

8.12 BAT SURVEY



15th December 2016

Neil Davidson, J&L Gibbons

cc:

David Withycombe, Director, Land Management Services

Dear Neil,

Proposed Improvement Works at Marble Hill Park, Twickenham, TW1 2NL – Preliminary Bat Survey Work

Introduction:

J & L Gibbons initially commissioned FOA Ecology Ltd to undertake an initial suite of bat detector surveys to investigate the use by roosting bats, if any, of four of the park's buildings; Marble Hill House, the Coach House, the Grotto and the Ice House.

Whilst on site the survey team carried out an ad hoc incidental ecological walkover of several of the other on-site buildings, which may be scheduled for demolition / proposed works, in order to inform the need for and if so, scope of, any further bat survey work.

It is understood that the project team is currently in the process of applying for a planning application for the renovation of several of the park's buildings (including the Marble Hill House, the Coach House, the Store Building and the Grotto) as well as for the demolition of the park's Pagoda and two out-buildings (i.e. a disused Toilet Block and the ticket shed). Additionally, some of the sites trees will be felled during the proposed re-development.

This letter report provides the methods, results, conclusion and recommendations of the initial bat detector survey work.

Summary

Main Findings of Initial Detector Survey Work:

For the initial bat detector survey work, no roosting bats were identified (observed or detected) to emerge from the Coach House during the dusk detector survey carried out on the 22nd September 2016, from Marble Hill House during the dusk detector survey carried out on the 26th September 2016 or from either the Grotto nor the Ice House during the dusk detector surveys carried out on the 27th September 2016, despite the identification of a single small-sized bat dropping within the Grotto.

Nonetheless, some evidence to infer the likely presence of bat roost(s), in the vicinity of at least one of the buildings in addition to the Grotto, namely the Coach House (see Discussion &



Conclusions) was identified and in order to confirm the presence or likely absence of roosting bats at these buildings, additional further survey work would be required.

In terms of incidental bat activity, 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.

Based upon the detector survey work, it is clear that the woodland and grassland areas adjacent to both the Coach House and Marble Hill House possess moderate/high value as bat foraging / commuting areas; the vegetated areas which surround the Grotto and Ice House are expected to be of similar value.

Discussion:

Based upon the findings of the initial emergence and swarming detector surveys, there is no direct evidence that the Coach House, Marble Hill House, the Grotto or the Ice House are in use by bats as a transitional autumn roost during September 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 cannot be discounted without further survey.

In terms of the Nathusius' pipistrelle, this species was detected on several occasions (on 22nd September detector survey of the Coach House and 26th September survey of the Marble Hill House) and once on 27th September detector survey of the Grotto, though the earliest detections on these 3 dates were not particularly 'early' (i.e. soon after sunset) being at 30 minutes after sunset, 36 minutes after sunset and 58 minutes after sunset respectively. That said, Nathusius' pipistrelle's emergence window can be relatively later than that of common and soprano pipistrelle.

In addition, one of the Nathusius' pipistrelle echolocation passes included a 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.

Accordingly, it is possible that a Nathusius' pipistrelle mating site and mating roost may occur nearby to the south-eastern corner of the Coach House, potentially within a neighbouring tree or else potentially within the Coach House itself; further survey work would be required to investigate this.

In terms of the *Nyctalus* species passes and single unseen long-eared bat species pass (26th September survey of Marble Hill House at 1 hour and 12 minutes after sunset, 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, 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 above named structures. Instead, further survey work (in the form of additional detector survey work and a formal [internal and external] inspection) will be required for all those buildings which are scheduled to be affected by the proposed development and possess a bat roost potential rating of Low or higher.

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 or low numbers of bat, possibly used during the hibernation period.

For the Grotto, given the discovery of this single small-sized bat dropping within this structure and the abundance of suitable bat roost (including hibernation) features, additional further bat survey work will also be necessary if the Grotto is to be affected by the proposed development.

Main Recommendations:

Based upon the proposed scope of works, the following further bat survey work recommendations for each building, each of which may be affected by the proposed works, are made:

- **Marble Hill House** – No further survey work necessary, *assuming no* external work or works that could impact roof/ eaves / loft spaces (directly or indirectly – the latter by noise, vibration, increased external light spillage etc.)
- **Coach House** – A formal building (internal and external) inspection is recommended, given that increased external lighting is proposed (see separate light spillage minimisation recommendation below). No further bat detector survey work necessary, *assuming no* external work or works that could impact roof / eaves / loft spaces or indirect impacts as a result of lighting.



- **Store building to the side of Coach House** – A formal (internal and external) building inspection is recommended along with a minimum of a single bat detector survey, carried out between May - August. *Further bat detector surveys may be required if direct evidence of bats is encountered and / or features which afford the building more than low bat roost potential are found.*
- **Grotto** – If the interior of the grotto is to be opened up, giving public access and / or the interpretation board would obscure / block any suitable bat roost feature(s), then further bat survey work will be required in the form of winter daytime hibernation visits and spring 2017 detector survey work.
- **Pagoda** - A formal (internal and external) building inspection is recommended. *Further bat detector surveys may be required if direct evidence of bats is encountered and / or features which afford the building more than negligible bat roost potential are found.*
- **Disused toilet block** - A formal (internal and external) building inspection is recommended along with a minimum of a single bat detector survey, carried out between May - August. *Further bat detector surveys may be required if direct evidence of bats is encountered and / or features which afford the building more than low bat roost potential are found.*
- **Ticket shed** - A formal (internal and external) building inspection is recommended along with a minimum of a single bat detector survey, carried out between May - August. *Further bat detector surveys may be required if direct evidence of bats is encountered and / or features which afford the building more than low bat roost potential are found.*
- **Sports block** - A formal (internal and external) building inspection is recommended, if this building is to be affected by the proposed works. *Further bat detector surveys may be required if direct evidence of bats is encountered and / or features which afford the building more than negligible bat roost potential are found.*
- **Buildings associated with Marble Hill Adventure playground** – if proposed to be affected by the works, specific bat survey work will be required

Some tree work will be taking place, including felling and tree surgery within the four woodland quarters to the east, west, south-east and south-west of Marble Hill House.

