

Appendix I.4 Bat Survey

East Reading Mass Rapid Transport Scheme

Bat Survey Report 2016 and 2018

On behalf of [Reading Borough Council](#)



Project Ref: 28791/3010 | Rev: 1.0 | Date: June 2017



Document Control Sheet

Project Name: East Reading MRT

Project Ref: 28791

Report Title: Bat Survey Report

Doc Ref: Final

Date: June 2017

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Revision	Date	Description	Prepared	Reviewed	Approved
1.0	10/10/2018	Update from 2016 Report to include 2018 Data	SF	JS / RM	SM

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Contents

1	Executive Summary	6
2	Introduction	7
	2.1 Overview.....	7
	2.2 Project Background	7
	2.3 Aims of Study	8
3	Methods.....	9
	3.1 Ground Level Tree Assessment 2016.....	9
	3.2 Dusk Emergence and Dawn Return to Roost Surveys 2016	9
	3.3 Activity Transect Surveys 2016	10
	3.4 Automated Static Detector Surveys 2016	11
	3.5 Activity Transect 2018	12
	3.6 Automated Static Detector Surveys 2018	12
	3.7 Data Analysis.....	13
	3.8 Survey Personnel	14
	3.9 Limitations to Methods	14
4	Results and Interpretation.....	15
	4.1 Overview.....	15
	4.2 Ground Level Tree Assessment 2016 Results.....	15
	4.3 Dusk Emergence Survey – Railway Bridge 2016	15
	4.4 Dusk Emergence and Dawn Return to Roost Surveys 2016 - G115, T88 and T91 ...	16
	4.5 Activity Transect Survey Results 2016.....	16
	4.6 Automated Static Detector Surveys 2016	17
	4.7 Activity Transect Survey Results 2018.....	18
	4.8 Automated Static Detector Survey Results 2018	18
	4.9 Interpretation of Activity Survey and Automated Static Detector Data.....	19
	4.10 Summary of Results and Interpretation of Results.....	22
	4.11 Legislative Considerations	22
5	Conclusion	24
	References	25
	Figures.....	27

Figures

Figure 1. Site Location Plan	27
Figure 2: Surveyor Locations.....	27
Figure 3a: Activity Transect Route and Automated Static Detector Locations 2016	27
Figure 3b: Activity Transect Route and Automated Static Detector Locations 2018	27
Figure 4: Ground Level Tree Assessment Results	27
Figure 5: Activity Transect Survey Results 2016.....	27
Figure 6: Activity Transect Survey Results 2018.....	27

Tables

Table 1: Personnel, Timings and Weather Conditions during the Dusk Emergence and Dawn Return to Roost Surveys in 2016	10
Table 2: Personnel, Timings and Weather Conditions during the Dusk and Dawn Activity Transect Surveys 2016.....	11
Table 3: Dates of Static Detectors Deployment - 2016	12
Table 4: Personnel, Timings and Weather Conditions during the Dusk and Dawn Activity Transect Surveys 2018.....	12
Table 5: Dates of Static Detectors Deployment	13
Photograph 1: Tree Group G115 showing a selection of the woodpecker holes present.....	29
Photograph 2: A wren observed using one of the woodpecker holes as a night roost	29
Table 4: Ground Level Tree Assessment Results 2016.....	30
Table 5: Bat Species Recorded (and number of soundfiles) during the Walked Transect	32
Table 6: Automated Static Detector Survey Results	33
Table 7: Dusk Survey Location L1, 14 th June 2016, Ed Austin	34
Table 8: Dusk Survey L2 14 th June 2016, Natalie White.....	37
Table 9: Dusk Survey L3 14 th June 2016, Stephen Foot	39
Table 10: Tree Group G115 Dawn Survey 4 th August 2016, Stephen Foot.....	41
Table 11: Tree Group G115 Dawn Survey 4 th August 2016, Ed Austin	41
Table 12: Tree T88 Dusk Survey 22 nd August 2016, Stephen Foot.....	41
Table 13: Tree T91 Dusk Survey 22 nd August 2016, Ed Austin	41
Table 14: Bat Species Recorded (and number of soundfiles) during the Walked Transects in 2018...	47
Table 15: Automated Static Detector Survey Results	48

