Ecology was contracted to undertake bat surveys and produce an ecology report and management plan for Natural England's 'Bats in Churches Project' (funded by Heritage Lottery Fund). The church assessed was St Andrews, Deopham in Norfolk. This report details the surveys that were undertaken and proposes a management approach to help reduce the impact of the bats on the church whilst minimising risks to the church's bat population.

2.2. St Andrew's Church, Deopham

2.2.1. Location

St Andrew's Church is located to the east of Church Road in the village of Deopham (population c. 500 people), Wymondham, Norfolk, NR18 9DG (grid reference: TG 04991 00477), see Figures 1 & 2. The church is within the district of South Norfolk, in a rural location. The immediate vicinity of the church has a number of mature trees, providing shelter, beyond which is an agricultural landscape.

The only statutory designated site within 2 km of the church is Sea Mere, Hingham, Site of Special Scientific Interest (SSSI), located approximately 1 km to the north-west of the church. The SSSI contains a large natural lake, grazing marsh, fen and deciduous woodland and is designated primarily for its diverse and species-rich habitats and ornithological interest¹.

Two non-statutory designated sites are situated within 2 km of the church: Hackford Marshes and Wicklewood Mere County Wildlife Site (CWS, ref. 149) is approximately 1.5 km to the north-east and Moneyhill Meadow CWS (ref. 160) is approximately 1.8 km to the west of the church.

2.2.2. Statement of Significance

Statement of Significance (2018), provided by the church:

"The embattled west tower of St Andrew's, one of the best in the county, is a very impressive structure and, at 100 feet, a landmark for miles around. It was built about 1450 in the Perpendicular style and extensively repointed at the end of the 20th century after being struck by lightning. The first stage of the tower has a base course with a quatrefoil motif; on the fronts of the buttresses shields are inserted into the quatrefoils,

¹ <https://designatedsites.naturalengland.org.uk/PDFsForWeb/Citation/1003834.pdf>

while the quatrefoils on the diagonal connections contain roses. The shields bear arms of the benefactors who contributed towards building the tower.

The buttresses on the tower are unusual in being 'set back' instead of the more usual 'angle' buttresses. On the western corners they are joined by connecting fillets which makes a sufficiently massive corner to include a turret stair. The buttresses go to the top and end in octagonal turrets.

A frieze on the string course just above the level of the west doorway has a continuous trail of vine leaves.

There is a considerable use of flint and stone 'flushwork' to decorate the buttresses, pinnacles and battlements.

The interior is spacious and well lit. In addition to a wide nave there are north and south aisles and a large chancel. There is no longer a screen between chancel and nave giving a unity and openness to the building.

The font has a variety of tracery motifs on the bowl and is probably 15th century.

The Rix memorial in the north-east corner relates that the Rev. Henry Rix, who died in 1728, left £60 to be laid out in lands to be put into trustees' hands for the teaching of four poor children to read and say the Church Catechism and for a sermon to be preached once yearly on the day of his death.

There are three piscinae.

The Nicholson organ is regularly maintained and used.

There are still 5 bells in the tower although only one of these can be used by means of a hammer to the outer rim. The bell frame is no longer strong enough to support the other bells although they remain in the belfry.

The pews are of an unusual design and are believed to pre-date their reordering in the nineteenth century.

The churchyard is still in use and well maintained by members of the community. Some families can trace their ancestry back through many generations of burials. The area to the north of the church is kept for wildflowers. There are several ancient yew trees.

The church is the most visually prominent building in the village."

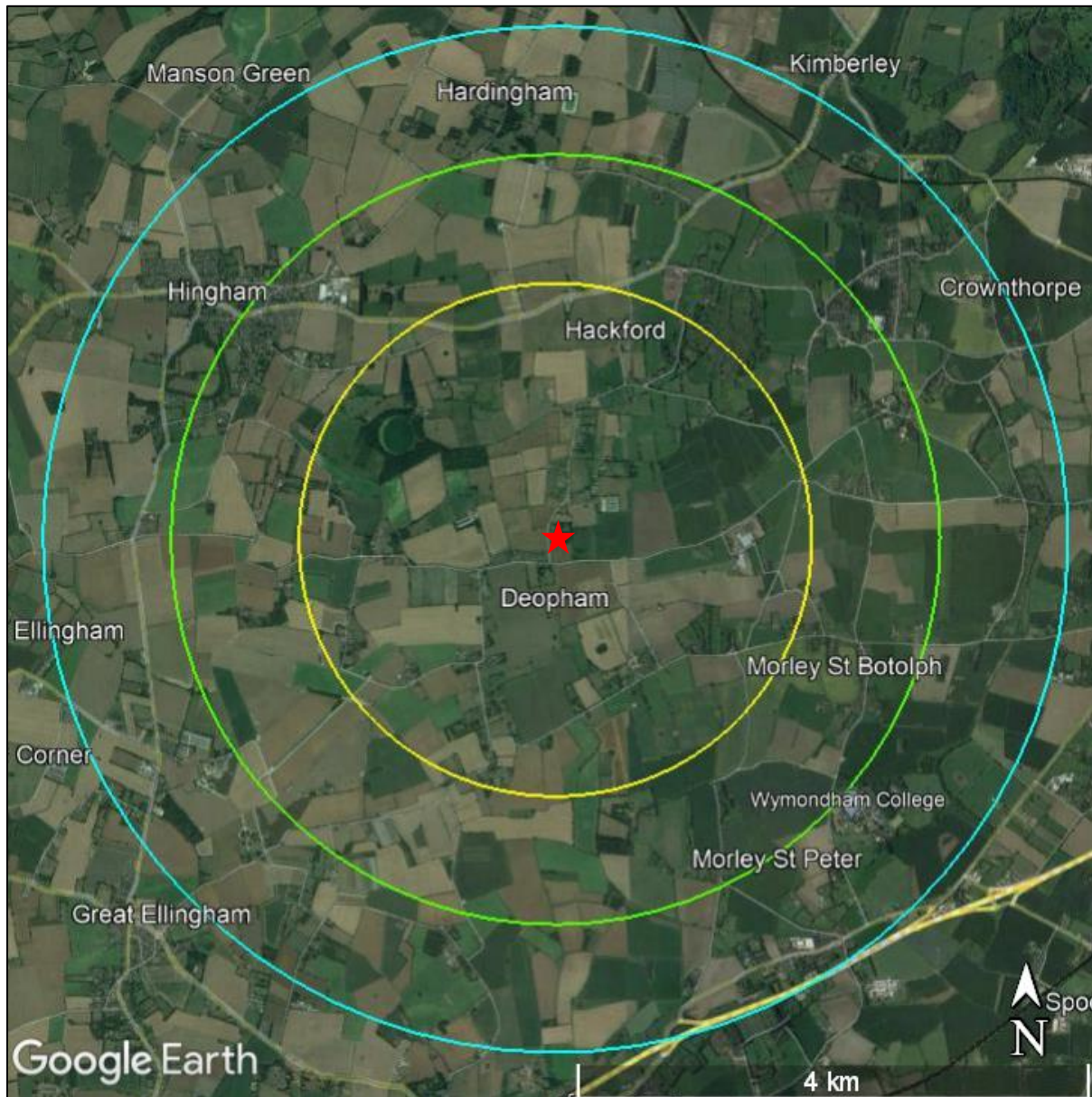


Figure 1. Location (landscape scale) of St Andrew’s Church, Deopham (red star) on Google Earth Pro 2021 aerial image. Yellow circle indicates the 2 km radius Core Sustenance Zone² (CSZ) around the church for common pipistrelles, green circle indicates the 3 km radius CSZ for soprano pipistrelles and the blue circle indicates the 4 km CSZ for the Natterer’s bat colony.

