


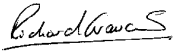


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**GREGGS BAKERY, TWICKENHAM
2019 BAT ACTIVITY SURVEY REPORT**

Version 2.0

Project	Prepared & Checked by	Approved by	Client	Status	Date
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Contents

1	Summary	5
2	Introduction	7
2.1	Instruction	7
2.2	Survey Objectives	7
2.3	Site Location and Setting	7
2.4	Brief Description of Proposed Development	8
2.5	Report Structure	8
3	Pre-Existing Survey Information	9
3.1	Introduction	9
3.2	Pre-existing Bat Activity Surveys	9
3.3	Desktop Study Records	10
3.4	Protected Species Licences	10
3.5	Preliminary Bat Roost Assessment	11
4	Bat Ecology and Legislation	12
4.1	Bat Ecology and Behaviour	12
4.1.1	<i>British Bats</i>	12
4.1.2	<i>Bat Roosts</i>	12
4.1.3	<i>Bat Behaviour</i>	12
4.2	Legal Protection	12
4.3	Bat Licences	13
5	Methods	14
5.1	Introduction	14
5.2	Survey Personnel	14
5.3	Bat Activity Transect & Exit / Re-Entry Surveys	15
5.4	Spot Roost Surveys	15
5.5	Automated Detector Surveys	15
5.6	Thermal Imaging Surveys	15
5.7	Equipment	15
5.8	Limitations	16
6	Results: Bat Activity Surveys	17
6.1	Introduction	17
6.2	Survey Schedule	17
6.3	Surveyor Locations	20

6.4	Weather Conditions	23
6.5	Existing Lighting	24
6.6	Bat Species Recorded during Bat Surveys	24
6.7	Bat Pass Numbers for Bat Surveys	25
6.8	Bat Activity Across the Site.....	26
6.9	Bat Activity Recorded – Per Species.....	27
6.10	Bat Activity Recorded – Per Month.....	28
6.11	Bat Activity Timings & Roosts Recorded from Bat Surveys.....	29
6.12	Location of Roosts.....	30
7	Results: Automated Detector Surveys	31
7.1	Automated Detector Session Schedule	31
7.2	Automated Detector Locations	31
7.3	Bat Species Recorded from Automated Detectors.....	32
8	Results: Thermal Imaging Surveys	33
8.1	Thermal Imaging Schedule.....	33
8.2	Thermal Imaging Locations.....	33
8.3	Bat Activity Recorded from Thermal Imaging	34
9	Interpretation & Recommendations	36
9.1	Introduction	36
9.2	Bat Species Composition.....	36
9.3	Bat Roost Sites.....	36
9.4	Precautionary Pre-Demolition Checks.....	36
9.5	Protection of the River Crane Corridor.....	36
9.6	Bat Monitoring.....	36
9.7	Consideration of Lighting.....	37
9.7.1	<i>Potential Impacts of Lighting</i>	<i>37</i>
9.7.2	<i>Designing a Site Specific Lighting Strategy.....</i>	<i>37</i>
9.7.3	<i>River Corridor Lighting Zones & Bats.....</i>	<i>37</i>
9.7.4	<i>Riverside Landscaping.....</i>	<i>38</i>
9.7.5	<i>Bespoke Lighting Detail.....</i>	<i>38</i>
9.8	Enhancement	39
10	Conclusion	41
	Appendix A	42

1 Summary

Introduction

Following recommendations in the 'Greggs Bakery, Twickenham 2018 Extended Phase 1 Habitat Survey 2018 Report'¹, Richard Graves Associates Ltd was instructed by London Square Developments Limited, to undertake a suite of bat surveys for the 'Greggs Bakery Site' in Twickenham, London (hereafter referred to as 'the site') to provide baseline information to support a planning application for a proposed new development.

Development Description

The proposed development will comprise the construction of 116 new homes, a B1 office building and associated car parking, landscaping and infrastructure².

Surveys conducted

A suite of bat surveys was undertaken throughout June, July, and September 2019, by experienced licensed surveyors. The surveys comprised:

- Bat Activity Transect Surveys across the site and the adjacent habitats (including the River Crane) and Exit and Re-Entry Surveys for the buildings on site considered to have (low) bat roost potential.
- At the start of the September Dusk Activity Transect Survey, and towards the end of the July 2019 Dawn Activity Transect Survey, surveyors conducted Spot Roost Surveys to gain information on likely roosting activity.
- Throughout the survey period, a series of automatic detector recording sessions were conducted at a variety of locations across the site.
- A thermal imaging system was used to detect heat signatures from any emerging bats, in order to aid detection of bats within the buildings on site and within key habitats.

Survey Findings

- The survey findings show that at least seven bat species use the site to forage on / near and commute over (common pipistrelle *Pipistrellus pipistrellus*, soprano pipistrelle *Pipistrellus pygmaeus*, brown long-eared *Plecotus auritus*, Leisler's *Nyctalus leisleri*, noctule *Nyctalus noctula*, Natterer's *Myotis nattereri* and Nathusius' bat *Pipistrellus nathusii*), plus an unidentified *Myotis* species).
- Soprano pipistrelles bats were the most frequently recorded bat species (accounting for over 83% of the calls recorded during the manual bat surveys), followed by common pipistrelles (accounting for over 11% of the calls recorded). Relatively frequent big bat species (noctules and Leisler's) were recorded, as well as, low numbers of *Myotis* bats (species unconfirmed), brown long-eared, Nathusius' pipistrelle and Natterer's bat.
- The vast majority of the bat activity observed during the surveys was recorded along the River Crane, both along the northern bank (off -site) and along the southern bank (adjacent to the northern site boundary) and over the adjacent green spaces such as Craneford Way Playing Fields.

¹ Richard Graves (2019) Greggs Bakery / Twickenham - 2018 Extended Phase 1 Habitat Survey Report Version 4.0

² Assael (2019) Greggs Bakery / Twickenham - Design and Access Statement

- Bat activity over the site itself was relatively limited in comparison to that recorded both along the river and the adjacent green spaces.
- No bats, of any species, were observed exiting or re-entering any of the buildings on site.
- A high level of early bat activity was recorded (off-site) along the River Crane. Based on the emergence times recorded during the surveys, at least four species of bat: common pipistrelle, soprano pipistrelle, Nathusius' pipistrelle and noctule, plus an unidentified *Myotis* species, are likely to be roosting near the site.

Minimising Impacts & Adding Enhancements

Based on the findings of the 2019 bat surveys and the 2018 Phase One Habitat Survey¹, the following impact avoidance, mitigation and enhancement measures has been / will be undertaken:

- The production of a site-specific, bat targeted, lighting strategy which will provide a darker, deeper and wider fly / foraging zone along the River Crane than currently exists³;
- Creation of a wider natural corridor formed as part of a river walkway to include a river corridor hedgerow and native tree planting⁴;
- Native species planting⁵;
- Green roof installation⁶;
- Bat box installation;
- Monitoring of the local bat population during the operational phases;
- Pre-clearance *precautionary* checks for bats in buildings; and
- Good construction practice to protect the off-site habitats, in particular, the River Crane corridor.

Conclusion

If the recommendations of this report, and the Phase 1 Habitat Survey Report¹, are undertaken at the appropriate stage there are no undue constraints, with respect to bats, to the proposed development.

³ Desco (2019) London Square Developments Ltd. Former Greggs Bakery Site Twickenham TW2 6RT. Exterior Lighting Assessment Supplementary Report: Minimising the Impact of Lighting on Nocturnal Wildlife. 1823-63-RPT-02

⁴ Assael (2019) Greggs Bakery / Twickenham - Design and Access Statement

⁵ Assael (2019) Greggs Bakery / Twickenham - Design and Access Statement

⁶ Assael (2019) Greggs Bakery / Twickenham - Design and Access Statement

2 Introduction

2.1 Instruction

Following recommendations in the 'Greggs Bakery, Twickenham 2018 Extended Phase 1 Habitat Survey 2018 Report'¹, Richard Graves Associates Ltd was instructed by London Square Developments Limited, to undertake a suite of bat surveys for the 'Greggs Bakery Site' in Twickenham, London (hereafter referred to as 'the site') to provide baseline information to support a planning application for a proposed new development.

This report sets out the methods, results and recommendations of the 2019 bat surveys.

2.2 Survey Objectives

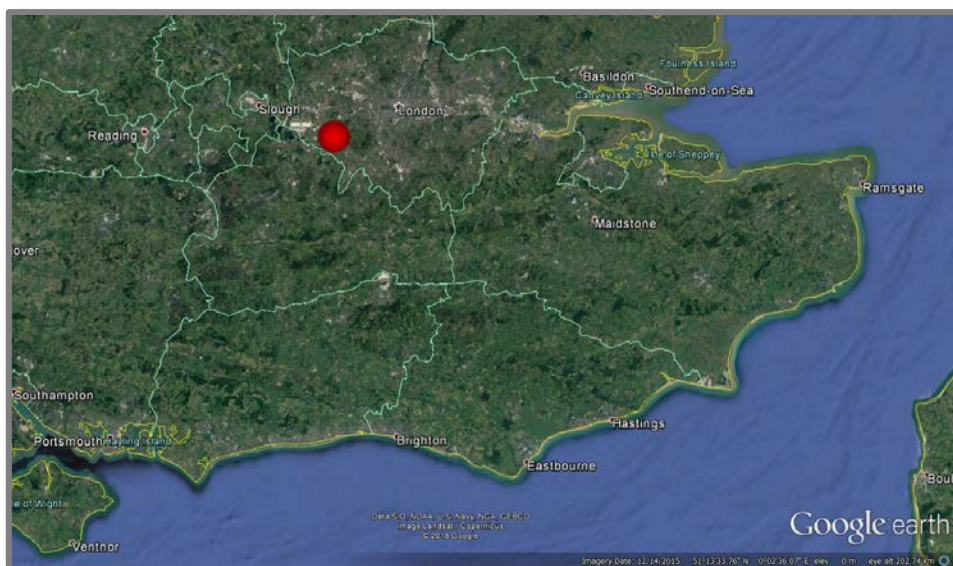
The aims of the bat surveys were as follows:

- Establish if bats are present on / in close proximity to the site;
- Gauge the general level of bat activity and bat species present on and in close proximity to the site;
- Assess what the bats use the site and surrounding habitats for;
- Establish what the temporal and seasonal distribution of recorded bat activity was on site;
- Identify bats exiting or entering bat roosts on the buildings within the site at the time of survey;
- If present, characterise the bat roost(s) in terms of species, number, access points, type of bat roost etc;
- Make recommendations for mitigation of construction / operational impacts; and
- Identify the need for further surveys, / or mitigation, where required.

2.3 Site Location and Setting

The Greggs Bakery Site covers approx. 1.1 hectare (ha)⁷, centred at Ordnance Survey (OS) grid reference: TQ 15321 73342, and is located in the London Borough of Richmond upon Thames in South West London. The site is situated in a largely residential neighbourhood. Immediately north of the site is the River Crane and the railway line and to the south of the site are a number of light industrial buildings (Figure 1).

Figure 1: Site location indicated by red marker © Google Earth 2019



⁷ Assael (2018) Greggs Bakery / Twickenham Consultants Pack October 2018 A2817 2-10R1

The site is located between two residential terraced streets, Crane Road and Norcutt Road. To the north it wraps around Crane Road and to the south it borders Edwin Road. (Figure 2).

Figure 2. Aerial Mapping indicating the Greggs Bakery Site (outlined in red) © Google Earth 2019



2.4 Brief Description of Proposed Development

The proposed development will comprise the construction of 116 new homes, a B1 office building and associated car parking, landscaping and infrastructure².

2.5 Report Structure

Following this introduction, the report is structured as follows:

- Chapter 3: provides a summary of the pre-existing bat survey information;
- Chapter 4: provides details of the relevant legislation and licencing requirements pertaining to bats;
- Chapter 5: details the survey methods employed to gather and analysis the bat data;
- Chapter 6: presents the findings of the Bat Activity Survey results;
- Chapter 7: presents the findings of the Automated Detector Survey results;
- Chapter 8: presents the findings of the Thermal Imaging Survey Results;
- Chapter 9: provides data interpretation and recommendations based on the survey findings; and
- Chapter 10: presents the report's conclusion.