A formal daytime ground-level bat roost assessment of all trees to be felled or subject to tree surgery is therefore initially recommended and should be undertaken during winter months (when there are no leaves on the trees). In addition, further bat survey work in the form of climbing inspections and / or bat detector survey work will be required if direct evidence of roosting bats and / or features which afford the tree with medium or high bat roost potential are found.

With respect to the proposed external lighting of the new café in the Coach House, it is recommended that FOA Ecology has ecological input into the preparation of a bat-friendly lighting



scheme for the new café in, in collaboration with the project team's lighting engineers.

Lastly, it is strongly advised that bat data from the London Bat Group (LBG) is purchased and collated, as LBG hold roost records and do not share these with GiGL.

Methodology

Emergence Detector Surveys

A total of four preliminary bat emergence detector surveys were carried out of 4 buildings at Marble Hill Park:

- Marble Hill House
- Coach House
- Grotto
- Ice House

The first a dusk emergence detector survey of the Coach House building on the 22nd September 2016, the second a dusk emergence detector survey of Marble Hill House on the 26th September 2016 and the third a dusk emergence detector survey of both the Grotto and the Ice House on the 27th September 2016. Each detector survey was carried out by a team of 1-4 surveyors, and also up to 2 night-vision video cameras (with supplementary infra-red lighting) paired with static detectors, positioned at different vantages around each building.

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), whereas the dawn 're-entry' survey commenced 90 minutes before sunrise and continued until sunrise.

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

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

Swarming Detector Survey Work of Possible Hibernation Sites

In addition, 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 determine 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).

Ad Hoc Ecological Walkover

Whilst on site the survey team carried out an ad hoc incidental ecological walkover of several of the other on-site buildings, which may be scheduled for demolition / proposed works, in order to inform the need for and if so, scope of, any further bat survey work, namely the following buildings:

- the Store Building associated with the Coach House
- Pagoda
- a disused Toilet Block
- ticket shed

Limitations

Emergence Detector Surveys

All 4 of the dusk 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 addition, given the October 2017 time-frame for the commencement of the proposed works, by conducting the first of the necessary suite of detector surveys in September 2016 shall allow for an earlier completion of the remaining detector survey visits in spring 2017.

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 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 surveyed structures until the further recommended detector survey work (and recommended formal building inspection) have been completed during spring 2017.

Swarming Detector Survey Work of Possible Hibernation Sites

No specific limitations were identified for this 5 nights 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, as discussed later in the report, for the Grotto (within which a bat dropping was



found and which possesses numerous suitable bat roost features), its use by roosting bats, including for hibernation, cannot be discounted.

The use of the grotto by hibernating bats would require further survey in January 2017 and February 2017, whilst its use for roosting during months when bats are active would require further detector survey work in spring 2017.

Ad Hoc Ecological Walkover

The ecological walkover did not comprise a formal external and internal inspection of the park's surveyed structures which are to be affected by the proposed works, and so a formal inspection will be required to thoroughly check for roosting bat evidence and to formally assess the level of bat roost potential of each of these structures.

Results

Ad Hoc Ecological Walkover

Based upon the ad hoc, incidental ecological walk the following 'tentative' ratings of bat roost potential are assigned to each surveyed building:

- Store adjacent to Coach House – a minimum of Low
- Disused toilet block – a minimum of Low
- Ticket shed – a minimum of Low
- Pagoda – Negligible
- Sports block – Negligible to Low
- Buildings associated with Marble Hill Adventure playground – a minimum of Low

However, it should be noted that these are only tentative ratings based on an incidental ecological walkover only. Therefore, the bat roost potential of these tentatively surveyed buildings as well as Marble Hill House, Coach House, Grotto and the Ice House will each need to be formally assessed during the recommended formal building (internal and external) inspections.

Emergence Detector Surveys

No roosting bats were identified (observed and / or detected) by any of the surveyors or night-vision video cameras to emerge from the Coach House, Marble Hill House, the Grotto or the Ice House during the initial dusk emergence bat detector surveys.

A large amount of incidental (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.



Based upon the detector survey work, it is clear that the woodland and grassland areas adjacent to both the Coach House and Marble Hill House possess moderate/high value as bat foraging / commuting areas; the vegetated areas which surround the Grotto and Ice House are expected to be of similar value.

This full survey data is provided in the tables in Appendix 1.

Swarming Detector Survey Work of Possible Hibernation Sites (Grotto & Ice House)

Neither of the static bat detectors deployed at the Grotto and the Ice House detected any activity directly within the confines of the Grotto or Ice House over the series of nights they were deployed for.

Nevertheless, during deployment of the static detector within the Grotto, however, a single small-sized bat dropping was discovered within the Grotto as well as numerous suitable bat roost features (including features suitable for hibernation).

For the ice House, 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, during the static detector deployment no evidence of roosting bats was found. Rather 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.

Bat 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 bat (a species which was recorded during the detector survey work, which is known to roost in buildings (including modern buildings), is a common bat species and thus is frequently encountered during development works.

Nyctalus species (either noctule or Leisler's) was also encountered. Noctule is also a Priority Species. Although it characteristically roosts in trees, it is also known to use buildings also.

Brown long-eared bat is additionally a Priority Species. A single possible long-eared bat passes was encountered (over 1 hour after sunset on 26th September) during the survey work, which



indicates this species is present in the local area, which is consistent with long-eared bat species also having possibly been recorded incidentally during the former detector survey of the Coach House by Fursefen Ecology.

For *Nathusius' pipistrelle*, although this species is not a National BAP priority species, in terms of its status, the *Nathusius' pipistrelle*, is rare but widespread in the British Isles (BCT). It was previously believed to be a wholly migratory species in Britain, however research has shown that this species, in some areas of Britain (including the south-east) is present year-round. Further, it is acknowledged (BCT) that males have a tendency to set up mating roosts close to their maternity roost site; this infers that a *Nathusius pipistrelle* maternity roost may potentially occur in the vicinity of the site.