²“A Core Sustenance Zone refers to the area surrounding a communal bat roost within which habitat availability and quality will have a significant influence on the resilience and conservation status of the colony using the roost.” (Bat Conservation Trust, 2016).

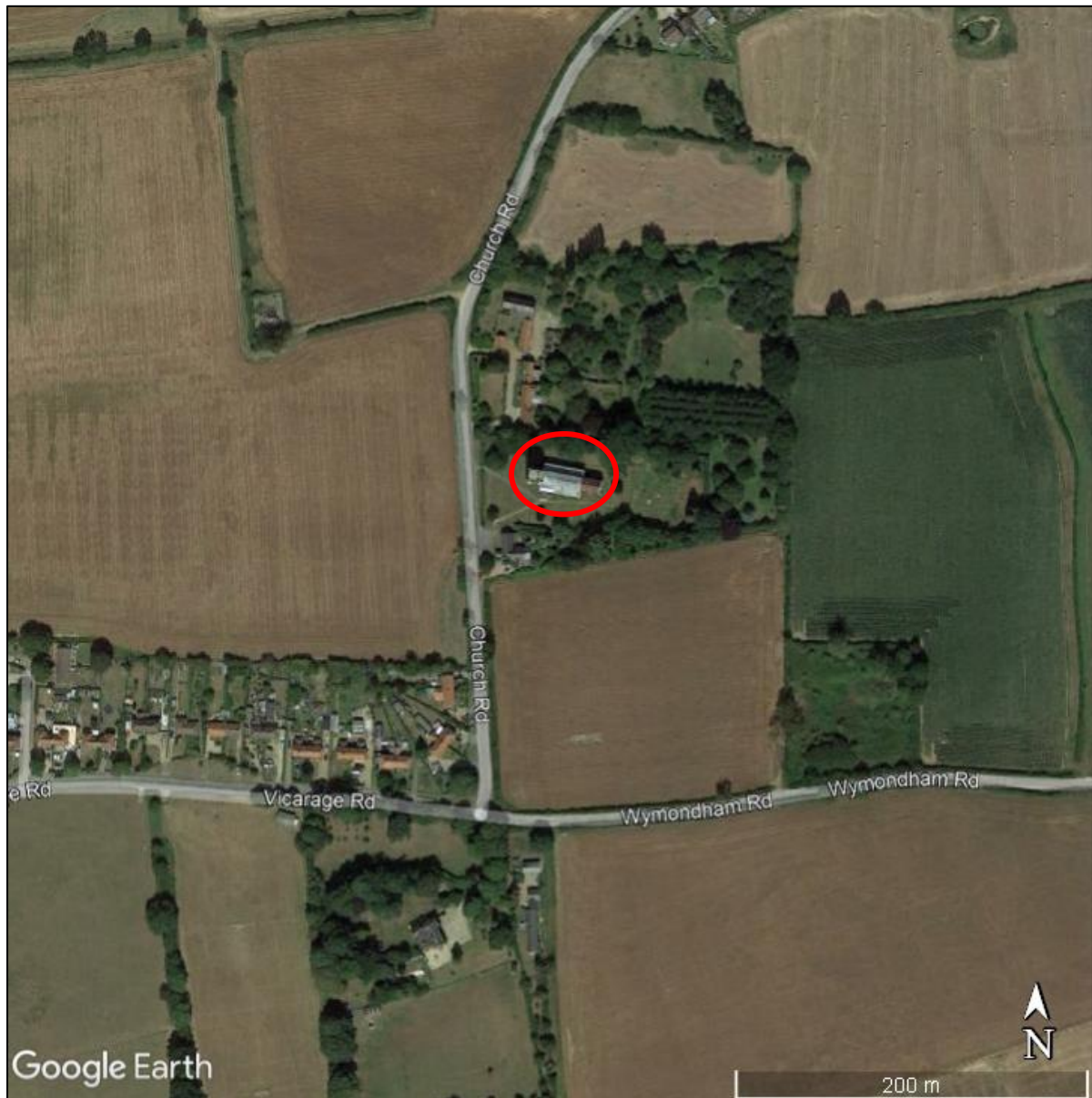


Figure 2. St Andrew's Church, Deopham (circled in red) with surrounding habitats - Google Earth Pro 2020 aerial image.

2.2.3. History of bat use/previous bat survey work

The church was subject to bat surveys in 2009 by Philip Parker Associates in relation to repair works (Philip Parker Associates, 2009) and was subsequently part of the University of Bristol Defra-funded research on mitigating the impacts of bats in churches (2011-2013, Zeale *et al.* 2014) – which trialled use of acoustic deterrents at the church.

Relevant findings from Defra Research Project: Improving mitigation success where bats occupy houses and historic buildings, particularly churches (Zeale *et al.* 2014):

- Deopham Church estimated colony size 60-80 Natterer's bats (2011-2013).

- Long-term acoustic deterrents were trialled at Deopham Church from July to September 2013. The deterrents were effective in keeping Natterer's bats away from specific roost locations, whilst the bats continued to roost elsewhere inside the church.
- For all Natterer's bats radio-tracked at eight church study sites (these did not include Deopham):
 - Bats roosted almost exclusively in the church buildings
 - Within the churches, bats had numerous roost locations and switched roosts frequently
 - Roosts outside of the church were typically single-occupancy tree roosts
 - Average emergence time was 85 ± 38 minutes after sunset
 - Bats foraged for a total of 373 ± 57 minutes
 - Individual bats were faithful to exclusive foraging patches
 - Bats returned well before sunrise, mean 114 ± 37 minutes before sunrise
 - Bats were rarely recorded night-roosting, with foraging usually in a single session
 - Night-roosting events lasted on average for 27 ± 13 minutes
- The study concluded that Natterer's bats are likely to be highly dependent on church roosts and if forced out may struggle to find suitable alternative colony roosts.
- Population models suggest that should exclusion/intervention result in even a small reduction in survival rates (e.g. due to becoming energetically stressed) or reduced productivity (perhaps more likely) there would be a declining growth rate for the colony.
- Potential negative impacts of exclusions on the Favourable Conservation Status³ of church Natterer's bat colonies are highlighted in light of the above two points.

Bat surveys undertaken by Philip Parker Associates in relation to repair works to the north aisle and cleaning of the belfry. A visual inspection was undertaken in March and August 2009 and dusk and dawn bat activity surveys in July 2009.

- Estimated maximum 50 Natterer's bats (moderate-sized maternity roost) – a number of different roost sites used; south aisle favoured but nave and tower also used. Main access via north-west corner of the chancel.