3 Pre-Existing Survey Information

3.1 Introduction

This section summaries the pre-existing survey information associated with the site, namely:

- Pre-existing bat surveys conducted along the local river system;
- Bat records from Greenspace Information for Greater London (GiGL);
- Protected Species Licence information from the Multi-Agency Geographic Information for the Countryside (MAGIC); and
- Preliminary Bat Roost Assessment findings for the buildings on site, undertaken during the 2018 Extended Phase 1 Habitat Survey¹.

3.2 Pre-existing Bat Activity Surveys

Bat Survey Reports for surveys conducted within the Crane Valley were accessed from the Friends of the River Crane Environment (FORCE) website⁸. Three bat survey reports, dated 2014, 2015 and 2016 were reviewed. A summary of their findings is presented below.

2014: Bat surveys were undertaken in 2014 by Furesfen on behalf of the Friends of the River Crane Environment (FORCE)⁹. The survey area included a 500m stretch of the River Crane corridor centred at TQ 156 735. The survey findings were summarised as follows:

- *“At least six and possibly seven bat species were recorded during the surveys: Common and Soprano Pipistrelle, Noctule and Leisler’s bat, Daubenton’s and possibly Natterer’s as well as Brown Long-eared bats.*
- *No bats were recorded emerging from structures or trees.*
- *The spread of bat registrations and the early emergence times are suggestive of the presence of a colony of Soprano Pipistrelles within the study area.*
- *The activity recorded on the static bat detector, indicated the importance of the corridor for bat commuting and foraging purposes.*
- *Whilst no bats were recorded emerging from the trees during the survey, it is likely that both the Nyctalus (Noctule and Leisler) and Myotis (Daubenton’s and Natterer’s bat) species were using trees for roosting. Brown Long-eared bats may be roosting in trees or historic buildings to the east of the corridor.”⁹*

2015: Bat surveys were undertaken in 2015 by Furesfen on behalf of FORCE and The London Borough of Richmond Parks Department¹⁰. The survey area comprised a 1,500m stretch of the Duke of Northumberland River centred at TQ 151 739. The survey findings were summarised as follows:

- *Six possibly seven bat species use the DNR corridor as a foraging area throughout the night [Common, Soprano and Nathusius’ Pipistrelle, Noctule and Leisler’s bat, Daubenton’s bat and a possible Serotine bat].*
- *The southern part of the corridor is the most active with a greater diversity of species in greater numbers. In the southern and central area of the study bats were recorded during their emergence period, this means that bats had not travelled far from a roost site.*

⁸ FORCE. 2019. WILDLIFE REPORTS IN THE CRANE VALLEY. [ONLINE] Available at: <https://www.force.org.uk/wildlife/wildlife-surveys/>. [Accessed 6 October 2019].

⁹ Furesfen (2014) Bat Survey Report, River Crane Corridor, Heatham Estate, Twickenham.

¹⁰ Furesfen (2015) Bat Survey Report, Duke Of Northumberland River (Dnr) Kneller Gardens To Whitton Dene, L.B’s Richmond And Hounslow.

- The northern section of the DNR suffers from anthropogenic disturbance of light, noise, dust and smell as well as macrophytes choking the stream. The survey demonstrated the changing use over time by the bat community dependant on the demands of the breeding season and their synergy with insect swarming behaviour.
- It is just as important therefore to look after and encourage insects by imposing limits on pollutants such as dust, light, fumes and noise.¹⁰

2016: Bat surveys were undertaken in 2016 by Furesfen on behalf of Hounslow Council with the collaboration from FORCE and assistance from Thames Water¹¹. The survey area comprised a 2000m stretch of the Duke of Northumberland River centred between Mogden Sewage Works and Isleworth Ait. The survey findings were summarised as follows:

- “Four bat species were detected during the surveys: common and soprano pipistrelle bats, Daubenton’s bat and a *Nyctalus* bat species- the latter only briefly.
- Two species were found roosting in the central and north-eastern parts of the catchment; a pipistrelle roost in residential property around St. John’s Park and a small roost of Daubenton’s bats at the Church Lane Bridge by the confluence with the Thames.
- Pipistrelle bats use the lower DNR corridor as a foraging area throughout the night; particularly the Sewage Works and on occasion, Silverhall Park.
- The survey demonstrated anthropogenic disturbance of light spillage and glare from several Sources.”¹¹

3.3 Desktop Study Records

Desktop data from the Local Records Centre Data (Greenspace Information for Greater London (GiGL)) were obtained to determine if any relevant bat records had been recorded on or near the site¹².

The desktop records included a variety of bat species all of which were located more than 300m from the site, although it’s very likely that bats forage and commute along the River Crane river corridor and the surrounding habitats on a frequent basis. Species included:

- Common pipistrelle *Pipistrellus pipistrellus*;
- Soprano pipistrelle *Pipistrellus pygmaeus*;
- Daubenton's bat *Myotis daubentonii*;
- Noctule *Nyctalus noctula*;
- Serotine *Eptesicus serotinus*;
- Brown long-eared *Plecotus auritus*;
- Leisler's bat *Nyctalus leisleri*; and
- Nathusius' pipistrelle *Pipistrellus nathusii*.

3.4 Protected Species Licences

Magic was used to search for granted European Protected Species Licence Applications relating to bats within 2km of the site. Two Bat EPS Licences were recorded within the search area:

- A record for a Bat EPS Licence (EPSM2011-2993), dated between 26th April 2011 and 31st August 2014, in relation to common pipistrelle and soprano pipistrelle bat(s).

¹¹ Furesfen (2016) Bat survey and report on the Duke of Northumberland's River (DNR), Mogden-Isleworth Ait.

¹² GiGL eCountability (2018) An Ecological Data Search for Greggs Bakery on behalf of Richard Graves Associates Ltd. Report Ref: 12500. Prepared on the 7th December 2018.

- A record for a Bat EPS Licence (2016-25082-EPS-MIT), dated between 6th of September 2016 and 1st September 2021, in relation to brown long-eared, soprano and common pipistrelle bat(s).

3.5 Preliminary Bat Roost Assessment

During the 2018 Extended Phase 1 Habitat Survey, the buildings within the site were subject to an external inspection for evidence of, and potential to support, bats¹. Where safe access permitted, an initial internal inspection of the buildings for bats / signs of bats was also conducted.

The potential of the buildings on site to host bat roosts was assessed to be generally low (with buildings categorised as possessing Low or Negligible Bat Roost Potential), and no bats or signs of bats were observed during the inspection. Many of the building were open-sided or, large and draughty and were therefore poorly insulated and less likely to provide stable temperatures. However, the site's close proximity to the River Crane, a likely bat commuting / foraging corridor, was considered to increase its potential suitability¹.

4 Bat Ecology and Legislation

4.1 Bat Ecology and Behaviour

4.1.1 *British Bats*

There are eighteen species currently known in the UK, of these ten have been recorded in London. The most commonly recorded species in London and the UK are common pipistrelle, soprano pipistrelle and brown long-eared¹³.

4.1.2 *Bat Roosts*

Bats may use several types of roosts during the course of the year, depending on their ecological requirements. During the active season (March to October) bats roost in maternity colonies, which may contain large numbers and are relatively easy to detect. Maternity roosts usually only contain females and their pups. Adult male bats and non-lactating females may use a variety of different roosts during the course of the year but usually roost individually or in small numbers.

Different roosts can be used during the day and night and by some bats specifically for feeding. These roosts, which for common species are of minor nature conservation significance, can be difficult to detect. Mating roosts, used during the autumn, are also often easy to detect because of the high level of activity (dominated by 'social' calls) associated with them.

During the winter months bats, enter a state of torpor within hibernation roosts. These roosts, which are considered to be of nature conservation significance, require very specific conditions of temperature and humidity, which are not present in many structures.

4.1.3 *Bat Behaviour*

Bats echolocate to communicate, navigate and feed with calls recorded as social, commuting and foraging. Bat calls are typically beyond the range of human hearing, so ultrasound detectors can be used to hear and record them. These calls can be further analysed. Observation of bats in the field by expert surveyors is also important to correctly interpret bat behaviour.

4.2 Legal Protection

All British bat species are protected under the Wildlife and Countryside Act 1981 (as amended)¹⁴ and the Conservation of Habitats and Species Regulations 2017, as amended¹⁵.

Bats are listed on Schedule 2 (European Protected Species of animals) of the Conservation of Habitats and Species Regulations 2017, as amended, and are subject to the provisions of Regulation 41 which makes it an offence to:

- deliberately capture, injure or kill any wild bat;
- deliberately disturb bats (where disturbance is likely to impair their ability to survive, breed or reproduce, rear or nurture their young; or to hibernate or migrate; or to affect significantly the local distribution or abundance of the species);
- damage or destroy a breeding site or resting place of a bat; or
- be in possession of, control, transport, sell or exchange, or offer for sale or exchange any live or dead bat or any part of a wild animal or anything derived from a bat or any part of a bat.

¹³ <http://natsmaps.com/LondonBatAtlas/> Accessed 6th October 2019.

¹⁴ HMG, 1981. The Wildlife and Countryside Act 1981. HMSO

¹⁵ HMG, 2017. The Conservation of Habitats and Species Regulations. London: HMSO

Bats are also listed on Schedule 5 of the Wildlife and Countryside Act 1981 (as amended) and are subject to the provisions of Section 9 of the Act, which make it an offence to:

- intentionally or recklessly disturb a bat whilst it is occupying a structure or place which it uses for shelter or protection;
- intentionally or recklessly obstruct access to any structure or place used for shelter or protection by a bat;
- sell, offer or expose for sale, or to possess or transport for sale a live or dead bat or any part of or anything derived from a bat.

4.3 Bat Licences

Developers must ensure that they commission reasonable survey efforts to determine bat presence and, if required, obtain the necessary European Protected Species Licence for development from the relevant Statutory Organisation (for this site, Natural England), which is likely to require appropriate mitigation for disturbance and loss of habitats.

5 Methods

5.1 Introduction

This section details the surveyors, dates, methods and limitations of the following bat surveys undertaken at the site in 2019:

- Dusk / Dawn Bat Activity Transect Surveys, with Spot Sampling;
- Exit / Re-Entry Surveys;
- Spot Roost Surveys;
- Automated Static Bat Detector Deployment; and
- Thermal Imaging System Surveys.

5.2 Survey Personnel

The following experienced surveyors conducted the 2019 bat surveys at the Site:

Richard Graves BSc (Hons) MSc PGDip CECOL CEnv FCIEEM

Richard has twenty-six years' experience as a practising ecologist and has been involved in bat surveys and survey design for major projects for over fifteen years and the development of good practice for bat surveys. Richard is a fellow of the Chartered Institute of Ecology and Environmental Management (CIEEM) a chartered ecologist and a chartered environmentalist. Richard is also class licenced for great crested newt surveys, a class licenced bat surveyor and technical review panel member of current good practice guidelines for bat surveys.

Suzy Cardy BSc (Hons) MSc CECOL MCIEEM

Dr Cardy has over fifteen years' experience in the management and execution of the ecological elements of large scale development projects including major rail infrastructure developments and one of the UK's largest translocation of protected species. Suzy is a chartered ecologist, has a Natural England Level 1 Bat survey licence and has managed bat related projects ranging from low numbers of more common bat species, to sites hosting significant maternity roosts with hundreds of breeding bats present and the design of complex hibernation mitigation. Suzy has worked with a variety of Clients across multiple sectors (transport, industrial, education, government, healthcare, commercial, leisure and power / energy).