Appendices

Appendix A	Summary of Relevant Legislation
Appendix B	Photographs
Appendix C	Ground Level Tree Assessment Results
Appendix D	Bat Activity Survey Results - 2016
Appendix E	Automated Static Detector Survey Results - 2016
Appendix F	Dusk Emergence/Dawn Re-entry Survey 2016 Results
Appendix G	Bat Activity Survey Results 2018
Appendix H	Automated Static Detector Survey Results - 2018

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1 Executive Summary

- 1.1.1 This Bat Survey Report has been prepared in respect of a planning application for a new Mass Rapid Transit (MRT) scheme to the east of Reading, Berkshire (referred to as the 'Proposed Development'). The redline boundary, referred to as the 'Application Site' is included on Figure 1.
- 1.1.2 A Preliminary Ecological Assessment (PEA) was completed by PBA in April 2016 including an ecological desk study and Phase 1 habitat survey of the Application Site. The desk study identified the presence of at least six species of bat within a 2 km radius of the Application Site with the field survey identifying the railway bridge and a number of mature trees within the Application Site as having the potential to provide roosting opportunities to bats. In addition, the woodland, tree-lines and adjacent watercourses (River Thames and River Kennet) were also considered to provide suitable foraging and commuting habitats for bats.
- 1.1.3 As a result of these initial findings PBA were commissioned to undertake a ground-level assessment of trees, a dusk emergence survey of the bridge as well as dusk emergence and dawn return to roost surveys of trees identified as having a high level of roosting potential in order to determine the presence/likely absence of roosting bats. Activity transect surveys supplemented by the use of automated static bat detectors were used to determine the extent that the Application Site and its immediate surrounds are used by foraging and commuting bats. These 2016 surveys were also supplemented with additional activity transect surveys and automated static detector surveys in August, September and October 2018.
- 1.1.4 No bats were found to be roosting in the railway bridge during the dusk emergence survey conducted in June 2016. Ten trees were found to support features capable of providing roosting opportunities to bats. Of these trees, three were subjected to more detailed ground-level inspection using a fibre-optic scope with one tree group (containing three trees) and two individual trees (all assessed as having high roosting potential) subjected to dusk emergence or dawn return to roost surveys. No bats were found to be roosting in any of the trees present on site.
- 1.1.5 The activity transect surveys and automated static detector surveys undertaken in 2016 and 2018 revealed that an assemblage of at least eight species of bat use the Application Site, and its immediate surrounds, with tree-lines, woodland parcels and the watercourses being the habitat features of most value.
- 1.1.6 This Executive Summary contains an overview of the key findings and conclusions. However, no reliance should be placed on any part of the executive summary until the whole of the report has been read.

2 Introduction

2.1 Overview

- 2.1.1 This Bat Survey Report has been prepared in respect of a planning application for a new Mass Rapid Transit (MRT) scheme to the east of Reading, Berkshire (referred to as the 'Proposed Development'). The redline boundary, referred to as the 'Application Site' is included on Figure 1.

2.2 Project Background

Site Location

- 2.2.1 The Application Site is located between Thames Valley Business Park and Napier Road, Reading, to the south of the River Thames and north of the Great Western Main Line Railway, as shown on Figure 1.
- 2.2.2 The Application Site comprises four main land parcels:
- Land which crosses the location of the permitted Thames Valley Park: Park & Ride Site, which had been recently cleared;
 - Land to the east of the River Kennet, which is dominated by a matrix of poor semi-improved grassland and tall ruderal habitat;
 - A central area of broadleaved woodland and riparian vegetation (i.e. vegetation along the river banks) associated with The Coal, Kennetmouth and Kings Meadow East Local Wildlife Site (LWS; see below); and
 - Land within the Tesco supermarket ownership at the western extent of the Application Site which is dominated by hardstanding and introduced shrub.
- 2.2.3 Other habitats across the Application Site include dense and scattered scrub, ephemeral/short-perennial vegetation and scattered trees.
- 2.2.4 Within a wider landscape context, the Application Site is located approximately 1 km north-east of Reading town centre within the county of Berkshire. South of the Application Site land use is dominated by residential and commercial development associated with Reading town. North of the Application Site lies the settlement of Caversham along with a network of lakes and other waterbodies (including a marina and rowing lakes) adjacent to the River Thames.