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

Discussion

Based upon the findings of the initial emergence and swarming detector surveys, there is no direct evidence that the Coach House, Marble Hill House, the Grotto or the Ice House are in use by bats as a transitional autumn roost during September 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 cannot be discounted without further survey.

In terms of the *Nathusius' pipistrelle*, this species was detected on several occasions (on 22nd September detector survey of the Coach House and 26th September survey of the Marble Hill House) and once on 27th September detector survey of the Grotto, though the earliest detections on these 3 dates were not particularly 'early' (i.e. soon after sunset) being at 30 minutes after sunset, 36 minutes after sunset and 58 minutes after sunset respectively. That said, *Nathusius' pipistrelle's* emergence window can be relatively later than that of common and soprano pipistrelle.

In addition, one of the *Nathusius' pipistrelle* echolocation passes included a 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.

Accordingly, it is possible that a Nathusius' pipistrelle mating site and mating roost may occur nearby to the south-eastern corner of the Coach House, potentially within a neighbouring tree or else potentially within the Coach House itself; further survey work would be required to investigate this.

In terms of the *Nyctalus* species passes and single unseen long-eared bat species pass (26th September survey of marble Hill House at 1 hour and 12 minutes after sunset, 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, 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 above named structures. Instead, further survey work (in the form of additional detector survey work and a formal [internal and external] inspection) will be required for all those buildings which are scheduled to be affected by the proposed development and possess a bat roost potential rating of Low or higher.

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 or low numbers of bat, possibly used during the hibernation period.

For the Grotto, given the discovery of this single small-sized bat dropping within this structure and the abundance of suitable bat roost (including hibernation) features, additional further bat survey work will also be necessary if the Grotto is to be affected by the proposed development.

Scheme Proposals

Building Works

Further information regarding the nature of the proposed works was provided on the 17th October 2016, summarised as follows:

- Marble Hill House – no external works are proposed, with works restricted to internal like-for-like repairs
- 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



- Store building to the side (north) of the Coach House – not to be demolished, but proposed works will comprise: change of use and insertion of fittings and equipment as dry storage for catering and shop stock (by EH direct)
- Grotto – There will be freestanding interpretation in the grotto but no changes to the fabric.
- Pagoda - will be demolished
- Disused toilet block – will likely be demolished
- Ticket shed – to be demolished

Tree / Woodland Works

The following proposals were provided by the project team regarding trees / woodland:

'There is no new external light proposed within the park, although there will be some lighting associated with the new cafe in the stable block. As part of the plans to reinterpret the original 18th Century landscape design, tree works including felling and tree surgery will be required primarily in the four woodland quarters to the east, west and south east and south west of the main house. At present we do not have a full tree survey, this has just been commissioned.'

Recommendations

Buildings

In line with the proposals changes in October 20165, FOA Ecology's initial further bat survey work recommendations have been revised in accordance with these changes.

Specifically, the following further bat survey work recommendations for each building, which may be affected by the proposed works, are made:

- **Marble Hill House** – No further survey work necessary, *assuming no* external work or works that could impact roof/ eaves / loft spaces (directly or indirectly – the latter by noise, vibration, increased external light spillage etc.)
- **Coach House** – A formal building (internal and external) inspection is recommended, given that increased external lighting is proposed (see separate light spillage minimisation recommendation below). No further bat detector survey work necessary, *assuming no* external work or works that could impact roof / eaves / loft spaces or indirect impacts as a result of lighting.
- **Store building to the side of Coach House** – A formal (internal and external) building inspection is recommended along with a minimum of a single bat detector survey, carried out between May - August. *Further bat detector surveys may be required if direct evidence of bats is encountered and / or features which afford the building more than low bat roost potential are found.*
- **Grotto** – If the interior of the grotto is to be opened up, giving public access, and / or the interpretation board would obscure / block any suitable bat roost feature(s), then further



bat survey work will be required in the form of winter daytime hibernation visits and spring 2017 detector survey work.

- **Pagoda** - A formal (internal and external) building inspection is recommended. *Further bat detector surveys may be required if direct evidence of bats is encountered and / or features which afford the building more than negligible bat roost potential are found.*
- **Disused toilet block** - A formal (internal and external) building inspection is recommended along with a minimum of a single bat detector survey, carried out between May - August. *Further bat detector surveys may be required if direct evidence of bats is encountered and / or features which afford the building more than low bat roost potential are found.*
- **Ticket shed** - A formal (internal and external) building inspection is recommended along with a minimum of a single bat detector survey, carried out between May - August. *Further bat detector surveys may be required if direct evidence of bats is encountered and / or features which afford the building more than low bat roost potential are found.*
- **Sports block** - A formal (internal and external) building inspection is recommended, if this building is to be affected by the proposed works. *Further bat detector surveys may be required if direct evidence of bats is encountered and / or features which afford the building more than negligible bat roost potential are found.*
- **Buildings associated with Marble Hill Adventure playground** – if proposed to be affected by the works, specific bat survey work will be required

Trees / Woodland

Some tree work will be taking place, including felling and tree surgery within the four woodland quarters to the east, west, south-east and south-west of Marble Hill House.

A formal daytime ground-level bat roost assessment of all trees to be felled and / or subject to tree surgery is therefore recommended and should be undertaken during winter months (when there are no leaves on the trees).

Further bat survey work in the form of climbing inspections and / or bat detector survey work will be required if direct evidence of roosting bats and / or features which afford the tree with medium or high bat roost potential are found.

Lighting scheme

Further, it is recommended that FOA Ecology has ecological input into the preparation of a bat-friendly lighting scheme for the new café in the Coach House, in collaboration with the project team's lighting engineers.

For information, although all but one of the bat species encountered at the site during the survey work, i.e. soprano pipistrelle, common pipistrelle, Nathusius' pipistrelle, *Nyctalus* species and



probable Leisler's, are characterised as being tolerant of and / or attracted to forage within externally lit areas, brown long-eared bat (for which a single possible pass was detected) and other bat species (e.g. *Myotis* species), the latter which are likely to be present in the area, are known to be dissuaded from using lit areas (Bat Conservation Trust, 2007 and Fure, A. 2006).

