Marble Hill Park, Twickenham Proposed Improvement Works

Combined Bat Survey Report 2016-2018

English Heritage

August 2018

CONTENTS

1. EXECUTIVE SUMMARY

1.1 BACKGROUND

English Heritage and its project team (led by J & L Gibbons) is currently in the process of applying for a planning application for improvement works to Marble Hill Park. These improvements are to include the renovation of several of the park's buildings (notably the Coach House) as well as the demolition of minor build structures (i.e. the park's Pagoda and two out-buildings, i.e. a disused Toilet Block and the ticket shed).

In addition, the proposed scheme encompasses restoring parts of the park to its 1752 and later 18th century condition. This element of the works will involve re-modelling of the 4 woodland quarters adjacent to Marble Hill House (including selective tree felling and surgery).

Initially in 2015, a Preliminary Ecological Appraisal report was conducted and prepared by Land Management Services (LMS, 2015). This report stated that further bat survey work would be required.

Subsequently, J & L Gibbons on behalf of English Heritage and the project team initially commissioned FOA Ecology Ltd to commence bat survey work in September 2016 and continue the bat work through the 2017 and 2018 bat survey seasons.

1.2 SCOPE OF BAT SURVEY WORK

The following bat survey work has been undertaken to inform the proposed scheme:

- 2016 Bat detector surveys of Marble Hill House, Coach House, Grotto and Ice House
- 2017 Collation of bat records
- 2017 Buildings (internal and external) inspection
- 2017 Ground-level tree assessment
- 2017 & 2018 Bat detector surveys of buildings B1 (Coach House), Building B3 (Ticket Office) and Building B4 (Disused toilet block) *NB – 1 remaining bat detector survey (during the pipistrelle mating window) is yet to be conducted for the Coach house B1 – scheduled for September 2018*
- 2017 & 2018 Bat detector surveys of 6no. trees (Arb. Trees G9.17 [FOA T10], G9.10 [FOA T13], G9.7, G8.31 [FOA T31], G8.53 and Arb tree T12)
- 2018 Climbing inspections of 5no. trees (Arb. Trees G9.17 [FOA T10], G9.10 [FOA T13], G9.7, G8.53 and Arb tree T12; G8.31 [FOA T31] was found to not be present)
- 2017 Bat activity surveys (monthly from June 2017 – October 2017), comprising walking transects and static detector deployment

This combined report provides the methods, results, conclusions and recommendations for the further bat survey work.

1.3 MAIN SURVEY FINDINGS & RECOMMENDATIONS

Buildings B1 (Coach House)

Pre-existing Furesfen Ecology Bat Survey Report for Coach House - 2011

Furesfen Ecology carried out bat survey work of the Coach House on behalf of English Heritage in 2011, in relation to other proposed minor roof restoration works (Furesfen Ecology, September 2011).

The 2011 bat work (external building inspection and 2 separate dusk detector surveys using 2 surveyors, 12th August 2011 and 1st September 2011), led by Alison Fure MSc CEnv MCIEEM identified that the Coach House possesses high potential for roosting bats. No direct evidence of bats (e.g. bat droppings) were found on the exterior of the building and no bats were observed to emerge from the Coach House. That said, soprano pipistrelle bats were encountered shortly after sunset, indicating the presence of a nearby roost.

During this bat survey work Furesfen Ecology encountered up to 5no. bat species were also encountered as follows:

- Soprano pipistrelle
- Common pipistrelle
- *Nyctalus* species, possible noctule
- long-eared species bat (single pass)
- *Myotis* species bat (single pass)

Survey work 2016 - 2017

No roosting bats were identified (observed and / or detected) to emerge from the Coach House, during the initial dusk emergence bat detector survey on 26th September 2016.

In addition to the abundant soprano and common pipistrelle passes, passes by Nathusius' pipistrelle were also detected.

In terms of the Nathusius' pipistrelle, this species was detected during the 22nd September detector survey of the Coach House (on 2 occasions) though the earliest detection was not especially 'early' (i.e. soon after sunset) being at 30 minutes after sunset. That said, Nathusius' pipistrelle's emergence window can be relatively later than that of common and soprano pipistrelle.

The second Nathusius' pipistrelle echolocation pass detected included a single characteristic Nathusius' pipistrelle advertisement call (a call which is made by a male individual most frequently during the mating season), specifically an unseen pass was detected by Surveyor D positioned at the south-eastern corner of the Coach House on 22nd September 2016 at 19:44 pm, i.e. 46 minutes after sunset. This may pertain to a mating call from a male Nathusius' pipistrelle; September falls within the mating season for this species.

It is known from research internationally that Nathusius' pipistrelle male bats can make advertisement calls either during songflight (i.e. whilst on the wing) at a mating site or else whilst stationary within the mating roost itself at the mating site.

It is relevant, however, that research has shown (John Russ, www.nathusius.org.uk/) that in England, this species characteristically calls from a stationary mating roost site, instead of using song-flight to attract a mate.

It should be re-iterated however that only a single advertisement call was detected, as opposed to constant mating calls throughout the duration of the survey.

Only a single faint Nathusius' echolocation pass was encountered during the July bat activity survey, namely at listening stop LS-G, i.e. along the park's southern boundary adjacent to the River Thames.

No Nathusius' pipistrelle social calls were associated with this single Nathusius' pipistrelle pass.

Further, no Nathusius' echolocation or social calls were detected during any of the other 2017 bat survey work either in the vicinity of the Coach House or elsewhere.

Accordingly, it is concluded that no evidence was gained to support the presence of a Nathusius' pipistrelle mating site and mating roost nearby to the south-eastern corner of the Coach House during 2017.

In terms of the *Nyctalus* species passes, all these passes were detected at times significantly outside (later than) these species typical emergence windows and so do not pertain to bats emerging from the surveyed buildings.

No roosting bats were identified (observed and / or detected) to return to roost to the Coach House, during the dawn return to roost bat detector survey on 26th July 2017 and no Nathusius' pipistrelle passes were encountered during this survey.

To summarise, therefore, no direct evidence of use of building B1, the Coach House, in 2017 by roosting bats was identified by the 2017 survey work. Therefore, it can be concluded that building B1 did not support a maternity roost during summer 2017 nor have any non-breeding summer roosts or mating roosts been identified in 2016 / 2017, including by Nathusius' pipistrelle.

Survey Work 2018

For the 16th July 2018 dusk survey, emergence of small numbers of pipistrelle bats from building B1, the Coach House, was observed:

- 3 soprano pipistrelles from eastern (front) elevation (in the region of the central gable façade)

The Coach house has therefore been confirmed to support a small non-breeding soprano pipistrelle summer roost in 2018.

No works are proposed at or in close proximity to the identified soprano pipistrelles' emergence location.

Accordingly, no bat licence is deemed necessary in respect of the proposed works to the Coach House; instead a non-licensed method statement (including external light spillage minimisation etc) will be sufficient to ensure that the proposed works due not materially disturb or have any other indirect effects on the identified roost.

To confirm, no Nathusius' pipistrelle passes were encountered during this survey.

The yet to be conducted September 2018 bat detector survey will investigate any occurrence of Nathusius pipistrelle at or within the immediate vicinity of the Coach House during the pipistrelle mating window.

This specific 2018 pipistrelle mating season survey visit is scheduled to occur in September, i.e. after the submission of the planning application – the results of which will be provided as a brief addendum page report.

The need for and scope of any bat mitigation (licensed or non-licensed) required for the Coach House will be informed by the September 2018 bat detector survey results and the nature of the proposed works to the Coach House.

In addition, preparation of a formal external light spillage minimisation strategy for the Coach House will be required.

Building B2 Coach House store

No direct evidence of use of this building by roosting bats has been identified by the building inspection of B2. This building is to be retained, with no structural changes proposed.

This building, however, will have a change of use and insertion of fittings and equipment as dry storage for catering and shop stock.

A pre-works repeat building inspection and a single dusk detector survey is recommended to determine the presence / likely absence of roosting bats in advance of the proposed increased level of usage of this storage building.

Building B3 (Ticket Office) and Building B4 (Disused toilet block)

No direct evidence of use of any of these buildings by roosting bats has been identified by the survey work undertaken in 2017.

Therefore, it can be concluded that none of these buildings have supported a maternity roost during summer 2017 nor were any non-breeding summer roosts identified in 2017.

No further specific pre-approval bat survey work is deemed required for these buildings.

The following measures will nonetheless be required:

- Repeat pre-demolition bat survey work, should in excess of 2-3 years lapse between the survey work and the proposed demolition date
- formalisation of contractor awareness of roosting bats in relation to demolition works and a protocol in the unlikely event that a roosting bat or bats are encountered
- provision of bat boxes for loss of potential roost sites

Building B5 Sports Hall

No direct evidence of use of any of this building by roosting bats has been identified by the building inspection and since it only possesses modest bat roost potential (negligible to low), no specific bat detector survey work is required according to the published guidelines. Further, only minor external works are proposed to this building as part of this scheme, none of which are understood to impact upon the modest identified bat roost features, in particular the ivy covering is to be retained.

Should it become necessary to remove this ivy covering, further bat survey work and / or mitigation measures would be required.

Building B6 Pagoda

No direct evidence of use of any of this structure by roosting bats has been identified by the building inspection and since it only possesses modest bat roost potential (negligible), no specific bat detector survey work is required according to the published guidelines.

Nonetheless, with regards to the Pagoda's proposed demolition, a pre-works repeat inspection of this structure should be undertaken to check for roosting bat evidence and additionally, as good practice,

contractor awareness of roosting bats in relation to demolition works should be formalised and a protocol in the unlikely event that a roosting bat or bats are encountered should be prepared.

Marble Hill House – B7

No emergence of roosting bats was observed for the 22nd September 2016 of Marble Hill House.

Additionally, no direct evidence of use of this building by bats has been identified by the 2018 internal and external inspection of roof spaces (including static deployment in the uppermost roof space) and basement areas.

No further specific pre-approval bat survey work is deemed required for this building, which is not understood to be subject to any direct structural works.

The following measures will nonetheless be required:

- Reducing the external lighting spillage upon and immediately adjacent to this building as far as is reasonably practicable
- Consideration of providing bat enhancements

Ice House – B8

No emergence of roosting bats was observed for the 27th September 2016 of Ice House.

Additionally, no direct evidence of use of this building by bats has been identified by the 2016 internal and external inspection of this ice house.

No further specific pre-approval bat survey work is deemed required for this building, which is not understood to be subject to any direct structural works.

The following measures will nonetheless be required:

- No lighting of or light spillage onto this building as far as is reasonably practicable
- Consideration of providing bat enhancements

Grotto – B9

No emergence of roosting bats was observed for the 27th September 2016 of the Grotto, despite the identification of a single small-sized bat dropping within the Grotto.

No further specific pre-approval bat survey work is deemed required for this structure, which is not understood to be subject to any direct structural works.

The following measures will nonetheless be required:

- No lighting of or light spillage onto this building as far as is reasonably practicable
- Consideration of providing bat enhancements

Arb. Trees T12, G9.17 [FOA T10], G9.10 [FOA T13], G9.7, G8.31 [FOA T31] and G8.53

No direct evidence of use of any of these trees by roosting bats has been identified by the survey work.

During the 2017 and / or 2018, none of these trees were found to support a maternity roost nor have any non-breeding summer roosts been identified.

The summer 2018 tree climbing inspection similarly did not identify any direct evidence of roosting bats for the 5 surveyed trees (i.e. Arb. Trees T12, G9.17 [FOA T10], G9.10 [FOA T13], G9.7, and G8.53; Arb G8.31 was no longer present), all of which (barring Arb G9.10) were assigned both low maternity and hibernation potential and moderate day / transitional roost potential and overall Moderate potential. Tree Arb G9.10, by comparison has been afforded Moderate maternity and day/transitional roost potential and low hibernation potential, but still overall Moderate potential.

It should be noted that there were significant limitations to the inspection of two trees (Arb G9.17 and Arb G9.7) which could not be climbed due to safety concerns.

No further specific pre-approval bat survey work is deemed required for these trees.

In terms of recommendations, a suite of mitigation measures will nonetheless need to be adopted for the proposed felling / tree surgery works for these trees, on account of both the limitations accounted for 2 of the trees and the nomadic nature of the use of trees by bats as detailed in the main report, including:

- repeat pre-felling bat survey work, should significant time lapse between the survey work and the proposed felling date for each tree in question
- a sensitive approach to felling, and, where necessary, a sensitive timing of the felling works (including accounting for nesting birds)
- formalisation of contractor awareness of roosting bats in relation to the felling works
- provision of bat boxes for loss of potential roost sites

Walking Transect Bat Activity Survey Work

To summarise, the bat activity survey work has demonstrated that several bat species forage within and traverse through the park, with activity dominated by soprano and common pipistrelles and 'big bat' species (noctule, Leislers and / or serotine) with a minority of passes pertaining to Nathusius' pipistrelle and *Myotis* / long-eared bat species.

It is evident therefore that bat activity is dominated by bat species which are not sensitive to night-time light levels (i.e. pipistrelles and big bat species). However, light sensitive species (*Myotis* / long-eared species) do also use the park. Indeed, the frequency of occurrence of *Myotis*/long-eared species within the park is likely to be underestimated by the survey work due to the reduced detectability of these species' echolocation calls.

In terms of the relative usage of the park, bat activity has been encountered throughout the park, mainly associated with edge habitats (i.e. tree lines and woodland edges) but also open habitats (e.g. noctule bats were observed foraging at height above the Great Lawn).

It should be noted, however, that although the results appear to indicate that relatively greater bat activity was encountered in the vicinity of the woodland quarters, this is considered to in part be due to the fact that the woodland quarters were subject to relatively higher survey effort (i.e. a higher density of listening stops were positioned within and adjacent to the woodland quarters; the aim of the bias in survey effort was to maximise the chance of encountering relatively rarer and relatively more quiet echolocating bat species in the vicinity the proposed works areas).

However, even taking the survey effort bias into consideration, it is considered that the woodland quarters, in particular the tops of the tree canopies and the dark protected edge habitat created by the woodland edges, constitute a regular and well used foraging / commuting resource for bats within the

context of the park. The Western Avenue (which links the woodland quarters to the site's southern boundary tree line) also is evidently regularly used by bats.

The other edge habitats present in the wider park, i.e. the tree lines and edge habitats along the park's north, south, east and western boundaries are similarly used frequently and relatively equally, with no apparent specific foci of activity encountered for these other edge habitats during the walking transects.

To clarify, the walking transects did not incidentally identify any significant roosts or any movements of large numbers of bats.

Static Bat Monitoring Survey Work

For the static bat monitoring survey work, in summary, in all cases bat activity is dominated by pipistrelle species, typically being dominated by soprano pipistrelle, though on occasion common pipistrelle or pipistrelle sp. (with peak frequency intermediate of common and soprano pipistrelle) dominate.

A minority of passes pertained to other bat species, namely 'big bat' species (noctule, Leislers, serotine and / or *Nyctalus* sp.).

No *Myotis* sp. or long-eared sp. bat passes were detected during the static monitoring, despite both species having been detected incidentally during either emergence survey work and / or during walking transect survey work. The lack of detections of *Myotis* sp. or long-eared sp. bat is considered to be attributed to the reduced detectability of these typically quiet echolocating species, rather than indicating their absence; indeed, their occurrence at least at low levels has been confirmed by other bat survey work.

Comparing the total number of bat passes at the same locations in different months, the total number of passes is found to be highly variable.

Southern park boundary, adjacent to the River Thames

The greatest volume of bat activity (492 passes) was recorded along the tree line on the southern boundary of the park, adjacent to the River Thames. This is to be expected since the River Thames and the habitats immediately adjacent to it is known to be an important foraging and commuting corridor for local bat populations. Indeed, Richmond's Species Action Plan for bats lists several important sites for bats and includes on this list the River Thames corridor; Marble Hill Park itself lies along this corridor.

Further, in recognition of the importance of this corridor for bats, in recent years funding was procured to establish bat-friendly lighting along Warren's Footpath (Warren Footpath Lighting Project, Thames Landscape Strategy in Action! London's Arcadia Draft Report February 2009, Francesca Morrison) which is the footpath which lies between the southern boundary of Marble Hill Park and the River Thames itself.

It has therefore been necessary to safeguard use of this corridor by bats, as part of the scheme. Although early scheme designs included removal of trees from the southern boundary of the park, given the importance of the connectivity of this linear tree line to bats, the project team agreed to amend the scheme to allow for retention of these trees.

Edge of south-west woodland quarter

The static location at the edge of the south-west woodland quarter in September 2017 recorded a comparable (relatively) high volume of bat activity (489 passes) to that adjacent to the River Thames,

though a comparatively lesser volume of activity was detected at this same position on the edge of the south-west woodland quarter (113 passes) in August 2017, indicating temporal variation in bat activity levels at the same location from month to month.

Other woodland quarters

For the other woodland quarters, levels of bat activity varied from relatively minimal activity (4 passes) in the north-western woodland quarter (in June 2017), through modest activity (18 passes in September 2017 and 20 passes in October 2017) at the edge of the south-east quarter to relatively moderate activity (74 passes in October 2017 and 266 passes in July 2017) for the north-eastern woodland quarter and 122 passes for Western Avenue in August 2017.

Despite the temporal and local positional variation in activity levels, it is evident from the static data that the woodland quarters collectively (i.e. the areas for which works are proposed) and the Western Avenue (i.e. no tree felling is proposed along this avenue) provide a foraging resource for local bat populations and also provide corridors for the local bat populations to move between their roosts and foraging areas further afield, including potentially across the River Thames to foraging habitats beyond, e.g. Richmond Park.

In conclusion, the retention and / or re-creation of the existing bat foraging resources as well as the retention and / or recreation of the linear flight features (edge habitats) and the connectivity of these various edge habitats (tree lines and edge habitats of the woodland quarters) across the park, as well as in the maintenance of current night-time lighting levels, if not a reduction (and adoption of a formal external light spillage minimisation strategy), are considered to be necessary to safeguard the continued existing use of the park and its wider environs by bats.

1.4 Habitat Changes & Woodland Re-modelling

Works Description

The proposed restoration of the park to its 1752 and later 18th century condition will involve re-modelling of the 4 woodland quarters adjacent to Marble Hill House including selective tree felling and surgery.

The proposed tree removal works, however, have been the subject of detailed discussion within the project team and between the project team and London Borough of Richmond upon Thames, and several revisions to the scheme proposals have been made, to reduce as far as reasonably practicable any potential impacts upon bats, such iterative changes include:

- creation of relatively more thicket habitat in northern woodland quarters
- temporally staged vegetation / tree clearance in the woodland quarters (commencing summer 2019);
    - (i) woodland quarters (barring the 2 reserved areas) will undergo a programme of works over a 3-year period
    - (ii) works to the 2 reserved areas, i.e. parts of the south-east and south-west quarters will take place after this project as part of a phased approach to woodland improvements works.
- retention of all existing trees along Western Avenue

The final chosen proposed scheme, which includes significant proposed new soft landscaping / planting is expected to result in the following main changes to the existing habitats:

- Opening up of the dense and closed-canopy 4 woodland quarters (via selective tree felling and coppicing), to create a more open formal ornamental garden / parkland-like habitat, comprising of retained scattered mature standard trees, shrubs alongside newly planted avenues and palisades of trees, hedge networks, with newly created paths, flower gardens and amenity grassland

- Bolstering and widening the Western and Eastern avenues by way of planting of additional groves and avenues of new trees

- Creation of improved habitat edges, grading from the boundary woodland strips through smaller trees and wildflower edges to the formally managed amenity grassland lawns. These improved edge habitats include the creation of wide scattered tree and wildflower habitat edges at the south-east and south-west corners of the East Meadow and West Meadow, respectively, as well as either side of exiting tree line that runs E-W across the centre of the East Meadow and along the south side of the existing tree line which extends along the northern edge of East Meadow.

Short-term effects

In the short term, without specific mitigation measures (i.e. in the absence of temporally staged works, proposals for replacement / new planting and minimisation of external lighting spillage etc), the concurrent felling of numerous trees, coppicing, and clearance of existing shrubbery would constitute a major change to the existing bat habitats, including a material short-term reduction in available bat foraging resource (via tree felling, coppicing and vegetation clearance) as well as a material changes to the existing linear flight line features (i.e. woodland edge habitats).

It will therefore be necessary for the following measures to be adopted to soften and lessen these short-term habitat changes:

- Formalisation of a plan of staged tree removal and staged coppicing
- Use of mature tree / shrub specimens in replacement planting

Medium to long-term effects

In the medium to long-term, the new planting of lines / rows of trees, hedgerow networks and other proposed new planting (e.g. thicket planting, wilderness planting, shrub and herbaceous planting etc) and provision of bat boxes will functionally re-create the existing bat foraging / roosting resources as well as re-creating the linear flight features (edge habitats) and the connectivity of these various edge habitats (tree lines and edge habitats of the woodland quarters) across the park.

Assuming there is no increase in night-time lighting levels or else the adoption of a formal external light spillage minimisation strategy, and with the inclusion of bat-friendly replacement planting and provision of bat boxes, it is assessed that the proposed scheme which includes for park-wide replacement / new soft landscaping works (e.g. the creation of enhanced habitat edges) will not have an adverse effect on roosting, foraging and / or commuting bats in the medium to long-term, once the proposed new planting has matured.

1.5 MITIGATION

Building demolition/extension works and tree felling

For building demolition/extension works and tree felling, precautionary mitigation measures are proposed.

Provision of tree-mounted and building-mounted bat boxes

Provision of bat boxes is proposed to compensate for loss of suitable bat roost sites due to building demolition and tree felling.

External Light Spillage Minimisation

It will be necessary for the construction phase (including all contractor car parking areas, working compounds and storage areas) and also the operational phase of the park improvements (e.g. in the vicinity of the Coach House and all retained / proposed new habitats, including the woodland quarters) to ensure that any proposed new external lighting is subject to light spillage minimisation control measures, particularly in the vicinity of the retained and proposed new habitats and the proposed bat boxes.

Ecological input into the preparation of an appropriate external lighting spillage minimisation scheme for the new café in the Coach House with be required, encompassing collaboration between the project ecologist and the project team's lighting engineers.

The preparation of a formal lighting plan is expected to be conditioned and all relevant BCT/ILE guidelines will need to be adopted.

Retained bat roost trees

For retained trees with bat roost potential, it will be necessary to adopt a strategy to ensure that these trees' suitable bat features can safely be retained (i.e. tree surgery as necessary, as guided by a bat worker, may be required to meet H&S needs whilst retaining bat features)

Bat-friendly Plant Species

Wherever practicable, bat-friendly plants such as night-scented plants that attract flying insects, will be incorporated into the new soft landscaping scheme.