Proposed Development

- 2.2.5 The Proposed Development is described as follows:

'Construction of a segregated fast-track public transport, pedestrian and cycle bridge and viaduct, comprising concrete bridge structure with a river span of 59.5m and a land span of 316m, supported by concrete columns, steel beams and reinforced soil embankment, together with new footpath links and existing footpath alterations, replacement supermarket car parking provision, junction improvements and landscaping'.

Ecological Background

- 2.2.6 A Preliminary Ecological Assessment (PEA) was completed by PBA in April 2016 including an ecological desk study and Phase 1 habitat survey of the Application Site.

- 2.2.7 The desk study element of the assessment returned records of the following bat species from within a 2 km radius of the Application Site; Daubenton's bat *Myotis daubentonii*, noctule bat *Nyctalus noctula*, common pipistrelle *Pipistrellus pipistrellus*, soprano pipistrelle *Pipistrellus pygmaeus* and brown long eared bat *Plecotus auritus* with additional records for bat sp. *Chiroptera* and pipistrelle bat species *Pipistrellus* sp. Confirmed roost records were returned for bat sp., located 1.5 km south of the Application Site in 2009, and soprano pipistrelle, located 0.8 km south west of the Application Site in 2010.
- 2.2.8 Although no buildings or built structures are found on-site, the railway bridge over the River Kennet is located immediately adjacent to the south of the Application Site at grid reference SU 730 738. The bridge was identified as providing features suitable for use by roosting bats (e.g. gaps in the brickwork, cracks where mortar may be missing, etc.). Further to this, several mature and semi-mature trees identified within the Application Site were noted to be of sufficient age and condition to support potential roost features (e.g. split limbs, gaps, rot holes, etc.). Such trees were contained both within on-site woodland and as standalone specimens.
- 2.2.9 Habitats across the Application Site were also considered to range in value for use by foraging and commuting bats with linear features such as the woodland edges, lines of trees and the off-site but immediately adjacent River Thames and River Kennet considered to be of greatest value. In light of these initial findings further survey to determine the presence of roosting bats and the extent to which foraging and commuting bats use the Application Site was recommended (PBA, 2016).

2.3 Aims of Study

- 2.3.1 In order to determine the status of bats using the Application Site, PBA were commissioned to undertake the following:
- i. A ground-level assessment of trees followed by further detailed inspection and dusk emergence/dawn return to roost surveys of trees classified as having a high/moderate level of roosting potential completed in 2016;
 - ii. A dusk emergence survey of the railway bridge spanning the River Kennet in 2016;
 - iii. In 2016, monthly activity transect surveys between May and September inclusive supplemented through the use of automated static bat detectors deployed for a period of five nights at a time between May and October inclusive; and
 - iv. In 2018, monthly activity transect surveys between August and October inclusive supplemented through the use of automated static bat detectors deployed for five nights at a time between these months.
- 2.3.2 The purpose of these surveys was to determine presence/likely absence of roosting bats and the level of bat activity in and around the Application Site to inform necessary mitigation and enhancement measures that could be implemented to improve the Application Site post-development for bats. This report sets out the study findings, providing the following information:
- The results of the ground-level tree assessment (GLTA);
 - The results of the dusk emergence and dawn return to roost surveys on the railway bridge and trees;
 - The results of the activity transect and automated static detector surveys in 2016 and 2018; and
 - A summary of the legislative protection afforded to bats.

3 Methods

3.1 Ground Level Tree Assessment 2016

3.1.1 An assessment of the potential for all trees within the Application Site to provide opportunities for roosting bats was undertaken on the 11th July 2016 by Stephen Foot and Ed Austin. Weather conditions were partially cloudy (5/8 cloud cover) with a moderate breeze (Beaufort Scale F3-F4) and warm temperatures of 23°C. Trees were inspected from the ground, using binoculars and a high-power torch as necessary.