Consequently, as roosting, foraging and commuting bats may be present in the vicinity of the site it is advised that any proposed additional external lighting of the proposed development should be minimised.

In addition, many other species of wildlife benefit from dark corridors, e.g. nocturnal species such as hedgehog.

The Bat Conservation Trust suggests several means by which external lighting can be minimised, as follows:

- 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.

Bat Record Purchase & Collation

It is strongly advised that bat data from the London Bat Group (LBG) is purchased and collated, as LBG hold roost records and do not share these with GiGL.



Appendix 1 - Bat Detector Survey Data:

Weather:

Weather conditions for each detector survey are provided in the table below:

Building	Survey type and time of dusk/dawn	Survey Date	Weather
Coach House	Dusk – 18:58	22/09/16	Max temp. 17°C, Min temp. 16°C, dry, mild, 9mph wind, 75% humidity, 3/8 cloud cover
Marble Hill House	Dusk – 18:49	26/09/2016	Max temp. 14°C, Min temp. 11°C, dry, still to light breeze, 1/8 cloud cover
Grotto & Ice House	Dusk – 18:47	27/09/2016	19°C, dry, 9mph south westerly wind, 85% humidity, 8/8 cloud cover

Results:

Results are summarised below for each surveyor during each survey.

Single Dusk Detector Survey of the Coach House building - Dusk 22nd September 2016

Surveyor position A - on the north east side of the building

Time	Species detected	Comments
19:12	Pipistrelle sp.	Unseen, very faint. Not detected on the recorder. 14 minutes after sunset.
19:12	Pipistrelle sp.	Unseen, foraging to the north of the surveyor. Not detected on the recorder. 14 minutes after sunset.
19:16	Soprano pipistrelle	Unseen, foraging to the north of the surveyor. Then seen, foraging low down and flying from east to west, and around the corner of the building. 18 minutes after sunset.
19:23	Soprano pipistrelle	Seen, foraging low down and flying from east to west, and around the corner of the building.
19:24	Soprano pipistrelle	Seen, with constant foraging with social calls along the front of the ivy covered building and around the northern corner until 19:29.



Time	Species detected	Comments
19:29	Common pipistrelle	Seen, commuting from the north side of the building towards the park. 31 minutes after sunset.
19:30	Common pipistrelle	Unseen.
19:31	Common pipistrelle	Seen, foraging from the north side of the building towards the park.
19:32	Soprano pipistrelle	Seen, with constant foraging and social calls along the front of the ivy covered building and around the northern corner and also overhead of the surveyor until 19:39.
19:36	Common pipistrelle	Unseen.
19:40	Soprano pipistrelle	Unseen, social calls.
19:41	Soprano pipistrelle	Seen, flying back and forth overhead between the surveyor and the northern woodland.
19:41	Common pipistrelle	Seen, flying back and forth overhead between the surveyor and the northern woodland.
19:42	Soprano pipistrelle	Seen, flying back and forth overhead between the surveyor and the northern woodland with some social calls.
19:43	Soprano pipistrelle	Unseen, constant foraging with some social calls until 19:49.
19:44	<i>Nyctalus</i> sp.	Unseen. 46 minutes after sunset.
19:45	Common pipistrelle	Unseen.
19:50	Common pipistrelle	Unseen, 1 pass.
19:51	Common pipistrelle	Unseen, 1 pass.
19:52	Soprano pipistrelle	Unseen, foraging with social calls until 20:00.
20:00	Common pipistrelle	Unseen, brief with some social calls.
20:00	Soprano pipistrelle	Unseen, foraging.
20:02	Common pipistrelle	Unseen, intermittent foraging passes until 20:06.
20:07	Soprano pipistrelle	Unseen, foraging close by until 20:09.
20:11	Common pipistrelle	Unseen, 1 pass.
20:11	Soprano pipistrelle	Unseen, 1 pass.
20:16	Soprano pipistrelle	Unseen, intermittent activity until 20:18.



Time	Species detected	Comments
20:19	Common pipistrelle	Unseen, 1 pass.
20:22	Common pipistrelle	Unseen, foraging close by.
20:24	Soprano pipistrelle	Unseen, intermittent foraging activity with some social calls until 20:27.

Surveyor position B - on the south west corner of the coach house.

Time	Species detected	Comments
19:21	Pipistrelle sp.	2 single social calls picked up on recorder. 23 minutes after sunset.
19:25	Soprano pipistrelle	Bat observed not heard, circling opposite east elevation of building. 27 minutes after sunset.
19:26	Soprano pipistrelle	Bat observed around south elevation of house; flying west to east along south elevation. Social calls also detected.
19:27	Common pipistrelle	Flying west to east through trees opposite south elevation of building. 29 minutes after sunset.
19:29	Common pipistrelle	Observed flying around south end of courtyard (due west of building).
19:31	Soprano pipistrelle	Bat observed not heard, circling opposite east elevation of building. Social calls also detected.
19:33	Soprano pipistrelle	Bat observed flying over south west corner of building, flying due north east.
19:35	Soprano pipistrelle	Bat observed flying east to west over south side of building.
19:37	Common pipistrelle	Bat observed circling in courtyard (due west of building) before flying due east along south elevation of building.
19:39	Soprano pipistrelle	Bat observed circling in courtyard (due west of building).
19:41	Common pipistrelle	Bat observed flying due north east, flying around south and east elevations of the building. Foraging behavior then heard not seen. Social calls also detected.
19:44	Soprano pipistrelle	Bat observed flying north east to south west, then foraging behavior heard not seen. Social calls also detected.
19:45	Soprano pipistrelle & Common pipistrelle	Bat observed around south elevation of house; flying east to west along south elevation. Both pipistrelle species detected.
19:46	Common pipistrelle	Bat observed not heard, circling opposite east elevation of building.