1.6 ENHANCEMENTS

Ice House

The ice house's entrance is currently entirely blocked. It is recommended that bat access and bat roosting features (i.e. wall-mounted tiles / wooden panels etc) be provided into / within the ice house, assuming providing access to bats does not compromise the survival of the rare spider reportedly found in the icehouse.

Grotto

For the existing grotto, it is recommended that consideration is given to creating additional crevice features in grotto by small-sized localised removal of mortar from brickwork at the rear / back of the grotto.

The barred locked gate should also be retained to prevent public access into the grotto itself; EH has confirmed the barred gate will remain.

Marble Hill House Basement

For the existing basement, consideration should be given to shutting off one or more of the small partition rooms in basement (including the partition room with louvred window) to encourage their use by roosting / hibernating bats. Installation of wall-mounted (tile / wooden panel) crevice bat roost features are recommended for crevice-dwelling bat species. Also, the vegetation overhanging the stairwell will need to be routinely managed / trimmed back.

Increased Linear Habitat Connectivity

It is proposed that consideration is given to, via tree and / or shrub planting (and a ground cover of tall wildflower rich grassland), creating a greater linear linkage (for the purpose of bat commuting) between the E-W tree line that partially bisects the East Meadow and the series of irregularly scattered standard trees in the southern half of the East Meadow.

1.7 CONCLUSIONS

Without any mitigation (i.e. in the absence of temporally staged works, proposals for replacement / new planting and minimisation of external lighting spillage etc) the proposed scheme has the potential to have a **moderate negative** affect on bats.

Assuming that all specified mitigation measures are implemented in full (i.e. including temporal staging of tree/vegetation works and proposals for replacement / new planting, minimisation of external lighting spillage etc), bats are likely to be safeguarded and the park-wide scheme will, in the medium to long-term, provide a **neutral to minor positive impact** on bats.

If the enhancement mitigations are additionally adopted, collectively it is likely that there will be a **moderate positive** impact on bats.

2. INTRODUCTION

2.1 DEVELOPMENT BACKGROUND

English Heritage and its project team (led by J & L Gibbons) is currently in the process of applying for a planning application for improvement works to Marble Hill Park. These improvements are to include the renovation of several of the park's buildings (e.g. the Coach House) as well as the demolition of minor build structures (i.e. the park's Pagoda and two out-buildings, i.e. a disused Toilet Block and the ticket shed).

In addition, the proposed scheme encompasses restoring parts of the park to its 1752 and later 18th century condition. This element of the works will involve re-modelling of the 4 woodland quarters adjacent to Marble Hill House including selective tree felling and surgery.

2.2 ECOLOGY BACKGROUND

Initially in 2015, a Preliminary Ecological Appraisal report was conducted and prepared by Land Management Services (LMS, 2015). This report stated that further bat survey work would be required.

Subsequently, J & L Gibbons on behalf of English Heritage and the project team initially commissioned FOA Ecology Ltd to commence bat survey work in September 2016 and continue the bat work through the 2017-2018 bat survey seasons.

2.3 SCOPE OF THE WORKS

The following bat survey work has been undertaken to inform the proposed scheme:

- 2016 Bat detector surveys of Marble Hill House, Coach House, Grotto and Ice House
- 2017 Collation of bat records
- 2017 Buildings (internal and external) inspection
- 2017 Ground-level tree assessment
- 2017 & 2018 Bat detector surveys of buildings B1 (Coach House), Building B3 (Ticket Office) and Building B4 (Disused toilet block) *NB – 1 remaining bat detector survey (during the pipistrelle mating window) is yet to be conducted for the Coach house – scheduled for September 2018*
- 2017 & 2018 Bat detector surveys of 6no. trees (Arb. Trees G9.17 [FOA T10], G9.10 [FOA T13], G9.7, G8.31 [FOA T31], G8.53 and Arb tree T12)
- 2018 Climbing inspections of 5no. trees (Arb. Trees G9.17 [FOA T10], G9.10 [FOA T13], G9.7, G8.53 and Arb tree T12; G8.31 [FOA T31] was found to not be present)
- 2017 Bat activity surveys (monthly from June 2017 – October 2017), comprising walking transects and static detector deployment

This combined report provides the methods, results, conclusions and recommendations for the further bat survey work, based upon the bat survey work undertaken between 2016 and 2018.

3. LEGISLATION

All bat species are fully protected under the Wildlife & Countryside Act 1981, as amended, Countryside and Rights of Way Act 2000 and the Conservation of Habitats and Species Regulations 2010, as amended. Taken together, this makes it an offence to intentionally or deliberately capture, kill or injure or disturb bats (whether in a roost or not), and intentionally or recklessly damage, destroy or obstruct access to their roosts. In addition, existing legislation (subsequent to the amendment of the Conservation Regulations) and planning policy is currently being re-interpreted and emerging thinking is that there is legal basis for the protection of important bat foraging and commuting habitats or else for mitigation and/or compensation for its loss.

Further, several species of bat are also Priority Species in the National Biodiversity Plan and species of principal importance for the conservation of biodiversity in England, including soprano pipistrelle and brown long-eared bat which are both known to roost in buildings (including modern buildings) and also trees, are common bat species and thus are frequently encountered during development works.

In terms of local BAPs, all bat species which are found in the Greater London area are London (regional) priority species and Richmond upon Thames (local) priority species.

In addition, the Countryside & Rights of Way (CRoW) Act 2000 affirms that Biodiversity Action Plan (BAP) species (as well as habitats) are material considerations within the planning system.

4. METHODOLOGY

4.1 BAT RECORD PURCHASE & COLLATION

The London Bat Group was commissioned in 2017 to provide their records of bat species within the local area, which are summarised within this report.

4.2 BUILDING & TREE INSPECTION METHODOLOGIES

The daytime inspection of site buildings (B1-B6) and the ground-level daytime assessment of the trees within four woodland quarters (to the east, west and south east and south west of the main Marble Hill House) was undertaken by Natural England bat survey licence holder Fleur Oliver CEnv MCIEEM along with 2 assistants on 6th February 2017. A second daytime ground-level inspection of the site trees was additionally undertaken on 10th February 2017, to survey those trees which were not inspected on the 6th February 2017, due to fading light levels.

On 27th June 2017 several additional trees were subject to a ground-level inspection, on account of recent scheme changes determining that these further trees would be affected by the scheme.

The primary aims of the building and tree inspection was to look for direct evidence of roosting bats, identify suitable bat access and roosting features and to assign each building and tree with the level of bat roost potential. This information would then allow any potential constraints with regard to roosting bats and the proposed renovation to be determined.

This inspection involved the use of binoculars, ladders, mirrors and high-powered torches, as necessary.

The inspection was carried out by a 3-person survey team (i.e. the bat survey licence holder and 2no. assistants) due to H&S issues associated with working at height, and in accordance with recently published guidelines (Collins, 2016).

Building Inspection Methodology

Specifically, for the building inspection, each of the surveyed buildings (B1—B6) were inspected both externally and internally for evidence of roosting bats:

- B1: Coach house
- B2: Coach house store building
- B3: Ticket office
- B4: Disused toilet block
- B5: Park offices / sports centre
- B6: Pagoda

For the external inspection, the perimeter of each building was walked and the exterior was assessed with the aid of binoculars and high-powered torch. Notes were made on the construction type and features providing potential access points and roosting opportunities for bats, including (but not exclusively):

- Suitable gaps beneath roof and hanging tiles;
- Suitable access points via head of gable end walls;
- Gaps created by missing mortar in brickwork;
- Gaps around lead flashing;

- Access via eaves; and,
- Access points via soffits / barge boards, etc.

For the internal inspection, the interior of each building, including any identified loft spaces, was accessed and inspected. Notes were made relating to the relevant characteristics of internal features providing potential access points and roosting opportunities for bats, including (but not exclusively):

- Suitable gaps between tiles and roofing liner;
- Access points via eaves;
- Gaps between timbers;
- Gaps around top of gable end walls;
- Gaps within roof walling; and,
- Clean ridge beams.

Bat Evidence

The following signs of bats were looked for:

- Bat droppings;
- Dark staining caused by bat faeces;
- Polished surfaces at a possible access point;
- Staining caused by the natural oils in bat fur; and,
- Scratch marks made by bat claws.

Evidence of any other protected / notable species, e.g. nesting birds, was also recorded where incidentally noted.

Assessment of Bat Roost Potential

Each of the 6 surveyed buildings (B1-B6) and the surveyed trees were then assessed as to their potential to support roosting bats and were placed into one of the six following categories:

Bat Potential Category	Description
Confirmed Roost	Evidence of roosting bats identified.
High	Building / tree with numerous potentially suitable summer roosting sites, including at least one feature that may potentially be used as a hibernaculum.
Medium	Building /tree with numerous potentially suitable summer roosting sites.
Low	Building / tree with a few potentially suitable summer roosting sites.
Negligible	Building / tree with a negligible number of potentially suitable summer roosting sites.
None	No apparently suitable roosting sites.

Inspection of other park buildings

In addition to the formal inspection of buildings B1-B6, Marble Hill House (B7), the ice house (B8) and the grotto (B9) were also subject to a similar, but informal, inspection, following the same methodology as for B1-B6.

In addition to the inspection itself, for Marble Hill House, 2no static (Anabat Express) bat detectors were deployed in the upper-most enclosed loft space of the main house between 27th July 2018 and 10th August 2018, in order to investigate any bat activity within this loft space; direct access into which was precluded for safety reasons.

Tree Inspection Methodology

Trees were assessed from ground level (using binoculars and high-powered torches, as necessary) during the daytime to identify features giving them potential to support bats.

In particular, those features that could act as roosting places were searched for, including:

- Hollow trunk / branch;
- Rot hole;
- Split branch;
- Peeling bark;
- Woodpecker holes; and,
- Dense ivy covering.

Ratings were also given for the surveyed trees if any were deemed to have features giving them potential to support bats.

4.3 Building detector Survey Work

Bat detector survey work of site buildings B1, B3 and B4 (as well as the initial single dusk surveys of Marble Hill house, the Ice House and the Grotto) was conducted in accordance with Collins 2016, adopting the required survey effort and adhering to the required minimum survey spacing:

- Building B1 – Coach House – Moderate/High potential – 1 dusk (22nd September 2016), 1 separate dawn (26th July 2017) and 1 dusk (16th July 2018); NB: *a single, yet to be conducted, September 2018 dusk bat detector survey will investigate any occurrence of Nathusius' pipistrelle at or within the immediate vicinity of the Coach House during the pipistrelle mating window.*
- Building B3 – Ticket Office – Low potential – 1 dusk survey (15th June 2017)
- Building B4 - Disused toilet block – Low potential – 1 dawn survey (16th June 2017)
- Marble Hill House – 1 dusk (26th September 2016)
- Ice house –1 dusk (27th September 2016)
- Grotto – 1 dusk (27th September 2016)

In terms of methodology, in accordance with recently published guidelines (Collins, 2016) and best practice the dusk 'emergence' survey commenced 20 minutes before sunset and continued until emergence was considered to have finished (i.e. 1.5 hours after sunset). The dawn detector survey commenced 1.5 hours before sunrise and continued until return to roost was considered to have finished (i.e. sunrise or else 15 minutes after sunrise).

The 2016 surveyor team comprised: Fleur Oliver (2015-14626-CLS-CLS), Helen Ruffhead, Sophie O'Hehir and / or Martin Hunt.

The 2017 surveyor team included Natural England bat survey licence holders Fleur Oliver CEnv MCIEEM and Mary Barnard, alongside bat surveyors Rhianna Dix, Danial Shutt and Martin Hunt.

The 2018 surveyor team included Natural England bat survey licence holders Fleur Oliver CEnv MCIEEM and Mary Barnard, alongside bat surveyor Martin Hunt.

The surveyor team used a variety of bat detectors, including time-expansion (Pettersson D240X), full spectrum (Pettersson M500 and / Batlogger) and frequency division devices (BatBox Duet and Anabat Express), with all bat calls being recorded (using Roland R-05 recorder for Pettersson D240X detector, Yoga tablet for Pettersson M500 or the Batlogger / Anabat Express itself). Following the surveys, the bat recordings were analysed using the relevant bat analysis software packages (i.e. BatSound, BatExplorer and Analook), to species level where possible.

2016 Preliminary Swarming Detector Survey Work of Possible Hibernation Sites

In 2016, 1 static Anabat Express bat detector was deployed for a minimum of 5 nights (21st to 27th September 2016) at the Grotto and another Anabat Express at the Ice House (over the same nights) in order to investigate whether these structures were being used for swarming and / or hibernation.

Following the surveys, the bat recordings were analysed using the relevant bat analysis software packages (i.e. Analook).

4.4 Tree Detector Survey Work

Bat detector survey work of the 6no. surveyed trees was conducted in accordance with Collins 2016, adopting the required survey effort and adhering to the required minimum survey spacing.

High potential:

- Arb. Trees G9.17 [FOA T10] – Mature lime – dawn (14th July 2017), dusk (3rd August 2017) and dusk (17th August 2017)

Moderate potential:

- Arb T12 – Mature horse chestnut – dawn (14th July 2017), dusk (3rd August 2017) and dusk (14th September 2017)
- G9.10 [FOA T13] – Mature dead tree - dawn (14th July 2017) and dusk (3rd August 2017)
- G9.7 – Pedunculate oak – dusk (13th July 2017) and dawn (4th August 2017)
- G8.31 [FOA T31] – Dead cherry - dusk (13th July 2017) and dawn (4th August 2017)
- G8.53 – Dead sycamore - dusk (13th July 2017), dusk (25th July 2017) and dawn (10th August 2018)

4.5 2018 Tree Climbing Inspection

A tree climbing inspection for bats of six trees (Arb T12, Arb G9.17, Arb G9.10, Arb G9.7, Arb G8.31 and Arb G8.53) was undertaken on behalf of FOA Ecology by Jon Bannon BSc MSc MCIEEM and Steve Allen, both of whom are licensed bat workers (Natural England class licence registration numbers 2015-11543-CLSCLS and CLS-11941, respectively) and are certified in tree climbing and aerial rescue.

In the first instance, trees were inspected from ground level (using a high-powered torch and close-focusing binoculars) to determine the location of potential roosting features (PRFs). Trees were then climbed with the aid of a rope and harness (or ladders, where trees were considered unsafe to climb) to allow all accessible PRFs to be checked for bats and/or secondary evidence of bats using a handheld torch and Ridgid micro CA-300 endoscope.

Detailed information on each PRF was recorded, including type of feature (classified in-line with the Bat Tree Habitat Key1), approximate height above ground, aspect and cavity dimensions. The trees were then graded and placed into a category (negligible, low, moderate or high) for their level of potential to support roosting bats.

4.6 Bat Activity Survey Work

Due to the proposed woodland quarter works a change of habitat will occur from the current closed woodland canopy in each quarter into relatively more open formal parkland / garden-type habitats. It was therefore recommended that the potential effect of this habitat change on bat species (including those light sensitive species) that use and / or roost in these woodland quarters (numerous trees with high or moderate bat roost potential have been identified within these quarters) be investigated via bat activity survey work.

The recommended bat activity survey work was designed to follow Collins 2016 to comprise both a series of night time walking transects and the deployment of static bat detectors throughout the bat survey season.

Since the extent of this woodland habitat change / modification is relatively small-scale in nature (relative to the size of the entire Marble Hill Park, within which other woodland areas are present) and given that additional (and more extensive) woodland areas occur in the environs, it is proposed that bat activity survey work need not follow the scope of published guidance (Collins, 2016) for High potential habitat but rather that the following site-specific, proportionate (relatively lesser) survey effort be adopted, as agreed with the Richmond upon Thames planning ecologist:

- One ‘walking transect’ bat activity survey per month between June and October inclusive; each activity survey to be at dusk, with one dusk/dawn
- Each month, deployment of 2 static Anabat Express bat detectors (for 5 nights) during each ‘walking transect’ bat activity survey, with the statics deployed at different locations (within the proposed impact zones) each month
- Walking Transect route to cover the entire Marble Hill Park, including woodland quarters and scheme impact areas, to investigate the relative importance of the woodland quarters and scheme impact areas, compared to the remainder of the Park
- Adoption of fixed and timed listening stops to maximise the chance of detecting quiet bat species

The start and end points and direction of travel for each of the months’ activity surveys is summarised as follows:

- 21st June 2017 Dusk – start White Lodge entrance, then LS-K, then LS-A and anti-clockwise around park to LS-L leg along southern boundary
- 25th July 2017 Dusk – start White Lodge entrance, then LS-K, then LS-A and anti-clockwise around park to LS-L leg along southern boundary
- 15th August 2017 Dusk – start LS-F, travelling clockwise and end at LS-F
- 20th September 2017 Dusk – start LS-E, travelling anti-clockwise and end at LS-E

- 21st September 2017 Dawn – start LS-L leg along southern boundary, travelling clockwise and end at LS-K
- 18th October 2017 Dusk – start LS-K, travelling anti-clockwise, and end at LS-L leg along southern boundary

In terms of methodology, in accordance with recently published guidelines (Collins, 2016) the dusk 'walkover' survey commenced at sunset and continued until at least 2 hours after sunset.

The walking transect was carried out at a slow and steady walking pace, covered the entire Marble Hill Park, including the woodland quarters and other scheme impact areas and encompassed a total of 12 fixed position and fixed time (5 minute) listening stops (LS), i.e. LS-A-L. Bat activity was also monitored whilst walking between the listening stops and all activity encountered between listening stops was recorded and the associated position mapped.

The surveyor team used a variety of bat detectors, including full spectrum (Batlogger, Pettersson M500), time-expansion (Pettersson D240X) and frequency division devices (BatBox Duet and Anabat Express), with all bat calls being recorded (using Roland R-05 recorder for Pettersson D240X detector, Yoga tablet for Pettersson M500 or the Batlogger / Anabat Express itself). Following the surveys, the bat recordings were analysed using the relevant bat analysis software packages (i.e. BatExplorer, Bound and Analook), to species level where possible.

The bat detector survey work team comprised of Natural England bat survey licence holders Fleur Oliver CEnv MCIEEM and Mary Barnard, alongside bat surveyors Rhianna Dix, Danial Shutt, Helen Ruffhead (2016), Sophie O'Hehir (2016) and Martin Hunt.

4.7 LIMITATIONS

Bat Building Inspection

In terms of survey timing, building inspections are not strictly seasonally constrained and can be carried out at any time of year. Nonetheless, the potential loss of external evidence of bats due to weathering by winter wind, rain, frost etc. can occur, making the results of the inspection less reliable and robust. Completing the survey inside of winter months increased the risk of this.

In terms of the internal inspection, for buildings B1-B6 all buildings and loft spaces were fully accessed allowing a full inspection of the roof space to be completed.

For Marble Hill House, health and safety concerns precluded direct access into its upper enclosed loft space; instead the inspection was undertaken from the loft hatch using high powered torches and close-focussed binoculars. In addition, 2 static (Anabat Express) bat detectors were deployed in this loft space to check for bat activity, to mitigate for no direct access being gained.

Daytime Ground-level Bat Tree Inspection

With regards to the tree inspection, the initial daytime ground-level inspection was conducted over winter months when deciduous trees lacked any leaves, i.e. at a time of year when any suitable bat roost features, are most readily identified; no material limitations were therefore identified for this inspection.

For the additional inspection, undertaken on 27th June 2017, dense canopy foliage (and also epicormic growth) in some instances may have obscured bat features.

On balance, however, both the building inspection and the tree inspection are considered to have been sufficiently robust to enable the survey conclusions to be reliably drawn.

Building Detector Survey Work 2016

All 4 of the dusk emergence detector surveys were undertaken in the month of September, i.e. outside of the recently published guidelines (Collins, 2016) key survey window (May to August, during which period maternity roosts may be identified) though during a month which is still considered suitable if sub-optimal (i.e. by virtue of being outside the maternity window and subject to possible poor weather).

However, the month of September, is the optimal month in which to investigate use of these buildings by roosting bats as a mating and / or transitional roost.

In terms of weather suitability in September 2016, every effort was made to schedule the detector surveys during suitable weather conditions, i.e. mild, dry and non-windy conditions. Indeed, as demonstrated in the weather table provided in the appendix, the weather conditions are considered to have been suitable.

To summarise, as the emergence detector surveys were undertaken outside of the maternity roost survey window it is not possible to conclude on the presence or likely absence of roosting bats (including maternity roosts) from the 4 structures surveyed in 2016 until the further recommended detector survey work (and recommended formal building inspection) have been completed during spring 2017.

For the swarming detector survey work of possible hibernation sites, no specific limitations were identified for this 5-night static bat detector monitoring at both the Grotto and the Ice House. However, it should be cautioned that, as for any survey, the data can only provide a snapshot of the use of a structure for the time of the survey.

On this basis, for the grotto, within which a bat dropping was found and which possesses numerous suitable bat roost features, its current use by roosting bats, including for hibernation, cannot be discounted.

Building Detector Survey Work 2017

No material limitations were encountered.

The detector surveys were all undertaken in accordance with recently published guidelines (Collins, 2016) including visits within the key window of May and August, i.e. during which period maternity roosts may be identified and also with the survey visits being separated by at least the necessary specified minimum spacing.

In addition, every effort was made to schedule the detector surveys during suitable weather conditions, i.e. mild, dry and non-windy conditions. Indeed, as demonstrated in the weather table provided in the appendix, the weather conditions are considered to have been suitable.

Building Detector Survey Work 2018

No material limitations were encountered.

The detector surveys were all undertaken in accordance with recently published guidelines (Collins, 2016) including visits within the key window of May and August, i.e. during which period maternity roosts may be identified.

In addition, every effort was made to schedule the detector surveys during suitable weather conditions, i.e. mild, dry and non-windy conditions. Indeed, as demonstrated in the weather table provided in the appendix, the weather conditions are considered to have been suitable.

Tree Detector Survey Work 2017 & 2018

No material limitations were encountered, although it is acknowledged that the dense nature of the woodland quarters made ground-level viewing of some of the highest tree features, and any associated bat activity at these locations, moderately difficult. This limitation was most notable for tree G9.7; accordingly, specific felling mitigation is recommended.

Tree Climbing Inspection 2018

The tree climbing inspection was undertaken on 27 June 2018, which is within the bat maternity period and is considered to be an optimal time of year to conduct this type of survey. Weather conditions during the inspection were hot, sunny, dry and calm (Beaufort Scale F0). There were, however, significant limitations to the inspection of two trees (Arb G9.17 and Arb G9.7), as follows:

- Arb G9.17 – 2 of the identified PRFs were not checked as tree considered unsafe to climb due to significant rot at base. Tree in leaf so not possible to fully check for additional PRF in canopy
- Arb G9.7 - Tree inspected from ladder only as not considered safe to climb. This is considered to be a significant limitation as it was not possible to check gaps under loose bark or check for PRF above ladder level due to dense foliage of from adjacent trees.