Dr Liat Wicks BSc (Hons) MSc CECOL MCIEEM

Dr Wicks is an ecological consultant and Chartered Ecologist with fifteen years' professional experience specialising in bat surveys, mitigation, sound analysis and advice across the UK. She is a class 2 licenced bat surveyor and has produced numerous EPS applications and Bat Masterplans for major infrastructure projects. Between 2012 and 2013 Dr Wicks was Head of Biodiversity at the Bat Conservation Trust.

Anna McDermott BSc (Hons) MCIEEM

Anna has worked in ecological consultancy for more than fourteen years. Anna has extensive experience in dedicated species surveys, including bats, reptiles, great crested newts, water voles, otters and badgers. She has successfully designed and implemented mitigation measures for a number of protected species. Anna has also produced and currently holds European Protected Species (EPS) mitigation licences for bats.

Dr Kevin Hume BSc (Hons) MSc MCIEEM

Dr Hume is a principal ecologist with thirteen years' experience including bat survey and investigation all over the UK. Dr Hume is also a fully licenced bat surveyor.

Dr Heather Fulford BSc (Hons) MSc MCIEEM

Dr Fulford has over eight years' ecological consultancy experience, including undertaking multiple bat potential roost assessments, both for trees and buildings, bat dusk emergence and dawn re-entry

surveys as well as bat activity surveys over the south of England. She is a member of Wiltshire Bat Group and has assisted with box checks, mist-netting, radio tracking and harp-trapping of bats.

5.3 Bat Activity Transect & Exit / Re-Entry Surveys

Table 1 (Section 6) sets out the schedule and details of the Bat Activity Transect Surveys and Ext /Re-Entry Surveys conducted at the site in 2019. Bat activity at levels at key locations was recorded during the transect surveys by conducting a number of Spot Samples.

The Dusk/ Dawn Bat Activity Transect Surveys and the Exit / Re-Entry Surveys were conducted within the active season for bats in 2019. In accordance with the Bat Surveys for Professional Ecologists, Good Practice Guidelines 3rd Edition¹⁶, the dusk surveys were conducted from approximately between 15 minutes before sunset until approximately one and half - two hours after sunset. The dawn surveys were conducted from approximately one and half - two hours before sunrise until approx. sunrise.

5.4 Spot Roost Surveys

At the start of the September Dusk Activity Transect Survey, and towards the end of the July 2019 Dawn Activity Transect Survey surveyors conducted Spot Roost Surveys to gain information on likely roosting activity at the following locations. The surveys focused on Buildings assessed to have some (albeit, low) bat roost potential as determined during the Preliminary Ground Level Roost Assessment: Buildings 1, 2, 5, 6, 7a, 7b and 8, 10, 11 and 12 (Appendix A).

5.5 Automated Detector Surveys

Automated bat detectors (Anabat Express and Wildlife Acoustics SM4) were deployed during the June and September surveys for bat call recording sessions. Following the end of the recording sessions, the automated detector(s) was retrieved, and the data collected and analysed.

5.6 Thermal Imaging Surveys

A thermal imaging system (using a FLIR T630SC thermal imaging camera) was used to record heat signatures from any emerging bats, in order to aid detection of bats within the buildings and habitats on site / near the site. The thermal imaging system is sufficiently sensitive to record bats otherwise not visible where their body temperatures are higher than their surroundings and ambient temperature (as would be anticipated during the active season). The camera was deployed during the June, July, and September Surveys.

5.7 Equipment

The manual activity surveys were undertaken using the following equipment:

- Elekon Bat Logger M (Time expansion TE);
- Echometer Touch Pro ((TE));
- Ipad and iPhone using GPS HD Pro application; and
- Kestrel 3500 Weathermeter.

Sound analysis of bat calls was undertaken using the following software as appropriate to the detectors:

- Kaleidoscope Pro (EM Touch);
- Bat Explorer (Bat Logger); and
- Weather data was recorded on site using a Kestrel 3500 Weathermeter, the Bat Loggers and from the WeatherOnline weather database.

¹⁶ Collins, J. (., 2016. Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edn)., London: The Bat Conservation Trust.

Bat data were analysed and reported using:

- R (www.cran.r-project.org/);
- RMarkdown (<http://rmarkdown.rstudio.com/>); and
- RStudio™ (<https://www.rstudio.com>).

5.8 Limitations

- Bat detectors favour recording of those bats which make loud calls (for example: pipistrelles and noctules) over those which make quieter calls or do not echolocate (for example brown long-eared and some *Myotis* bats). This potential bias introduced by the detectors is compensated for by the visual clues observed by experienced surveyors.
- Bats are highly mobile and their distribution over nights and seasons transient. Therefore, a single site survey provides only a snapshot of the conditions at the time of survey with regards to nature conservation status. Bats also use several different roosts at different times of year and between years.
- Reduced species identification power due to the use of zero crossing data collected by the Anabat Express i.e. the level / accuracy of species identification is subject to the constraints associated with zero-crossing data (i.e. lack of call harmonics and amplitude information). Zero crossing is also very susceptible to the presence of non-bat related noise. As a result, it is likely that the identification of some species will be limited. Where calls could not be reliably identified at least to genus they were excluded from analysis.
- All of the bat surveys were generally conducted suitable conditions and bats were recorded during every survey. However, light, occasional, drizzle was experienced during the June surveys and the July Dusk survey was conducted in exceptionally warm weather (32.5°C), likely to promote bat activity. There was a minor occurrence of thunder and lightning towards the end of the July Dawn Survey.
- The Dawn Re-Entry Survey started approx. 10mins late, however the automated detectors were recording during this period and therefore the starting time of the survey is not considered to have significantly impacted the survey results.
- This report includes a series of infographics which illustrate each bat pass recorded as symbol on an aerial plan. It is important to note that the mapping of the bat passes is indicative and approximate due to the tolerance ranges of the GPS systems used to record the bat pass locations.
- No bats were recorded during Automated Detector Session 5 due to a recording fault.

6 Results: Bat Activity Surveys

6.1 Introduction

The sections below present a summary of bat data collected, infographics generated using the data and provide an interpretation of the data set collected from the manual bat survey (see Section 7 and Section 8 for the Automated Detector and Thermal Camera results, respectively). The following results are presented here:

- Dusk / Dawn Bat Activity Transect Surveys; and
- Exit / Re-Entry and Spot Roost Surveys.

6.2 Survey Schedule

The bat surveys were conducted within the active season for bats in 2019 (Table 1). The surveys focused key areas and habitats on and off-site (Figure 3):

- Area A - Buildings on site within the section of the site accessed *via* Gould Road;
- Area B - Buildings on site within the section of the site accessed *via* Edwin Road;
- River Crane - Sections of the river that flow adjacent to and in close proximity to the site;
- Rail Bridge - Rail bridge near Marsh Farm Road with good views of the habitats surrounding the site; and
- Craneford Way Playing Fields - a large open green space adjacent to the River Crane.

Figure 3: Key Areas Covered by Bat Surveys Google Earth 2019©



Table 1: 2019 Bat Survey Schedule

Date (2019)	Sunset / Sunrise Time	Survey Type	Description	Spot Roost Surveys During Transect?		Spot Samples During Transect?	
				Conducted?	Location (Figs 4-9)	Conducted?	Location (Figs 4-9)
June							
24 th June	21:20	Dusk Activity Transect	– One of the six surveyors walking a transect along the sections of the River Crane close to site.	No	-	Yes	– River Bridge (off site) – River Crane – north bank (off-site) – Craneford Way Playing Fields
		Dusk Exit Survey	– Five of the six surveyors conducting Exit Surveys for the buildings with (low) bat roost potential on site (Area A & Area B).	No	-	No	-
25 th June	04:47	Dawn Activity Transect	– One of the six surveyors walking a transect along the sections of the River Crane close to site.	No	-	Yes	– River Bridge (off site) – River Crane – north bank (off-site) – Craneford Way Playing Fields
		Dawn Re-Entry Survey	– Five of the six surveyors conducting Re-Entry Surveys for the buildings with (low) bat roost potential on site (Area A & Area B).	No	-	No	-
July							
25 th July	20:58	Dusk Activity Transect	– Two surveyors walking a transect which covered both areas of the site (Area A & B), the Rail Bridge, River Bridge and sections of the River Crane, close to site.	No	-	Yes	– River Bridge (off site) – Rail Bridge (off site) – Site Area A – Site Area B

26 th July	05:17	Dawn Exit Survey	<ul style="list-style-type: none"> - Two surveyors walking a transect which covered both areas of the site (Area A & B), the Rail Bridge, River Bridge and sections of the River Crane, close to site. - Spot Roost Survey at the sections of the site close to the River Crane and buildings in Area A approx. one hour before dawn. 	Yes	<ul style="list-style-type: none"> - Sections of the site close to the River Crane. - Buildings in Area A 	Yes	<ul style="list-style-type: none"> - River Bridge (off site) - Rail Bridge (off site) - Site Area A - Site Area B - Craneford Way Playing Fields
September							
12 th September	19:22	Dusk Activity Transect	<ul style="list-style-type: none"> - Two Surveyors conducting a Spot Roost Survey of Area A buildings and the sections of the site close to the River Crane until approx. one hour after dusk. - Followed by Transect Survey to Area B. 	Yes	<ul style="list-style-type: none"> - Sections of the site close to the River Crane. - Buildings in Area A 	Yes	<ul style="list-style-type: none"> - Site Area B
13 th September	06:33	Dawn	<ul style="list-style-type: none"> - Two Surveyors conducting an Exit Survey of Area A buildings and the sections of the site close to the River Crane. 	No	-	No	-

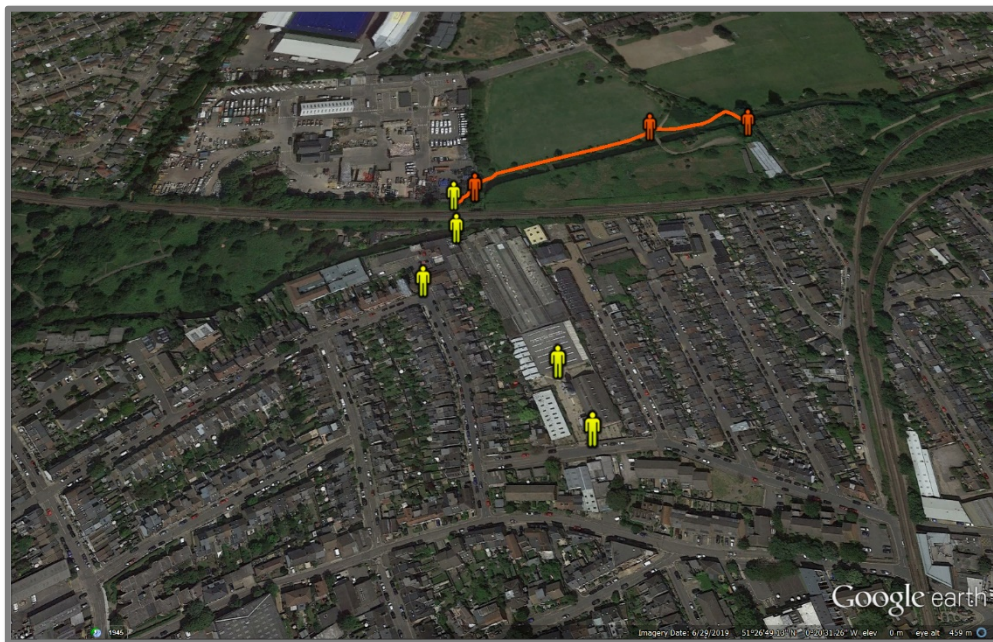
6.3 Surveyor Locations

The transect routes and the surveyor locations during the bat surveys are shown in Figure 4 - 9.