Time	Species detected	Comments
		Some social calls also detected.
19:47	Common pipistrelle	Heard not seen. Single call detected.
19:50	Soprano pipistrelle	Not observed, picked up on recorder.
19:51	Common pipistrelle	Bat observed flying north west to south east.
19:55	Unidentified bat species.	Heard not seen, 1 pass. Not picked up on recorder. 57 minutes after sunset.
19:58	Soprano pipistrelle	Not observed, picked up on recorder.
20:00	Pipistrelle sp.	Heard not seen, 1 pass. Not picked up on recorder.
20:03	Soprano pipistrelle	Heard not seen, 2 passes. Not picked up on recorder.
20:04	Common pipistrelle	Heard not seen.
20:05	Soprano pipistrelle	Heard not seen, 1 pass.
20:11	Soprano pipistrelle	Bat observed flying north east to south west. Social calls also detected.
20:12	Common pipistrelle & Soprano pipistrelle	Heard not seen, multiple passes. Social calls also detected.
20:13	Pipistrelle sp.	Bat observed around south elevation of house; flying east to west along south elevation. Not picked up on recorder.
20:15	Soprano pipistrelle	Not observed, picked up on recorder.
20:19	Common pipistrelle	Heard not seen, 1 pass.
20:20	Soprano pipistrelle	Not observed, picked up on recorder.
20:22	Soprano pipistrelle	Heard not seen, 1 pass. Social calls also detected.
20:23	Soprano pipistrelle	Heard not seen, foraging. Social calls also detected.
20:24	Soprano pipistrelle	Bat observed foraging around courtyard (due west of building).
20:26	Soprano pipistrelle	Heard not seen, foraging, multiple passes.
20:27	Common pipistrelle & Soprano pipistrelle	Heard not seen, 1 pass. Both pipistrelle species detected.



Surveyor position C - on the northern portion of the western face of the coach house building

Time	Species detected	Comments
18:59	Soprano pipistrelle	Seen, flying to the north in front of the building at ridge height whilst still very light; no emergence observed. 1 minute after sunset.
19:09	Soprano pipistrelle	Seen, flying from the north to the west, north of the building. 11 minutes after sunset.
19:10	Soprano pipistrelle	Seen, foraging around the glade to the north of the building.
19:12	Soprano pipistrelle	Seen, foraging around the glade to the north of the building.
19:13	Soprano pipistrelle	Seen, foraging around the glade to the north of the building.
19:14	Soprano pipistrelle	Seen, flying south in front of the building.
19:15	Soprano pipistrelle	Seen, flying north in front of the building.
19:17	Soprano pipistrelle	Seen, flying north in front of the building.
19:23	Soprano pipistrelle	Heard but not seen.
19:25	Soprano pipistrelle	Heard but not seen.
19:26	Soprano pipistrelle	Heard, initially unseen and then seen, flying south over the building.
19:28	Nathusius' pipistrelle	Seen, foraging around the glade to the north and in circuits in front of the building. 30 minutes after sunset.
19:29	Soprano pipistrelle	Heard but not seen.
19:30	Soprano pipistrelle	Seen, flying across the building towards the glade to the north with some social calls.
19:31	Soprano pipistrelle	Heard but not seen, foraging.
19:36	Soprano pipistrelle x 1 pipistrelle sp. x 1	2 bats seen flying across the building to the north.
19:37	Soprano pipistrelle	Heard but not seen.
19:39	Soprano pipistrelle x 2	Heard but not seen.
19:40	Soprano pipistrelle	Heard but not seen, some social calls.
19:42	Soprano pipistrelle	Heard, initially unseen and then seen, flying north west from over the building.



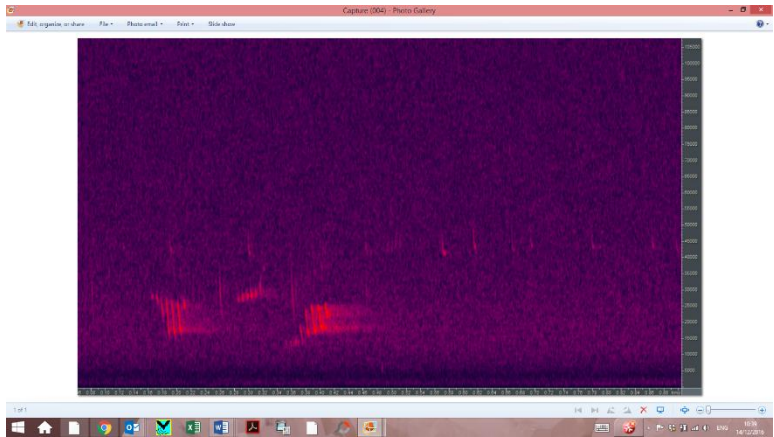
Time	Species detected	Comments
19:44	<i>Nyctalus sp.</i> (Probably Leisler's)	Heard but not seen. 46 minutes after sunset.
19:45	Soprano pipistrelle	Heard but not seen.
19:46	Common pipistrelle	Heard but not seen. 48 minutes after sunset.
19:49	Soprano pipistrelle	Heard but not seen, with some social calls.
19:50	Common pipistrelle	Heard but not seen, foraging.
19:54	Soprano pipistrelle	Heard but not seen.
19:55	Soprano pipistrelle x 2	Heard but not seen.
19:57	Soprano pipistrelle	Heard but not seen, with some social calls.
19:59	Common pipistrelle	Heard but not seen, with some social calls.
20:00	Soprano pipistrelle	Heard but not seen.
20:04	Common pipistrelle	Heard but not seen.
20:07	Soprano pipistrelle	Heard but not seen, with some social calls.
20:07	Common pipistrelle	Heard but not seen.
20:16	Soprano pipistrelle	Heard but not seen.
20:17	Soprano pipistrelle	Heard but not seen.
20:18	Soprano pipistrelle	Heard but not seen, with some social calls.
20:24	Soprano pipistrelle	Heard but not seen, with some social calls.