Bat Activity Survey Work

For the walking transects, no material limitations were encountered.

For the deployment of static bat detectors, equipment (Anabat Express) malfunction necessitated repeated re-deployment of the static detectors and lack of recordings on one occasion. However, static monitoring has been conducted monthly from June through to October inclusive and therefore it is considered that sufficient bat activity data will have been collected over this period to robustly identify bat activity patterns and trends across the park.

In addition, it should be noted that Anabat Express bat detectors are acknowledged to only detect a sample of the total bat activity and therefore the results should be interpreted with this in mind.

Summary

To summarise, the bat survey work conducted to date is considered to be a reliable base of information for making this report's recommendations, whilst the ongoing bat survey work (single remaining bat dusk detector survey scheduled for September 2018 during the pipistrelle mating window) will further define the scope of required mitigation measures.

5. SURVEY RESULTS

5.1 BAT RECORDS

At 2017, no records for bats are held by The London Bat Group for any of the Marble Hill buildings or park trees' themselves. However, numerous bat species records (including both roost and non-roost records) are held for the park, the park's environs and land within the 2-km search area of the park, as follows:

Bats – Roost Records

A total of 33 roost records for 4 different species are held by LBG as follows:

- Common pipistrelle – 2 records, the closest 1.1 km (from the sports block) in 2007 and the most recent in 2010, 1.9 km (from the coach house building).
- Soprano pipistrelle – 10 records, the closest and most recent 325 m (from the coach house building) in 2016.
- Pipistrelle sp. – 20 records, the closest 35 m (from the coach house building) in 1990 and the most recent in 2009, 1.3 km (from the coach house building).
- Daubenton's bat – 1 record, 1.9 km from the site in 2006.

Bats – Non-Roost Records

- Common pipistrelle – 60 records, the closest 155 m (from the south-western woodland quarter) in 1994 and the most recent in 2016, 760 m (from the south-eastern woodland quarter).
- Soprano pipistrelle – 130 records, the closest 50 m (from the Pagoda) in 2009 and the most recent in 2016, 760 m (from the south-eastern woodland quarter).
- Nathusius' pipistrelle – 17 records, the closest 270 m (from the south-eastern woodland quarter) in 2006 and the most recent in 2016, 1.9 km (from the south-eastern woodland quarter).
- Pipistrelle sp. – 56 records, the closest 135 m (from the south-eastern woodland quarter) in 2011 and the most recent in 2015, 1.7 km (from the south-eastern forest fragment).
- Noctule – 39 records, the closest 135 m from the site (from the south-eastern woodland quarter) in 2011 and the most recent in 2016, 770 m (from the south-eastern woodland quarter).
- Leisler's bat – 6 records, the closest and most recent, 490 m (from the coach house) in 2015.
- *Nyctalus* (noctule or Leisler's) sp. – 2 records, the closest and most recent 615 m from the south-western woodland quarter in 2010.
- Serotine bat – 7 records, the closest 250 m from the south-western woodland quarter in 1999 and the most recent in 2016, 760 m from the south-eastern woodland quarter
- Daubenton's bat – 44 records, the closest, 135 m in 2011 from the south-eastern woodland quarter and the most recent in 2016, 1.9 km from the south-eastern woodland quarter
- Natterer's bat – 19 records, the closest 395 m from the site in 2006 from the south-western woodland quarter and the most recent in 2016, 765 m from the south-eastern woodland quarter
- *Myotis* sp. – 33 records, the closest 200 m from the south-western woodland quarter in 2006 and the most recent in 2014, 410 m from the sports complex
- Brown long-eared bat – 8 records, the closest 135 m from the south-eastern woodland quarter in 2011 and the most recent in 2016, 760 m from the south-eastern woodland quarter
- *Plecotus* (long-eared bat) sp. – 1 record, 590 m from the sports complex) in 2008.
- Bat sp. – 8 records, the closest 220 m from the coach house in 2008 and the most recent in 2016, 1.7 km from the coach house store building.

5.2 BUILDING INSPECTION

Buildings B1-B6

As detailed in Appendix 1, no direct evidence of use by roosting bats has been identified for any of these 6 surveyed buildings B1-B6 (see Appendix 2 for building location plan). However, most of the surveyed buildings have been identified to possess some external and / or internal features that provide suitable access points / roost sites for bats.

Based upon both the identified suitable bat access / roost features and the buildings' context in the wider landscape, each building has been afforded the following bat roost potential:

- B1: Coach house Building: Moderate/High
- B2: Coach house store building: Low
- B3: Ticket office: Low
- B4: Disused toilet block: Low
- B5: Park offices / sports centre: Negligible to Low (due to ivy cladding)
- B6: Pagoda: Negligible

Given that the proposed scheme is understood to encompass the renovation, extension and / or demolition of either the entirety or else sections of 5 of the 6 surveyed buildings (building B2 is not to be structurally affected), in the event that a bat roost or roosts does / do occur within any of these buildings, the proposed works for the building(s) in question could result in an offence being committed, i.e. in the event that a current bat roost or roosts within the building is damaged/obstructed/destroyed and / or individual roosting bats are killed or injured as a result of the proposed works.

Specific proposed works as follows:

- B1 - Coach House / Stable Block – not to be demolished, but instead it will be retained and works will be limited to small areas of altered openings at ground-floor and strip out of ground-floor partitions and finishes
- B2 - Store building to the side (north) of the Coach House – not to be demolished, no structural changes are proposed (instead change of use and insertion of fittings and equipment as dry storage for catering and shop stock)
- B3 Ticket shed – to be demolished
- B4 - Disused toilet block – to be demolished
- B5 - Pagoda - will be demolished
- B6 – Sports block – only minor external works (e.g. window / door replacement); ivy cladding not to be removed as part of this scheme
- Marble Hill House – no external work or works that could impact roof / eaves / loft spaces or indirect impacts as a result of lighting
- Ice houses – no changes to the fabric
- Grotto – no changes to the fabric.

According to current published guidance (Collins, 2016), any structure with Low or above bat roost potential should be subject not only to an inspection but also detector survey work, in order to determine the presence or likely absence of roosting bats.

In line with published guidance, therefore, bat detector survey was recommended for those buildings which are both proposed to be affected by the works and which possess Low or above potential, i.e.

buildings B1 (Coach House), B3 (Ticket office) and B4 (Disused toilet block). These recommended surveys were undertaken and are reported upon in this document.

Other park buildings

No direct evidence of roosting bats was identified in either Marble Hill House B7 (including no bat activity recorded by the 2 static bat detectors in the upper loft space) in 2018 or the ice house B8 in September 2016.

A single small-sized bat dropping was, however, found within the grotto B9 in September 2016.

As stated previously, although none of these 3 structures are to be subject to any direct structural works, these buildings were subject to both an inspection and a single detector survey, in order to investigate any opportunities for enhancement of these structures for roosting bats.

5.3 Tree Inspection

The daytime, ground-level tree inspection findings and photographs are tabulated in Appendix 3 and potential bat roost tree plans are given in Appendix 4.

As described in Appendix 3, no direct evidence of use by roosting bats has been identified for any of the surveyed trees. However, many of the surveyed trees have been identified to possess some features that provide suitable access points / roost sites for bats.

Based upon both the identified suitable bat access / roost features and the trees' context in the wider landscape, the site's trees have been afforded the following bat roost potential:

- High: 3, G9.17 [FOA T10], 46 and 47
- Moderate: Arb. tree T12, G9.7, G8.53 1, 2, 4, 5, 11, 12, G9.10 [FOA T13], 14, 15, 16, 17, 21, 22, 29, G8.31 [FOA T31], 33, 42, 43, 44, 45, 48 and 59
- Low: G3.31. G7.187, 6, 8, 9, 18, 19, 20, 23, 24, 25, 26, 27, 28, 30, 32, 34, 35, 36, 37, 38, 39, 40, 41, 49, 50, 51, 52, 54, 56, 57 and 58
- Negligible: G8.32, Arb. tree nos. T47-T50, Arb. tree T56, 7, 53, 55 and 60

Given that the proposed scheme is understood to include the removal and / or surgery of some of the surveyed trees, in the event that a bat roost or roosts do occur within the effected tree(s), the proposed works would result in an offence being committed, i.e. in the event that a current bat roost or roosts within the effected tree(s) is damaged/destroyed/obstructed and / or individual roosting bats are killed or injured as a result of the proposed tree felling and / or surgery works.

Based upon a review of the Tree Removal Plan, and clarified during a site meeting with the project team,

Although the majority of potential bat roost trees are to be retained, it was determined that 6no. trees with moderate or above bat roost potential are proposed to either be directly removed as part of the woodland quarter works or else to be coppiced / subject to tree works, bulleted as follows:

High potential:

- Arb. Tree G9.17 [FOA T10] – Mature lime

Moderate potential:

- Arb T12 – Mature horse chestnut
- G9.10 [FOA T13] – Mature dead tree
- G9.7 – Pedunculate oak
- G8.31 [FOA T31] – Dead cherry
- G8.53 – Dead sycamore

According to current published guidance (Collins, 2016), any tree with Moderate or above bat roost potential should be subject not only to an inspection but also detector survey work, in order to determine the presence or likely absence of roosting bats.

In line with published guidance, therefore, further bat survey work, was recommended for the above bulleted 6no. trees and has been undertaken, with the results reported upon in this document.

To clarify, all other potential bat roost trees which are scheduled to be felled appear from the Tree Removal Plan to be either of Negligible or Low bat roost potential and, in accordance with Collins 2016, would not require further bat survey work.

5.4 Buildings Detector Survey Work

Pre-existing Furesfen Ecology Bat Survey Report for Coach House - 2011

Furesfen Ecology carried out bat survey work of the Coach House on behalf of English Heritage in 2011, in relation to other proposed minor roof restoration works (Furesfen Ecology, September 2011).

The 2011 bat work (external building inspection and 2 separate dusk detector surveys using 2 surveyors, 12th August 2011 and 1st September 2011), led by Alison Fure MSc CEnv MIEEM identified that the Coach House possesses high potential for roosting bats. No direct evidence of bats (e.g. bat droppings) were found on the exterior of the building and no bats were observed to emerge from the Coach House. That said, soprano pipistrelle bats were encountered shortly after sunset, indicating the presence of a nearby roost.

During this bat survey work Furesfen Ecology encountered up to 5no bat species were also encountered as follows:

- Soprano pipistrelle
- Common pipistrelle
- *Nyctalus* species, possible noctule
- long-eared species bat (single pass)
- *Myotis* species bat (single pass)

Building B1 – Coach House – September 2016 dusk survey

No roosting bats were identified (observed and / or detected) to emerge from the Coach House, during the initial dusk emergence bat detector survey in 2016.

However, some of the bat passes detected during the September detector survey work, were encountered very soon after sunset. In particular the earliest passes detected during the 22nd September survey of the Coach House of a soprano pipistrelle only 1 minute after sunset infers that this individual evidently roosts in the immediate vicinity of the Coach House, despite this bat not being

observed to emerge from this building itself; use of the Coach House itself by roosting bats could not be ruled out without further detector survey.

A large amount of incidental (foraging and commuting) bat activity, dominated by soprano and common pipistrelle, was encountered around the Coach House.

In addition to the abundant soprano and common pipistrelle passes, passes by the following species were also detected: Nathusius' pipistrelle, *Nyctalus* species (either noctule or Leisler's), probable Leisler's; a single possible long-eared bat pass was detected elsewhere in the park on this evening.

In terms of the Nathusius' pipistrelle, this species was detected during the 22nd September detector survey of the Coach House (on 2 occasions) though the earliest detection was not especially 'early' (i.e. soon after sunset) being at 30 minutes after sunset respectively. That said, Nathusius' pipistrelle's emergence window can be relatively later than that of common and soprano pipistrelle.

The second Nathusius' pipistrelle echolocation pass detected included a single characteristic Nathusius' pipistrelle advertisement call (a call which is made by a male individual most frequently during the mating season), specifically an unseen pass was detected by Surveyor D positioned at the south-eastern corner of the Coach House on 22nd September 2016 at 19:44 pm, i.e. 46 minutes after sunset. This may pertain to a mating call from a male Nathusius' pipistrelle; September falls within the mating season for this species.

It is known from research internationally that Nathusius' pipistrelle male bats can make advertisement calls either during songflight (i.e. whilst on the wing) at a mating site or else whilst stationary within the mating roost itself at the mating site.

It is relevant, however, that research has shown (John Russ, www.nathusius.org.uk/) that in England, this species characteristically calls from a stationary mating roost site, instead of using song-flight to attract a mate.

It should be re-iterated however that only a single advertisement call was detected, as opposed to constant mating calls throughout the duration of the survey.

Only a single faint Nathusius' echolocation pass was encountered during the July bat activity survey, namely at listening stop LS-G, i.e. along the park's southern boundary adjacent to the River Thames.

No Nathusius' pipistrelle social calls were associated with this single Nathusius' pipistrelle pass.

Further, no Nathuisus' echolocation or social calls were detected during any of the other 2017 bat surveys either in the vicinity of the Coach House nor elsewhere in the park. Accordingly, no evidence was gained to support the presence of a mating site and mating roost nearby to the south-eastern corner of the Coach House in 2016.

In terms of the *Nyctalus* species passes, all these passes were detected at times significantly outside (later than) these species typical emergence windows and so do not pertain to bats emerging from the surveyed buildings.

With regard to the possible presence of maternity roosts in 2017, as the detector surveys were carried out outside of the maternity roost survey window (May to August) it was not possible to confirm the presence or likely absence of maternity roosts from the Coach House. Instead, further survey work (in the form of additional detector survey work and a formal [internal and external] inspection) was recommended for 2017.

Building B1 – Coach House – dawn 26th July 2017

No roosting bats were identified (observed and / or detected) to emerge from the Coach House, during the dawn return to roost bat detector survey.

However, late (close to sunrise) detections of a single soprano pipistrelle (5 minutes before sunrise) and a single pipistrelle sp. bat (7 minutes before sunrise) were encountered, though were unseen and therefore did not return to roost within the Coach House; evidently these individual bats roost relatively locally.

No Nathusius' pipistrelle passes were encountered during this survey.

Building B1 – Coach House – 2016 & 2017 Summary

To summarise, therefore, no direct evidence of use of building B1 by roosting bats has been identified by the survey work 2016 & 2017. Therefore, it can be concluded that building B1 did not support a maternity roost during summer 2017 nor have any non-breeding summer roosts or mating roosts been identified in 2016 / 2017, including by Nathusius pipistrelle.

Building B1 – Coach House – 2018

For the 16th July 2018 dusk survey, emergence of small numbers of pipistrelle bats from building B1, the Coach House, was observed:

- 3 soprano pipistrelles from eastern (front) elevation (in the region of the central gable façade)

The Coach house has therefore been confirmed to support a small non-breeding soprano pipistrelle summer roost in 2018.

No works are proposed at or in close proximity to the identified soprano pipistrelles' emergence location.

Accordingly, no bat licence is deemed necessary in respect of the proposed works to the Coach House; instead a non-licensed method statement (including external light spillage minimisation etc) will be sufficient to ensure that the proposed works due not materially disturb or have any other indirect effects on the identified roost.

No Nathusius' pipistrelle passes were encountered during this survey.

The yet to be conducted September 2018 bat detector survey will investigate any occurrence of Nathusius pipistrelle at or within the immediate vicinity of the Coach House during the pipistrelle mating window.

This specific 2018 pipistrelle mating season survey visit is scheduled to occur in September, i.e. after the submission of the planning application – the results of which will be provided as a brief addendum page report.

The need for and scope of any bat mitigation (licensed or non-licensed) required for the Coach House will be informed by the September 2018 bat detector survey results and the nature of the proposed works to the Coach House.

Building B2

No direct evidence of use of this building by roosting bats has been identified by the building inspection of B2. This building is to be retained, with no structural changes proposed.

This building, however, will have a change of use and insertion of fittings and equipment as dry storage for catering and shop stock.

A pre-works repeat building inspection and a single dusk detector survey is recommended to determine the presence / likely absence of roosting bats in advance of the proposed increased level of usage of this storage building.

Building B3 (Ticket Office) and Building 4 (Disused toilet block)

No bats were observed to emerge from building B3 or return to roost into building B4 during the detector survey of each of these buildings undertaken on 5th and 16th June 2017.

Roosting bats are, therefore, concluded to be currently likely absent from buildings B3 and B4.

Building B5 Sports Hall

No direct evidence of use of any of this building by roosting bats has been identified by the building inspection and since it only possesses modest bat roost potential (negligible to low), no specific bat detector survey work is required according to the published guidelines. Further, only minor external works are proposed to this building as part of this scheme, none of which are understood to impact upon the modest identified bat roost features, in particular the ivy covering is to be retained.

Building B6 Pagoda

No direct evidence of use of any of this structure by roosting bats has been identified by the building inspection and since it only possesses modest bat roost potential (negligible), no specific bat detector survey work is required according to the published guidelines.

Marble Hill House B7

No emergence of roosting bats was observed for the 22nd September 2016 of Marble Hill House.

Additionally, no direct evidence of use of this building by bats has been identified by the 2018 internal and external inspection of roof spaces (including static deployment in the uppermost roof space) and basement areas.

No further specific pre-approval bat survey work is deemed required for this building, which is not understood to be subject to any direct structural works; instead the objective of the initial bat survey work is to investigate opportunities to enhance this building for roosting bats.

Ice House B8

No emergence of roosting bats was observed for the 27th September 2016 of Ice House.

Additionally, no direct evidence of use of this building by bats has been identified by the 2016 internal and external inspection of this ice house.

No bat activity was recorded by the Anabat Express which was deployed for a minimum of 5 nights (21st to 27th September 2016) at the Ice House to investigate whether these structures were being used for swarming and / or hibernation.

No further specific pre-approval bat survey work is deemed required for this building, which is not understood to be subject to any direct structural works; instead the objective of the initial bat survey work is to investigate opportunities to enhance this building for roosting bats.

Grotto B9

No emergence of roosting bats was observed for the 27th September 2016 of the Grotto, despite the identification of a single small-sized bat dropping within the Grotto.

The identification of a single small-sized bat dropping within the Grotto could be interpreted variably, either as a result of the cursory exploration of the crevices in the Grotto, or else as a minor (non-significant, i.e. non-maternity), occasional roost of a single bat and / or low numbers of bats, possibly used during the hibernation period.

No bat activity was recorded by the Anabat Express which was deployed for a minimum of 5 nights (21st to 27th September 2016) at the Grotto to investigate whether these structures were being used for swarming and / or hibernation.

No further specific pre-approval bat survey work is deemed required for this building, which is not understood to be subject to any direct structural works; instead the objective of the initial bat survey work is to investigate opportunities to enhance this building for roosting bats.

General Incidental Bat Detector Survey Activity

In terms of incidental bat activity encountered in the 2016 bat detector survey work, a large amount of foraging and commuting bat activity, dominated by soprano and common pipistrelle, was encountered around both the Coach House and Marble Hill House, whilst a similar amount of incidental bat activity was encountered around the Grotto and the Ice House.

In addition to the abundant soprano and common pipistrelle passes, passes by the following species were also detected: Nathusius' pipistrelle, Nyctalus species (either noctule or Leisler's), probable Leisler's and also a single possible long-eared bat pass.

In terms of incidental bat activity encountered in 2017, a moderate amount of general bat (predominantly foraging) activity was encountered during the survey work, being dominated by common pipistrelle bat passes.

Several other bat species were encountered namely: soprano pipistrelle, pipistrelle sp., noctule, *Nyctalus* species (including possible Leislers) and *Myotis* / long-eared bat species.

Incidental bat activity encountered in the 2018 detector survey work, comprised of soprano pipistrelle, common pipistrelle, pipistrelle sp. and *Nyctalus* (including Noctule) bat species.

Tabulated survey results are given in Appendix 5.

5.5 Tree Bat Detector Survey Work

Arb Trees G9.17 [FOA T10] and G9.10 [FOA T13]

No bats were directly observed to emerge from or return to roost into high-potential tree FOA T10 (which was subject to 3 separate surveys) or moderate-potential tree (i.e. subject to 2 separate surveys) T13.

During the 3rd August dusk detector survey of both trees FOA T10 and FOA T13 early single soprano pipistrelle passes were observed and / or detected, as early as 11 minutes before sunset flying at canopy level above tree FOA T13 and as early as 7 minutes before sunset a soprano pipistrelle was detected (thought unseen) by the surveyor at T10.

During the 3rd (17th August 2017 dusk survey) of tree FOA T10 (incidentally surveying FOA T13), the early passes by low number of soprano pipistrelles / pipistrelle sp. were again encountered, with the earliest detected 5 minutes after sunset by surveyor on north-east side of FOA T10.

Subsequently, during the August 2017 bat activity walking transect of the park, again low numbers (1-3no. individuals observed at any one time) of soprano pipistrelles were encountered and these appeared to be flying from the direction of the mature standard trees along the edge of the amenity grassland field to the north of the north-western woodland quarter; to clarify, these mature standard trees are not expected to be affected by the scheme (assuming adoption of external light spillage minimisation measures for construction stage and operational stage).

Based upon the survey observations and detections, therefore, it is considered that the encountered soprano pipistrelle activity close to sunset does not pertain the surveyed trees T10 and T13 but rather standard trees to the north of the north-west woodland quarter.

Trees G9.7 and G8.31 [FOA T31]

No bats were directly observed to emerge from or return to roost into moderate-potential trees (i.e. subject to 2 separate surveys) G9.7 and FOA T31.

For the dusk detector survey (13th July), the first pass bat encountered by both the surveyors at both G9.7 and FOA T31 was an unidentified bat species, i.e. an unidentified (and un-recorded) small-sized bat was observed above trees at G9.7 at 14 minutes after sunset and at FOA T31 at 20 minutes after sunset.

Since neither of these passes were recorded it is not possible to say to what species the observed bat pertains. However, based upon the timings of the observations (shortly after sunset) and bat size, it is considered most likely that the observations pertain to early-emerging species, e.g. pipistrelles.

For the 4th August dawn survey of these trees, for both trees, only one moderately late (close to sunrise) soprano pipistrelle pass was detected (though unseen), at 15 minutes before sunrise by the surveyors for both G9.8 and FOA T31, though no return to roost was observed for either of these trees. The limitations associated with the very dense canopy around tree G9.7, however, are acknowledged and felling mitigation is therefore proposed.

Tree G8.53

No bats were directly observed to emerge from moderate-potential tree G8.53 for either of the two dusk surveys and no particularly early bat passes were observed or detected.