³Article 1(i) of the EU Habitats Directive defines the conservation status of a species as "*the sum of the influences acting on the species concerned that may affect the long term distribution and abundance of its populations*" and states "**conservation status will be taken as 'favourable' when: population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats...**".

- Estimated maximum 12 common pipistrelles (possible small maternity roost). Main access via the west (tower) door.

3. Methodology

3.1. Visual inspection

A detailed daytime visual inspection of the church was undertaken on the 29th April 2021 by Dr Charlotte Packman (see Table 1 for surveyor details). The visual inspection provided an update to the 'Light Touch Survey' which was completed on 25th September 2017 (using the 'Bats in Churches Heritage Lottery Fund Heritage Grant Bat Roost Visit Report Form', see Appendix 1, attached as a separate document as contains personal details).

The visual inspection updated information on bat usage of the building (probable species, impacts, photos and observations). A torch, endoscope, binoculars, camera and ladder were available for use during the inspection.

An initial meeting was held prior to the visual inspection, attended by:

- Churchwardens Kathleen Flowerday and Angela Phoenix
- Church Architect Ruth Blackman
- Bats in Churches Project staff: Engagement Officer Diana Spencer and Heritage Advisor Rachel Arnold
- Ecologist Charlotte Packman

3.2. Bat activity surveys

Bat activity surveys were undertaken between May and August 2021, following the Bats in Churches Class Licence Survey Criteria (see Appendix 2). The activity surveys sought to identify/confirm species using the church, bat numbers, roost locations, exit and re-entry points and observe behaviour (both inside and outside the church).

Dusk emergence surveys were undertaken on: 12th May, 27th July and 17th August 2021. Dusk emergence surveys are best suited to obtaining accurate counts (most, if not all the bats, are likely to emerge during the survey and in a manner that is relatively easy to count), determining exit locations, species and, internally, roost locations. Note that where a bat is recorded re-entering the church during an emergence survey, the subsequent bat to emerge (if applicable and if of the same species) is not counted to avoid potentially counting the same individual emerging more than once during a survey, thereby giving a minimum count as the total.

The dawn re-entry survey was carried out on 20th July 2021. The dawn re-entry survey focussed on assessing bat activity inside and outside of the church, identifying/confirming species using the church, roost locations, entry points and observations of behaviour. Dawn surveys are less well suited to reliably recording numbers of bats roosting at a church. This is because accurate counts of bats re-entering at larger roosts can be difficult due to 'dawn swarming' behaviour and because some bats will almost certainly have already returned to the roost before the survey

commences. Note that where a bat is recorded emerging from the church during a re-entry survey, the subsequent bat to re-enter (if applicable and if of the same species) is not counted to avoid potentially counting the same individual re-entering more than once during a survey, thereby giving a minimum count as the total. The dawn survey took place later than the planned May to mid-June period due to poor weather necessitating repeated cancellations and re-scheduling.

Survey details, including surveyors, timings and weather conditions (which were suitable), are provided in Table 2.

Four-six surveyors were present for each survey to observe potential bat access/roost locations on the building's exterior, with one surveyor always positioned inside the church for the duration of the survey (see Table 1 for surveyor details and credentials). Each surveyor was equipped with an infrared camcorder (Canon XA11/20) and the building's exterior and interior subject to infrared floodlighting to provide excellent visibility in the dark, without disturbing the bats. Where necessary, infrared camera footage was subsequently reviewed using VLC Media Player. Surveyors were also equipped with full spectrum recording bat detectors (mostly Wildlife Acoustics Echo Meter Touch). Where verification was needed, bat call recordings were subsequently reviewed using Kaleidoscope Viewer (Wildlife Acoustics). Surveyors also utilised two-way radios to corroborate observations between surveyors and especially for comparing exterior and interior observations during surveys (e.g. exterior versus interior exit and re-entry locations and determining if any roosts were exterior roosts only). Tally counters were used to aid accurate recording of numbers.

Table 1. Surveyor names, initials (as used in Table 2) and credentials.

Surveyor name & qualifications	Initials	Bat licences held	Licence numbers
Dr Charlotte Packman BSc (Hons), MSc, PhD CEcol ¹ MCIEEM ²	CP	Bats in Churches Class Licence (CL32, Level 2) Bat Mitigation Class Licence (CL21) Level 3 Bat Survey Class Licence (CL19) Level 4 Bat Survey Class Licence (CL20)	B32RC001 RC155 2015-16479-CLS-CLS 2015-11760-CLS-CLS
Ben Jervis BSc (Hons), MSc MCIEEM ²	BJ	Level 2 Bat Survey Class Licence (CL18)	2016-25752-CLS-CLS
Christine Hipperson BSc (Hons) MCIEEM ²	CH	Level 2 Bat Survey Class Licence (CL18)	2015-16077-CLS-CLS
Holly Nichols BSc (Hons)	HN	Level 2 Bat Survey Class Licence (CL18)	2020-44423-CLS-CLS
Karl Charters BSc (Hons)	KC	Level 2 Bat Survey Class Licence (CL18)	2015-13353-CLS-CLS
John Worthington-Hill BSc (Hons), MSc	JW	n/a	n/a
William Soar BSc (Hons)	WS	n/a	n/a
Sarah Morrison BSc (Hons), MSc	SM	n/a	n/a

¹CEcol = Chartered Ecologist (with the Chartered Institute for Ecology & Environmental Management)

²MCIEEM = (full) Member of the Chartered Institute for Ecology & Environmental Management

Table 2. Bat activity survey timings (24 hr), weather conditions and surveyors (see Table 1 for surveyor details).

Dusk/ dawn survey	Date	Survey timings			Weather conditions				
		Sunset/ sunrise	Survey start	Survey end	Start temp. (°C)	End temp. (°C)	Precipitation	Windspeed (Beaufort Scale)	Cloud cover (%)
Dusk 1	12/05/21	20:40	20:25	22:20	11	9	Nil	0	60
Surveyors: CP, HN, JW, KC, BJ, CH									
Dusk 2	27/07/21	20:56	20:41	22:32	14	12	Nil	2	80
Surveyors: CP, BJ, KC, JW, CH									
Dusk 3	17/08/21	20:19	20:00	22:15	14	12	Light drizzle	3	100
Surveyors: JW, KC, SM, CH, BJ									
Dawn 1	20/07/21	04:58	02:58	04:58	14	13	Nil	0	5
Surveyors: CP, KC, SM, WS									

4. Results

4.1. Visual inspection

Refer to the St Andrew's Church, Deopham 'Light Touch Survey' 'Bats in Churches Heritage Lottery Fund Heritage Grant Bat Roost Visit Report Form' from 25th September 2017. This contains personal details (names and addresses etc.) and therefore is not included here but is attached as a separate Appendix (1). The findings from the original Light Touch Survey and updated survey of 29th April 2021 are summarised here and, for the visual inspection element, in Figure 3. Photographs of the church are provided in Appendix 3.