Surveyor position D - on the south east corner of the building

Time	Species detected	Comments
19:17	Soprano pipistrelle	Observed flying from bell tower due south east. 19 minutes after sunset.
19:23	Soprano pipistrelle	Heard not seen, brief.
19:25	Soprano pipistrelle	Observed foraging in to east elevation of coach house and circling above roof.
19:26	Common pipistrelle	Heard not seen, foraging and social calls. 28 minutes after sunset.
19:27	Soprano pipistrelle	Observed flying from west, circling over coach house roof and flying due east. Then heard not seen for 2 minutes.
19:30	Soprano pipistrelle	Heard not seen, brief, social calling.
19:31	Common pipistrelle	Heard not seen, brief, social calling.
19:31	Soprano pipistrelle	Observed flying from west, circling over coach house roof and flying due east.
19:32	Soprano pipistrelle	Heard not seen, foraging.
19:32	Common pipistrelle	Heard not seen, foraging.
19:33	Soprano pipistrelle	Observed flying from west, circling over coach house roof and flying due east. Then heard not seen for 2 minutes.
19:35	Soprano pipistrelle	Observed flying due north west over coach house roof. Then continuous heard not seen for 2 minutes.
19:37	Common pipistrelle	Heard not seen.
19:38	Soprano pipistrelle	Heard not seen, some social calling. Continuous for 4 minutes.
19:43	Common pipistrelle	Heard not seen.
19:43	Soprano pipistrelle	Heard not seen. Social calling.
19:44	Common pipistrelle	Heard not seen.
19:44	1x Soprano pipistrelle and 1x Common pipistrelle	Heard not seen. Social calling.
19:44	Nathusius' pipistrelle	Heard, not seen. Echolocation calls and also one characteristic



Time	Species detected	Comments
		Nathusius' pipistrelle advertisement call. 46 minutes after sunset. 
19:44	<i>Nyctalus</i> sp. (Probably Leisler's)	Heard not seen.46 minutes after sunset.
19:45	Soprano pipistrelle	Heard not seen, some social calling. Continuous for 2 minutes.
19:47	Common pipistrelle	Heard not seen, social calling.
19:48	Soprano pipistrelle	Heard not seen.
19:49	Common pipistrelle	Heard not seen.
19:49	Soprano pipistrelle	Heard not seen.
19:50	Nathusius' pipistrelle	Heard not seen, brief.
19:50	Common pipistrelle	Heard not seen.
19:51	Common pipistrelle	Heard not seen.
19:51	Soprano pipistrelle	Heard not seen, some social calling. Continuous for 11 minutes.
20:02	Common pipistrelle	Heard not seen. Continuous for 4 minutes.
20:06	Soprano pipistrelle	Heard not seen, some social calling. Continuous for 13 minutes.
20:22	Common pipistrelle	Heard not seen.
20:23	Soprano pipistrelle	Heard not seen, some social calling. Continuous for 5 minutes.



Surveyor position E - to the north of the coach house building

Time	Species detected	Comments
18:59	Soprano pipistrelle	Not observed, detected on recorder. 1 minute after sunset.
19:08	Soprano pipistrelle	Not observed, detected for 3 continuous minutes. 10 minutes after sunset.
19:11	Soprano pipistrelle	One bat seen flying over the ridge of the building from the south west towards the north east. Continuously detected for 3 minutes.
19:16	Soprano pipistrelle	One bat seen flying from the west then around the northern chimney stack.
19:17	Soprano pipistrelle	One bat seen flying towards the north west, first appearing at the building ridge.
19:24	Soprano pipistrelle	One bat seen flying over the building from the west to the east.
19:24	Soprano pipistrelle	One bat seen flying over the ridge of the building towards the north
19:26	Soprano pipistrelle	One bat seen flying a circuit around the northern end of the building.
19:26	Soprano pipistrelle	Two bats seen flying circuits over the northern half of the building before flying towards the east.
19:27	Soprano pipistrelle	One bat seen flying a circuit over the northern end of the building before flying towards the east.
19:28	Soprano pipistrelle	One bat seen flying around the northern side of the building and then flying towards the eastern side of the building.
19:28	Soprano pipistrelle & Nathusius' pipistrelle	Two bats seen foraging in front of the eastern side of the building. 30 minutes after sunset.
19:29	Nathusius' pipistrelle	Unseen. 31 minutes after sunset.
19:31	Soprano pipistrelle	One bat seen flying from over the building ridge towards the north.
19:31	Soprano pipistrelle & Common pipistrelle	Two bats seen flying around in front of the eastern side of the building. 33 minutes after sunset.
19:33	Soprano pipistrelle	One bat seen flying low to the ground from the western side of the building towards the eastern side.
19:34	Soprano pipistrelle	One bat seen flying from the western side of the building towards the eastern side.
19:35	Soprano pipistrelle	One bat seen flying low to the ground from the western side of the building towards the eastern side. Social calls also detected.



Time	Species detected	Comments
19:36	Soprano pipistrelle	One bat seen flying over the top of the building towards the north.
19:36	Soprano pipistrelle	One bat seen flying low to the ground from the western side of the building towards the eastern side.
19:37	Soprano pipistrelle	One bat seen flying from the western side of the building towards the eastern side.
19:37	Soprano pipistrelle	One bat seen flying from the western side of the building towards the eastern side.
19:39	Soprano pipistrelle	Not observed, detected on recorder continuously for 2 minutes.
19:42	Soprano pipistrelle	One bat seen, flying over the building from west to east.
19:43	Soprano pipistrelle	One bat seen flying from the eastern side of the building towards the western side. Picked up on detector continuously for 6 minutes.
19:44	<i>Nyctalus</i> sp.	Not observed, detected on recorder. 46 minutes after sunset.
19:49	Soprano pipistrelle	One bat seen briefly, close to the camera. Social calling.
19:50	Nathusius' pipistrelle	Not observed, detected on recorder. 52 minutes after sunset.
19:52	Soprano pipistrelle	Not observed, detected on recorder. Social calls also detected. Continuous for 9 minutes.
19:59	Nathusius' pipistrelle	Not observed, detected on recorder.
19:59	Soprano pipistrelle	Not observed, detected on recorder.
20:06	Soprano pipistrelle	Not observed, detected on recorder. Social calls also detected. Continuous for 3 minutes.
20:16	Soprano pipistrelle	Not observed, detected on recorder. Social calls also detected. Continuous for 2 minutes.
20:24	Soprano pipistrelle	Not observed, detected on recorder. Social calls also detected. Continuous for 6 minutes.