For the dawn survey on 10th August 2018, minimal bat activity was encountered and no return to roost was observed for this tree.

Arb Tree T12 - Mature horse chestnut

In relation to Arb. tree T12, the mature horse chestnut to the rear of the Coach House, early bat activity was also encountered on 3rd August dusk survey of Arb tree T12 by the surveyor, with a single soprano pipistrelle pass observed 8 minutes before sunset. No equivalent late bat activity however was recorded for this tree during its dawn survey on 14th July 2017.

Based upon the early soprano pipistrelle pass encountered on the 3rd August dusk survey, it was recommended that an additional (3rd) bat detector survey be undertaken in September 2017, to confirm the presence or likely absence of roosting bats from Arb tree T12. This third survey was undertaken on 14th September 2017. No bats emerged from this tree during the 3rd survey; instead 1 soprano pipistrelle bat was observed to fly from the direction of a retained dead tree (to the north of Arb tree T12) close to sunset (4 minutes before sunset) inferring that this bat may have emerged from this dead tree or another tree in its immediate vicinity (i.e. not Arb tree T12).

Incidental Bat Activity

In terms of incidental bat activity, again, as for the building detector surveys, a moderate amount of general bat (predominantly foraging) activity was encountered during the survey work, being dominated by pipistrelle (soprano and common) bat passes with a minority of other passes, i.e. *Nyctalus* species (noctule and possibly Leisler) and *Myotis* / long-eared species.

Tabulated survey results are given in Appendix 5.

5.6 Tree Climbing Inspection

The summer 2018 tree climbing inspection similarly did not identify any direct evidence of roosting bats for the 5 surveyed trees (i.e. Arb. Trees T12, G9.17 [FOA T10], G9.10 [FOA T13], G9.7, and G8.53; Arb G8.31 was no longer present), all of which (barring Arb G9.10) were assigned both low maternity and hibernation potential and moderate day / transitional roost potential and overall Moderate potential. Tree Arb G9.10, by comparison has been afforded Moderate maternity and day/transitional roost potential and low hibernation potential, but still overall Moderate potential. Results are detailed in Appendix 3.

5.7 Bat Activity Survey Work

June 2017 Walking Transect

A variety of different bat species were encountered, dominated by pipistrelle bats (soprano, common and pipistrelle sp. with peak frequency intermediate of common and soprano pipistrelle), with regular detections of *Nyctalus* species (noctule and possibly Leislers also), occasional possible detection of serotine and a single pass of a *Myotis* / long-eared bat species.

Bat activity was encountered along the majority of the length of the walking transect (including the edges of the woodland quarters and the Western Avenue) with bat activity detected at 9 of the 12 listening stops; no bat activity was detected within the centre of the south-west woodland quarter (LS-D), along the southern edge of the eastern end of the park adjacent to the River Thames (LS-G) or the at the listening stop at the south-west corner of the park (LS-L).

July 2017 Walking Transect

Only pipistrelle bats were encountered during the July walking transect, with activity dominated by soprano pipistrelle. Common pipistrelle passes were regularly encountered, alongside occasional pipistrelle sp. passes (with peak frequency intermediate of common and soprano pipistrelle). In addition, a single, faint (distant) Nathusius' pass was detected at listening stop LS-G which is located along the park's southern boundary which neighbours the River Thames.

Bat activity was encountered along effectively the entire length of the walking transect (including the edges of the woodland quarters and the Western Avenue) with bat activity detected at 10 of the 12 listening stops; no bat activity was detected at the listening stop within the centre of south-west woodland quarter (LS-D) or at the final listening stop leg along the south-west corner of the park (LS-L).

The July 2017 survey, as stated elsewhere, also provided confirmation of the likely occurrence of a soprano pipistrelle roost potentially located in the vicinity of the mature standard trees along the edge of the amenity grassland field to the north of the north-western woodland quarter.

August 2017 Walking Transect

Pipistrelle bat activity (common, soprano and pipistrelle sp. [with peak frequency intermediate of common and soprano pipistrelle]) dominated the bat activity encountered during the August walking transect with the only other bat passes encountered being two *Nyctalus* species (possibly Leislers).

A similar pattern of bat activity was observed whereby bat activity was encountered both around the woodland quarters and the Western Avenue as well as at and between several of the listening stops throughout the wider park, specifically along the park's eastern and western edges; no bat activity was encountered along the park's northern or southern boundary on this occasion.

September Dusk 2017 Walking Transect

During the September dusk bat activity survey, bat activity was dominated equally by noctule and pipistrelle (common and soprano pipistrelle) bat passes; no other bat species were encountered.

Bat activity during this survey was most widespread, being encountered both around the woodland quarters and along the Western avenue as well as at all bar one (LS-F) listening stops and also frequently between the listening stops.

September Dawn 2017 Walking Transect

During the September dawn bat activity survey activity was dominated by soprano pipistrelle bat passes, with frequent common pipistrelle and pipistrelle sp. (with peak frequency intermediate of common and soprano pipistrelle) passes and a single noctule pass.

Bat activity during this survey demonstrated a similar pattern of widespread use of the park's edge habitats (tree lines and woodland edge), including multiple soprano pipistrelle passes detected at several locations adjacent to the park's southern boundary which neighbours the River Thames.

October Dusk 2017 Walking Transect

During the October dusk bat activity survey, activity exclusively pertained to pipistrelle species, being dominated by common pipistrelle, with abundant soprano pipistrelle passes and occasional pipistrelle sp. (with peak frequency intermediate of common and soprano pipistrelle) passes.

In contrast to all the previous bat activity surveys, during the October survey bat activity bat activity was largely limited to the vicinity of the woodland quarters and also LS-K (i.e. the tree group between the north-western woodland quarter and the Coach House). Within the wider park, bat activity was restricted to 2 listening stops (LS-G and LS-J) and at three locations between LS-J and LS-K.

Walking Transect Summary

To summarise, the bat activity survey work has demonstrated that bat activity is largely dominated by pipistrelle (common and soprano) species and *Nyctalus* sp. (mainly noctule), with a minority of passes by other bat species.

In terms of the relative usage of the park, bat activity has been encountered throughout the park, mainly associated with edge habitats (i.e. tree lines and woodland edges) but also open habitats (e.g. noctule bats were observed foraging at height above the Great Lawn).

It should be noted, however, that although the results plans appear to indicate that relatively greater bat activity was encountered in the vicinity of the woodland quarters, this is considered to in part be due to the fact that the woodland quarters were subject to relatively higher survey effort (i.e. a higher density of listening stops were positioned within and adjacent to the woodland quarters; the aim of the bias in survey effort was to maximise the chance of encountering relatively rarer and relatively more quiet echolocating bat species (and also potentially roosts) at the proposed works areas.

However, even taking the survey effort bias into consideration, it is considered that the woodland quarters, in particular the tree canopies and the dark protected edge habitat created by the woodland edges constituent a regular and well used foraging / commuting resource for bats within the context of the park. The Western Avenue (which links the woodland quarters to the site's southern boundary tree line) also is evidently regularly used by bats.

The other edge habitats present in the wider park, i.e. the tree lines and edge habitats along the park's north, south, east and western boundaries are similarly used frequently and relatively equally, with no apparent specific foci of activity.

In conclusion, the retention or else the re-creation of functional edge habitats and the connectivity of these various edge habitats (tree lines and edge habitats of the woodland quarters) across the park, as well as no increase in night-time lighting, will be necessary to safeguard the current use of the park by bats.

The walking transect route plan (labelling the listening stops) and the results plans for all activity surveys are given in Appendix 6.

To clarify, the walking transects did not incidentally identify any significant roosts or any movements of large numbers of bats.

5.8 BAT STATIC MONITORING

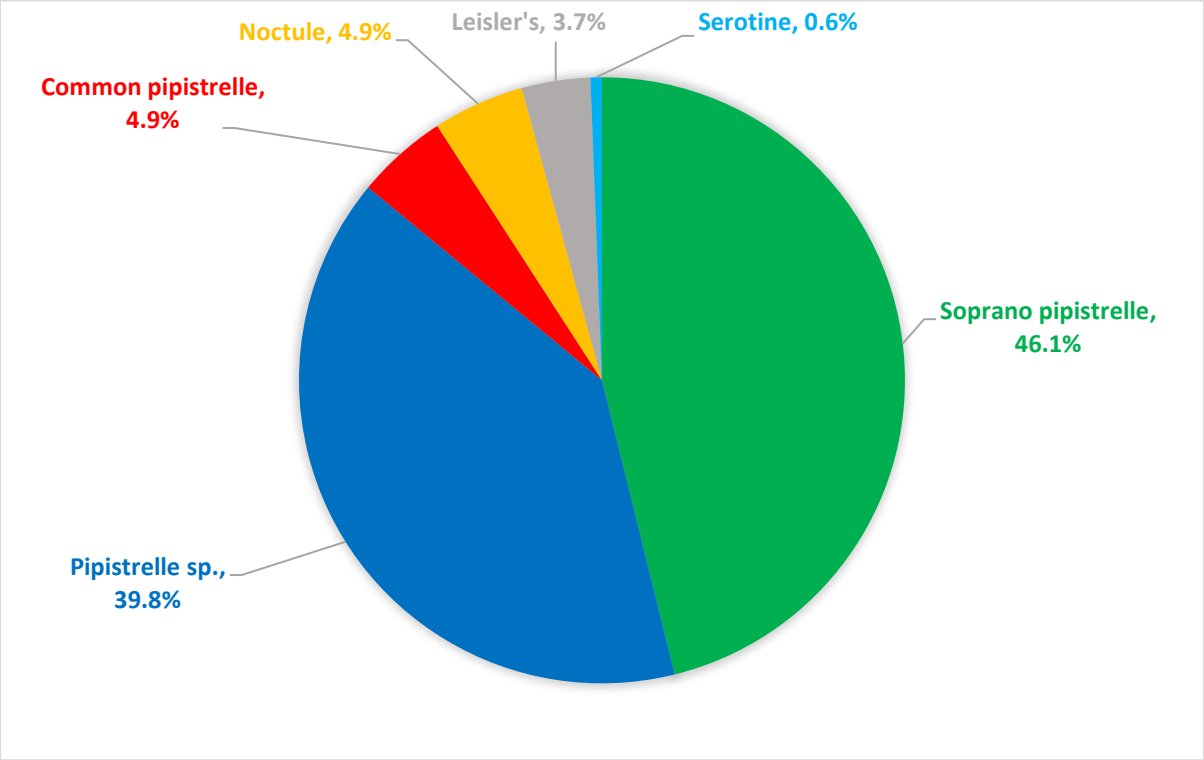
June 2017 Static Bat Detector Monitoring

In June 2017 (21st to 26th June), one static bat detector was positioned on the tree line on the southern boundary of the park (adjacent to the River Thames) at the southern end of the Eastern Avenue, i.e. where localised tree removal was initially proposed (no such removal is now proposed).

This static, positioned adjacent to the River Thames and upon a tree line (which itself is continuous with other tree lines) recorded the greatest volume of bat activity (a total of 492 passes), with bat activity encountered over the 5 nights for which it was deployed. Bat activity was dominated by pipistrelle (common and soprano) bat passes, with frequent 'big bat' passes (noctule, Leislers and / or serotine), summarised and depicted as follows:

Species	**Passes**	**Percentage of all passes**
Soprano pipistrelle	227	46.1%
Pipistrelle sp.	196	39.8%
Common pipistrelle	24	4.9%
Noctule	24	4.9%
Leisler's	18	3.7%
Serotine	3	0.6%
Total	492	100%

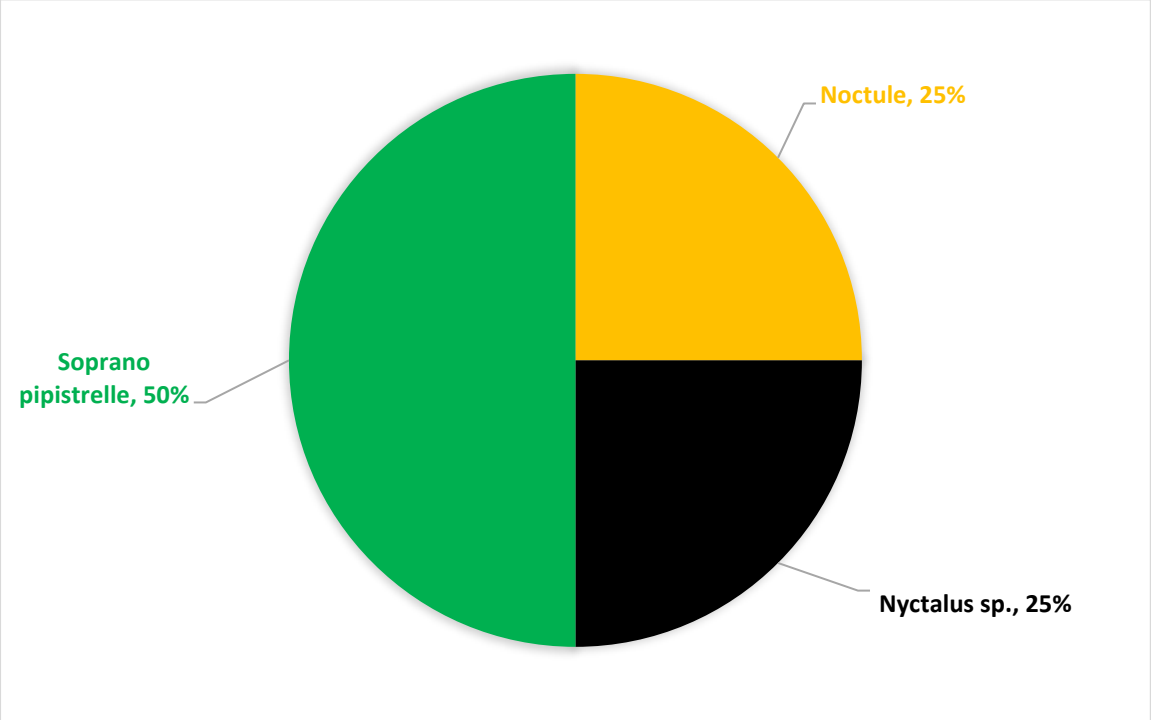
The proportion of passes made by each bat species is shown diagrammatically in the chart below:



The second static bat detector was positioned within the centre of the north-west woodland quarter. Only 4no. bat passes were detected during this 5 night period, comprising noctule, *Nyctalus* sp. (probable noctule), and 2 soprano pipistrelle passes, summarised and depicted as follows:

Species	**Passes**	**Percentage of all passes**
Soprano pipistrelle	2	50%
Noctule	1	25%
Nyctalus sp.	1	25%
Total	4	100%

The proportion of passes made by each bat species is shown diagrammatically in the chart below:



July 2017 Static Bat Detector Monitoring

In July 2017, initially, two static detectors were deployed on 25th July 2017.

Upon checking, however, it was found that the static detectors had malfunctioned / failed to record bat activity.

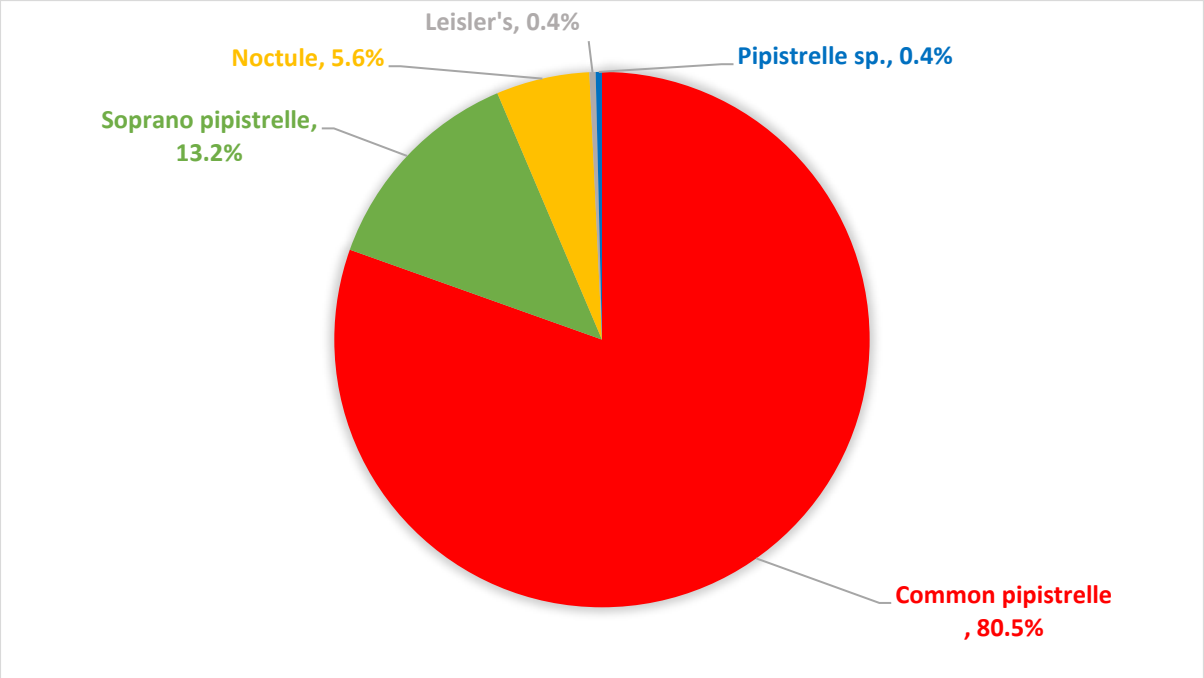
Following repeated re-deployment, the static bat detector positioned within the north-eastern woodland quarter captured 5 consecutive nights data between 7th and 12th August 2017. During this 5 night period, bat activity was detected throughout this window (total of 266 passes), with the exception of the evening of 9th August and also between midnight and dawn on the 11th.

Bat activity was dominated by common pipistrelle passes, with frequent soprano pipistrelle passes, with occasional passes by *Nyctalus* species (noctule and Leislers) and one pipistrelle sp. (with peak frequency intermediate of common and soprano pipistrelle) pass, summarised and depicted as follows:

Species	Passes	Percentage of all passes
Common pipistrelle	214	80.5%
Soprano pipistrelle	35	13.2%
Noctule	15	5.6%

Species	Passes	Percentage of all passes
Leisler's	1	0.4%
Pipistrelle sp.	1	0.4%
Total	266	100%

The proportion of passes made by each bat species is shown diagrammatically in the chart below:



The static detector deployed within the south-east woodland quarter between 26th and 31st July 2017, despite remaining on during this period, it did not record any bat activity nor any noise files. Given the lack of both bat passes and noise files, it is considered that the microphone may not have been working. Hence the lack of bat passes is expected to pertain to a microphone fault, not an absence of bat activity.

A static detector was re-deployed within the south-east woodland quarter during both the September and October 2017 bat activity survey visits.

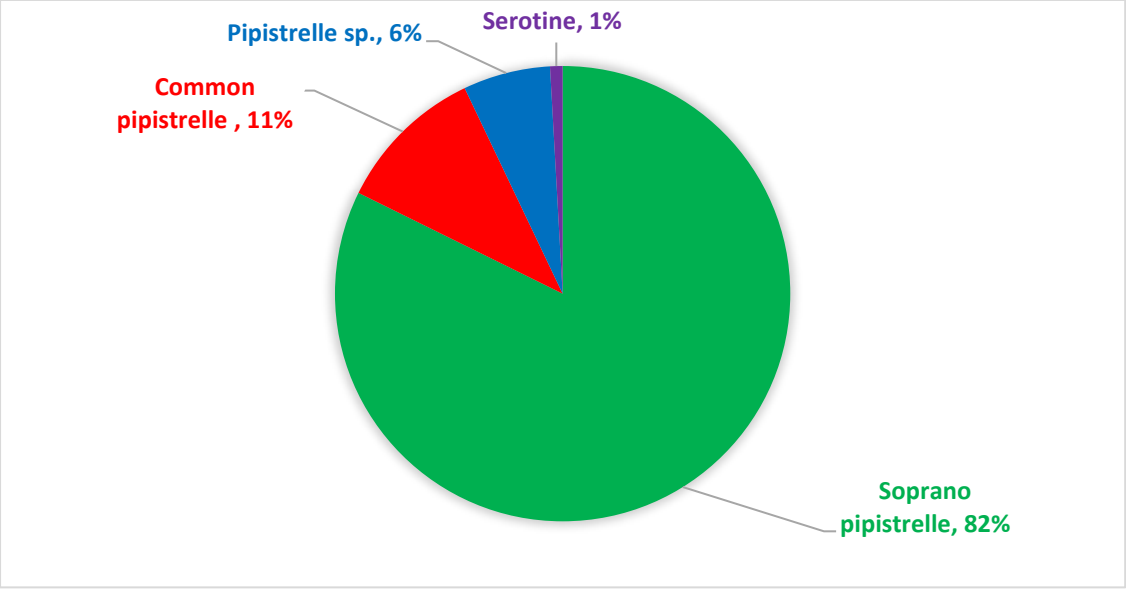
August 2017 Static Bat Detector Monitoring

One of the static detectors was located on the edge of the south-west woodland quarter for 5 nights between 24th and 29th August 2017.