St Andrews is a large medieval flint church with lead (nave, aisles and porch) and peg tile (chancel) roof coverings. Long-term impacts of bat presence can be seen throughout the church: staining/bleaching from bat droppings/urine on floor tiles, walls, pews, organ pipes, rood screen (removed from its original position and stored inside the church in sections), decalog boards (at west end of nave/tower), ledger stones and memorials.

At the time of the visual inspection, fresh Natterer's bat-type droppings were concentrated (indicative of roost locations) at the east end of the nave (beneath the central ridge beam, particularly below truss apexes), east end of the south aisle, north wall and west end of the south aisle, north wall. The main access point for the probable Natterer's bats (with droppings adhered to the walls on the interior and exterior) was at the west end of the chancel, north side (at eaves level). There were also some Natterer's bat-type droppings adhered to both sides of the tower/west door and, to a lesser extent, to the south door, suggesting these doors are also used for access.

There was a concentration of pipistrelle droppings (wall and floor) at the west end of the south aisle, suggesting a probable roost location here. The tower/west door and tower floor had a large number of pipistrelle droppings, indicating that this is their main access point (also a small number of pipistrelle droppings on the south door, indicating a minor access point).

The church appears highly 'bat-porous' with many potential access points at eaves level along the nave, aisles and chancel as well as over doors.

The church representatives described concerns about bat droppings and urine (hygiene as well as the substantial cleaning burden they create) and staining to floors, pews and monuments. Measures taken to date to try to manage the impact of bats on the church include plastic sheet coverings, cleaning and acoustic deterrent trials (Zeale *et al.* 2014, see 2.2.3). Coverings and cleaning are not sufficient to mitigate the damage from droppings and urine and are not sustainable or manageable in the long-term.

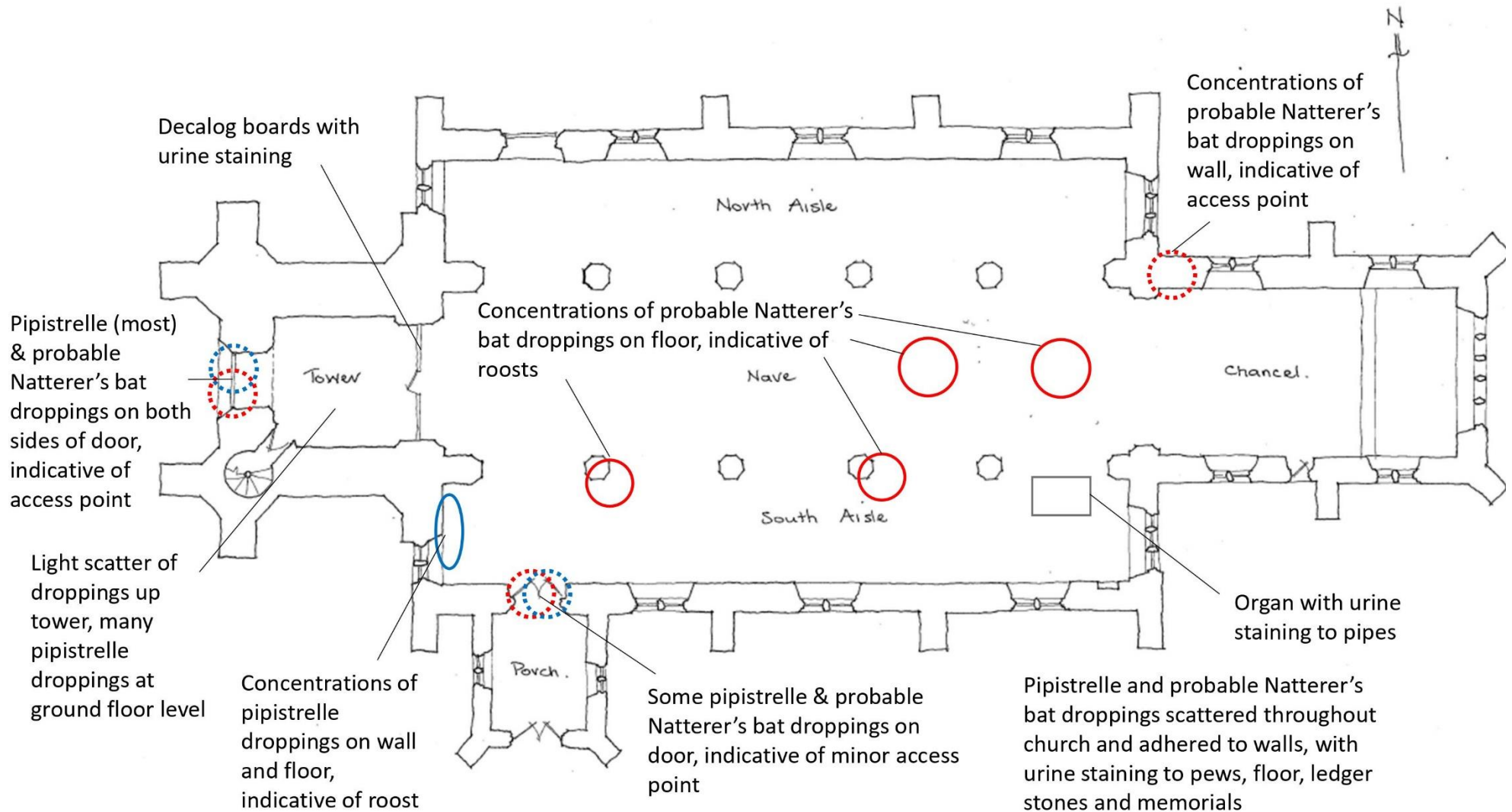


Figure 3. Visual inspection results (shown on church plan by Birdsall, Swash & Blackman Ltd). Probable roost areas circled (solid line) in red (for Natterer's bats) and blue (for pipistrelles). Probable access points circled with dashed line, species colours as for roosts.

4.2. Bat activity surveys

The highest count for Natterer's bats was recorded during the 27th July dusk survey. A total of 58 Natterer's bats were counted. The behaviour of the bats indicated that the young were volant at this stage and most were emerging from the church. The main roost areas for the Natterer's bats are above the central ridge beam of the nave (mostly at the truss apexes) and in particular the eastern end appears to be favoured (R1 in Figures 4 & 5A). There is also a roost in the south aisle, on the north wall, eastern end (R2, Figure 4 & 5B).

The Natterer's bats utilise three main entry/exit points to/from the church interior: at eaves level at the east end of the south side of the nave (labelled A1 on Figures 4 & 5A), at eaves level at the west corner of the north side of the nave (A2, Figures 4 & 5C and over the tower/west door (A3, Figures 4 & 5D). The preferred entry point is A1, which was also the preferred exit during the first (May) survey only (no observed use during subsequent emergence surveys). Smaller numbers also entered at A2. For the July and August dusk surveys, A2 was the preferred exit location, with smaller numbers also existing from A3.

The highest count for common pipistrelles was 34, during the July dawn re-entry survey. Most of these re-entered over the tower door (A3, Figures 4 & 5D). Smaller numbers recorded re-entering from the exterior on the south side of the nave and aisle (see Figure 4) were not recorded re-entering on the interior side, suggesting these may be exterior roosts. The major exit point for the common pipistrelles was also at the tower door (A3), with individual bats also exiting at multiple locations along the south side of the nave (and aisle), which are thought to be possible exterior roosts (see Figure 4). A small pipistrelle roost was confirmed on the south side of the central nave at a truss (R3, Figures 4 & 5A) during the dawn survey.