3.1.2 The Bat Conservation Trust has developed a survey protocol (Collins, 2016) which categorises the potential for trees to support roosting bats. Using the categories detailed below, an assessment was made of the potential for each tree/group of trees included within the survey to support roosting bats:

- Known or Confirmed Roost: Confirmed bat roost with field evidence of the presence of bats (trees where bat(s), and/or clear evidence of bat use, were found to be present).
- High Potential: Trees with multiple highly suitable features capable of supporting larger roosts.
- Moderate Potential: Trees with definite bat potential supporting fewer features than high potential trees.
- Low Potential: Trees with no obvious potential although the tree is of a size and age that elevated surveys may result in cracks or crevices being found; or the tree supports some features which may have limited potential to support bats.
- Negligible Potential: Trees with no potential to support bat roosts (Trees with no obvious features with potential to support a bat roost).

3.1.3 Trees supporting potential roosting features of low enough height to be safely accessed by ladder were also inspected with the aid of a fibre-optic scope to search for evidence of bats (bat droppings) or bats themselves. This included trees T136, T163 and T180 (Table 4 in Appendix C lists these trees/tree groups using the tree numbering system detailed in the tree schedule provided by Tree Work Environmental Practice (Tree Work Environmental Practice, 2016) with the locations of these trees shown on Figure 4).

3.2 Dusk Emergence and Dawn Return to Roost Surveys 2016

3.2.1 Survey visits were conducted on the railway bridge and trees T88, T91 and G115 (assessed as having at least a moderate level of roosting potential). These visits were undertaken in accordance with the Bat Conservation Trusts Good Practice Guidance (Collins, 2016) in suitable weather conditions as detailed in Table 1. The surveys were undertaken at an optimal time of year, when bats are active and are likely to be using summer/maternity roosts. The dusk emergence surveys began 15 minutes before sunset and continued until 1.75 hours after sunset. The dawn return to roost surveys began 1.75 hours before sunrise and finished at sunrise. Where bat activity was still evident close to sunrise, surveys were extended a further 15 minutes after sunrise.

3.2.2 Three surveyors were used during the survey of the bridge, with two surveyors used on tree group G115 (supported by a night vision camera) with one surveyor on each of trees T88 and T91 (also supported by a night vision camera). This allowed the potential roosting features present on the bridge and trees to be fully observed. These surveyor locations are shown in Figure 2. The personnel, timings and weather conditions recorded during these visits are shown in Table 1.

Table 1: Personnel, Timings and Weather Conditions during the Dusk Emergence and Dawn Return to Roost Surveys in 2016

Date and Structure/ Tree	Time of Survey	Time of Sunset/ Sunrise	Personnel (see Section 3.8)	Location Number (refer to Figure2)	Weather Conditions
27/06/16 Railway Bridge	21:07 – 23:07	21:22	EA NW SF	L1 L2 L3	Dry with partial cloud cover (5/8-7/8 cloud cover) and calm conditions (Beaufort Scale F1). Air temperatures ranged between 14 and 16°C
04/08/16 Tree Group G115	03:48 – 05:33	05:33	SF EA	L4 L5	Dry with mostly clear skies (2/8 cloud cover) and a light-moderate breeze (Beaufort Scale F2-F3). Air temperatures ranged between 17 and 16°C.
22/08/16 Trees T88 and T91	19:56 – 21:56	20:11	EA SF	L6 L7	Dry and partially cloud cover (cloud cover 5/8-2/8) with a light breeze (Beaufort Scale F2) with air temperatures ranging between 21 and 22°C during the survey.

- 3.2.3 The surveyors used EM3+ and Elekon Batlogger M bat detectors to listen to and record echolocation calls of bats observed. During the survey, surveyors mapped the flight-lines used by any bats observed and noted any features used by the bats to exit/enter the building. The recorded calls were subsequently analysed using Analook computer software following the survey to confirm the identification of the species observed in the field.
- 3.2.4 During the dusk emergence and dawn return to roost surveys, bat activity within the vicinity of the bridge and trees was also recorded as incidental observations, with the species of bat and number of passes also noted.
- 3.2.5 Two-way radios were used by the surveyors during each survey to communicate information about bat activity to one another and gain a greater understanding of the use of the Application Site by bats.