This static recorded a total of 113 bat passes over the 5 nights for which it was deployed. Bat activity was dominated by soprano pipistrelle passes, with occasional common pipistrelle and pipistrelle sp. (with peak frequency intermediate of common and soprano pipistrelle) passes and a single probable serotine pass, summarised and depicted as follows:

Species	Passes	Percentage of all passes
Soprano pipistrelle	93	82%
Common pipistrelle	12	11%
Pipistrelle sp.	7	6%
Serotine - possible	1	1%
Total	113	100%

The proportion of passes made by each bat species is shown diagrammatically in the chart below:

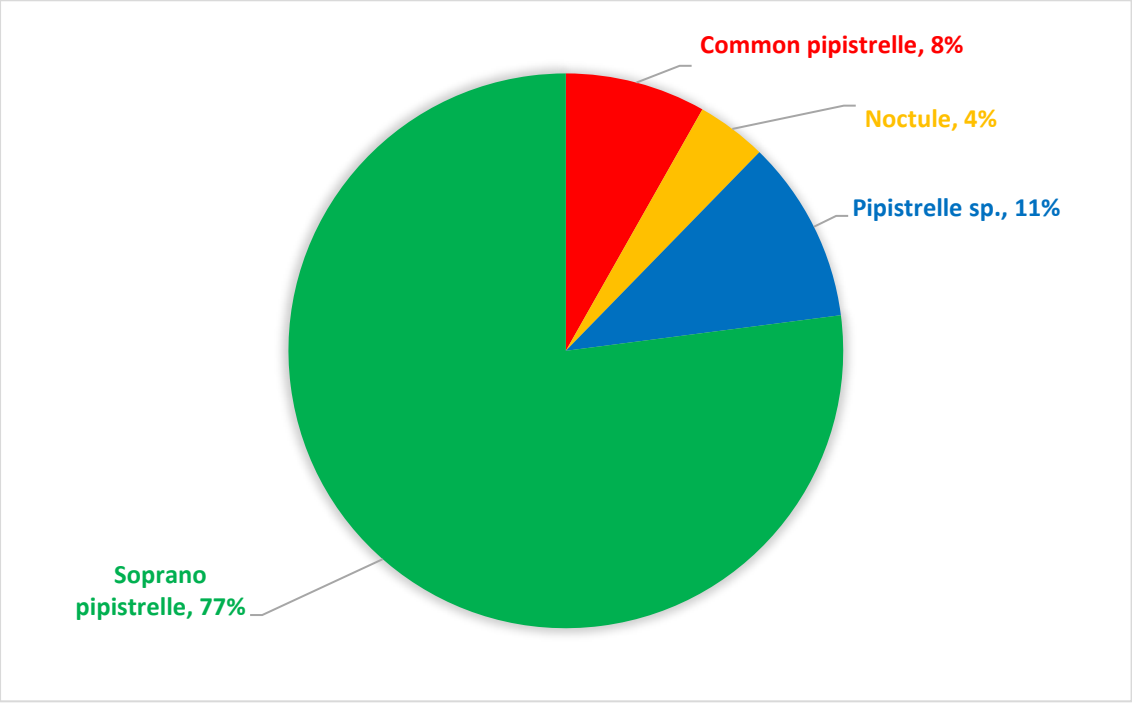


The second static detector was located upon one of the trees within the Western Avenue and was also deployed for 5 nights between 24th and 29th August 2017.

This static recorded a total of 122 bat passes over the 5 nights for which it was deployed. Bat activity was again dominated by soprano pipistrelle passes, with occasional common pipistrelle and pipistrelle sp. (with peak frequency intermediate of common and soprano pipistrelle) passes and 5 noctule passes, summarised and depicted as follows:

Species	Passes	Percentage of all passes
Soprano pipistrelle	94	77%
Pipistrelle sp.	13	11%
Common pipistrelle	10	8%
Noctule	5	4%
Total	122	100%

The proportion of passes made by each bat species is shown diagrammatically in the chart below:



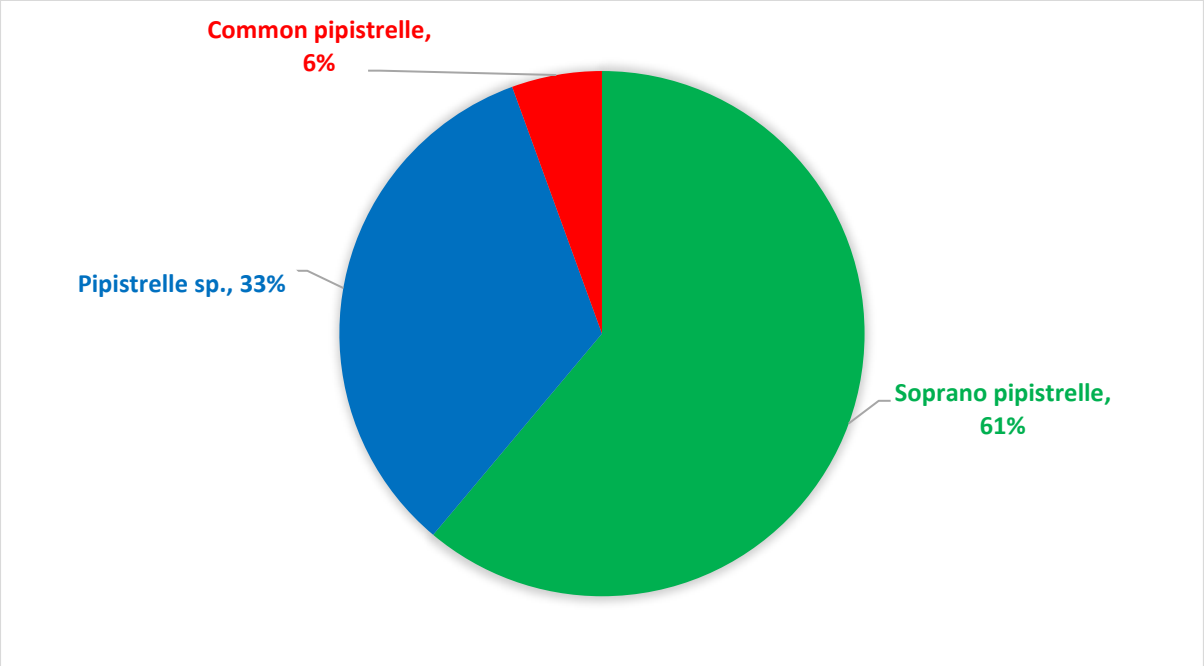
September 2017 Static Bat Detector Monitoring

One of the static detectors was located on the edge of the south-eastern woodland quarter between 20th and 25th September 2017.

This static recorded a total of 18 bat passes over the 5 nights for which it was deployed. Bat activity was again dominated by soprano pipistrelle passes, with frequent pipistrelle sp. (with peak frequency intermediate of common and soprano pipistrelle) passes and a single common pipistrelle pass, summarised and depicted as follows:

Species	Passes	Percentage of all passes
Soprano pipistrelle	11	61%
Pipistrelle sp.	6	33%
Common pipistrelle	1	6%
Total	18	100%

The proportion of passes made by each bat species is shown diagrammatically in the chart below:



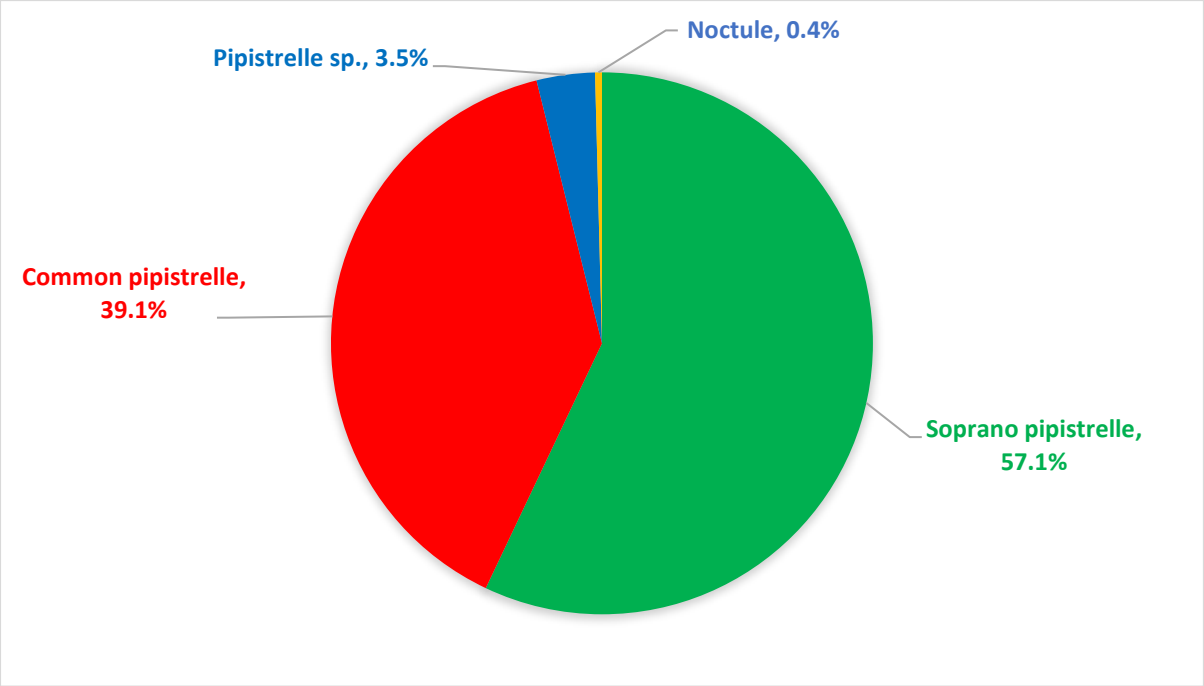
The second static detector was located on the edge of the south-western woodland quarter also between 20th and 25th September 2017.

This static recorded a total of 489 bat passes over the 5 nights for which it was deployed. Bat activity was again dominated by soprano pipistrelle passes, with abundant common pipistrelle passes, occasional pipistrelle sp. (with peak frequency intermediate of common and soprano pipistrelle) passes and 2 noctule passes, as summarised and depicted as follows:

Species	Passes	Percentage of all passes
Soprano pipistrelle	279	57.1%

Common pipistrelle	191	39.1%
Pipistrelle sp.	17	3.5%
Noctule	2	0.4%
Total	489	100%

The proportion of passes made by each bat species is shown diagrammatically in the chart below:



October 2017 Static Bat Detector Monitoring

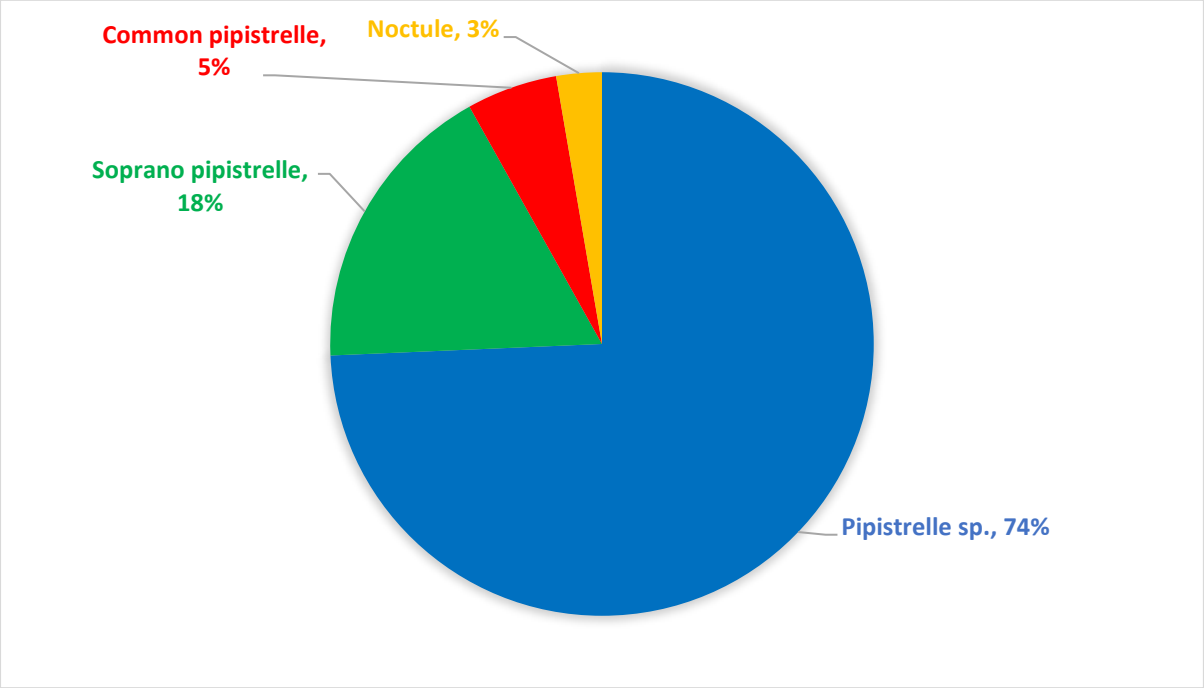
The first static detector was located on the edge of the north-east woodland quarter between 18th and 23rd October 2017.

This static recorded a total of 74 bat passes over the 5 nights for which it was deployed. Bat activity was on this occasion dominated by pipistrelle sp. (with peak frequency intermediate of common and soprano pipistrelle) passes with occasional soprano and common pipistrelle passes, and 2 noctule passes, as summarised and depicted as follows:

Species	**Passes**	**Percentage of all passes**
Pipistrelle sp.	55	74%
Soprano pipistrelle	13	18%

Common pipistrelle	4	5%
Noctule	2	3%
Total	74	100%

The proportion of passes made by each bat species is shown diagrammatically in the chart below:

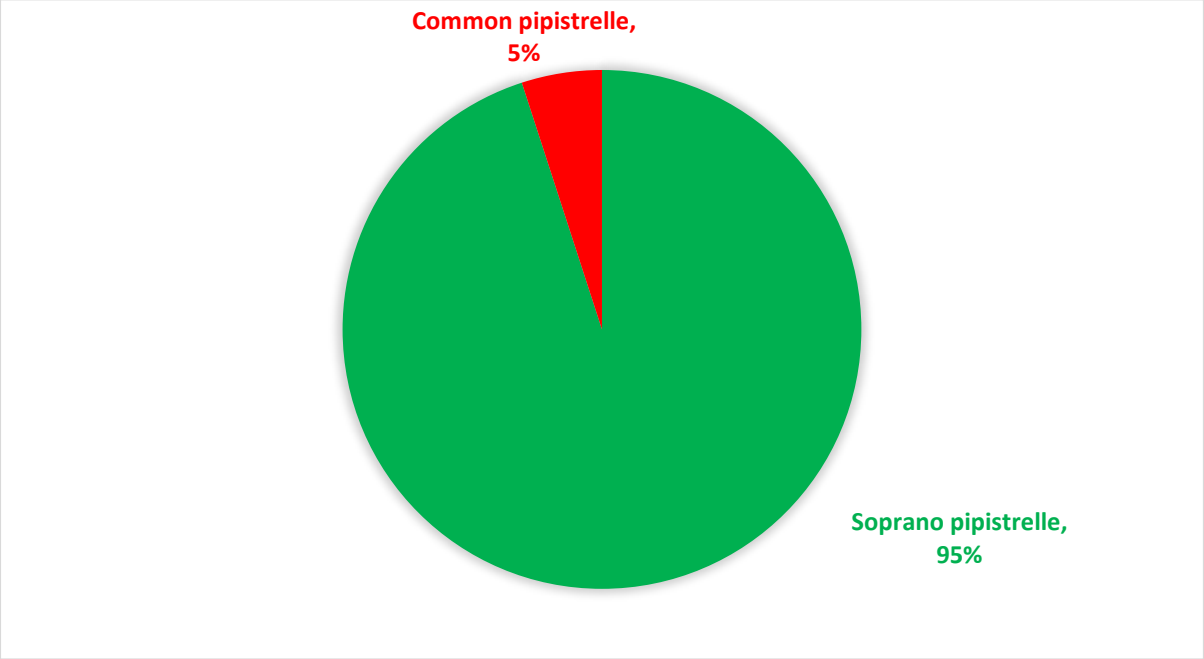


The second static detector was located on the edge of the south-east woodland quarter also between 18th and 23rd October 2017.

This static recorded a total of 20 bat passes over the 5 nights for which it was deployed. Bat activity was on this occasion dominated by soprano pipistrelle passes with a single common pipistrelle pass, as summarised and depicted as follows:

Species	**Passes**	**Percentage of all passes**
Soprano pipistrelle	19	95%
Common pipistrelle	1	5%
Total	20	100%

The proportion of passes made by each bat species is shown diagrammatically in the chart below:



Summary - Static Bat Detector Monitoring

In summary, in all cases bat activity is dominated by pipistrelle species, typically soprano pipistrelle, though on occasion common pipistrelle or pipistrelle sp. (with peak frequency intermediate of common and soprano pipistrelle).

A minority of passes pertained to other bat species, namely 'big bat' species (noctule, Leislers, possible serotine and *Nyctalus* sp.).

No *Myotis* sp. or long-eared sp. bat passes were detected during the static monitoring, despite both having been detected incidentally during either emergence survey work and / or during walking transect survey work. The lack of detections of *Myotis* sp. or long-eared sp. bat is considered to be attributed to the reduced detectability of these typically quiet echolocating species, rather than indicating their absence; indeed, their occurrence at least at low levels has been confirmed by other bat survey work.

Comparing the total number of bat passes between the same locations in different months, the total number of passes is found to be highly variable, as demonstrated in the following table:

Month	Total no. passes					
	NW wood quarter	NE wood quarter	SE wood quarter	SW wood quarter	Southern boundary, adjacent Thames	Western Avenue
June	✓ - 4 (within centre of wood)				✓ - 492	
July		✓ - 266 (within centre of wood)	✓ n/a – no data recorded			
August				✓ - 113 (on edge of wood)		✓ - 122
September			✓ - 18 (on edge of wood)	✓ - 489 (on edge of wood)		
October		✓ - 74 (on edge of wood)	✓ - 20 (on edge of wood)			

The greatest volume of bat activity (492 passes) was recorded along the tree line on the southern boundary of the park, adjacent to the River Thames. This is to be expected since the River Thames and the habitats immediately adjacent to it is known to be an important foraging and commuting corridor for local bat populations. Indeed, Richmond's Species Action Plan for bats lists several important sites for bats and includes on this list the River Thames corridor. Marble Hill Park itself lies along this corridor.

Further, in recognition of the importance of this corridor for bats, in recent years funding was procured to establish bat-friendly lighting along Warren's Footpath (Warren Footpath Lighting Project, Thames Landscape Strategy in Action! London's Arcadia Draft Report February 2009 Francesca Morrison) which is the footpath which lies between the southern boundary of Marble Hill Park and the River Thames itself.

It has therefore been necessary to safeguard use of this corridor by bats, as part of the scheme. Indeed, early scheme designs included removal of trees from the southern boundary of the park; however, based upon the importance of the connectivity of this linear tree line to bats, the project team agreed to amend the scheme to allow for retention of these trees.

The static location at the edge of the south-west woodland quarter in September recorded a comparable volume of bat activity (489 passes) to that adjacent to the River Thames, though a comparatively lesser volume of activity was detected at this same position (113 passes) in August, indicating temporal variation at the same location.

For the other woodland quarters, levels of bat activity varied from minimal activity (4 passes) in the north-western woodland quarter (in June), through modest activity (18 passes in September, 20 passes in October) at the edge of the south-east quarter to moderate activity (74 passes in October, and 266 passes in July) for the north-eastern woodland quarter and 122 passes for Western Avenue in August.

Despite the temporal and local positional variation in activity levels, it is evident from the static data that the woodland quarters collectively (i.e. the areas for which works are proposed) and the Western Avenue (i.e. no tree felling is proposed along this avenue) provide a foraging resource for local bat populations and also provide corridors for the local bat populations to move between their roosts and foraging areas further afield, including potentially across the River Thames to foraging habitats beyond, e.g. Richmond Park.

In conclusion, the retention and / or re-creation of the existing bat foraging resources as well as the retention and / or recreation of the linear flight features (edge habitats) and the connectivity of these various edge habitats (tree lines and edge habitats of the woodland quarters) across the park, as well as in the maintenance of current night-time lighting levels, if not a reduction (and adoption of a formal external light spillage minimisation strategy), will be necessary to safeguard the continued existing use of the park and its wider environs by bats.

The static detector location plans are given in Appendix 7.

6. DISCUSSION & RECOMMENDATIONS

6.1 BUILDING B1

For the 16th July 2018 dusk survey, emergence of small numbers of pipistrelle bats from building B1, the Coach House, was observed:

- 3 soprano pipistrelles from eastern (front) elevation (in the region of the central gable façade)

The Coach house has therefore been confirmed to support a small non-breeding soprano pipistrelle summer roost in 2018.

No works are proposed at or in close proximity to the identified soprano pipistrelles' emergence location.

Accordingly, no bat licence is deemed necessary in respect of the proposed works to the Coach House; instead a non-licensed method statement (including external light spillage minimisation etc) will be sufficient to ensure that the proposed works due not materially disturb or have any other indirect effects on the identified roost.

No Nathusius' pipistrelle passes were encountered during this survey.

The yet to be conducted September 2018 bat detector survey will investigate any occurrence of Nathusius pipistrelle at or within the immediate vicinity of the Coach House during the pipistrelle mating window. This specific 2018 pipistrelle mating season survey visit is scheduled to occur in September, i.e. after the submission of the planning application – the results of which will be provided as a brief addendum page report.

The need for and scope of any bat mitigation (licensed or non-licensed) required for the Coach House will be informed by the September 2018 bat detector survey results and the nature of the proposed works to the Coach House.

In addition, preparation of a formal external light spillage minimisation strategy for the Coach House will be required.

6.2 BUILDING B2

No direct evidence of use of this building by roosting bats has been identified by the building inspection of B2. This building is to be retained, with no structural changes proposed.

This building, however, will have a change of use and insertion of fittings and equipment as dry storage for catering and shop stock.

A pre-works repeat building inspection and a single dusk detector survey is recommended to determine the presence / likely absence of roosting bats in advance of the proposed increased level of usage of this storage building.

6.3 BUILDINGS B3 AND B4

No direct evidence of use of any of these buildings by roosting bats has been identified by the survey work.

Therefore, it can be concluded that none of these buildings have supported a maternity roost during summer 2017 nor have any non-breeding summer roosts been identified.

No further specific pre-approval bat emergence / return to roost detector survey work is, however, deemed required for these buildings.

Despite the fact that no evidence of roosting bats has been incidentally identified for either of these buildings, the following mitigation will nonetheless be required:

- Repeat pre-demolition bat survey work, should in excess of 2-3 years lapse between the survey work and the proposed demolition date
- A tool box talk regarding roosting bats will be included in site induction given by the site manager, with CIRIA's bats tool box talk used for this purpose and kept on file by the site manager – see below (an electronic copy will be provided to the site manager by the project ecologist)
- The roosting bats tool box talk will state the protocol that will be followed in the event that a bat or bats is / are found during the demolition of buildings B3 and B4 and the extension works to B1.
- The protocol will be that: the works will immediately cease, and the site manager will immediately contact the project ecologist (contact details to be held by site manager) whom will advise how to proceed, and in particular will contact Natural England and discuss the possible need for the works to resume under a European Protected Species bat licence from Natural England.
- Provision of bat boxes for loss of potential roost sites

Further, any building demolition / extension works will also need to take into account the risk of nesting birds being present. Either works will need avoid the main nesting bird period (March to August inclusive) or else these works will also be preceded by a nesting bird check.

Recommendations - If roosting bats are confirmed present

For information, if a bat roost or roosts are found within any of the buildings to be demolished (B3 and B4) by the recommended repeat pre-demolition bat survey work, a licence from Natural England (NE) will need to be applied for and be granted to allow the lawful undertaking of the works in question. The type of licence required, i.e. a full (NE) European Protected Species (EPS) bat licence or a Natural England low impact bat class licence will depend upon the status / type of roost(s) which is / are present.