A maximum of six soprano pipistrelles were recorded, during the August dusk survey, with smaller numbers present for the other surveys. Their main access point is over the tower door (A3, Figures 4 & 5D). Individual soprano pipistrelles were observed exiting/entering from the exterior side at the north and south sides of the nave and north aisle, which may be exterior roosts only (see Figure 4).

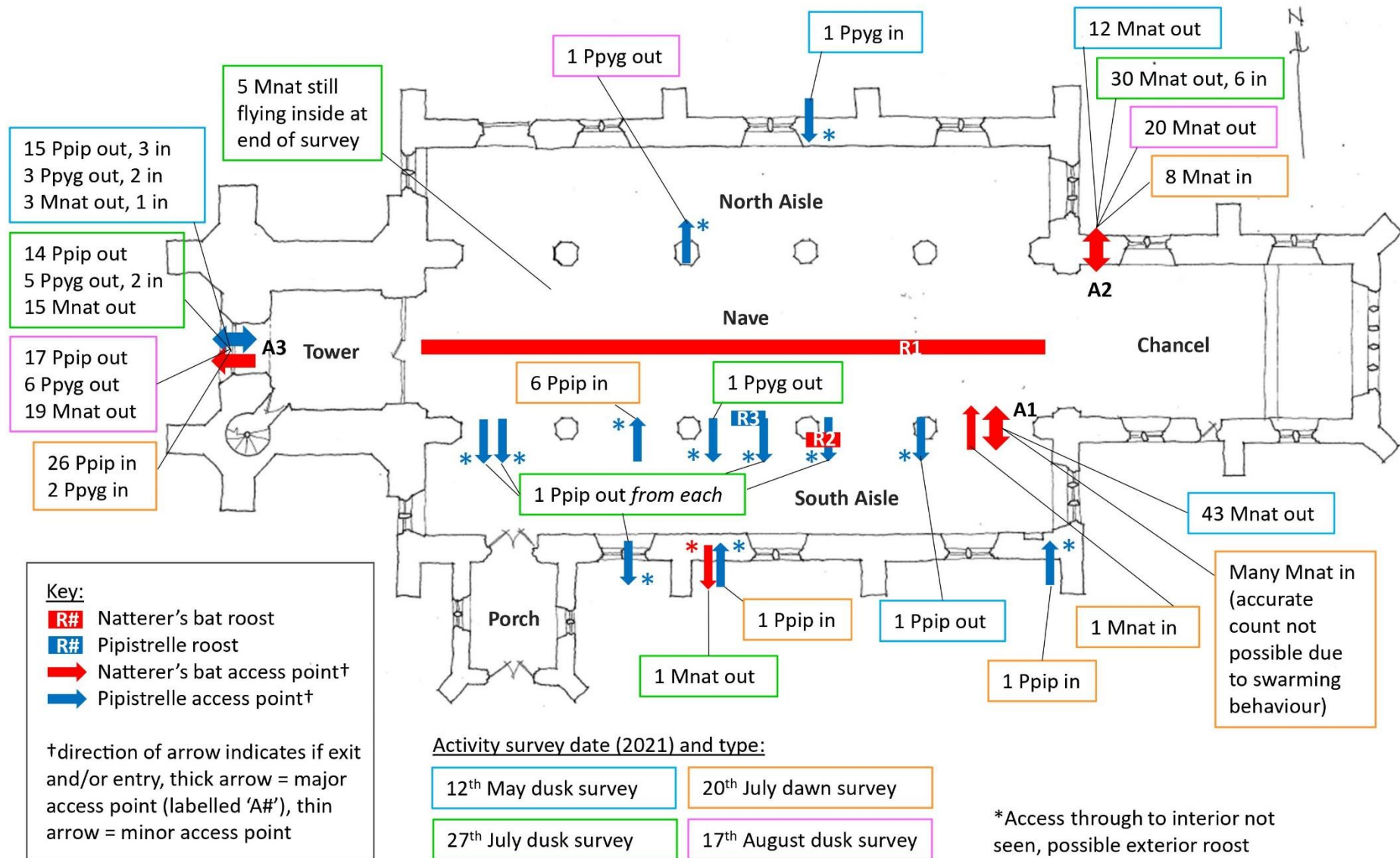


Figure 4. Bat activity survey results: access points (exit and/or entry indicated) by species (see key) and numbers observed for each survey. Main roost areas identified during activity surveys are also shown by species. Species abbreviations: Mnat = Natterer's bat, Ppip = common pipistrelle, Ppyg = soprano pipistrelle. Results shown on church plan by Birdsall, Swash & Blackman Ltd.