3.3 Activity Transect Surveys 2016

- 3.3.1 The Application Site extends approximately 1.0 km in length and predominantly consists of riverside/riparian habitats, small pockets of grassland with parcels of woodland and areas of dense scrub. The western third of the Application Site comprises hardstanding consisting of the supermarket carpark and roads. When considered in combination these habitats categorise the Application Site as being of moderate quality with regard to its suitability to support foraging and commuting bats (Collins, 2016). Therefore, dusk or dawn activity transect surveys were undertaken each month between May and September.
- 3.3.2 One transect route was devised that covered the Application Site as a whole. During this activity survey, a pair of surveyors walked the transect of the Application Site, stopping at regular intervals for periods of 3 minutes. The dusk transects began 15 minutes before sunset (to ensure that earlier emerging species were fully considered) and finished two hours after sunset. The dawn transect survey began two hours before sunrise and finished at sunrise (or later if depending on current levels of bat activity). During the surveys bat detectors were used (EM3+ and Batlogger M detectors); calls registered by the bat detectors were recorded for later analysis using specialist computer software (Analook); see Section 3.7. During the

surveys, any visual observations or bat call registrations (passes) were noted, recording time, location, species and activity.

- 3.3.3 A plan showing the transect route taken during the surveys in 2016 is given in Figure 3a. The direction of the transect route was altered on each visit in order to ensure that all points of the transect route were covered during the times of peak bat activity at some stage during the suite of survey visits.
- 3.3.4 Dates, times and weather conditions of each of the transect survey visits are provided in Table 2 below.

Table 2: Personnel, Timings and Weather Conditions during the Dusk and Dawn Activity Transect Surveys 2016

Date	Time of Survey	Time of Sunrise	Personnel (see Section 3.8)	Weather Conditions
24/05/16	20:47- 23:02	21:02	SF EA	Dry with clear skies throughout the duration of the survey (1/8 cloud cover). A moderate breeze was present (Beaufort Scale F3-F4) at the start of the survey which lessened towards the survey finish (Beaufort Scale F2). Air temperatures ranged between 16°C and 12°C.
13/06/16	21:07 – 23:22	21:22	SF EA	Dry for the most part with a heavy shower in the middle of the survey with partially cloudy skies at the start of the survey (cloud cover 4/8) becoming more overcast by the survey finish (cloud cover 8/8). A light breeze was present throughout (Beaufort Scale F1-F2) with air temperatures ranging between 18°C and 16°C.
11/07/16	21:03- 23:18	21:18	SF EA	Dry with partially cloudy skies and a moderate breeze throughout the duration of the survey (5/8 cloud cover and Beaufort Scale F2-F3). Air temperatures ranged between 18°C and 16°C.
12/07/16	03:02- 05:02	05:02	SF EA	Dry and partially cloudy (cloud cover 5/8) at the survey start with cloud clearing by the survey end (2/8 cloud cover). A light breeze was present throughout (Beaufort Scale F1-F2) and air temperatures ranged between 15°C and 14°C.
15/08/16	20:10 – 22:25	20:25	SF EA	Dry with clear skies and a light breeze throughout the survey (1/8 cloud cover and Beaufort Scale F2). Air temperatures ranged between 22 and 19°C.
12/09/16	19:09 – 21:24	19:24	SF EA	Dry and overcast (5/8 – 7/8 cloud cover) with a light breeze (Beaufort Scale F1-F2) and air temperatures ranging between 21 and 20°C.

3.4 Automated Static Detector Surveys 2016

- 3.4.1 Automated static bat detectors (Anabat Express[®]) were deployed at two locations along the transect route in each of the survey months as well as in October (i.e. May-October 2016 inclusive). These static detectors (S1 and S2) were deployed to passively record bat activity within these two areas of the Application Site for a minimum of five consecutive nights during

each of the visits (Collins, 2016). The static detectors were set to turn on half an hour before sunset and switch off half an hour after sunrise.

- 3.4.2 Table 3 below details the dates that detectors were installed with the locations of static detectors shown on Figure 3a.