Figure 4: Surveyor Locations June 2019 – Dusk Survey Google Earth 2019©



Figure 5: Surveyor Locations June 2019 – Dawn Survey Google Earth 2019©







Key:		Exit/ Re-Entry Surveyor Location;		Spot Sample Surveyor Location;		Spot Roost Surveyor Location
				Transect Route		

Figure 6: Surveyor Locations July 2019 – Dusk Survey Google Earth 2019©



Figure 7: Surveyor Locations July 2019 – Dawn Survey Google Earth 2019©






Key:		Exit/ Re-Entry Surveyor Location;		Spot Sample Surveyor Location;		Spot Roost Surveyor Location
				Transect Route		

Figure 8: Surveyor Locations September 2019 – Dusk Survey Google Earth 2019©

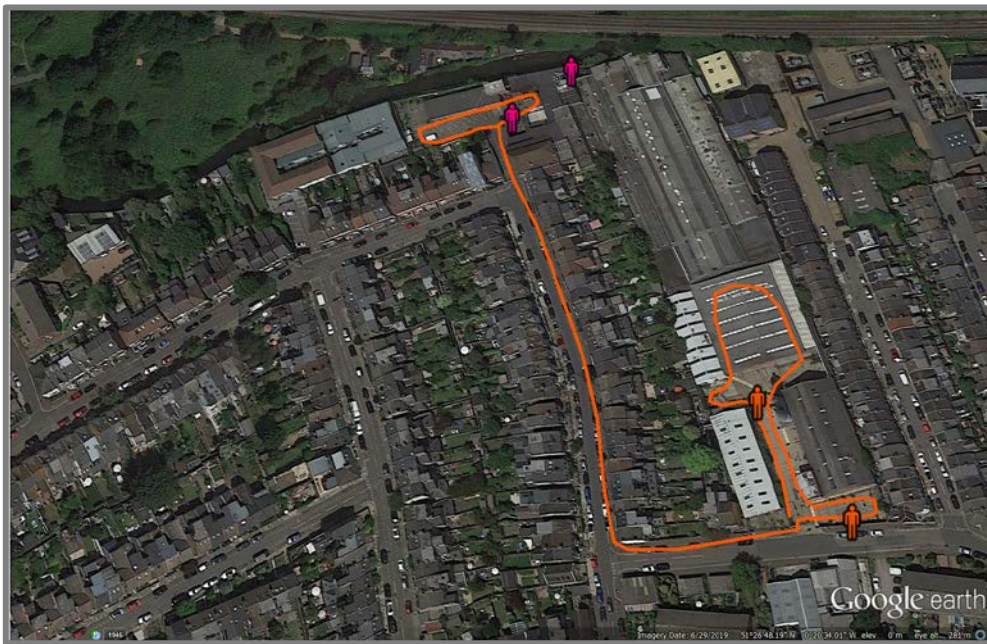






Figure 9: Surveyor Locations September 2019 – Dawn Survey Google Earth 2019©



Key:	 Exit/ Re-Entry Surveyor Location;	 Spot Sample Surveyor Location;	 Spot Roost Surveyor Location
		 Transect Route	

6.4 Weather Conditions

Temperatures and conditions during all the surveys were suitable for recording bats (Table 2) (also see the Limitations section).

Table 2: Bat Surveys Weather Conditions Summary

Date (2019)	Start/ End	Survey Timings Temp (°C)	Relative Humidity (%)	Wind Speed (mph)	Cloud Cover (oktas)	Rain
24 th June	Start	21.1	77	0	8	✘
	End	20.06	84	0	8	Light drizzle
25 th June	Start	20.2	91	0	8	Light drizzle
	End	18.0	97	0	8	Light drizzle
25 th July	Start	32.5	39	0	7	✘
	End	27.0	54	0	8	✘
25 th July	Start	25.0	49	0	5	✘
	End	21.0	74	0	6	Thunder & Lighting towards end of surveys Light drizzle
12 th September	Start	21.3	72	0	7	✘
	End	16.6	78	0	8	✘
12 th September	Start	16.2	65	0	4	✘
	End	14.7	69	0	5	✘

6.5 Existing Lighting

During the June survey and subsequent surveys, it was noted that external (security) and internal (building interior) lighting of the site was directly illuminating sections of the River Crane adjacent to the north of the site.

6.6 Bat Species Recorded during Bat Surveys

Six bat species and a number of unidentified *Myotis* bat calls were recorded using the site in 2019 during the Bat Surveys (Table 3).

Table 3: Bat Species Recorded During the Bat Surveys

Scientific Name	Common Names	Bat Species Description
<i>Plecotus auritus</i>	Brown long-eared	The ears of a brown long-eared bat are nearly as long as its body. Their highly sensitive hearing means they can hunt by listening for sounds made by insects, rather than using echolocation, which some moths can detect. Brown long-eared bats are found hunting amongst vegetation in gardens and parks, along hedgerows and in woodland where they will pluck insects off leaves as well as catching them mid-air.
<i>Pipistrellus pipistrellus</i>	Common pipistrelle	Common pipistrelles are the most common and widespread of all British bat species. They are found in lots of places, including towns and cities, as well as in the countryside. They are small, and their flight is fast and jerky as they pursue small insects which they catch and eat whilst flying. A single pipistrelle can consume up to 3,000 insects in one night.
<i>Nyctalus leisleri</i>	Leisler's bat	Leisler's are typically a forest species roosting in holes in trees, although they are also known to roost in the houses. They have golden-tipped hair and were formally known as the hairy-armed bat.
<i>Myotis spp.</i>	<i>Myotis</i> sp.	Unconfirmed species of <i>Myotis</i> bat.
<i>Pipistrellus nathusii</i>	Nathusius' pipistrelle	This bat is quite rare in the UK, though records have increased in recent years. It is migratory and is most commonly found in autumn, although there are now records of colonies remaining all year and breeding in the UK. It is similar in appearance to, but slightly larger than the common and soprano pipistrelles and the fur on its back is longer, sometimes giving a shaggy appearance. The Nathusius' is strongly associated with water and woodlands.
<i>Nyctalus noctula</i>	Noctule	Noctules are fairly large for a British bat. The noctule is generally one of the first bats to be seen of an evening, and they like to hunt over open ground, particularly pasture.
<i>Pipistrellus pygmaeus</i>	Soprano pipistrelle	The soprano pipistrelle was discovered as a different species to the common pipistrelle in the 1990s - they are very similar, but they use slightly different echolocation calls and there are subtle differences in how they look. They also tend to roost and hunt in slightly different places, with the soprano pipistrelle favouring river habitat and wetland areas.

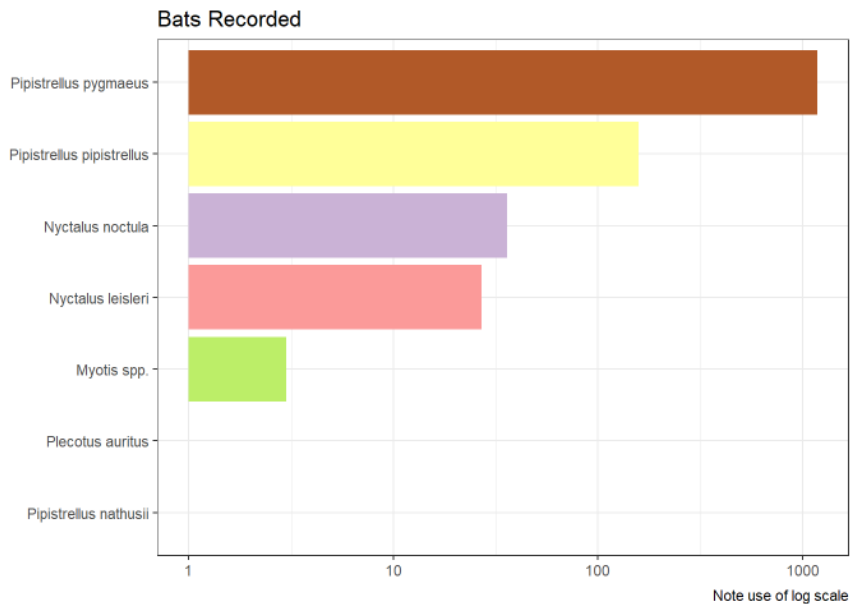
6.7 Bat Pass Numbers for Bat Surveys

Soprano pipistrelles bats were the most frequently recorded bat species (accounting for over 83% of the bat passes recorded), followed by common pipistrelles (accounting for over 11% of the bat passes recorded). Relatively frequent 'big bat' species, noctules and Leisler's bats, were also recorded as well as low numbers *Myotis* bats (species unconfirmed), brown long-eared and Nathusius' pipistrelle (Table 4 and Figure 10).

Table 4: Summary of Bat Pass Numbers from the Bat Surveys¹⁷

Scientific Name	Common Names	Bat Pass Count	Colour in Figures
<i>Plecotus auritus</i>	Brown long-eared	1 (0.07%)	Dark Red
<i>Pipistrellus pipistrellus</i>	Common pipistrelle	158 (11.26%)	Yellow
<i>Nyctalus leisleri</i>	Leisler's bat	27 (1.92%)	Light Red
<i>Myotis spp.</i>	<i>Myotis sp.</i>	3 (0.21%)	Light Green
<i>Pipistrellus nathusii</i>	Nathusius' pipistrelle	1 (0.07%)	Purple
<i>Nyctalus noctula</i>	Noctule	36 (2.57%)	Light Purple
<i>Pipistrellus pygmaeus</i>	Soprano pipistrelle	1,177 (83.89%)	Brown
Total		1,403	

Figure 10: Bat Passes, per Species -Total Calls Bat Surveys



¹⁷ "Relative bat activity can be measured from the search-phase echolocation calls of bats or, more commonly, from 'bat passes/sequences' – where a pass/sequence is a series of calls belonging to an individual bat" Paola F. Reason, Stuart E. Newson & Kate E. Jones (2016) Recommendations for using automatic bat identification software with full spectrum recordings.

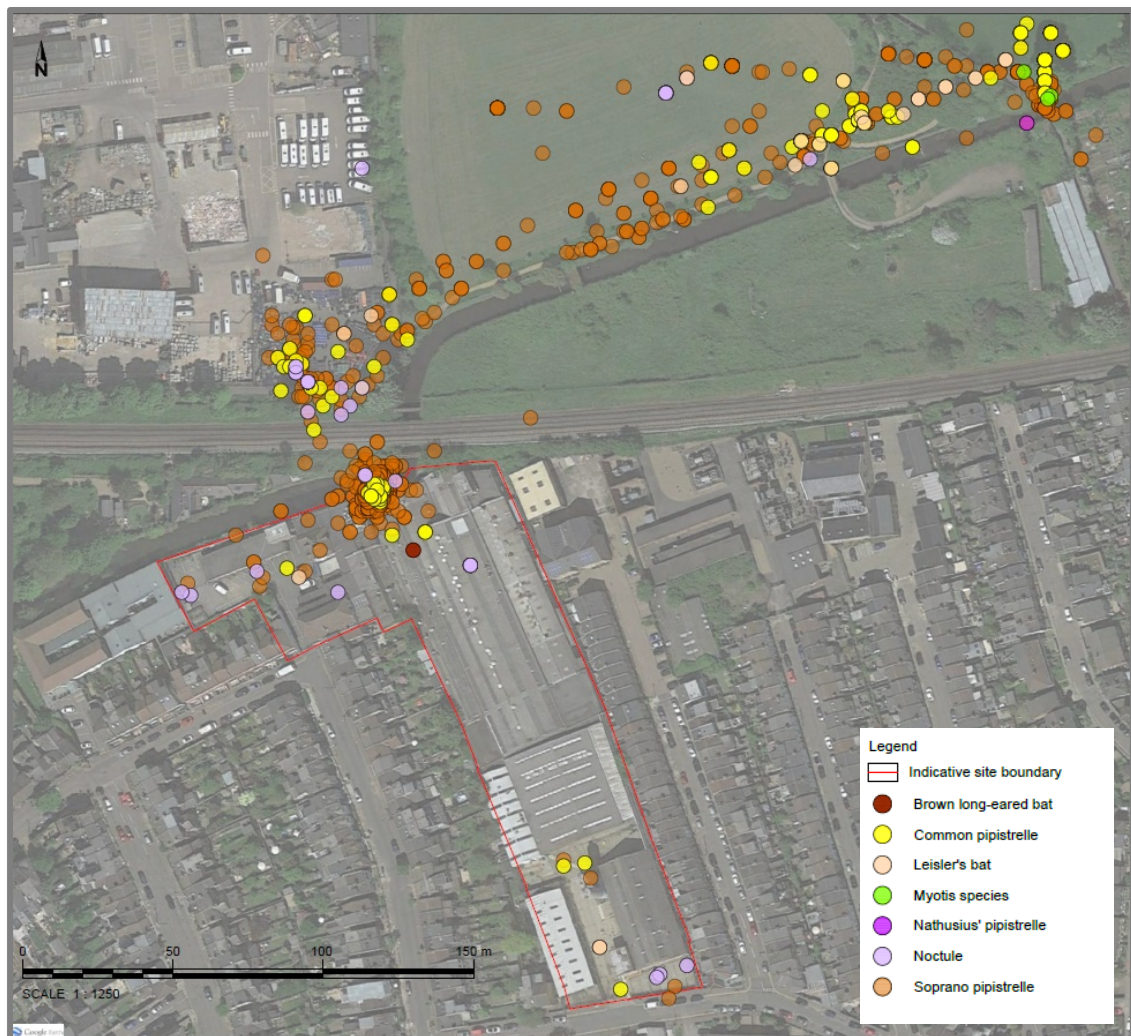
6.8 Bat Activity Across the Site

An illustration of the bat activity recorded across the site, for the manual bat surveys combined, is presented in Figure 11. The surveys across the site enabled both acoustic recordings of each species detected, and visualisation of their flight paths, behaviour and direction of flight during the earlier part of the night and later parts of the pre-dawn surveys.