Surveyor position F - positioned on the southern portion of the western edge of the coach house building

Time	Species detected	Comments
19:28	Pipistrelle sp.	Seen flying from west towards the building, then over the building and to the south. 30 minutes after sunset.
19:31	Soprano pipistrelle	Seen, flying from west towards the building, then over the building and to the north.



Time	Species detected	Comments
19:32	Soprano pipistrelle	Seen, flying from behind surveyor B, over the building between chimney and bell tower and off to the north-west.
19:34	Pipistrelle sp.	Seen, making circuits high above the ridge height of the building. 36 minutes after sunset.

Single Dusk Detector Survey of the Marble Hill building - Dusk 26th September 2016

Surveyor position A - a context view of the south elevation of the building.

Time	Species detected	Comments
19:09	Soprano pipistrelle	Heard but not seen. 20 minutes after sunset.
19:16	Pipistrelle sp.	Heard but not seen. Not detected on recorder. 27 minutes after sunset.
19:19	Soprano pipistrelle	Seen, foraging in front of the building.
19:20	Soprano pipistrelle	Heard but not seen, foraging.
19:21	Soprano pipistrelle	Seen, foraging in front of the building.
19:23	Soprano pipistrelle	Heard but not seen.
19:25	Soprano pipistrelle	Heard but not seen, foraging with some social calls.
19:26	Soprano pipistrelle	Unobserved. Detected on recorder.
19:28	Soprano pipistrelle	Heard but not seen, foraging with some social calls until 19:32.
19:33	Soprano pipistrelle	Heard but not seen, foraging.
19:34	Soprano pipistrelle	Heard but not seen.
19:35	Common pipistrelle	Unobserved. Detected on recorder. 48 minutes after sunset.
19:38	Common pipistrelle	Heard but not seen.
19:46	Soprano pipistrelle	Heard but not seen.
19:52	Pipistrelle sp.	Heard but not seen. Not detected on recorder.
19:54	Soprano pipistrelle	Heard but not seen.
19:57	Pipistrelle sp.	Heard but not seen. Not detected on recorder.



Surveyor position B - on the south west corner of the building, with a close view of south and west elevations.

Time	Species detected	Comments
19:11	Soprano pipistrelle	Heard not seen, brief. 22 minutes after sunset.
19:14	Soprano pipistrelle	2 individuals heard, 1 seen flying east to south west along south elevation of building at building-height. Social calling.
19:15	Soprano pipistrelle	Multiple individuals heard, 1 seen flying east to south west along south elevation of building at building-height.
19:15	Soprano pipistrelle	1 individual observed flying due north east along south elevation of building at building height.
19:16	Soprano pipistrelle	2 individuals heard not seen.
19:16	Soprano pipistrelle	1 individual seen flying east to south west along south elevation of building at building-height.
19:16	Soprano pipistrelle	2 individuals seen circling cherry tree located opposite the west elevation of the building.
19:17	Common pipistrelle	Observed flying east to south west along south elevation of building at building-height. 28 minutes after sunset.
19:19	Soprano pipistrelle	Observed circling opposite west elevation of building, returning due north.
19:19	Soprano pipistrelle	Observed flying along the south elevation of the building at building-height and returning due south west.
19:20	Soprano pipistrelle	Observed flying due north east along south elevation of building at building-height.
19:20	Soprano pipistrelle	Observed flying due north east along south elevation of building at building-height.
19:20	Soprano pipistrelle	Heard not seen.
19:20	Soprano pipistrelle	Observed flying along the south elevation of the building at building-height and returning due north east.
19:21	Soprano pipistrelle	Observed flying along the south elevation of the building at building-height and returning due north east.
19:22	Soprano pipistrelle	Observed circling opposite west elevation of building, returning due north.
19:23	Soprano pipistrelle	Observed circling opposite west elevation of building, returning due north.
19:24	Soprano pipistrelle	Observed circling opposite west elevation of building, returning due north.



Time	Species detected	Comments
19:24	Soprano pipistrelle	Heard not seen.
19:25	Common pipistrelle	Heard not seen, foraging.
19:25	Soprano pipistrelle	Heard not seen, foraging. Continuous for 3 minutes. Social calling.
19:29	Soprano pipistrelle	Observed foraging over surveyor position.
19:32	Soprano pipistrelle	2 individuals heard, 1 seen foraging. Continuous for 4 minutes.
19:36	Soprano pipistrelle	Observed circling opposite west elevation of building, returning due south.
19:38	Soprano pipistrelle	Observed circling opposite west elevation of building, returning due south.
19:39	Common pipistrelle & Soprano pipistrelle	2 individuals heard not seen.
19:42	Soprano pipistrelle	2 individuals heard not seen.
19:45	Soprano pipistrelle	2 individuals heard not seen, social calling.
19:46	Soprano pipistrelle	2 individuals, heard not seen. Social calling.
19:48	Soprano pipistrelle	Heard not seen, continuous for 4 minutes.
19:52	Common pipistrelle	2 individuals, heard not seen, foraging. Some social calling.
19:52	Soprano pipistrelle	Heard not seen, foraging and social calls. Continuous for 7 minutes.
19:59	Soprano pipistrelle	2 individuals, heard not seen. Continuous for 3 minutes.
20:09	Soprano pipistrelle	Heard not seen, foraging. Continuous for 10 minutes (until end of survey).



Surveyor position C - a context view of the north elevation of the building.