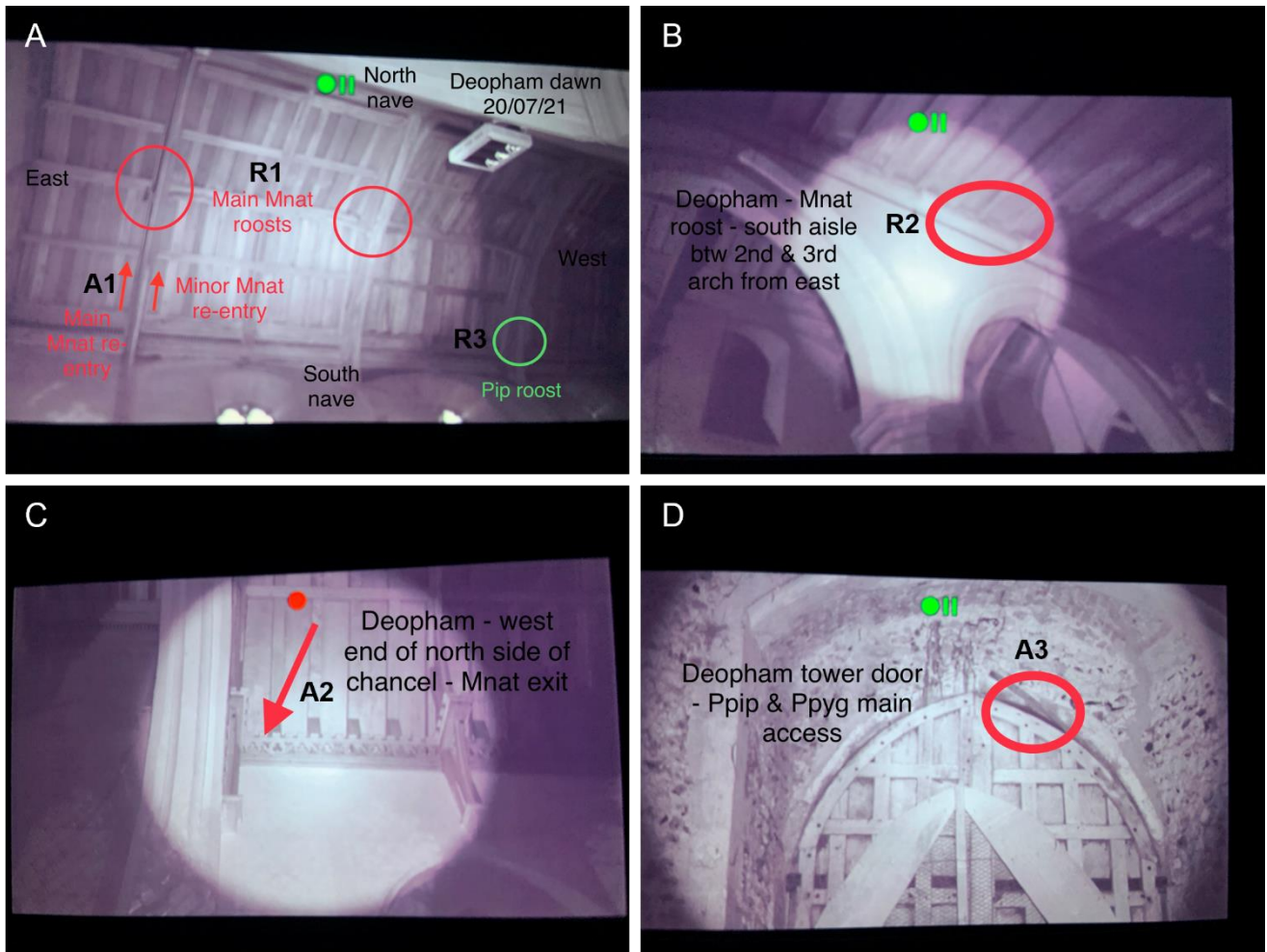


Figure 5. Annotated infrared photos taken during activity surveys showing interior roost locations and access points. Roosts (Rx) and main access points (Ax) are labelled as in Figure 4.

5. Discussion

The data show that St Andrews is home to a medium-sized maternity colony of Natterer's bats (peak count 58), although its importance may be elevated when looked at in the context of significant declines in Natterer's bat populations at a number of Norfolk churches over the last 10 years. Philip Parker Associates (2009) recorded up to 50 Natterer's bats during surveys at the church in 2009 and Zeale et al. (2014) reported an estimated colony size of 60-80 Natterer's bats (see 2.2.3), indicating that numbers have remained broadly consistent over the last 12 years.

There is also a probable small maternity colony of common pipistrelles present (peak count 34) and small numbers (up to six) of soprano pipistrelles using the church as a (non-maternity) day roost. Philip Parker Associates (2009) did not record soprano pipistrelles at the church and the estimated maximum number of common pipistrelles was lower in 2009, at 12 individuals.

Main roost locations for Natterer's bats (eastern end of the south aisle (north wall) and nave) and common pipistrelles (south side of the nave) are broadly similar to those identified in 2009 (Philip Parker Associates). Similarly, as in 2009, the pipistrelles were mainly using the tower/west door for access and the Natterer's bats the eaves access at the west end of the north side of the chancel. However, an additional major access point was identified for Natterer's bats during the 2021 surveys, at eaves level on the southern side of the nave, east end. This is of particular importance as this now appears to be the major entry location for Natterer's bats into the church interior (while the chancel access remains a key exit location). The Natterer's bats were also found to be using the main pipistrelle access over the tower door. Multiple pipistrelle access points were located on both sides of the nave and aisles but most of these are thought to be probable exterior roosts only. However, it is evident that the church is highly 'bat-porous' with many potential access points throughout.

5.1. Proposed management plan

Progress meeting

At a progress meeting on 29th September 2021 (attended by the Churchwardens and PCC members, the Church Architect Ruth Blackman, Bats in Churches Engagement Officer Diana Spencer and Ecologist C. Packman), management options were discussed. Options are presented here. Should any of these be taken forward, the Church Architect and Ecologist will need to be consulted further and detailed specifications drawn-up.

Faculty Jurisdiction (Amendment) Rules 2019

In relation to the Faculty Jurisdiction (Amendment) Rules 2019, an assessment will need to be made as to whether works falls under List A or List B (neither requiring a Faculty,

but the latter requiring written approval from the Archdeacon) or if a Faculty is required (along with consultation of The Norwich Diocesan Advisory Committee, DAC).

Bat licence

A bat licence (Site Registration under the Bats in Churches Class Licence, administered by Natural England) may be needed, depending on the options chosen. This can be prepared and submitted by a Bats in Churches Class Licence Registered Consultant (C. Packman is registered to use this licence). Licences are time-consuming to prepare and, once submitted, Natural England typically take six weeks (can be longer) to issue the licence.

Approaches for mitigating the impacts of bats on churches

Approaches for reducing the impact of bats on churches typically fall into four main categories: 'protection', 'deterrent', 'restriction' and 'creation'.

1. **Protection** - measures to protect specific items from damage from bat droppings and urine. Likely to be most suitable where impacts from bats are relatively minor and localised. Unlikely to require a bat licence.

Example: deflector boards placed over a monument.

Advantages: typically low cost and relatively quick and easy to install.

Disadvantages: addresses the 'symptoms' but not the cause, may be more suitable as short-term measures/may not be an effective long-term solution and may require maintenance.

2. **Deterrence** – measures to deter bats from roosting at or using a specific area, typically where concentrations of droppings beneath a roost are damaging an item of heritage significance, or for hygiene reasons e.g. roost is directly above a food preparation/kitchen/children's play area. Other roost locations inside the building continue to be used.

Example: acoustic deterrent positioned beneath a specific roost location to encourage bats to move from that roost feature.

Advantages: typically low cost and relatively quick and easy to install.

Disadvantages: addresses the 'symptoms' but not the cause, may be more suitable as short-term measures/may not be effective long-term solution. Localised effect, not suitable for sites with significant widespread impacts. Requires electrical supply. Sound produced is uncomfortable for people, but the unit is used with a timer so

only operated at night (and can be switched off for any evening services). Bat licence required.

- 3. Restriction/partial exclusion** – confining the bats to specific areas around access points/preventing access to interior to limit impacts. This approach is typically coupled with blocking and (4.) 'Creation' as a 'carrot and stick' approach. Likely to be most suitable where bat impacts are substantial (large numbers of bats causing widespread damage to items of heritage significance and limiting use of the church). May only be suitable at some churches i.e. due to the church construction, layout and use, location of bat roosts and access points and species present. Restricted roost areas must provide a range of conditions and options that can support the species and roost types present at the church.

Examples: partition to confine bats to a section of the church, false ceiling to create a void that contains the bats, blocking and 'boxing-in' to confine bats to void above wall-top.

Advantages: can be very effective in removing impacts from bats (particularly where these are widespread and significant) whilst retaining roosts at the church, long-term solution, typically requires little maintenance.

Disadvantages: usually costly and 'high risk' i.e. for the church – may not be successful, for the bats – may cause desertion or impact numbers or breeding success (if restricted roost area(s) does not provide suitable conditions), can take a long time for bats to adopt/adjust. May require repeated/reactionary blocking to achieve desired result. Blocking of highly 'bat-porous' churches is unlikely to succeed. Needs close monitoring to ensure bat welfare is not harmed and to maximise the likelihood of success. Typically requires a phased approach over the course of at least a year. Requires a bat licence.