The vast majority of the bat activity observed during the surveys was recorded along the River Crane, both along the northern bank (off -site) and along the southern bank (adjacent to the northern site boundary). Bat activity over the site itself was relatively limited in comparison to that recorded both along the river and over the adjacent green spaces such as Craneford Way Playing Fields.

Bats used the linear habitat features off-site, specifically the river corridor, for commuting, favouring those these areas which are typically dark and sheltered in nature.

Figure 11: Bat Activity – Bat Passes from All 2019 Bat Surveys Combined¹⁸ © Google Earth 2019



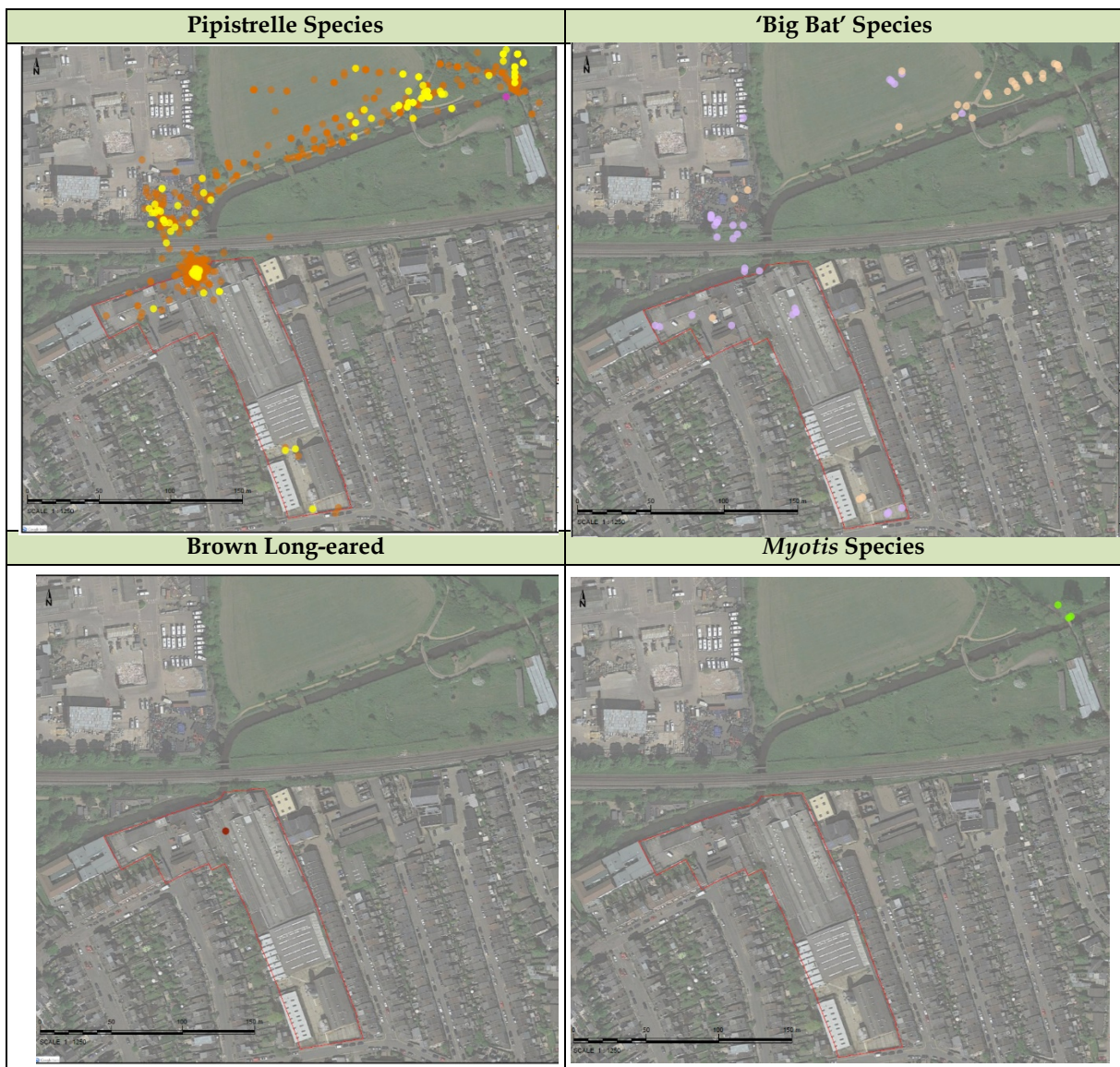
¹⁸ Please note, the areas of the map without colour doesn't reflect an area of no bats; it could also mean that the surveyor walking the transect couldn't reach these areas or spent too short a time at these locations to observe a bat.

6.9 Bat Activity Recorded – Per Species

The locations of the bat observations for each species group are recorded in Figure 12. The different pipistrelle species were relatively evenly distributed along the river corridor, with occasional recordings over both Area A and Area B of the site. The single recording of the Nathusius' pipistrelle bat was recorded at the River Bridge spanning the River Crane.

The high-flying 'big bat' species, noctule and Leisler's, were recorded commuting and foraging over more open habitat such as bare ground, playing fields and buildings as well as along the river corridor. These species are typically not tied to linear features in the landscape. A single brown long-eared bat was recorded during the surveys. The *Myotis* species (unidentified *Myotis* species) were almost exclusively recorded foraging over the river suggesting that the species may have been a Daubenton's or Natterer's bats which are notably linked to water, over which they hunt.

Figure 12: Location of Bat Observations, by Species © Google Earth 2019



6.10 Bat Activity Recorded – Per Month

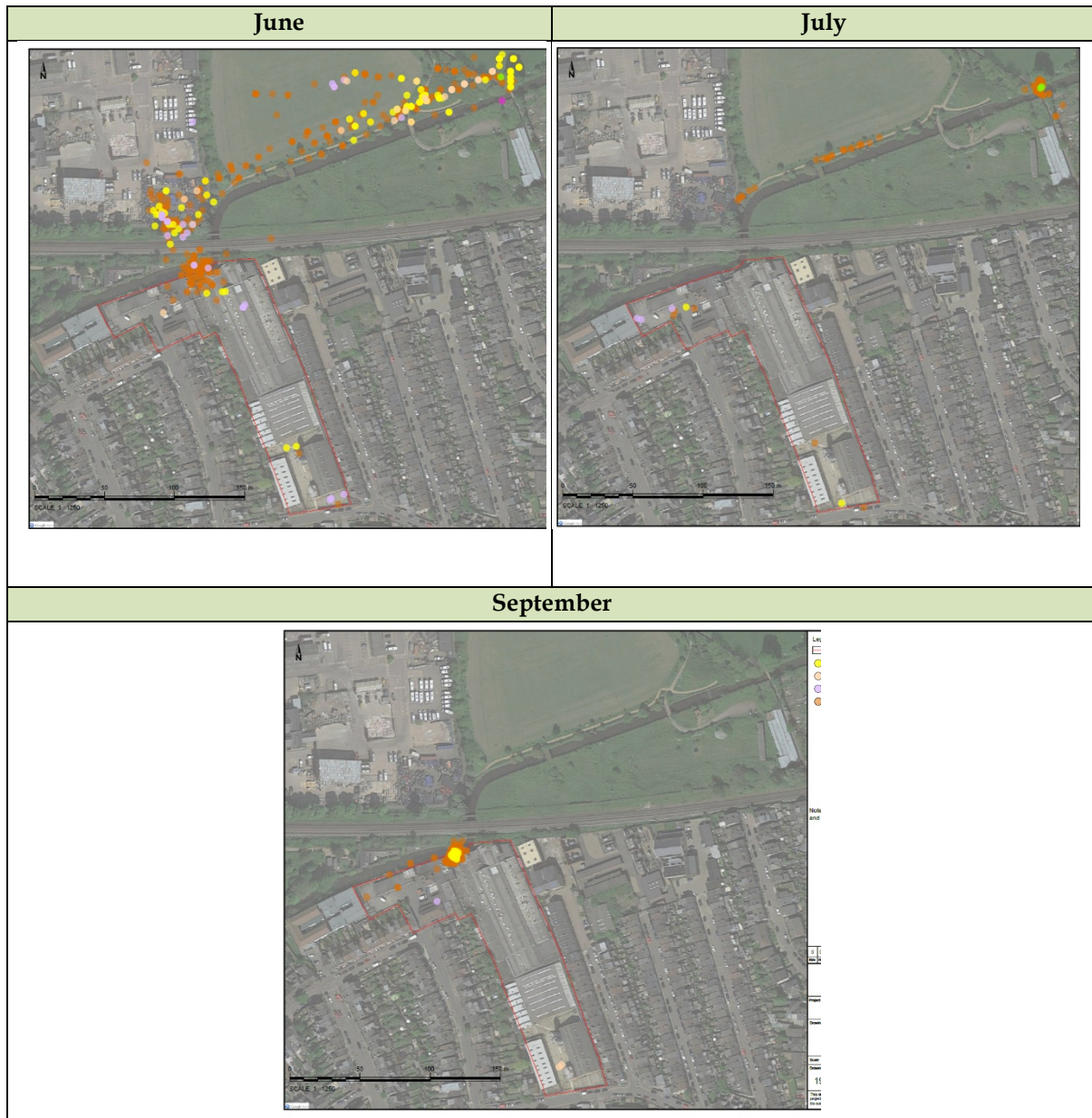
The number of bat species recorded per month, ranged from six to three. The highest species richness was recorded in June (Table 5 and Figure 13).

Table 5: Bat Passes, per Month -Total Calls Recorded from the Bat Surveys

Year	Number of Bat Species Recorded
June	6
July	3
September	4
Maximum	6

* Excludes calls identified to only genera level i.e. *Myotis*

Figure 13: Location of Bat Observations, by Month © Google Earth 2019



6.11 Bat Activity Timings & Roosts Recorded from Bat Surveys

No bats were observed exiting or re-entering any of the buildings on site during any survey. In terms of bats roosting activity near the site in general, Figures 14 – 16 show the first bat species recorded during the evening period; from dusk to 90 minutes after sunset time, for each dusk survey. The coloured dots show the bat species and time they were observed. The white bar indicates the approximate time the bat species exit from their roost; based on (Russ 2012¹⁹). Based on the emergence times, the following species are likely to be roosting near the site:

- Soprano pipistrelle (Figure 14, 15 and 16);
- Common pipistrelle (Figure 14);
- Leisler's (Figure 14); and
- *Myotis* species (species unconfirmed); (Figure 15).