Time	Species detected	Comments
19:11	Pipistrelle sp.	Bat observed commuting at building-height, north east to south west, along north elevation of main house. 22 minutes after sunset.
19:15	Common pipistrelle	Bat observed commuting at building-height, south west to north east, along north elevation of main house. 26 minutes after sunset.
19:24	Pipistrelle sp.	Heard not seen, 2 passes. Not picked up on recorder. 35 minutes after sunset.
19:27	Common pipistrelle	Heard not seen, 1 pass, faint. Not picked up on recorder.
19:28	Common pipistrelle	Heard not seen, 1 pass, faint. Not picked up on recorder.
19:29	Pipistrelle sp.	Heard not seen, 1 pass, faint. Not picked up on recorder.
19:40	Soprano pipistrelle	Heard not seen, 1 pass, very faint.
19:51	Common pipistrelle	Heard not seen, 1 pass.
19:55	Soprano pipistrelle	Heard not seen, 1 pass, faint.
20:01	Possible long-eared bat species	Heard not seen, 1 pass, faint. 1 hour 12 minutes after sunset.

Surveyor position D - on the north-western corner of the building, with a close view of the north and west elevations.

Time	Species detected	Comments
19:11	Soprano pipistrelle	Heard not seen, brief, 22 minutes after sunset.
19:15	Soprano pipistrelle	Heard not seen, foraging and social calls.
19:17	Soprano pipistrelle	Heard not seen, foraging and social calls.
19:17	Common pipistrelle	Heard not seen, foraging. 28 minutes after sunset.
19:24	Common pipistrelle	Observed flying along north elevation of building before turning around north corner of building onto east elevation.
19:25	Nathusius' pipistrelle	Heard not seen, brief. 36 minutes after sunset
19:26	Soprano pipistrelle	Heard not seen, brief, social calls.



Time	Species detected	Comments
19:32	Soprano pipistrelle	Heard not seen, brief, social calls.
19:35	Soprano pipistrelle	Heard not seen, brief.
19:39	Nathusius pipistrelle & Soprano pipistrelle	Heard not seen, brief.
19:41	Soprano pipistrelle	Heard not seen, brief.
19:43	Nathusius' pipistrelle	Heard not seen, brief.
19:47	Soprano pipistrelle	Heard not seen, brief, social calls.
19:51	Soprano pipistrelle	Heard not seen, brief, social calls
19:56	Soprano pipistrelle	Heard not seen, brief.
19:59	Soprano pipistrelle	Heard not seen, brief.
20:23	Common pipistrelle	Heard not seen, brief.

Surveyor position E - a view of the eastern façade of Marble Hill House

Time	Species detected	Comments
19:17	Unidentified (small-sized / pipistrelle-sized) bat species	Seen flying from north to south and around the corner of the building in a south-western direction at second floor level; no emergence. 28 minutes after sunset.
19:19	As above	Seen flying from behind the building towards the south-east; no emergence.
19:19	As above	Seen flying from behind the building towards the south-east; no emergence.
19:20	As above	Seen flying from behind the building towards the south; no emergence.
19:28	As above	Seen flying from north to south away from the building; no emergence.
19:31	As above	Seen flying from behind camera towards the north; no emergence.



Single Dusk Detector Survey of the Grotto - Dusk 27th September 2016

Surveyor position A – direct view of the front of Grotto entrance

Time	Species detected	Comments
19:00	Soprano pipistrelle	Heard not seen. 13 minutes after sunset.
19:03	Pipistrelle sp.	Heard not seen. Not picked up on recorder. 16 minutes after sunset.
19:05	Pipistrelle sp.	Observed foraging above shrubbery above grotto. Then heard not seen foraging for 5 minutes. Not picked up on recorder.
19:10	Soprano pipistrelle	Observed foraging above shrubbery above grotto.
19:11	Soprano pipistrelle	Observed foraging above grotto. Then heard not seen foraging for 7 minutes.
19:18	Soprano pipistrelle	Observed foraging above shrubbery above grotto. Then heard not seen foraging for 4 minutes.
19:19	Common pipistrelle	Not observed, 1 pass picked up on detector, social calling. 32 minutes after sunset.
19:22	Soprano pipistrelle	Observed foraging above shrubbery above grotto. Then heard not seen foraging for 4 minutes.
19:26	Common pipistrelle	Observed foraging above shrubbery above grotto. Then heard not seen foraging for 4 minutes.
19:30	Common pipistrelle	Observed foraging above shrubbery above grotto. Then heard not seen foraging for 2 minutes.
19:32	Common pipistrelle	Heard not seen, 2 individuals foraging. Then 1 individual heard foraging continuously for 5 minutes.
19:37	Common pipistrelle	Heard not seen, 2 individuals foraging and social calling.
19:38	Common pipistrelle	Observed foraging above shrubbery above grotto. Continuous for 5 minutes.
19:45	Nathusius' pipistrelle & Common pipistrelle	Heard not seen, 2 individuals foraging. 58 minutes after sunset.
19:47	Common pipistrelle & Soprano pipistrelle	Heard not seen, foraging and social calling. Continuous for 10 minutes.
20:00	Common pipistrelle	Heard not seen, foraging. Continuous for 4 minutes.
20:09	Pipistrelle sp.	Heard not seen, foraging.
20:11	Soprano pipistrelle	Not observed, picked up on recorder. Continuous for 2 minutes.



Single Dusk Detector Survey of the Ice House - Dusk 27th September 2016

Surveyor position A – direct view of the front of the Ice House Entrance

Time	Species detected	Comments
19:04	Common pipistrelle	Heard not seen, brief. Not picked up on recorder. 17 minutes after sunset.
19:08	Soprano pipistrelle	Heard not seen, brief, social call. 21 minutes after sunset.
19:08	Common pipistrelle	Heard not seen, brief.
19:11	Soprano pipistrelle	Heard not seen, social calling. Continuous for 3 minutes.
19:14	Common pipistrelle	Heard not seen, foraging and social calling. Continuous for 3 minutes.
19:45	Unidentified bat species	Heard not seen, brief. Not picked up on recorder. 58 minutes after sunset.

Static Bat (Swarming) Activity Survey Results

Ice House – 21st to 27th September 2016 – no bat activity

Grotto – 21st to 27th September 2016 – no bat activity