Examples of churches where this approach has been successful: All Saints Church, Braunston-in-Rutland and St Nicholas Church, Stanford on Avon (both with soprano pipistrelle maternity colonies which have been maintained at the churches but without access to the interior).

- 4. Creation** – provision of new roosting opportunities/'enhancements' at or in close proximity to the church. 'Carrot no stick' approach (typically where partial exclusion/blocking is not feasible but impacts are significant and widespread, also appropriate for medium to high conservation significance roosts).

Example: provision of a large maternity bat box on church exterior, construction of rafter bat boxes, opening-up of putlog holes on building's exterior, creation of suitable conditions and roost features in tower.

Advantages: lower risk to bats compared to 'restriction' (no forced exclusion) and therefore does not require intensive monitoring, not limited by bat roost locations or access points, likely to be less costly and more easily achievable than 'restriction', may not require a bat licence (e.g. if creation is not at existing access points or roost areas).

Disadvantages: no reduction in impact on church until new roosts adopted, which typically takes several years and success is by no means guaranteed (i.e. new roosts may not be adopted) – however if new roosts are at least partially adopted, could be followed-up with some 'restriction'/blocking if appropriate (licence required).

Examples of churches where this approach has been successful: St Nicholas Church, Stanford on Avon (soprano pipistrelle maternity colony adopted large, heated exterior bat box on north side of church – but it was several years before the maternity colony moved into the box).

Options for St Andrews (a combination of options may be chosen), see Figure 6:

1. Protection

- Deflector 'hood' to be fitted over decalog boards to reduce staining/bleaching from urine and dropping deposition by flying bats.
- Rood screen sections to be placed together and protected by a deflector 'hood' or cover to prevent staining/bleaching from urine and dropping deposition by flying bats.

These should be cost-effective measures to help protect items of heritage significance from further damage whilst allowing time for 'creation' measures to be found by bats.

2. Deterrence

- Unlikely to be suitable for the church.

3. Restriction/partial exclusion

- Exclusion of bats from the interior is very unlikely to be feasible for this large, highly 'bat-porous' church, with many potential access points, therefore would be unlikely to succeed and probably prohibitively costly.
- Unlikely to be suitable for restricting bats to a specific area of the church.
- However, restriction of some access points could encourage uptake of below 'creation' options:
 - Fitting a one-way excluder (on exterior side) or blocking the north-west corner of the chancel access (A2) could encourage uptake of rafter bat boxes by Natterer's bats (see below, phased approach e.g. one-way excluder fitted after bats have had a season to find/use the rafter bat boxes). Access may be possible by ladder.
 - Fitting a second set of 'false' doors on the inside of the tower door (with a roost space created between the two sets of doors).

4. Creation

- Opening-up (creating an access slot) into exterior putlog holes on multiple elevations. Natterer's bats are known to use these features at other medieval churches in Norfolk (including maternity use and even where they could also access the interior e.g. Wood Dalling, Narborough, Thompson and Great Bircham Churches, Philip Parker pers. comm.). This should be relatively inexpensive and may be completed with planned inspection works.
- Construction of one or two rafter bat boxes at the Natterer's bat main access on the south side of the nave (connected to the access points – 'restriction'). These are discreet/blend in well so should not be visually obtrusive. Heating not required as on south elevation. Higher costs associated with high level access required (cherry picker or scaffolding).
- Construction of a suitable bat box for common pipistrelle maternity use in the arch above the tower door – to be coupled with 'restriction' by installation of false doors in front (restriction can be controlled/phased by having doors open for the first season, allowing the bats time to find and become accustomed to the new roost, or until some use of the box is confirmed). Box would benefit from heating (installation of a reptile vivarium type heater inside the box).
- Addition of bat boxes to church exterior to provide a range of suitable roost features for both Natterer's bats and pipistrelles. Stone-coloured Greenwood Ecohabitats boxes would blend in well and could be positioned at eaves level along the south aisle (access may be possible by ladder).

Poster can be produced for the church to display for visitors with information about the bats and mitigation approaches being used.

Monitoring methods

- Regular activity surveys (and visual inspections) to check numbers, access locations, roost locations, uptake of artificial roosts and progress towards reducing impact. For licensed works, the requirement is for a minimum of two visits per season (pre- and post-maternity) for five years post-works. More intensive monitoring may be needed short-term, following works.
- Roost cameras could be fitted to the pipistrelle box and/or rafter bat boxes, providing footage for the church to use/a feature of interest and also enabling monitoring of box use. Requires an electrical supply to the boxes.
- May be possible to monitor some putlog holes and bat boxes with camera traps and/or physical inspection using a ladder (where reachable) and endoscope to check for signs of bat use.