Figure 14: 24th June Bat Emergence Times During the Dusk Survey

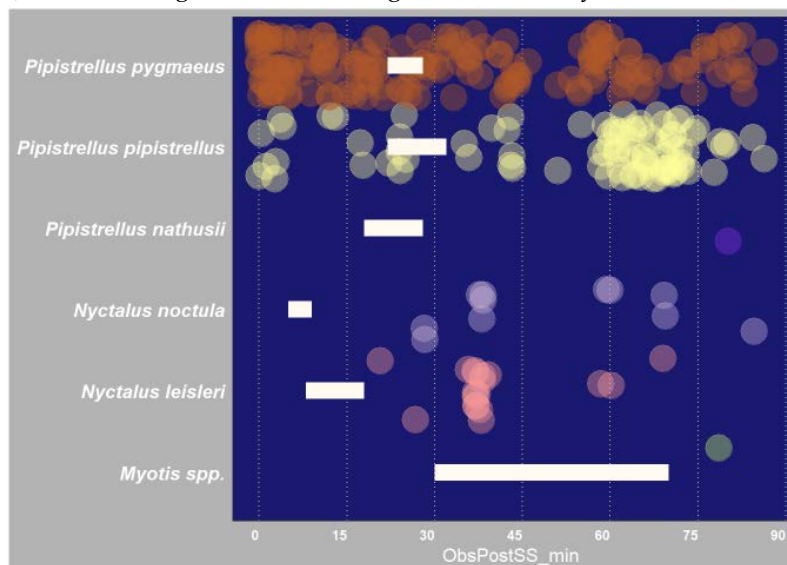
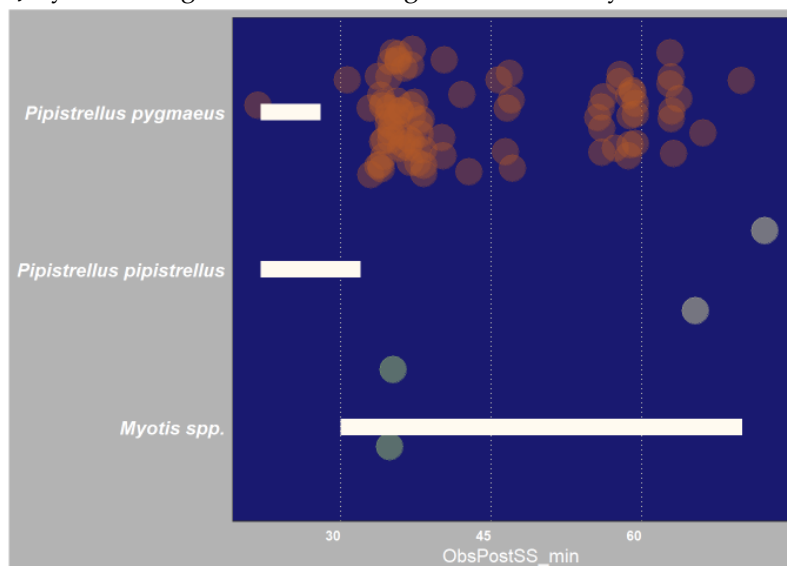
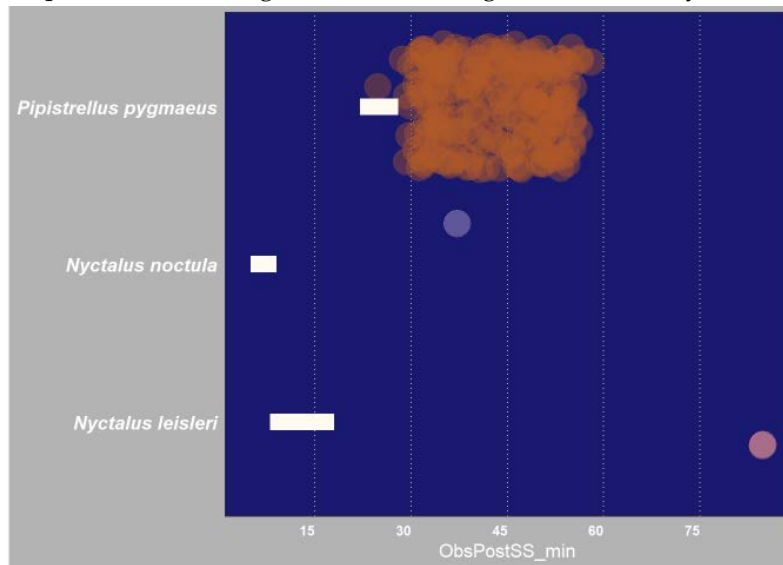


Figure 15: 25th July Bat Emergence Times During the Dusk Survey



¹⁹ Russ, R (2012) British Bat Calls: A Guide to Species Identification.

Figure 16: 12th September Bat Emergence Times During the Dusk Survey



6.12 Location of Roosts

No bats were observed directly exiting or re-entering any building on site during any surveys.

The locations of the first observations per species (Figure 17) clearly illustrates that the majority of the earliest bat observations are situated along the river corridor with hot spots by the River Bridge. Two early recordings were located near the site; a soprano pipistrelle recorded on the September survey where the site lies adjacent to the river and a soprano pipistrelle recording from the July survey which was observed commuting along Crane Road (rather than across the site).

Figure 17 : Bat Emergence: First Observations per Species © Google Earth 2019



7 Results: Automated Detector Surveys

7.1 Automated Detector Session Schedule

Six automated detectors recording sessions were undertaken at the site at four locations. The dates of the automatic detector deployment and retrieval is shown in Table 6.

Table 6: Summary of Automated Detector Sessions

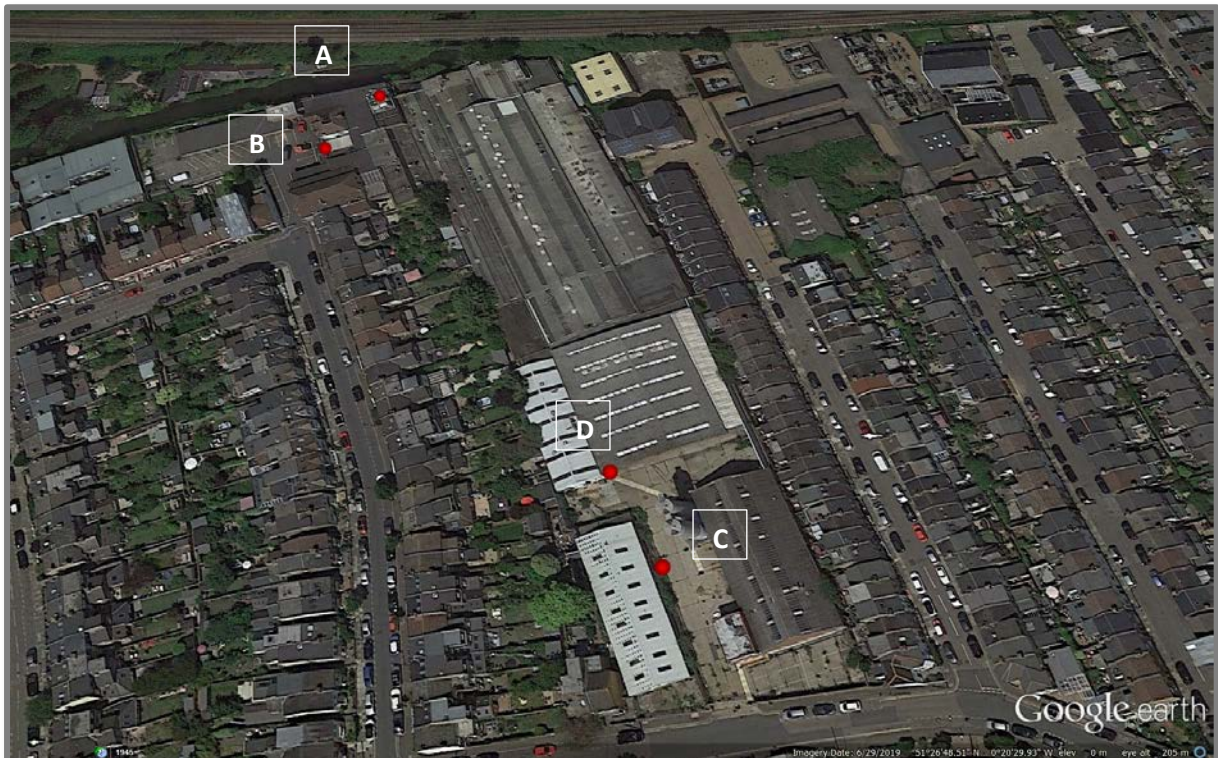
Automatic Detector Session	Automatic Detector Location (Fig 18)	Automatic Detector Session	Automatic Detector Model	Deployment Date (2019)	Retrieval Date (2019)
1	A	1	Anabat Express	24 th June 2019	25 th June 2019
2	B	2	SM4	24 th June 2019	25 th June 2019
3	C	3	Anabat Express	24 th June 2019	25 th June 2019
4	B	4	Anabat Express	12 th September	13 th September
*5	D	5	Anabat Express	12 th September	13 th September
6	A	6	SM4	12 th September	13 th September

* No bats were recorded during Automated Detector Session 5 due to a recording fault.

7.2 Automated Detector Locations

The location of the four automated detector locations are illustrated in Figure 18.

Figure 18: Automated Detector Locations Sessions © Google Earth 2019



7.3 Bat Species Recorded from Automated Detectors

A considerable volume of bat activity was recorded by the automated detectors during their deployment (Table 7). Five bat species, plus an unidentified *Myotis* species, were recorded by the automated detectors.

Common pipistrelles, soprano pipistrelles, Leisler's, noctule and an unidentified *Myotis* species were recorded both by the automated detectors and during the manual bat surveys. Brown long-eared and Nathusius pipistrelle were only recorded during the manual bat surveys, whilst Natterer's bat *Myotis nattereri* was only recorded by the automated detectors. Natterer's are a medium sized, slow (but agile) flying bat with long fur. They are often found foraging near water and trees. In addition to the flying insects typically predated on by UK bats, Natterer's bats hunt beetles and spiders straight from vegetation and can hover for short periods of time.

The majority (over 78%) of the bat passes recorded were from soprano pipistrelle bats. Despite differences in the number of recording sessions, levels of activity recorded adjacent to the River Crane (Location A- total bat passes: 1,337 (98.7%)) far outweighed that recorded on site (Locations B and C – total bat passes: 18 (1.3%)).

Table 7: Summary of Bat Pass Numbers from Automated Detector Sessions

Common Names	Bat Pass Count						Totals
	1 Location A	2 Location B	3 Location C	4 Location B	5* Location D	6 Location A	
Common pipistrelle	29	1	1	0	-	94	125 (9.23%)
Leisler's bat	23	15	0	0	-	98	136 (10.04)
<i>Myotis</i> sp.	0	0	0	0	-	10	10 (0.74%)
Natterer's bat	0	0	0	0	-	1	1 (0.07%)
Noctule	8	0	0	0	-	12	20 (1.48%)
Soprano pipistrelle	1	1	0	0	-	1,061	1,063 (78.45%)
Total	61	17	1	0	-	1,276	1,355 (100%)

* No bats were recorded during Automated Detector Session 5 due to a recording fault.

8 Results: Thermal Imaging Surveys

8.1 Thermal Imaging Schedule

Thermal imaging systems were used to detect heat signatures from any emerging bats. The thermal cameras were deployed during the following surveys:

Table 8: Summary of Thermal Imaging Sessions

Date (2019)	Camera Location (Fig X)	Camera Model
24 th June	A	LIR T1030SC
25 th June	B	LIR T1030SC
25 th July	C	LIR T1030SC
26 th July	A	LIR T1030SC
12 th September	D	LIR T1030SC
13 th September	D	LIR T1030SC

8.2 Thermal Imaging Locations

The deployment locations of the thermal imaging camera is shown in Figure 19.