Table 3: Dates of Static Detectors Deployment - 2016

Month	Dates of Static Monitoring		No. Nights Survey
	From	To	
May	24 th May 2016	29 th May 2016	5
June	14 th June 2016	19 th June 2016	5
July	11 th July 2016	16 th July 2016	5
August	15 th August 2016	20 th August 2016	5
September	12 th September 2016	17 th September 2016	5
October	12 th October 2016	17 th October 2016	5

3.5 Activity Transect 2018

- 3.5.1 In 2018, the transect surveys were repeated in August, September and October. The purpose of this was to ensure that the data collated in 2016 remains representative with regard to the assemblage of bats present and the levels of activity within the Application Site. The method and route utilised in 2016 were repeated in the 2018 surveys with only a minor alteration to the route where it previously entered the recently cleared TVP P&R Site.
- 3.5.2 Dates, times and weather conditions of each of the transect survey visits undertaken in 2018 are provided in Table 4 below.

Table 4: Personnel, Timings and Weather Conditions during the Dusk and Dawn Activity Transect Surveys 2018

Date	Time of Survey	Time of Sunrise	Personnel (see Section 3.8)	Weather Conditions
01/08/18	20:37-22:52	20:52	SF EA	Dry with partially cloudy skies (3/8 cloud cover) clearing at the survey end (1/8 cloud cover). A light breeze was present (Beaufort Scale F1-F2) with air temperatures ranging between 22°C and 19°C.
13/09/18	19:09 – 21:24	19:24	SF EA	Dry with partially cloudy skies (cloud cover 2/8-3/8) and a light to moderate breeze was present throughout (Beaufort Scale F2-F3). Air temperatures ranged between 17°C and 14°C.
04/10/18	18:21 – 20:36	18:36	SF EA	Dry with partially cloudy skies (5/8-6/8 cloud cover) and a light breeze (Beaufort Scale F2). Air temperatures were mild ranging between 15°C and 16°C.

3.6 Automated Static Detector Surveys 2018

- 3.6.1 As per the 2016 surveys, two automated static detectors were deployed to passively record bat data over five consecutive nights. Detector S1 was sited in the same location as during the 2016 surveys with the location of S2 altered by approximately 30m given the presence of rough sleepers.

- 3.6.2 Table 5 below details the dates that detectors were installed with the locations of static detectors shown on Figure 3b.

Table 5: Dates of Static Detectors Deployment

Month	Dates of Static Monitoring		No. Nights Survey
	From	To	
August	1 st August 2018	6 th August 2018	5
September	13 th September 2018	18 th September 2018	5
October	29 th September 2018	4 th October 2018	5

3.7 Data Analysis

- 3.7.1 Bats generate echolocation calls which were recorded by the detectors during the dusk emergence and dawn return to roost surveys, activity transect surveys and automated static detector surveys. These were analysed using Analook software to give an indication of the species of bat present and their relative levels of activity. The software enables analysis of the relative activity of different species of bats by counting the minimum number of bats recorded within discrete sound files. Once triggered by ultrasound, the EM3+ and Anabat Express detectors record sound files with a duration of 15 seconds, which may contain a number of individual bat calls (or passes), or discrete groups of ultrasound 'pulses'.
- 3.7.2 In 2018, the surveyors used a Bat Logger M bat detector to listen to and record echolocation calls of bats observed. During the survey, the surveyor made a note of the flight-lines used by any bats (if present and observed). The recorded calls were analysed using BatExplorer computer software following the survey to confirm the identification of the species observed in the field. A bat pass was defined as an unbroken stream of echolocation calls, heard as a series of 'clicks' on the bat detector as the bat passed in and out of the detector's range. The BatExplorer software classifies the beginning of a new pass once there has been a break of more than 1.5 seconds between call pulses (i.e. a distinct break in activity).
- 3.7.3 Where possible, bat calls are identified to species level. However, species of the genus *Myotis* are grouped together in most cases as their calls are similar in structure and have overlapping call parameters, making species identification problematic (Russ, 2012). When determining *Myotis* calls approximately 30% of calls were fully analysed (slope, call duration, peak frequency, etc, to arrive at the most likely species); where calls were closely timed (i.e. within consecutive files) these were assumed to be the same species unless calls looked significantly different.
- 3.7.4 For *Pipistrellus* species the following criteria based on measurements of peak frequency are used to classify calls:
- Common pipistrelle ≥ 42 and $<49\text{KHz}$;
 - Soprano pipistrelle $\geq 51\text{KHz}$;
 - Nathusius pipistrelle $<39\text{KHz}$;
 - Common/soprano pipistrelle ≥ 49 and $<51\text{KHz}$; and
 - Common/Nathusius pipistrelle ≥ 39 and $<42\text{KHz}$.
- 3.7.5 In addition, the following categories are used for calls which cannot be identified with confidence due to the overlap in call characteristics between species or species groups:
- *Myotis/Plecotus* sp.;
 - *Nyctalus* sp. (either Leisler's bat or noctule);

- Serotine/Leisler's; and
- Serotine/*Plecotus* sp.