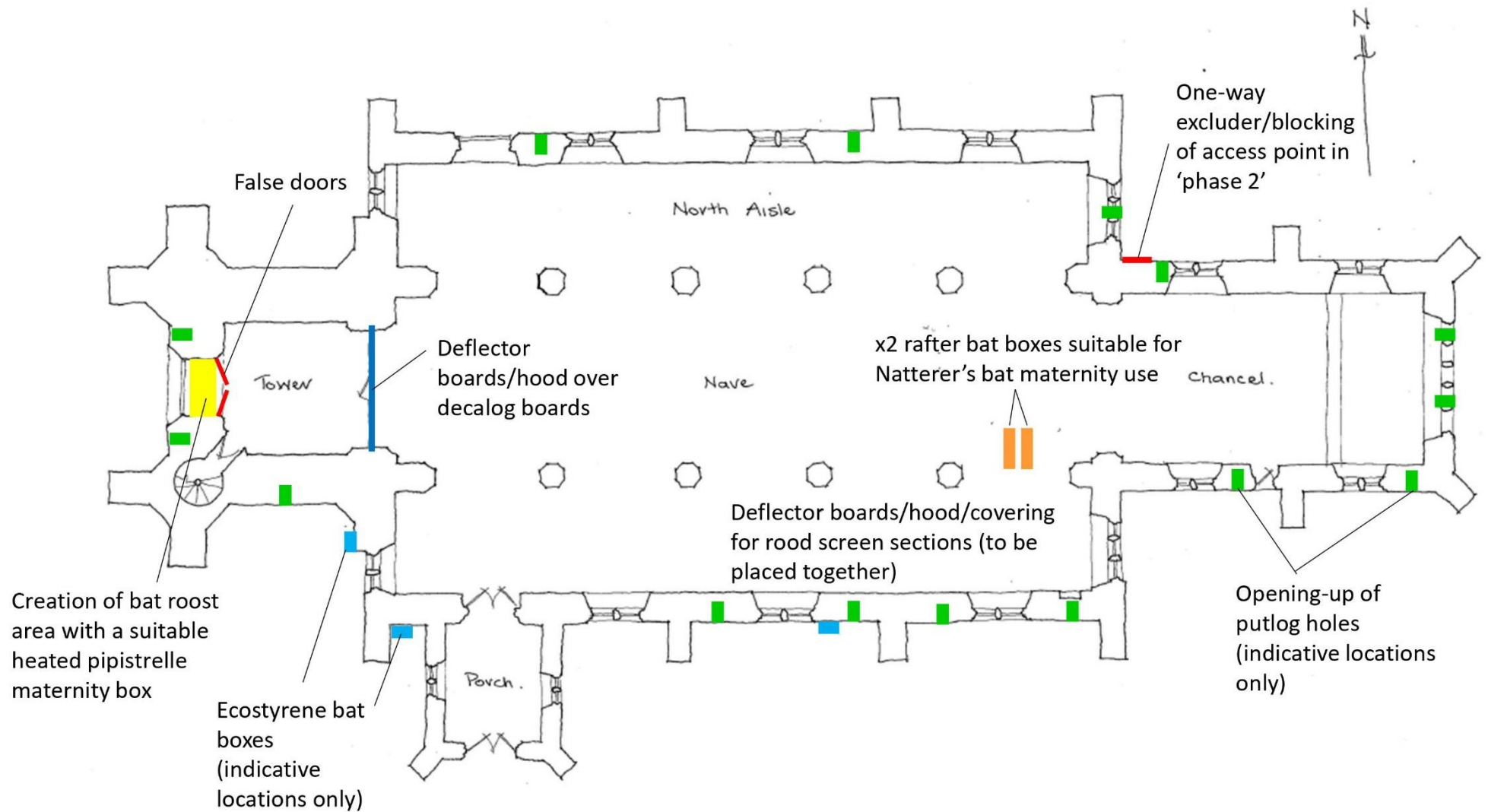


Figure 6. Annotated church plan (plan by Birdsall, Swash & Blackman Ltd) showing locations of management intervention options.

It is important to recognise that there are no guarantees that the management options will be effective in significantly reducing the impact of bats on the church: bats can behave in unexpected ways and these approaches have not been fully tested before. It is also important to note that it typically takes several years for bats to start using newly created/artificial roosts and bat boxes. However, with a detailed understanding of how bats are using the building, the proposed approaches are considered to be the most appropriate, with the highest chance of success and which balance the need to protect both the church and the bat populations.

The proposed approaches will provide a range of different roost options and conditions, thereby maximising the likelihood of uptake by the bats and minimising the risk of impacting negatively on the bat population. **Comprehensive monitoring is essential to assess the effectiveness of the approaches both in terms of reducing the impact of bats on the church *and* protecting the bat population (i.e. has Favourable Conservation Status been maintained?), to assess if any adjustments to measures are required and also to determine the suitability of approaches to help other churches in future.**

Cost estimates are provided in a separate Appendix (4, Excel spreadsheet). For accurate costings for capital works it will be necessary to obtain quotes from contractors.

6. References

Bat Conservation Trust (2016) Core sustenance zones: determining zone size. Bat Conservation Trust, London. Available at

https://cdn.bats.org.uk/pdf/Resources/Core_Sustenance_Zones_Explained_04.02.16.pdf?mtime=20190219173135&focal=none

Philip Parker Associates (2009) St Andrew's Church, Deopham, Norfolk - Bat survey and assessment in respect of proposed repair works. Philip Parker Associates, King's Lynn.

Zeale, M.R., Stone, E., Bennitt, E., Newson, S., Parker, S., Haysom, K., Browne, W.J., Harris, S. and Jones, G. (2014) Defra Research Project WM0322 Improving mitigation success where bats occupy houses and historic buildings, particularly churches. Final Report. Available here:

<http://randd.defra.gov.uk/Default.aspx?Menu=Menu&Module=More&Location=North&Completed=2&ProjectID=17863>

Appendix 1: Bat Roost Visit Report Form, Sept 2017

'Bats in Churches Heritage Lottery Fund Heritage Grant Bat Roost Visit Report Form' – completed 25th September 2017.

Submitted as a separate document as includes personal details.

Appendix 2: Bats in Churches Class Licence Survey Criteria

Natural England - minimum survey standards for site registration

The following survey standard describes the **minimum** survey effort required to enable registration of a church for the Bats in Churches Class Licence.

1. High quality survey data, accurately reflecting the usage of the building by bats, must be presented representing at least one full active season.
2. Places of worship will vary considerably in size and structural complexity so methods, techniques and frequency of surveys used must be appropriate and adjusted to suit each situation. Survey methods chosen should maximise collection of information. Surveys should continue until the relevant level of information has been collected.
3. At least four surveys, comprising three dusk and one dawn survey, and one thorough physical inspection, must have been completed for each church applying to be registered in the season prior to starting licensable works. Larger and more complex buildings might require a greater survey effort both in terms of numbers of surveys and numbers of surveyors involved.
4. Surveys should be undertaken in the optimum period for bats (as stated in the BCT Good Practice Guidelines) between May-August. At least one dusk activity survey must be presented from each of the following periods and each survey must be conducted at least two weeks apart:
 - a. May to mid-June;
 - b. Mid-June to end July; and
 - c. August to mid-September.
5. Survey data must be presented from the most recent active season prior to the start of works. If licensed works are planned to begin post maternity period and before the following spring, and a full suite of surveys was conducted the previous year, an update survey will be required during early or mid-maternity period in the year that work is to commence.

6. If surveys meeting the requirements were not undertaken in the active season preceding the intended start of works, but were undertaken within 3 years, a reduced survey effort will be acceptable. In these cases a minimum of two update surveys (one of which must be a dusk survey) will be required. Update surveys should be undertaken between May and August but both may be undertaken earlier in the year i.e. pre or during the maternity period, to allow work to take place immediately prior to or after the maternity season.
7. The mandatory dawn survey must be conducted during the early survey period between May and mid-June. It may be timed to take place directly after an emergence survey.
8. A surveyor must be present inside the building during a dawn survey to identify internal access points.
9. If during the update surveys it is identified that usage of the building by bats has changed significantly, any pre-agreed approach to mitigation must be re-appraised.
10. All major entry and exit points for bats on the exterior of the building *must* be identified. Entry and exit points on the interior of the building *should* be identified.
11. Surveys must identify species of bat and approximate numbers of bats of each species using the building. If breeding roosts are present, this will include a clear understanding of where nursery clusters form and how these and all other roost sites within the building are accessed.
12. Special attention should be given to establishing if access to the interior void of the building is required to access roosting locations or if these locations can be accessed by bats directly from the exterior.

Appendix 3: Photographs (general)



Photo 1. Southern elevation.



Photo 2. Northern elevation.



Photo 3. Nave interior (from west end facing east).



Photo 4. Chancel interior (facing east).



Photo 5. South aisle (from west end facing east).



Photo 6. North aisle (from west end facing east).



Photo 7. Decalogue boards (between tower and west end of nave).



Photo 8. Tower/west door (main pipistrelle access, also used by Natterer's bats). Potential location for false doors to create an enclosed pipistrelle roost area between the two sets of doors (with the addition of a large, heated bat box).



Photo 9. Tower door exterior.



Photo 10. Porch.



Photo 11. Urine bleaching to floor tiles.



Photo 12. Urine staining to pews.



Photo 13. Section of rood screen.

Appendix 4: Budget/estimated costs

Attached as a separate Excel spreadsheet document.