Figure 19: Aerial Mapping indicating the Location of the Thermal Imaging Camera during Bat Surveys © Google Earth 2019



8.3 Bat Activity Recorded from Thermal Imaging

Thermal images of the buildings on site and the adjacent habitats were taken during the bat surveys (Figure 20). However, no bats were detected emerging or re-entering any of the buildings on site on the thermal imaging cameras.

Figure 20: Examples of Thermal Images of the Buildings and Habitats on Site

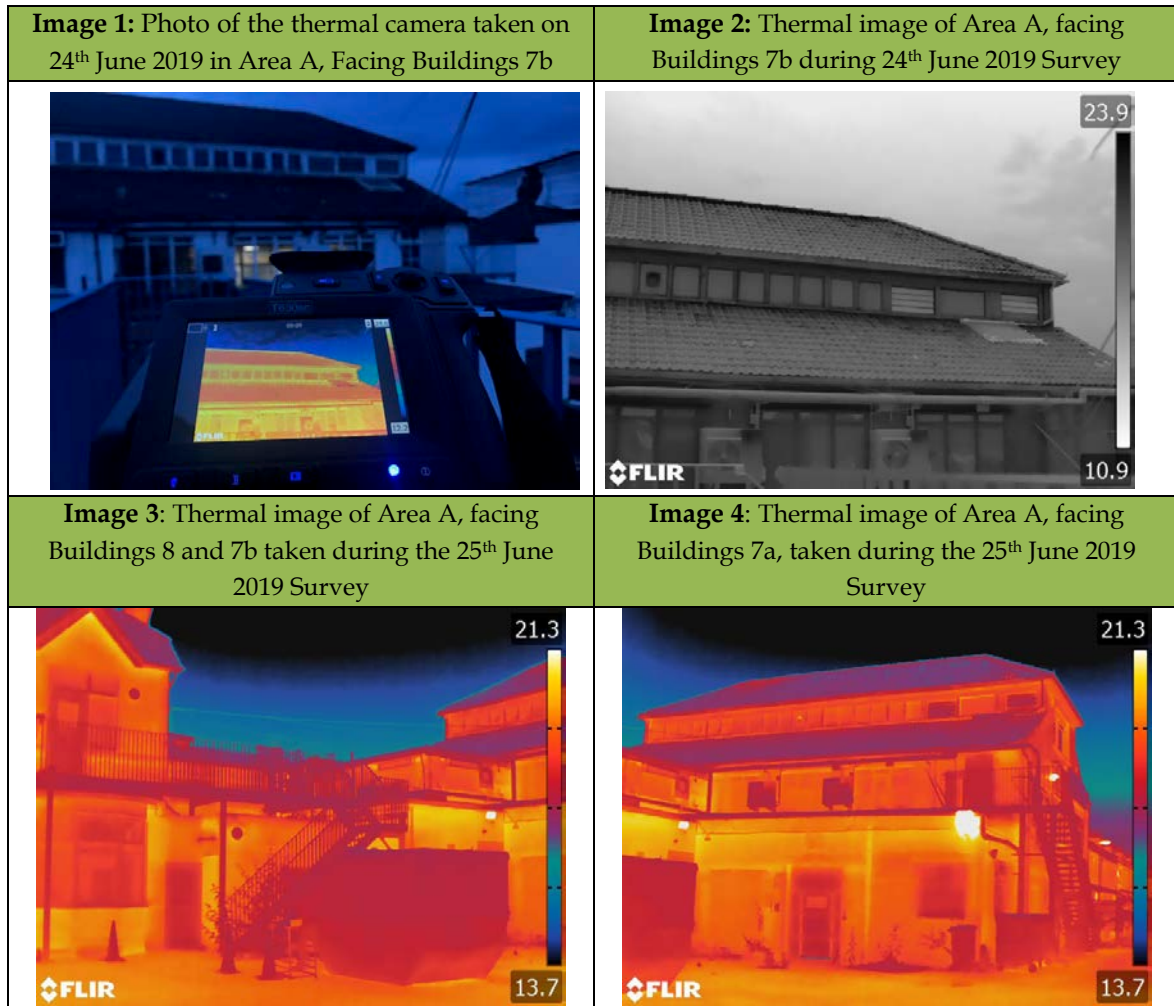


Image 5: Thermal image of a soprano pipistrelle bat foraging over the River Crane, photo taken from the River bridge looking eastwards

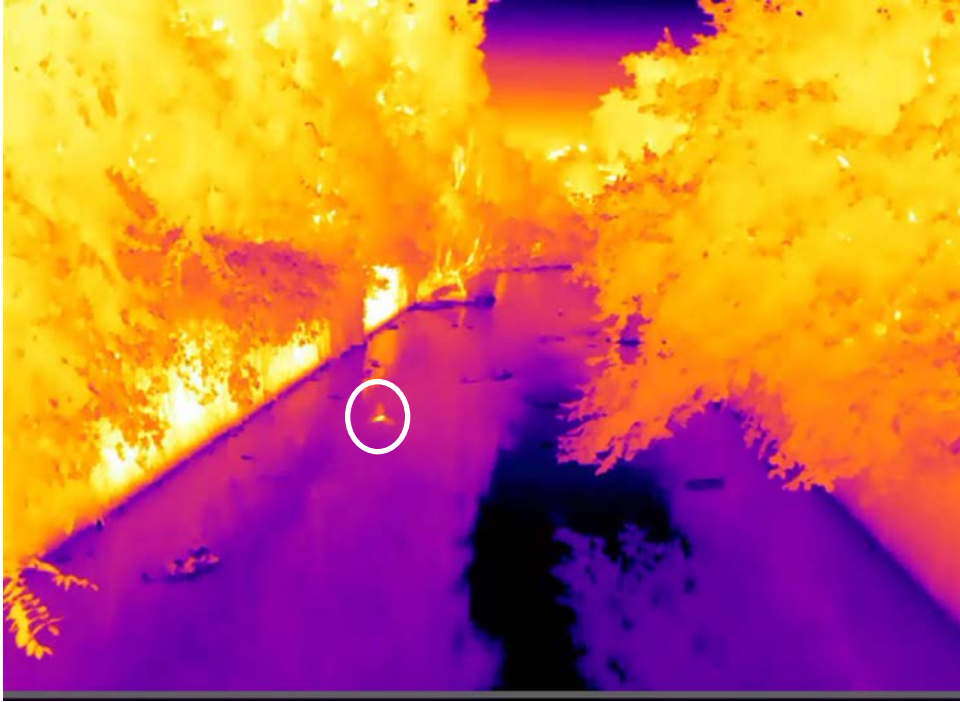
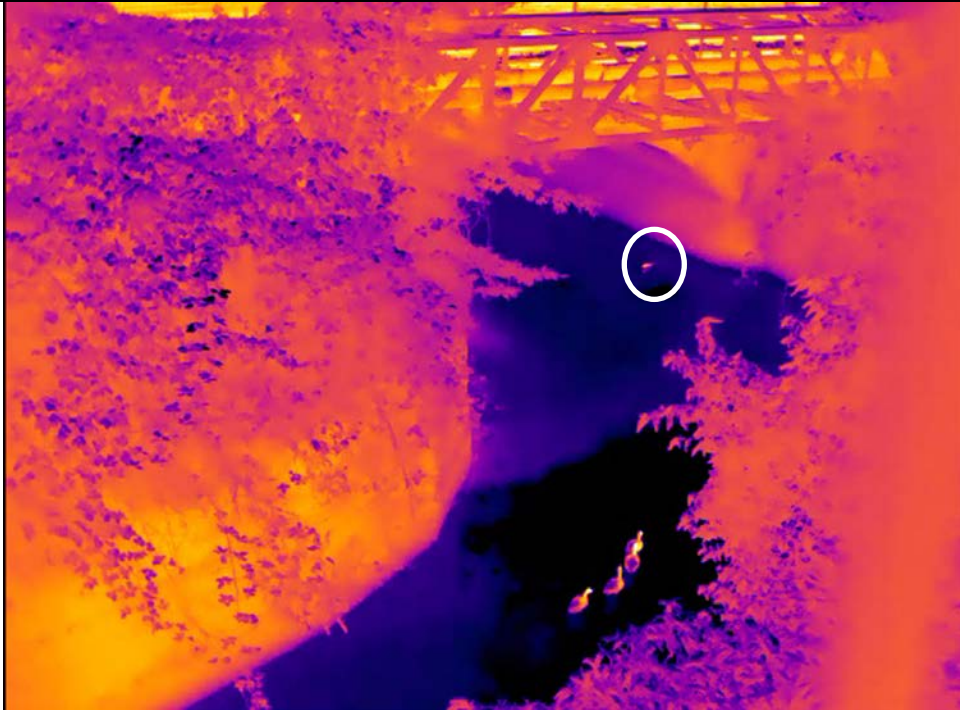


Image 6: Thermal image of a soprano pipistrelle bat foraging over the River Crane, photo taken from the north of the Site, overlooking the south bank of the River Crane, looking eastwards



9 Interpretation & Recommendations

9.1 Introduction

The following chapter makes recommendations for the avoidance of harm to bats and their habitats, and enhancements to benefit bats, based on the levels of activity and evidence of bats recorded in 2019.

9.2 Bat Species Composition

The survey findings show that at least seven species of bat use the site to forage on / near and commute over (common pipistrelle, soprano pipistrelle, brown long-eared, Leisler's, noctule, Natterer's and Nathusius' bat, plus an unidentified *Myotis* species).

9.3 Bat Roost Sites

No bats, of any species, were observed exiting or re-entering the buildings on site. However, a high level of early bat activity was recorded off-site, along the River Crane corridor and over the local green spaces, such as the Craneford Way Playing Fields. Based on the emergence times recorded during the surveys, at least four species of bat: common pipistrelle, soprano pipistrelle, Leisler's, plus an unidentified *Myotis* species, are likely to be roosting near the site.

9.4 Precautionary Pre-Demolition Checks

Throughout 2018 and 2019, a comprehensive suite of bat potential assessments and surveys has been conducted and a considerable volume of bat data has been recorded and analysed for this site. The bat species that currently use the site and the features that are important to them for commuting and foraging have largely been identified.

Post survey, the buildings on site are considered to possess low / negligible bat roost potential and no further surveys of the buildings are deemed necessary. However, as building conditions can deteriorate over time, leading to concomitant changes in bat suitability, if building demolition is delayed beyond the start of the next bat active season (April / May 2020), as a *precautionary* measure, one follow-up Bat Dusk/Dawn Survey should be conducted, before demolition begins.

If a bat is observed during the building demolition, works must stop immediately and a suitably qualified and licenced ecologist consulted immediately. In this situation, a Natural England licence would be required prior to the re-start of works. Appropriate mitigation may be required including replacement roosts may also be needed, to ensure the favourable conservation status of the species is maintained.

9.5 Protection of the River Crane Corridor

The results from the bat surveys shows that bats are using the River Crane Corridor to forage and commute. It is important that good construction practice in relation to ecology should be followed during the site clearance and construction works to prevent water course pollution (for example, avoidance of run-off and lighting).

Where a Demolition Management Plan (DMP) / Construction Management Plan (CMP) and Site Waste Management Plan (SWMP) are prepared for the development, its recommended that they include a section detailing the provisions aimed at protecting biodiversity, including avoiding any additional lighting of the watercourse during construction.

9.6 Bat Monitoring

It is recommended that bat activity is monitored for five years' post development (one dusk / dawn survey to be conducted years 1, 3 and 5) to assess the level of use of the site by bats, in particular the use of the River Crane River Corridor by the local bat population. The findings of the surveys will be used to inform the landscape management of the site as per the Landscape and Ecology Management Plan (LEMP).

9.7 Consideration of Lighting

9.7.1 *Potential Impacts of Lighting*

Lighting schemes can damage bat foraging habitat directly through loss of land and spatial exclusion of bats due to high illuminance, or indirectly by severing commuting routes from roosts, through light spillage polluting hedgerows, mature tree lines and other linear features often used by commuting bats. Lighting around roosts has also been shown to delay emergence, causing bats to miss the peak in insect prey abundance affecting survival and health²⁰.