Whichever licence is appropriate, in both instances a suite of bat mitigation measures will need to be adopted. The scope of the necessary mitigation measures will be governed by the status / type of roost(s) which is / are present.

There is however expected to be scope, within the numerous built structures and extensive grounds of Marble Hill Park to accommodate all necessary bat mitigation measures, in particular appropriate replacement roost provision.

6.4 BUILDING B5

No direct evidence of use of any of this building by roosting bats has been identified by the building inspection and since it only possesses modest bat roost potential (negligible to low), no specific bat detector survey work is required according to the published guidelines. Further, only minor external works are proposed to this building as part of this scheme, none of which are understood to impact upon the modest identified bat roost features, in particular the ivy covering is to be retained.

Roosting bats are therefore not expected to constrain the proposed sports hall works.

Nonetheless, with regards to the proposed minor external works to the sports hall, as good practice, contractor awareness of roosting bats in relation to demolition works should be formalised and a protocol in the unlikely event that a roosting bat or bats are encountered be prepared.

6.5 BUILDING B6

No direct evidence of use of any of this structure by roosting bats has been identified by the building inspection and since it only possesses modest bat roost potential (negligible), no specific bat detector survey work is required according to the published guidelines.

Nonetheless, with regards to the Pagoda's proposed demolition, a pre-works repeat inspection of this structure should be undertaken to check for roosting bat evidence and additionally, as good practice, contractor awareness of roosting bats in relation to demolition works should be formalised and a protocol in the unlikely event that a roosting bat or bats are encountered should be prepared.

Recommendations – loss of potential roost sites

To mitigate for loss of potential roosting sites due to the proposed demolition works of B3 and B4 and the extension of B1, bat boxes will be installed within the fabric of or upon the external walls of the proposed new Coach House extension and / or upon existing retained built structures.

A minimum of 10no. building bat boxes will be provided with models selected to be suitable for the range of bat species encountered at the park and for all seasons.

6.6 T12, G9.17 [FOA T10], G9.10 [FOA T13], G9.7, G8.31 [FOA T31] AND G8.53

No direct evidence of use of any of these trees by roosting bats has been identified by the survey work.

Therefore, it can be concluded that none of these trees have supported a maternity roost during summer 2017 or 2018 nor have any non-breeding summer roosts been identified.

No further specific pre-approval bat survey work is deemed required for these trees.

In terms of recommendations, a suite of mitigation measures will nonetheless need to be adopted for the proposed felling / tree surgery works for these trees, on account of both the limitations accounted for 2 of the trees and the nomadic nature of the use of trees by bats, including:

- repeat pre-felling bat survey work, should significant time lapse between the survey work and the proposed felling date for each tree in question (potentially using a mobile elevated work platform for those trees which are unsafe to climb, e.g. G9.7 and G9.17)
- a sensitive / soft approach to felling, and, where necessary, a sensitive timing of the felling works (including accounting for nesting birds)
- formalisation of contractor awareness of roosting bats in relation to the felling works and protocol in unlikely event that bats are encountered
- provision of bat boxes for loss of potential roost sites

Recommendations - If roosting bats are confirmed present

For information, if a bat roost or roosts are found within any of the trees proposed to be felled / subject to tree surgery works by the pre-works bat survey or else during the process of felling, a licence from Natural England (NE) will need to be applied for and be granted to allow the lawful undertaking of the works in question. The type of licence required, i.e. a full (NE) European Protected Species (EPS) bat

licence or a Natural England low impact bat class licence will depend upon the status / type of roost(s) which is / are present.

Whichever licence is appropriate, in both instances a suite of bat mitigation measures will need to be adopted. The scope of the necessary mitigation measures will be governed by the status / type of roost(s) which is / are present.

There is however expected to be scope, within the extensive grounds of Marble Hill Park to accommodate any and all necessary bat mitigation measures, in particular appropriate replacement roost provision.

Recommendations – loss of potential roost sites

To mitigate for loss of potential roosting sites due to the proposed felling of these trees, bat boxes will fixed to retained suitably sized and located park trees.

A minimum of 16no. tree-mounted bat boxes will be provided with models selected to be suitable for the range of bat species encountered at the park and for all seasons.

Retained bat roost trees

For retained trees with bat roost potential, it will be necessary to adopt a strategy to ensure that these trees' suitable bat features can safely be retained (i.e. tree surgery as necessary, as guided by a bat worker, may be required to meet H&S needs whilst retaining bat features).

6.7 Bat Foraging and Commuting Activity

The bat activity survey work has demonstrated that several bat species forage within and traverse through the park, with activity dominated by soprano and common pipistrelles and 'big bat' species (noctule, Leislers and / or possibly serotine) with a minority of passes pertaining to Nathusius' pipistrelle and *Myotis* / long-eared bat species.

It is evident therefore that bat activity is dominated by bat species which are not sensitive to night-time light levels (i.e. pipistrelles and big bat species). However, light sensitive species (*Myotis* and long-eared species) do also use the park. Indeed, the frequency of occurrence of *Myotis* and long-eared species within the park is likely to be underestimated due to the reduced detectability of these species' echolocation calls.

In terms of the relative usage of the park, bat activity has been encountered throughout the park, mainly associated with edge habitats (i.e. tree lines and woodland edges) but also open habitats (e.g. noctule bats were observed foraging at height above the Great Lawn).

It should be noted, however, that although the walking transect results plans appear to indicate that relatively greater bat activity was encountered in the vicinity of the woodland quarters, this is considered to in part be due to the fact that the woodland quarters were subject to relatively higher survey effort (i.e. a higher density of listening stops were positioned within and adjacent to the woodland quarters; the aim of the bias in survey effort was to maximise the chance of encountering relatively rarer and relatively more quiet echolocating bat species (and also potentially roosts) at the proposed works areas.

However, even taking the survey effort bias into consideration, it is considered that the woodland quarters, in particular the tree canopies and dark protected edge habitat created by the woodland edges constituent a regular and well used foraging / commuting resource for bats within the context of the

park. The Western Avenue (which links the woodland quarters to the site's southern boundary tree line) also is evidently regularly used by bats.

Indeed, the static location at the edge of the south-west woodland quarter in September recorded the second greatest volume of bat activity (489 passes) compared to 492 passes adjacent to the River Thames. A comparatively lesser volume of activity was detected at this same position at the south-west quarter (113 passes) in August, indicating temporal variation at the same location.

For the other woodland quarters, levels of bat activity varied from minimal activity (4 passes) in the north-western woodland quarter (in June), through modest activity (18 passes in September, 20 passes in October) at the edge of the south-east quarter to moderate activity (74 passes in October, and 266 passes in July) for the north-eastern woodland quarter and 122 passes for Western Avenue in August.

Despite the temporal and local positional variation in activity levels, it is evident from the static data that the woodland quarters collectively (i.e. the areas for which works are proposed) and the Western Avenue (i.e. no tree felling is proposed along this avenue) provide a foraging resource for local bat populations and also provide corridors for the local bat populations to move between their roosts and foraging areas further afield, including potentially across the River Thames to foraging habitats beyond, e.g. Richmond Park.

In conclusion, the retention and / or re-creation of the existing bat foraging resources as well as the retention and / or recreation of the linear flight features (edge habitats) and the connectivity of these various edge habitats (tree lines and edge habitats of the woodland quarters) across the park, as well as in the maintenance of current night-time lighting levels, if not a reduction (and adoption of a formal external light spillage minimisation strategy), are considered to be necessary to safeguard the continued existing use of the park and its wider environs by bats.

In terms of the greatest bat activity, the static detector monitoring has identified that the greatest volume of bat activity (492 passes) was recorded along the tree line on the southern boundary of the park, adjacent to the River Thames. This is to be expected since the River Thames and the habitats immediately adjacent to it is known to be an important foraging and commuting corridor for local bat populations. Indeed, Richmond's Species Action Plan for bats lists several important sites for bats and includes on this list the River Thames corridor. Marble Hill Park itself lies along this corridor. Indeed, in recognition of the importance of this corridor for bats, in recent years funding was procured to establish bat-friendly lighting along Warren's Footpath (Warren Footpath Lighting Project, Thames Landscape Strategy in Action! London's Arcadia Draft Report February 2009 Francesca Morrison) which is the footpath which lies between the southern boundary of Marble Hill Park and the River Thames itself.

It has therefore been necessary to safeguard use of this corridor by bats, as part of the scheme. Indeed, early scheme designs included removal of trees from the southern boundary of the park; however, based upon the importance of the connectivity of this linear tree line to bats, the project team agreed to amend the scheme to allow for retention of these trees.

6.8 Woodland re-modelling & New Landscaping

Habitat changes including Woodland re-modelling

The proposed restoration of the park to its 1752 and later 18th century condition will involve re-modelling of the 4 woodland quarters adjacent to Marble Hill House including selective tree felling and surgery.

The proposed tree removal works, however, have been the subject of detailed discussion within the project team and between the project team and London Borough of Richmond upon Thames, and

several revisions to the scheme proposals have been made, to reduce as far as reasonably practicable any potential impacts upon bats, such iterative changes include:

- creation of relatively more thicket habitat in northern woodland quarters
- temporally staged vegetation / tree clearance in the woodland quarters (commencing summer 2019);
    - (i) woodland quarters (barring the 2 reserved areas) will undergo a programme of works over a 3-year period
    - (ii) works to the 2 reserved areas, i.e. parts of the south-east and south-west quarters will take place after this project as part of a phased approach to woodland improvements works.
- retention of all existing trees along Western Avenue

The final chosen proposed scheme, which includes significant proposed new soft landscaping / planting is expected to result in the following main changes to the existing habitats:

- Opening up of the dense and closed-canopy 4 woodland quarters (via selective tree felling and coppicing), to create a more open formal ornamental garden / parkland-like habitat, comprising of retained scattered mature standard trees, shrubs alongside newly planted avenues and palisades of trees, hedge networks, with newly created paths, flower gardens and amenity grassland
- Bolstering and widening the Western and Eastern avenues by way of planting of additional groves and avenues of new trees
- Creation of improved habitat edges, grading from the boundary woodland strips through smaller trees and wildflower edges to the formally managed amenity grassland lawns. These improved edge habitats include the creation of wide scattered tree and wildflower habitat edges at the south-east and south-west corners of the East Meadow and West Meadow, respectively, as well as either side of exiting tree line that runs E-W across the centre of the East Meadow and along the south side of the existing tree line which extends along the northern edge of East Meadow.

Short-term effects

In the short term, without specific mitigation measures (i.e. in the absence of temporally staged works, proposals for replacement / new planting and minimisation of external lighting spillage etc), the concurrent felling of numerous trees, coppicing, and clearance of existing shrubbery would constitute a major change to the existing bat habitats, including a material short-term reduction in available bat foraging resource (via tree felling, coppicing and vegetation clearance) as well as a material changes to the existing linear flight line features (i.e. woodland edge habitats).

It will therefore be necessary for the following measures to be adopted to soften and lessen these short-term habitat changes:

- Formalisation of a plan of staged tree removal and staged coppicing
- Use of mature tree / shrub specimens in replacement planting

Medium to long-term effects

In the medium to long-term, the new planting of lines / rows of trees, hedgerow networks and other proposed new planting (e.g. thicket planting, wilderness planting, shrub and herbaceous planting etc) and provision of bat boxes will functionally re-create the existing bat foraging / roosting resources as well as re-creating the linear flight features (edge habitats) and the connectivity of these various edge habitats (tree lines and edge habitats of the woodland quarters) across the park.

Assuming there is no increase in night-time lighting levels or else the adoption of a formal external light spillage minimisation strategy, and with the inclusion of bat-friendly replacement planting and provision of bat boxes, it is assessed that the proposed scheme which includes for park-wide replacement / new soft landscaping works (e.g. the creation of enhanced habitat edges) will not have an adverse effect on roosting, foraging and / or commuting bats in the medium to long-term, once the proposed new planting has matured.

Recommendations – Bat-friendly Plant Species

Wherever practicable, bat-friendly plants such as night-scented plants that attract flying insects, will be incorporated into the new soft landscaping scheme.

Recommendations – Light Spillage Minimisation

It will be necessary for the construction phase (including all contractor car parking areas, working compounds and storage areas) and also the operational phase of the park improvements (e.g. in the vicinity of the Coach House and all retained / proposed new habitats, including the woodland quarters) to ensure that any proposed new external lighting is subject to light spillage minimisation control measures, particularly in the vicinity of the retained and proposed new habitats and the proposed bat boxes.

The justification for minimisation of the external lighting is that these features may be used by roosting, foraging and / or commuting bats, some species of which are sensitive to light (e.g. *Myotis* / long-eared species, which has been recorded at the park) are believed to be dissuaded from using lit areas. In addition, many other species of wildlife benefit from dark corridors, e.g. nocturnal species such as hedgehog and badger.

The Bat Conservation Trust and Institute of Lighting Engineers suggests several means by which external lighting can be minimised, and these will need to be adopted as appropriate:

- Do not provide excessive lighting. Use only the minimum amount of light needed for safety.
- Use narrow spectrum bulbs to lower the range of species affected by lighting, use light sources that emit minimal UV light and avoid the white and blue wavelengths of light to avoid attracting lots of insects (which results in reduction of insects in other areas that bats may be using for foraging).
- Lights should peak higher than 550 nm or use glass lantern covers to filter UV light. White LED lights do not emit UV but have been shown to disturb slow flying bat species.
- The use of low or high-pressure sodium lamps instead of mercury or metal halide lamps.
- Mercury lamps used should be fitted with UV filters.
- The brightness should be as low as legally possible.
- The times during which the lighting can be used should be limited to provide some dark periods.

- The lighting should be directed to where it is needed to avoid light spillage.
- Any upward lighting should be minimal or avoided to avoid light pollution. Also eliminate any bare bulbs.
- The spread of light should be kept near to, or below the horizontal – flat cut off hoods are best. Also, light can be restricted to selected areas by fitting hoods which direct the light below the horizontal plane, at preferably an angle less than 70 degrees.
- Limiting the height of lighting columns and directing light at a low level, which reduces the ecological impact of the light. However, higher mounting heights allow lower main beam angles, which can assist in reducing glare.
- For pedestrian lighting, use low-level lighting that is as directional as possible.
- Increase the spacing of lanterns.
- Use embedded road lights to illuminate the roadway and light only high-risk stretches of roads, such as crossings and junctions, allowing head lights to provide illumination at other times.
- Use lighting design software and professional lighting designers to predict where light spill will occur.
- Avoid using reflective surfaces under lights.
- Use temporary, close-boarded fencing until vegetation is mature enough to shield sensitive areas from lighting.
- Road or track ways along areas important for foraging bats should contain stretches left unlit to avoid isolation of bat colonies.
- No bat roost (including access points) should be directly illuminated.

Ecological input into the preparation of an appropriate external lighting spillage minimisation scheme for the new café in the Coach House with be required, encompassing collaboration between the project ecologist and the project team's lighting engineers.

7. CONCLUSIONS

Without any mitigation (i.e. in the absence of temporally staged works, proposals for replacement / new planting and minimisation of external lighting spillage etc) the proposed scheme has the potential to have a **moderate negative** affect on bats.

Assuming that all specified mitigation measures are implemented in full (i.e. including temporal staging of tree/vegetation works and proposals for replacement / new planting, minimisation of external lighting spillage etc), bats are likely to be safeguarded and the park-wide scheme will, in the medium to long-term, provide a **neutral to minor positive impact** on bats.

If the enhancement mitigations are additionally adopted, collectively it is likely that there will be a **moderate positive** impact on bats.

8. REFERENCES

Bat Conservation Trust (2010) Species Factsheet Series – BCT Publication. BCT

Bat Conservation Trust (2012a) Encouraging Bat – A Guide for Bat-friendly Gardening and Living.

Bat Conservation Trust and Institute of Lighting Engineers (ILE) (2008) Bats and Lighting in the UK. Bats and the Built Environment Series. Version 2, May 2009.

Bat Conservation Trust (2014b) Artificial Lighting and Wildlife – Interim Guidance: Recommendations to help minimise the impact of artificial lighting

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

Dietz et al. (2009) Bats of Britain Europe and Northern Africa. A&C Black.

Nathusius' pipistrelle in Great Britain & Ireland web-site; http://www.nathusius.org.uk/

Mitchell- Jones, A.J (2004) Bat Mitigation Guidelines. English Nature.

8.2.16 Rich, C & Longcore, T (2005) The Ecological Consequences of Artificial Night Lighting. Island Press

Russ, J (1999) The Bats of Britain and Ireland: Echolocation Calls, Sound Analysis and Species Identification. Alana Ecology Ltd.

Russ, J (2013) British Bat Calls a Guide to Species Identification. Pelagic Publishing.

Swift, S.M (1998) Long-eared Bats. T & A D Poyser Natural History

Furesfen (2011) Marble Hill Coach House, Marble Hill Park, Twickenham, September 2011

Land Management Services (2015) Marble Hill Park, Preliminary Ecological Appraisal for English Heritage, July 2015

Morrison F. (2009) Warren Footpath Lighting Project, Thames Landscape Strategy in Action! London’s Arcadia Draft Report February 2009

Richmond upon Thames Bats: Species Action Plan

9. APPENDIX 1 – BAT BUILDING INSPECTION RESULTS

B1 Coach House building

Internal Inspection

This building was a brick walled building with a tiled pitched roof. An access hatch to a loft space was located in the southern apartment outside the bathroom door. The loft space was small and was approximately 2 m x 1 m in size with roof height of approximately 75 cm. The ceiling of the loft space was covered by a plaster wall and the floor of the loft space shows timber joists with no insulation between. The ambient temperature was approximately 10°C. There were no droppings of any description on the loft floor.

In the kitchen of the southern apartment, there was an access hatch to the main loft space of the southern half of the coach house building. The loft space itself was observed to be timber framed with felt lining. The loft space was approximately 20 m x 3 m in size with a roof height of approximately 1 m. The floor of the loft space comprised wooden joists with fibreglass insulation in-between. Some modest cobwebbing was observed along the ridge beam of the loft space. No external light was observed to be coming in from the outside. The far, southern end of the loft space was a timber framed gable end and the northern wall of the loft space was a brick wall which comprised a firewall between two halves of the coach house building loft space. The brick wall had a brick missing allowing for cabling to pass through into the loft space beyond.

An additional section of loft space was observed to the west of the main loft hatch which comprised an area approximately 2 m x 1 m. This area housed the clock mechanism which drives the clock which is seen in the centre of the external front wall of the coach house at second floor level. A brick wall was observed at the gable end of this section of loft with several bricks missing allowing for the clock mechanism to reach the clock face. The floor was boarded out and some bird nesting material, an old wasp nest, and some small mammal skeletal remains were observed in this space.

Another hatch was situated above the main loft, which leads out onto the roof of the building and the bell tower above. With this loft hatch removed, the base of the bell tower pyramid can be observed with a mechanism for the bell protruding from the wooden base and a hole approximately 10 cm² which may allow access for bats.

A final loft hatch was identified in the kitchen of the flat at the northern end of the building, however, this loft hatch was painted closed and inaccessible due to its location directly above kitchen appliances; this loft space therefore was not inspected.

The southern section to the rear of the main coach house building comprised the cafe area. The loft space for this part of the building also comprised a timber framed structure with felt lining and tile roofing. It also had wooden joists with insulation in between and was partly boarded out. The loft space contained air ventilation ducting and a water tank. In this area some nesting material, old pigeon feathers, and an old wasp's nest was observed.

To the north west of the main coach house building was an extension which houses a toilet block as well as an engineering storage shed. The roof of this section was timber framed with a felt lining. It was divided into two sections, the first section for the engineering storage area was completely open, whilst the second section was observed to be above the men's toilets and the floor of this loft space was comprised of wooden timber joists with insulation between them. A large 1 m³ water tank was observed in this loft space. There was a large gap at eave level on every side of this section of the coach house building allowing for ample possible access for bats.

External inspection

Externally, the following features of suitability as bat roost / access points, were identified for this building:

- hole in corner of wall at eave level of ground floor, also gap between the wooden rafter and end wall adjacent to the cafe extension to the rear of the main building;
- slightly raised flashing where the dormer meets the roof;
- gap between the support pillar in the archway at ground floor level and the building wall on both sides of the pillar;
- air bricks on western wall above the archway;
- slightly raised roof tile behind the dormer above the cafe section;
- missing brick at eave level above the vent pipe on western wall;
- two gaps of missing mortar in the brickwork at first-floor level on the northern facade of the main building just below the chimney;
- small section of raised flashing on the corner of the soffit box at first-floor eave level on the northern façade;
- dense climber species across front of the building giving bird nesting potential with modest sized stems;
- two outlet pipes at the first-floor eave level at the front of the main building;
- large gap in the woodwork at the southern corner of the clock and gable at the front of the building;
- vent brick at the first-floor eave level on the southern facade of the main building;
- creeper with potential for bat crevices on the southern façade;
- gap under flashing at the first-floor eave level on the southern façade;
- gap at the ground floor eave level where the wooden fascia meets the main building.

Externally, for the café section of the Coach House, the following features of suitability as bat roost / access points, were identified for this section of the building:

- a small gap in the wooden fascia where electric cable emerges from building on the western facade of this section of building supplying the security light.

Externally, the north-west section extension of the main coach house which houses a toilet block as well as an engineering storage shed, was noted to possess the following features of suitability as bat roost / access points:

- ripped roofing felt allowing potential bat access between the felt and roof tiles on the southern facade;
- gap at eave level between the roof and the supporting walls all around this section of building;
- two missing bricks at 2 m high giving access into the wall cavity on the western façade.

B2: Coach house store building

Internal Inspection

The coach house shed building located to the north of the main coach house comprised a wooden framed building with a wooden-framed tiled hipped roof. The interior northern two thirds of the building was completely open with no enclosed loft space. The roof internal lining was wooden sarking with exposed rafters. The southern third of the building has an enclosed loft space with a small internal opening at the ridge level, there was no internal access to this loft space. The open roof space was observed to be heavily cobwebbed and no notable crevice opportunities for bat were observed.

External inspection

Externally, the following features of suitability as bat roost / access points, were identified for this building:

- a small gap at the end of the ridge tile southern facade;
- access point at eave level on north-east corner of building;
- a possible gap between roof ridge tiles at the northern end of building.

B3: Ticket office

Internal Inspection

Although there appeared to be an internal loft space to the sports hut building no access hatch into this loft space was found during the inspection.

External inspection

Externally, the following features of suitability as bat roost / access points, were identified for this building:

- gaps between wooden boarding on all facades, old birds nest observed under boarding of eastern facade gable
- gap between top of wall and roof where Ivy is growing through on southern facade
- gaps between timber and felt roof at eave level on southern and northern facades
- gaps in mortise joints on northern facade.