It should be noted that some bat species (common pipistrelle and noctule) can benefit from lighting and are known to forage around and above streetlights, whereas other species such as brown long-eared bats are light averse and will avoid brightly lit areas. As such the severity of impacts of any lighting scheme will vary depending on the species present.

9.7.2 *Designing a Site Specific Lighting Strategy*

As part of the design process, the impact of external lighting on the local biodiversity has been considered, in line with current guidance and in consultation with the Project Lighting Team (Desco (Design & Consultancy) Ltd)³. Any lighting during construction will be addressed in the CEMP.

The 'Exterior Lighting Assessment Supplementary Report: Minimising the Impact of Lighting on Nocturnal Wildlife'³ provides a site specific lighting strategy aimed at protecting bats and other nocturnal wildlife from the potential deleterious impacts of light spill on sensitive habitats.

The lighting strategy for the site has been formulated to avoid, and where this is not possible for safety or security reasons, minimise any light trespass on the River Crane Corridor so it can continue to function as a 'dark corridor'. The lighting strategy has been based on principles of the:

- Bats and Artificial Lighting in the UK²¹;
- Planning guidance (National Planning Policy Framework, 2019)²²; and
- Design Guidance Protecting Bats in Waterside Development²³.

as detailed on the following section.

9.7.3 *River Corridor Lighting Zones & Bats*

For bats, the risk of disturbance from light trespass decreases inland with the increasing distance from the water's edge. Therefore, a number of different 'lighting zones' can be delineated running parallel to the river. As set out in the 'Design Guidance Protecting Bats in Waterside Development'²³. Each of these zones can then be assigned light level limit to be imposed at the outset of scheme design as set out in the table below.

²⁰ Stone, E.L. (2013) Bats and Lighting: Overview of current evidence and mitigation guidance

²¹ Bat Conservation Trust and Institution of Lighting Professionals Guidance Note 08/ 18 "Bats and Artificial Lighting in the UK" Bats and the Built Environment Series

²² Ministry of Housing, Communities & Local Government. 2019. Policy paper: National Planning Policy Framework February 2019.

²³ The Environment & Design Team (2018) WaterSpace Design Guidance Protecting Bats in Waterside Development

Table 9: Summary of River Lighting Zones

Zone	Location	Distance from Water's Edge	Light Limit	Development
Zone A	At the river channel and bank. Includes natural and engineered banks and moorings etc.	Approx. 0-2m from water's edge	<0.1 lux	No development and no /limited human access.
Zone B	At the bank top which includes the towpath or can be flat ground with continuation of bank vegetation.	Approx. 2-6m from water's edge	<0.5 lux	No development, accept access ways for cyclists and pedestrians.
Zone C	At the development edge - the transitional zone between undisturbed river corridor and the built environment.	Approx. 6-10m from water's edge	<3.0 lux	Limited development such as communal amenity areas.
Zone D	Development Zone - includes illuminated parking and the first buildings in from the water's edge.	Variable	No lux limits	Buildings and hard standings.

9.7.4 Riverside Landscaping

The Site lighting strategy seeks to restrict the amount of light spill reaching the River Crane by providing light barriers in the form of a 600mm high brick wall with a 700mm slatted fence above. A continuous hedge, circa 1300mm high will also be planted behind the fence, on the riverside, to reduce the light spill onto the river from the new development.

9.7.5 Bespoke Lighting Detail

In accordance with good practice (Bats and artificial Lighting in the UK²¹) and planning guidance (National Planning Policy Framework, 2019²²), following additional key points have been incorporated into the lighting design:

- Lighting in the apartments will be recessed LED downlighting, set back from the windows;
- External luminaires will comprise LED lamps which produce no UV emissions which ensures insects are not attracted away from neighbouring habitats;
- The LED street luminaire design has been amended so that the 4000mm high columns adjacent to the river have been replaced with wall mounted bulkhead luminaires mounted on the development site of the perimeter wall to reduce/ minimise light spill across the river;
- Car park lighting will utilise LED lamps with eyelid shield to control light distribution and reduce upward light spill;
- The apartment blocks and housed in the proposed development will be set back approximately 11,000 mm from the edge of the river;
- Any use of uplighting on trees and other landscape features has been avoided; and
- The external lighting has been modelled using lighting design software, the calculation outputs of which are enclosed within the Exterior Lighting Assessment³. This has enabled lighting levels and

spill across the space to be accurately predicted, thus ensuring that light is not provided to areas which do not require illumination and that the River Crane remains a 'Dark Corridor'.

Overall, there would be improvement on the current factory situation (Figure 22) in relation to maintaining and creating the river dark corridor. The proposed changes will provide a darker, deeper and wider fly / foraging zone than currently exists. With all of the above mitigation applied, the residual light spill on the river corridor will be of the order 0.45lux, which is similar to that experience on a clear full moon (0.25- <1 lux) (Figure 23).

Figure 22: Photos of Existing Factory Light Spill on to River Corridor

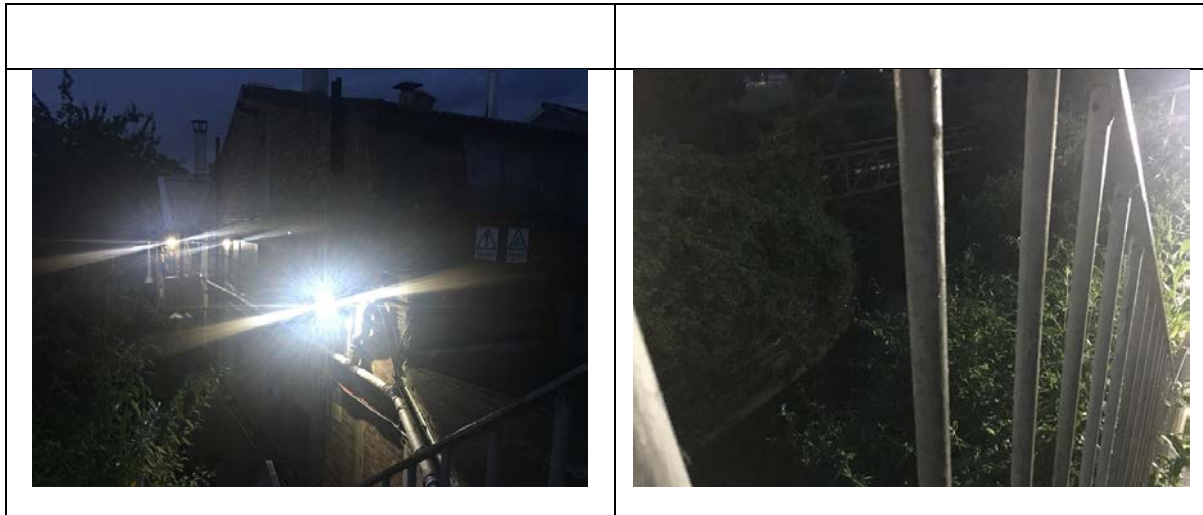
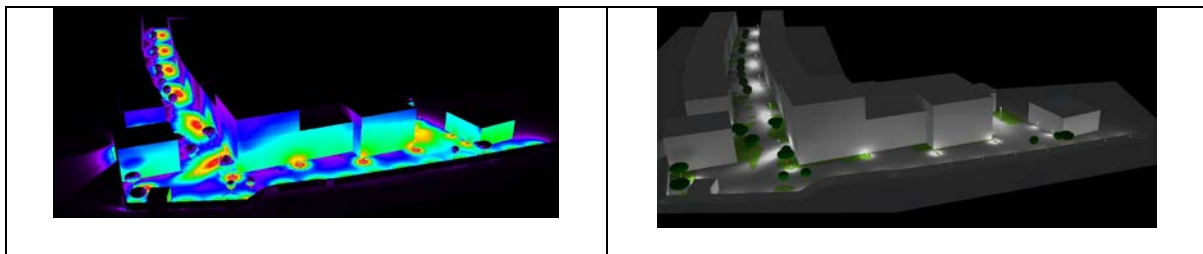


Figure 23: Revised Riverside External Lighting Illustrations 3-



9.8 Enhancement

Opportunities for biodiversity gain as well as avoiding impact have been considered and incorporated into the design. Based on the bat survey information at the site, the following enhancements, specific to bats, will be undertaken:

- Use of native species in landscaping proposals; tree, hedge and plant species planting as part of a landscaping scheme (using native species / species of value to biodiversity⁵). Species lists sources will include (Gunnell 2012²⁴) & (Bat Conservation Trust 2015²⁵) and the following native species: *Crataegus monogyna* (provides summer flowers and autumn berries and creates a dense hedge, good for nesting bird habitat), *Fagus sylvatica*, *Ilex aquifolium* (good evergreen species providing

²⁴ Gunnell, K., Grant, G and Williams, C. (2012). *Landscape and Urban Design for Bats and Biodiversity*, Bat Conservation Trust.

²⁵ Bat Conservation Trust, 2015. *Encouraging Bats: A Guide for Bat-Friendly Gardening and Living'* .

autumn food source for birds), *Silene dioica*, *Lychnis flos-cuculi*, *Galium verum*, *Leontodon hispidus*, *Leucanthemum vulgare*, *Lotus corniculatus*, *Primula veris*, *Prunella vulgaris*, *Ranunculus acris*, *Rumex acetosa*, , *Agrostis capillaris*, *Cynosurus cristatus*, *Festuca rubra* and *Acer campestre*.

- Creation of a wider natural corridor formed as part of the river walkway to include a river corridor hedgerow and native tree planting; and
- Creation of 150 m² of green roof(s) will provide habitat for invertebrates which bats can forage over
- Four bat boxes within new builds. Bat Boxes. These will be installed on site.

10 Conclusion

In 2019, Richard Graves Associates undertook a series of bat activity surveys on the Greggs Bakery Site, Twickenham. These surveys provide information in support of a Planning Application for proposed development.

The survey findings show that at least seven species of bat use the site to forage on / near and commute over (common pipistrelle, soprano pipistrelle, brown long-eared, Leisler's, noctule, Natterer's and Nathusius' bat, plus an unidentified *Myotis* species).

No bats, of any species, were observed exiting or re-entering any of the buildings on site. However, a high level of early bat activity was recorded (off-site) along the River Crane. Based on the emergence times recorded during the surveys, at least four species of bat: common pipistrelle, soprano pipistrelle, Nathusius' pipistrelle and noctule, plus an unidentified *Myotis* species, are likely to be roosting near the site.

The proposed development has been designed to minimise any impacts to the local bat population, whilst providing bat targeted enhancements.

The lighting strategy has been developed to ensure that there would be improvement on the current factory and security lighting in relation to maintaining and creating the river dark corridor. The proposed changes will provide a darker, deeper and wider fly / foraging zone than currently exists. With all of the lighting mitigation applied, the residual light spill on the river corridor will be of the order 0.45lux, which is similar to that experience on a clear full moon (0.25- <1 lux).

Opportunities for biodiversity gain, as well as avoiding impact have been considered and incorporated into the design. Based on the bat survey information at the site, enhancements, specific to bats, will comprise: a planting palette which benefits bats by providing a food sources for insects, tree planting to provide potential future roosting opportunities, bat boxes across the site and a green corridor of native hedge which will run parallel to the river corridor, adding a green linear feature along which bats can commute and forage.

A series of recommendations have been made which include: 1) *pre-cautionary* pre-clearance checks for bats in buildings; 2) the employment of good construction practice in relation to ecology (specifically the River Crane) during the site clearance and construction works to prevent water course pollution; and 3) Post-construction Bat Monitoring.

If the recommendations of this report, and the Phase 1 Habitat Survey Report¹, there are no undue constraints, with respect to bats, to the proposed development.

Appendix A

- Building References Plan

Building References

Greggs Bakery, Twickenham

Legend

- Building References
- ▬ Indicative Site Boundary