B4: Disused toilet block

Internal Inspection

This was a brick building with tiled hipped roof. Although there appeared to be an internal loft space to the disused toilet block, the only access was via a loft hatch at the eastern end of the building.

The internal loft space was observed to be no more than 75 cm to ridge height, with timber rafters and felt lining. Floor joists in the loft space were observed with fibreglass insulation in-between, the ambient temperature was approximately 5°C. No external light was observed entering the loft space. A large water tank was observed adjacent to the loft hatch, preventing access to the remainder of the loft space.

External inspection

Externally, the following features of suitability as bat roost / access points, were identified for this building:

- series of vent bricks located at eaves level arounds all sides of building
- open toilet window and other windows observed to be ajar
- missing mortar on hip joint at both ends of building
- four missing roof ridge tiles were observed and two of the remaining ridge tiles are observed to have gaps beneath them.

B5: Park offices/sports centre

Internal Inspection

Although the Park offices comprised a mostly ground floor level, flat roofed brick building, there was a second floor level that was situated above the plant room in the main office building. The upper level to the plant room was accessed via a ladder to a small wooden floor which then provided access to the top of a large steel tank. No droppings were observed on the wooden floor or on the top of the tank and moderate cobwebbing was observed throughout. No other loft space was found within the park office buildings.

External inspection

Externally, the following features of suitability as bat roost / access points, were identified for this building:

- louvres above plant room door providing potential bat mass access point;
- bird box at 2 m high on the northern facade of main building adjacent to the entrance;
- Ivy covering the South Western corner of the main park office building with thick stems providing good bird nesting potential with old nests observed.

B6: Pagoda

This was a brick walled and timber framed building with pitched roof covered by tarpaulin with wooden soffits. No bat crevice opportunities were observed, though this structure could potentially be used as a feeding perch by certain bat species.

B7: Marble Hill House

Basement

To access points from the exterior into the basement were identified, namely the louvred door and window to the basement area at the base of a stairwell on the southern elevation of the house.

In the interior of the basement (which is understood to be regularly accessed by park staff, i.e. every couple of months in the winter) was sub-divided into a series of interconnecting (door-less) rooms and was noted to feel relatively cool and humid. The brickwork internal walls of the basement were largely intact though several crevice features occur at locations where cabling / pipping passes through walls etc. In the boiler room, relatively more numerous crevices opportunities were noted including missing bricks into brickwork wall and a series of drilled holes towards the base of the brickwork wall etc.

The Garrets

The West and East Garrets comprise two roof / loft storage rooms on the upper / fourth floor of this building. Both loft storage rooms were mainly boarded, with insulation exposed at the eaves, with exposed roof beams and bitumen felt roof liner and steel metal roof supports.

No direct evidence of bats was identified (only small mammal nesting material was noted) and no daylight was visible within either space with the exception of one location.

Specifically, in the East Garret, one section of torn felt liner occurs, through which the roof pantiles and daylight are visible; this could present an access point for bats. Several dead cluster flies were noted directly beneath this crevice.

Both spaces were very hot (33 degrees), though the survey was undertaken in unseasonably warm weather.

On the southern elevation of the building, a small eave level roof space extends along the building's length and joins up with the West and East Garrets; this space was also visually inspected and no direct bat evidence was identified.

Upper enclosed loft space

The upper enclosed loft space was inspected from the loft hatch, due to heath and safety concerns; i.e. the loft space was not directly accessed.

The unboarded loft space's floor in covered by insulation material and the roof beams are exposed and the roof lined with bitumen felt. The roof space's trusses are limited to the peripheries of the space, providing an uncluttered flying space. No direct evidence of bats was identified; a large wasps' nest and cluster flies were however noted.

External features

During the external inspection the following features / access points were identified:

- Possible gaps/ crevices at the join of the dormers to the roof slopes
- Possible small section of missing mortar between hip tile and upper roof pantiles on the south-western hip

B8: Ice House

During the initial ice house inspection in September 2016, it was noted only a single potential access feature for bats into the Ice House was identified, in the form of the narrow gap between the Ice House door and its frame. Although the potential for bats to use this possible access feature to enter the ice house cannot be entirely discounted, the abundance of spiders within the ice house interior infer that this structure is unlikely to be accessed by bats, which would otherwise likely predate upon the exposed spiders.

Internally, no evidence of bats was found and no crevice features were noted.

B9: Grotto

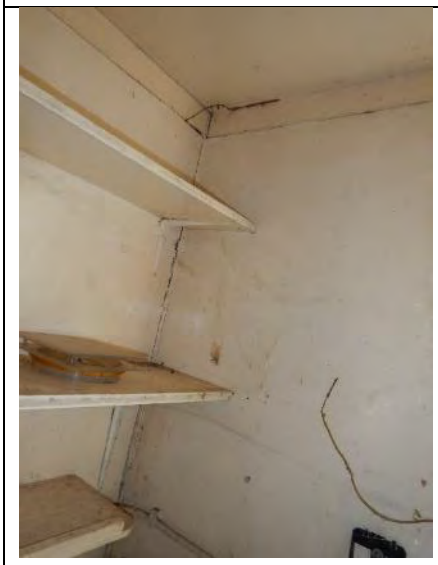
During the initial grotto inspection in September 2016, a single small-sized bat dropping was discovered within the Grotto. Although the grotto interior itself largely lacked crevices, the stone-work entrance to the grotto was noted to include numerous suitable bat roost features (including features suitable for hibernation).

Building B1-B6 Internal Inspection - Photographs:

Building B1 – Coach house	
	A view of the interior of the small loft space above the bathroom in the southernmost apartment of the coach house building.
	A view of the main loft space above the southernmost apartment.
	The brick firewall positioned to the north of the loft space with a missing brick shown to the right of the photo, revealing the loft space beyond.
	A view of the small loft space to the east of the main loft space described above, with the brick wall to the rear of the photo housing the clock face.

	A view of the bell tower situated above the loft space hatch in the kitchen area of the southernmost apartment. A hole can be seen in the underside of the bell mechanism housing, revealing a possible void within.
	View of skeletal remains found in the clock mechanism section of the loft space
	View of the northern rear extension of the coach house showing the timber framed roof with felt lining.
	A view of the water tank above the men's toilets in the rear extension of the coach house.

	A view of the air duct in the loft space above the southern extension of the coach house, where the cafe is situated, showing timber framed roof with felt lining and wooden joists on floor with insulation between.
	A picture showing some nesting material and an old wasp nest in the cafe section loft space.
	A picture showing several pigeon feathers in the cafe section loft space.
B2: Coach House Store building	
	A picture showing the internal roof space of the coach house shed building, comprising wooden sarking and a timber framed roof with exposed rafters. The northern two thirds of the building is open and the southern one third has an enclosed loft space.

	A view of the loft space entrance at the apex of the building in the southern one third of the coach house store building, as described above.
B3: Ticket office	
	Interior of the ticket office showing ceiling, with no loft hatch and no access from exterior wall paneling into interior. The interior itself lacks any crevice dwelling opportunities.
B4: Disused toilet block	
	A view of the wooden box cover for the water tank in the loft space above the disused toilet block, showing a timber framed roof with felt lining and much cobwebbing.
B5: Park offices	

	A view of the plant room loft space floor with the water tank shown to the left.
	A view of the top of the water tank described above.

Buildings B1-B6 External Inspection - Photographs:

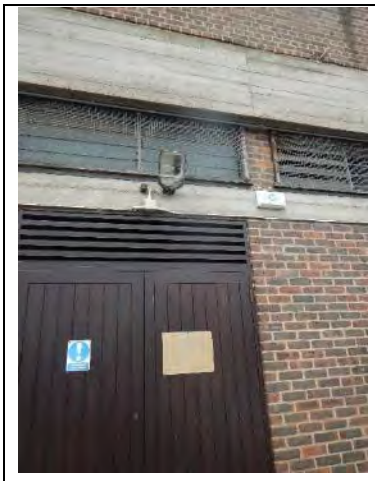
B1: Coach house	
	A view of the main chimney in the southern half of the coach house to the rear, showing raised lead flashing.
	A view of the underside of the eaves of the toilet block roof to the rear of the coach house, showing the open nature of the eaves. This provides potential access to bats on all three sides of this section of the coach house building.
	Missing mortar in the brickwork in the northern wall of the coach house building at first-floor level.

	A picture of the soffit box at eave level on the northern wall of the coach house building showing a possible gap between the lead flashing and wooden soffit, allowing possible access to bats.
	A view of the front of the coach house building at eave level, showing a gap in the woodwork which may allow access to bats into the roof void behind.
	An air vent situated at first-floor level, just below the eaves at the southern end of the coach house building, which may afford possible access to bats into a roof void or wall cavity.
	A gap in the brickwork adjacent to the wooden fascia where the southern rear extension to the coach house meets the main building.
B2: Coach House Store Building	

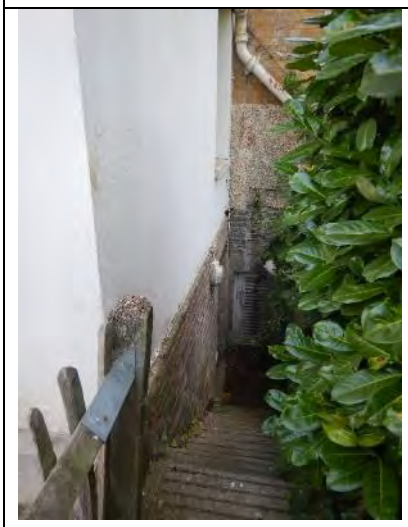
	A picture showing the south-west aspects of the coach house store building, with the wooden panelled walls and tiled roofing.
	A picture showing a gap at eave level of the coach house store building.

B3: Ticket office	
	A view of the southern aspect of the sports hut building showing the waney-edged boarding on the side and front walls, and the tiled roof.
	A close-up view of the underside of the waney-edged board at the eastern gable end showing large gaps under the board allowing possible space for roosting bats.
B4: Disused toilet block	
	The eastern facade of the disused toilet block showing the brick built walls and tiled roof.
	A picture showing missing ridge tiles.

	A picture showing missing mortar at the end of the roof ridge and the hip tiles.
B5: Park offices/sports centre	
	A view of the northern facade of the Park offices main building, showing the raised first-floor level above the plant room.
	A view from inside the main plant storage building, showing the open sides to the building, corrugated metal sheet roofing, steel frame structure and the netting on underside of roofing to prevent access to birds.
	The Western facade of the maintenance building showing the concrete walled and corrugated metal roof structure of the building.

	Picture showing louvres above plant room door.
	Bird box adjacent to entrance of the main park office.
	A view of parts of the ivy covering the south-west section of the main parks office building containing disused birds' nests.
B6: Pagoda	
	A picture showing the front of the pagoda building with the wooden frame structure and tarpaulin covered roof.

Other park Buildings - Internal Inspection - Photographs:

B7 -Marble Hill House – Basement	
	Context of louvred access points to basement, at foot of a stairwell
	Louvred (un-grilled) door to basement area, providing suitable bat access point into basement interior
	Louvred (un-grilled) window adjacent to basement door, providing suitable access point into basement interior

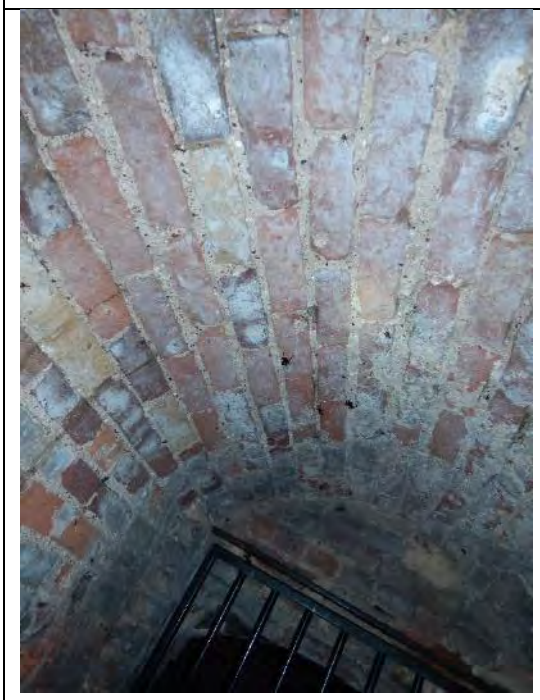
	Context view of interior of part of basement, indicating general lack / paucity of any crevice features for crevice roosting bat species; however, bats in hibernation occasionally roost in open on brickwork surface
	View of several drilled holes into brickwork
	View of cervices created by drill holes for cabling
B7 -Marble Hill House – The Garrets & Eaves	

	Context view of one of the two boarded roof spaces, i.e. the East Garret and West Garret.
	Close up view of a section of torn bitumen roofing felt liner towards the southern end of the East Garret, though which the roof tiles and daylight were visible.
	View of the eave roof spaces which extent the length of the southern elevation and link with the West and East Garret at either end.
B7 - Marble Hill House – Upper Enclosed Loft Space	
	View of the unboarded loft space showing how trusses are limited to the peripheries, providing an uncluttered flying space

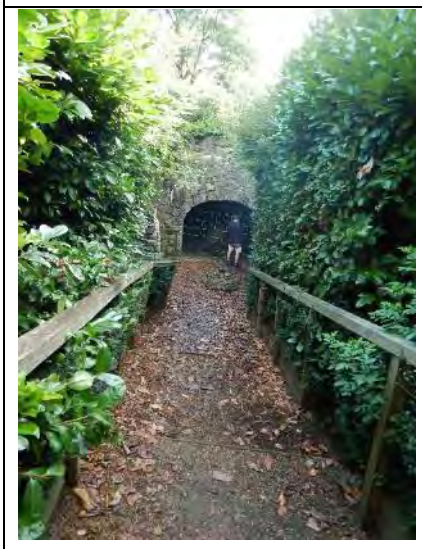
	View of exposed timber and bitumen lines roof slopes with insulation and occasional exposed joist; large wasps' nest in background
	Close up view of timber joints at apex of the hipped roof.
	Context of northern elevation
	Context of southern elevation

	Close up view of possible slight gap between mortar and hip tiles / upper most roof tile
	Close up view of dormers showing possible gaps

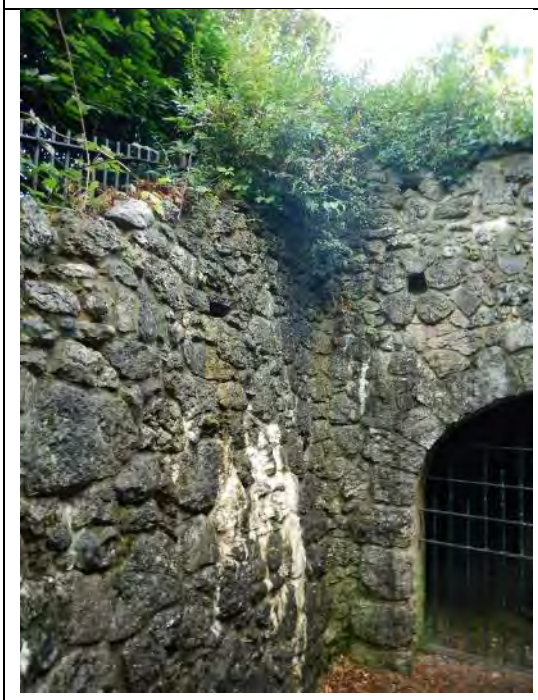
B8 – Ice House	
	A view of the context of the front of the ice house

	View from ice house exterior door into passageway with grill to sunken ice house in background
	Close up view of the brickwork ceiling of the ice house passageway showing intact mortar and several spiders

	View of the domed ceiling of the sunken ice house section, again with intact mortar

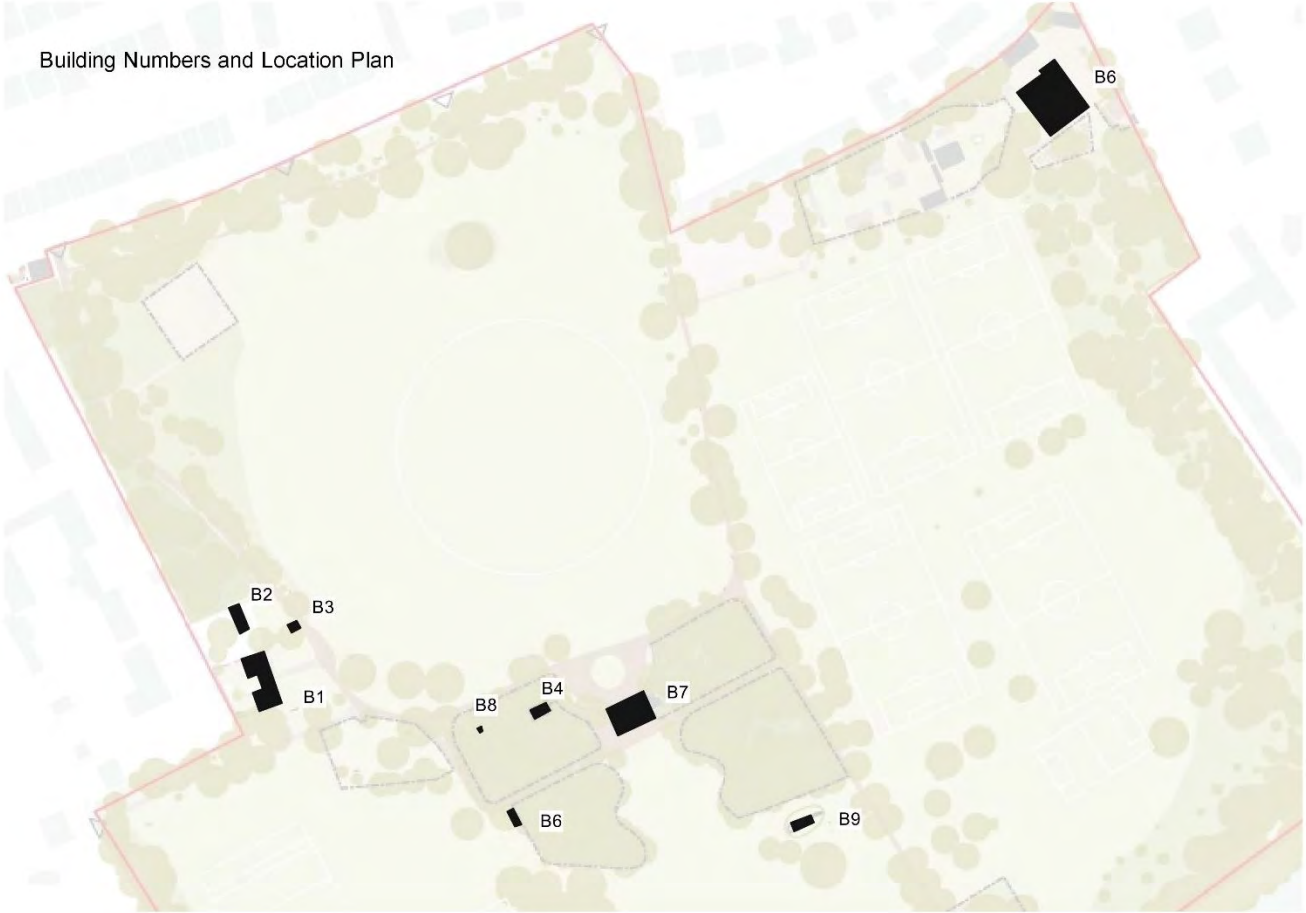
B9 – Grotto	
	A view of the context of the shrub and fence lined approach down to the slightly sunken grotto

	View at grill into the relatively small grotto
	View of the extent of the interior of the grotto, for which brickwork is largely intact, lacking many crevices
	Close of view of one of very few crevices within the grotto

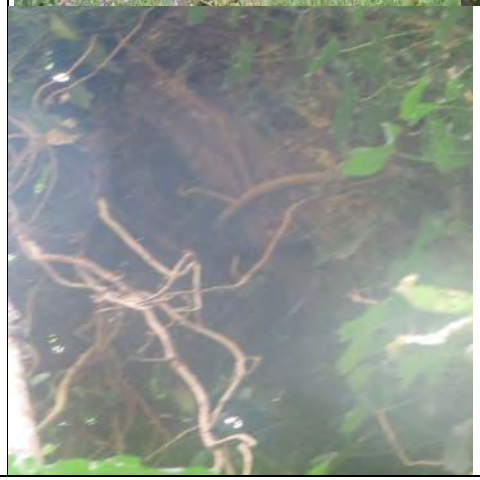
	View of the corner of the grotto upon the floor of which a single small-sized bat dropping was found
	View of the stone-work at the entrance to the grotto which possesses numerous crevices


foa
ecology

10. APPENDIX 2 – BUILDING PLAN



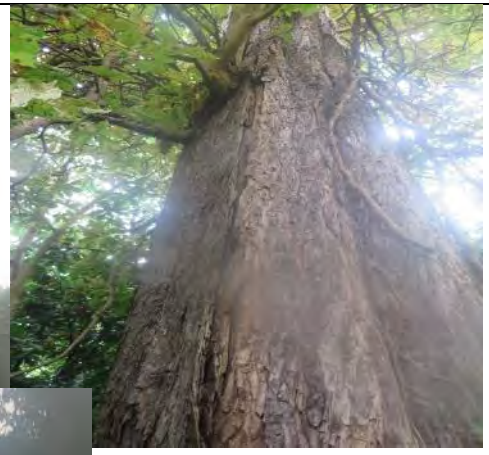
11. APPENDIX 3 – TREE BAT INSPECTION RESULTS

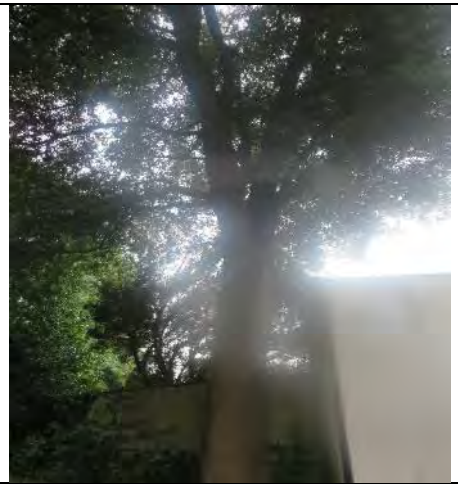
Arb. Tree Ref number	Tree species	Photographs	Description of features	BRP rating
G3.31	Horse Chestnut	  	-One trunk cavity -One branch cavity -Split bark near cavity	Low

G7.187	Black Locust		-Two trunk cavities -Flaking/loose bark all over tree -Split branch with loose bark	Low

G8 area	Dead Sycamore	 	-Truck split with small cavities -Mature dead ivy cover. -small flaking, loose bark all over	Moderate
G8.32	Dead Cherry		-moderate ivy cover	Negligible

Unnamed - South-west corner of seating paddock. South-east of Gatehouse.	Elder			-No features	Negligible

Arb. T12	Horse Chestnut	  	-Split branch with flaking bark producing crevices. -deep trunk crevices up the whole trunk	Moderate
T47	Yew		-No features	Negligible

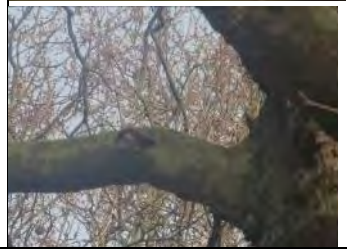
T48	Bay			-No features -Bird nest on branch adjacent to main house.	Negligible

T49	Silver Birch		-One Trunk cavity -Two branch cavities	Low/negligible

T50	Elder		-No features	Negligible
T56	Hop Hornbeam		-One branch cavity	Negligible

2016:

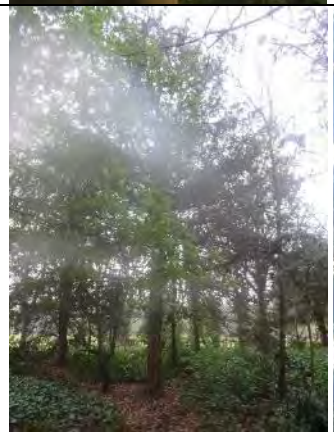
FOA & Arb. Tree Ref number	Tree species	Photographs	Description of features	BRP rating
1	London Plane	  	-One rot hole -One branch cavity -Flaking bark all over	Moderate

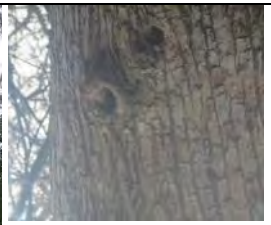
2	London Plane	   		-Two rot holes -One large trunk cavity at the base -Flaking bark all over	Moderate

3	Pedunculate Oak		-Two rot holes -One trunk cavity -Some rolls in a branch creating crevices -Flaking bark all over	High

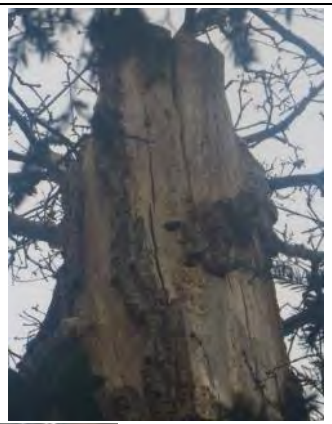
4	Robinia sp.	  	-Two rot holes -Flaking bark all over	Moderate
5	Robinia sp.	  	-One woodpecker hole -One tear-out wound -Flaking bark all over	Moderate

6	Atlas Cedar		-Two closed ended trunk cavities -One closed ended rot hole -Flaking bark on the trunk	Low
7	Sycamore		-Moderate ivy cover	Negligible

8	Unidentified	 	-2 rot holes -sparse ivy cover	Low
9	Coniferous sp.	 	-Splits and crevices all over	Low

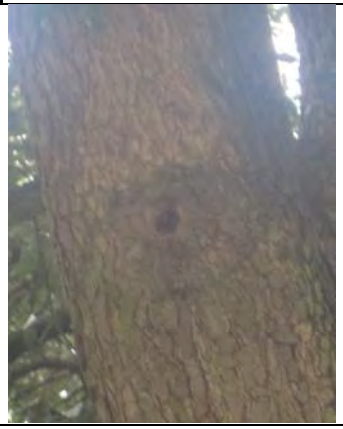
10, i.e. Arb Tree G9.17	Mature lime	   	-Several woodpecker holes -Several rot holes -Two areas of damaged bark creating crevices	High

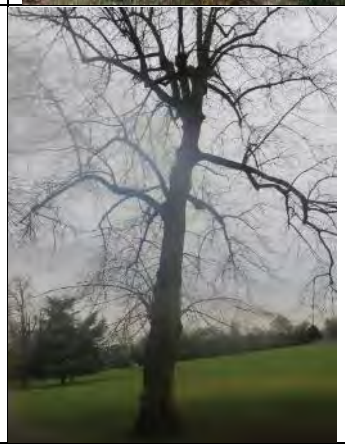
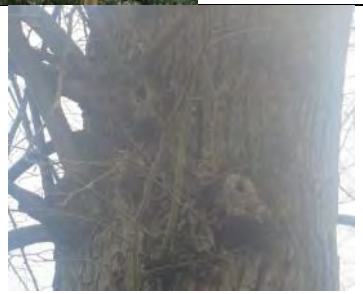
11	Unidentified		-One trunk cavity in the base of the tree which extends upwards	Moderate

12	Pedunculate Oak	  	-Several woodpecker holes -One trunk cavity, at the top of the tree -Loose bark	Moderate

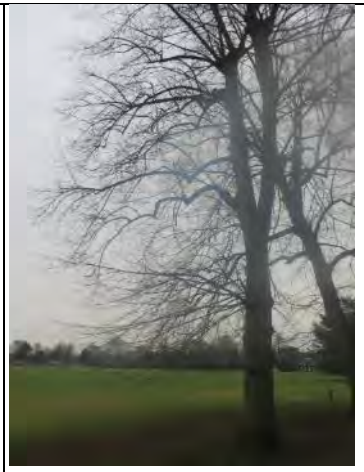
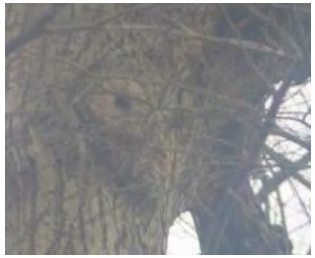
13 i.e. Arb G9.10	Dead tree	  	-One trunk cavity, at the top of the tree -One rot hole -Some woodpecker holes	Moderate
14	Unidentified	 	-One trunk cavity -Two callous rolls -A couple of woodpecker holes -Possibly open at top	Moderate

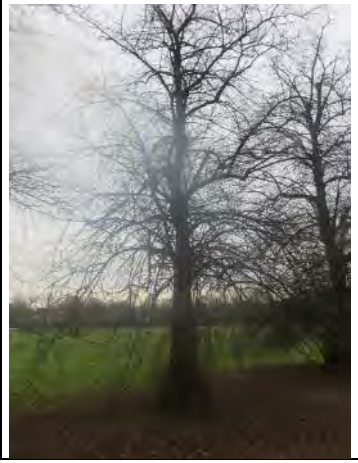
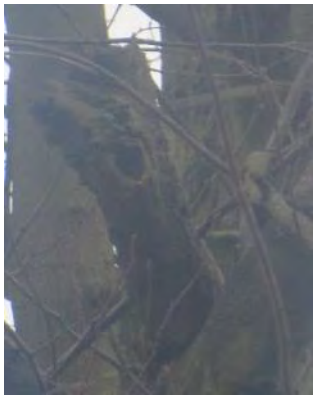
15	Unidentified	 	-One trunk cavity, and a possible open top -One branch cavity that potentially extends up, but provides a good crevice also	Moderate
16	Pedunculate Oak	  	-One Trunk cavity where the tree is open at the top -Loose and lifted bark with crevice beneath -Occasional woodpecker hole	Moderate

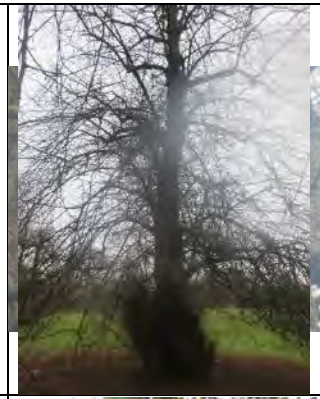
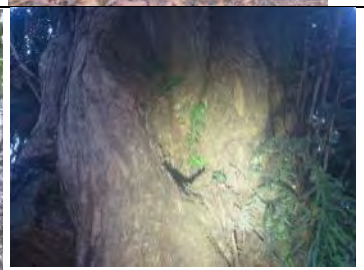
17	Common Beech			-Two rot holes, downward pointing	Moderate
18	Holm oak			-One small rot hole	Low

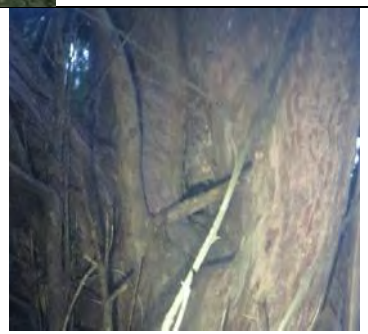
19 & 20	Common Yew		-Bark crevices present all over	Low
21	Common Lime	 	-Several small rot holes	Moderate

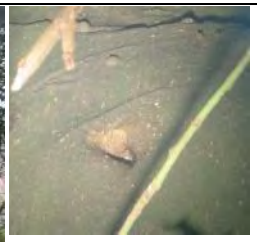
		  			

22	Common Lime	 	  		-Several rot holes / callous rolls	Moderate

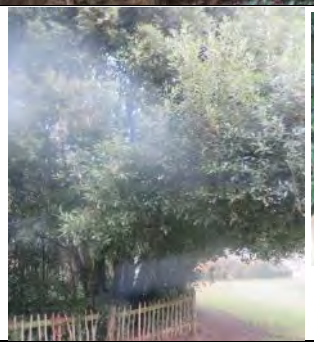
23	Common Lime	 	-One small rot hole	Low
24	Common Lime	 	-One rot hole	Low

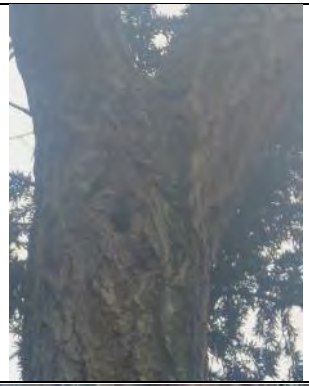
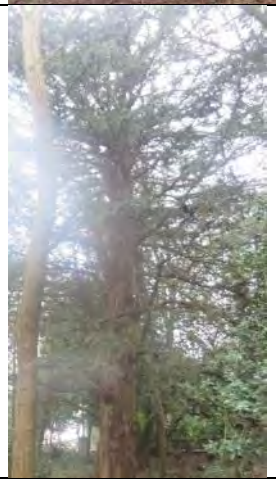
25	Common Lime	 	-One Trunk cavity -One rot hole -Deadwood in canopy	Low
26	Common Yew	 	-One shallow rot hole	Low

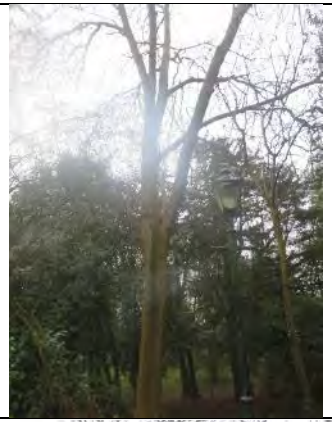
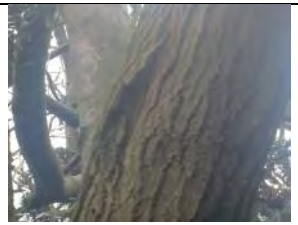
27& 28	Common Yew		-Loose bark and Crevices between branches and trunk	Low
29	Common Yew	 	-One hole in base of branch -Split bark	Moderate

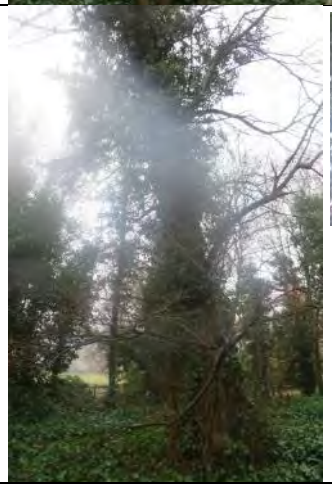
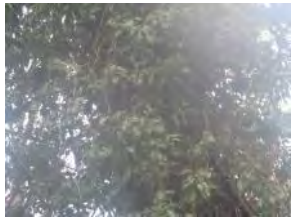
Tree Ref number	Tree species	Photographs	Description of features	BRP rating
30	Holly	  	-One Split in trunk near ground that extends upwards -One small branch cavity	Moderate
31, i.e. Arb tree G8.31	Cherry, dead	 	-One trunk cavity, comprising of rot in top of the tree, with several holes	Moderate

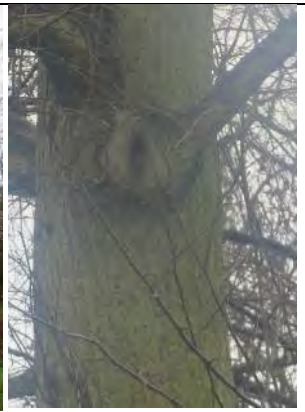
32	Ash	 	-One rot hole, from which a parakeet was observed emerging	Low
33	Unidentified	 	-One trunk cavity which extends upwards -Moderate ivy covering	Moderate

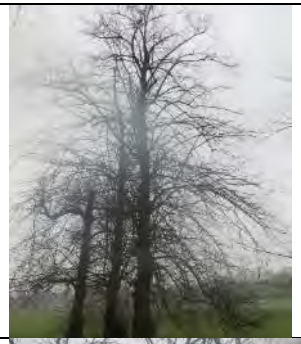
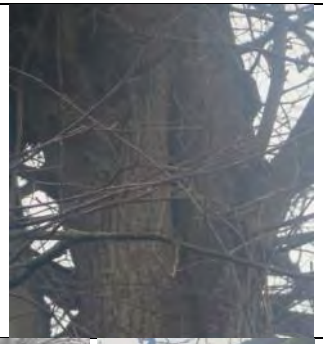
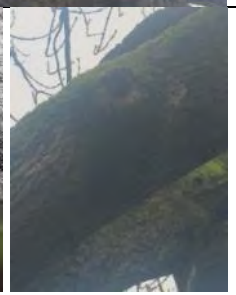
34	Unidentified, dead	  	-Loose and peeling bark all over, creating crevices	Low
35	Holm oak	 	-Large rotted out cavity at tree base. Possibly in use by a wild mammal due to presence of bedding material nearby	Low

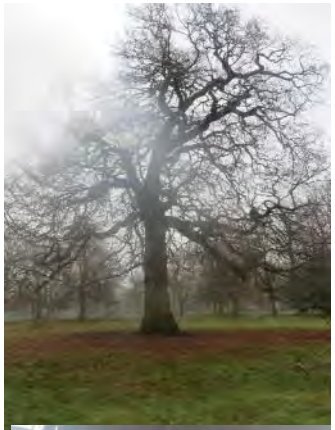
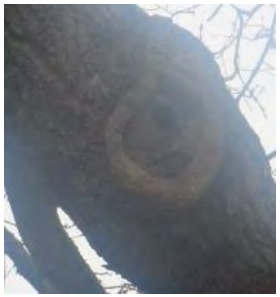
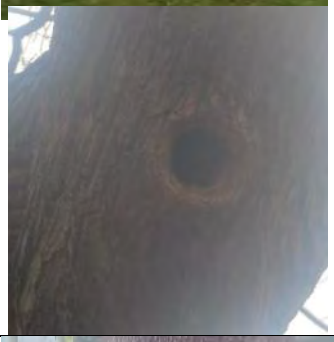
36	Sycamore/Maple	 	-One very small rot hole	Low
37	Unidentified	 	-Split bark and small crevices -One branch cavity in top of lower branch, open to elements	Low

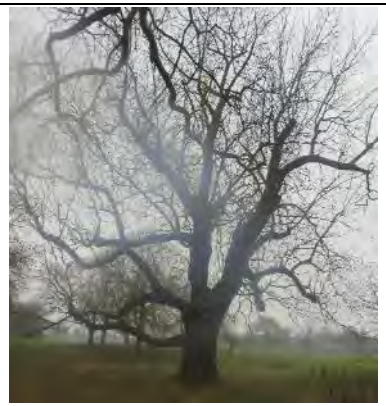
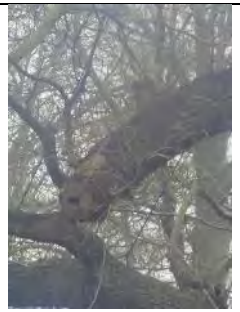
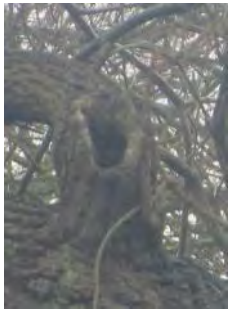
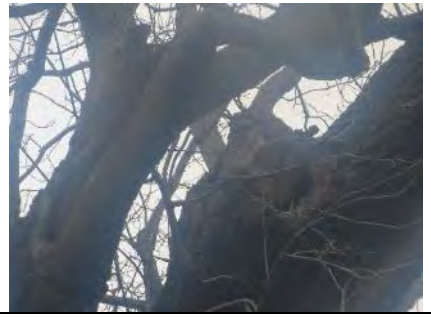
38	Common Ash	 	-One area of loose, lifted bark creating a crevice	Low
39	Pedunculate Oak		-Crevices in bark all over -Sparse ivy cover	Low

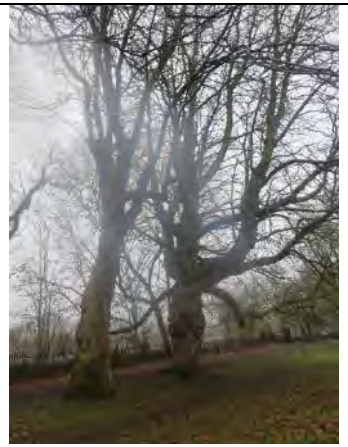
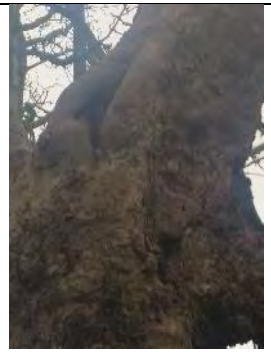
40	Unidentified		-Dense ivy cover	Low
41	Unidentified	 	-Dense ivy cover	Low
42	Lime	No image	-Dense ivy cover	Moderate

43	Common Lime	  	-One trunk cavity that extends upwards -Some ivy cover	Moderate

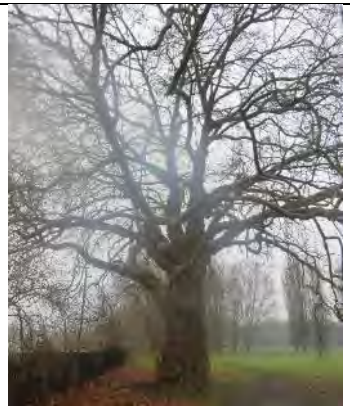
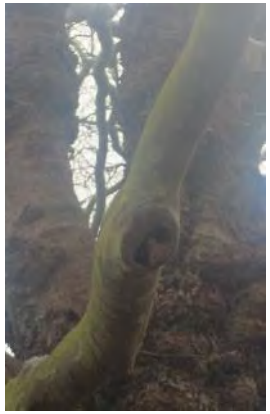
44	Common Lime	 	Split in trunk	Moderate
45	Common Ash	   	-Several rot holes	Moderate

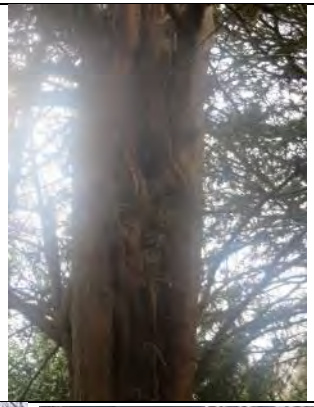
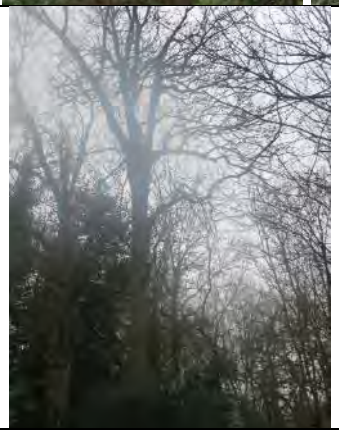
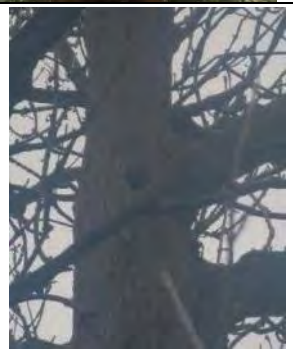
46	Pendulate oak	   	-Several rot holes -Several woodpecker holes -One trunk cavity at the base that extends upwards -One split branch	High
				

47	Black walnut – veteran specimen tree	    	-Several rot holes -Several woodpecker holes -Several branch cavities -Several parakeets and grey squirrel associated with tree	High

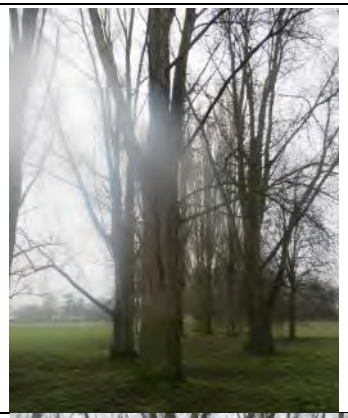
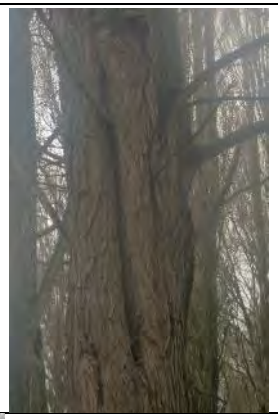
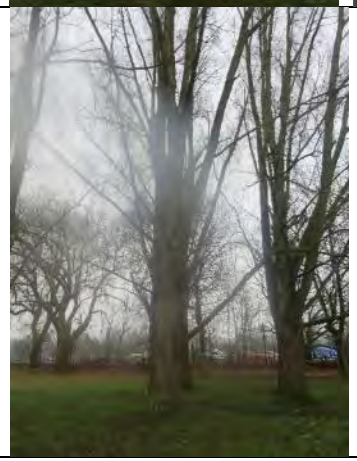
48	London plane	 		-One trunk cavity -Two branch cavities	Moderate

49	London plane			-One rot hole	Low

50	Maple / Acer sp.	   	-Crevices in bark -One rot hole	Low

51	Unidentified	 	-Many splits and crevices all over	Low
52	Ash	 	-Two woodpecker holes	Low

53	Ornamental birch	 	-Several blind ended rot holes	Negligible

54	Crack Willow: Arb	 	-One split in the bark -Several birds' nests	Low
55	Crack Willow		-Loose bark	Negligible