3.8 Survey Personnel

- 3.8.1 The bat surveys were led by Stephen Foot and Ed Austin. Stephen Foot (SF) MCIEEM has worked as a professional ecologist since 2005 and has held a licence to handle and disturb bats (Level 2 Class Licence) since 2010. During his time as a professional ecologist he has undertaken an extensive number of external and internal building assessments, dusk emergence and dawn return to roost surveys and activity transect surveys across the UK and Ireland. He has been involved in numerous projects requiring bespoke mitigation to be designed and implemented where proposed development has an impact on roosting bats. He undertakes voluntary surveys for his local bat group and is a registered bat carer (looking after injured bats found by members of the public).
- 3.8.2 Ed Austin (EA) MCIEEM has worked as a full-time professional ecologist since 2004 and began his career in environmental consultancy in 2002. During this time, he has also undertaken a large number of protected species surveys across the UK and has extensive experience in bat activity, emergence and dawn return to roost surveys throughout the UK and Ireland.
- 3.8.3 Natalie White (NW) MCIEEM assisted during the dusk emergence survey of the bridge. Natalie has worked as a professional ecologist since 2007 and also holds a licence to handle and disturb bats (Level 2 Class Licence). During this time Natalie has undertaken a number of dusk emergence and dawn return to roost surveys and activity transect surveys throughout the UK.

3.9 Limitations to Methods

- 3.9.1 The area included within the activity surveys (both 2016 and 2018) varied slightly from the Application Site – see Figures 3a and 3b for extent, with a more extensive survey area considered. This included land within the immediate surrounding of the Application Site, to both the east and west of the River Kennet. The results within these locations provide contextual information and as such, are not considered to limit the findings of the surveys.
- 3.9.2 Surveys were undertaken at an optimal time of year in suitable/good weather conditions. As such there are not considered to be any limitations to the bat survey methods or survey results.
- 3.9.3 In 2018 the location of detector S2 was relocated to an area of scrub approximately 30m from where it was sited in 2016 due to the presence of rough sleepers in the original location (see Figure 3b). This small alteration is not considered to have had an effect on the data collected given the small distance by which the detector location was altered.

4 Results and Interpretation

4.1 Overview

- 4.1.1 This section sets out the results of the bat surveys. The implications of the results are then explored with reference to current legislation and planning policy.

4.2 Ground Level Tree Assessment 2016 Results

- 4.2.1 A number of trees were found to be present within the Application Site that have the potential to provide roosting opportunities for bats. Table 4 in Appendix C lists these trees/tree groups using the tree numbering system detailed in the tree schedule provided by Tree Work Environmental Practice (Tree Work Environmental Practice, 2016) with the locations of these trees shown on Figure 4. All trees/tree groups listed on the schedule were assessed for their potential to support roosting bats. The survey results are summarised below.

- 4.2.2 Of the trees/tree groups surveyed the following roosting potentials were noted:

- Three trees/tree groups were assessed as having high roosting potential (T88, T91 and G115 (see Photograph 1 in Appendix B));
- One tree was assessed as having moderate roosting potential (T163); and
- Six trees were assessed as having low roosting potential (T53, T136, T146, T151, T153 and T180).

- 4.2.3 Of these trees, T136, T163 and T180 supported roosting features that were at low-level and could therefore be inspected with the aid of a ladder and a fibre-optic scope. No signs of roosting bats were found within these cavities at the time of the inspection. This inspection enabled current use of these trees by roosting bats to be ruled out. The high potential trees were subjected to additional survey effort (see Section 4.4 below).

4.3 Dusk Emergence Survey – Railway Bridge 2016

- 4.3.1 No bats were observed emerging from the bridge during the dusk survey. The earliest bats recorded were a noctule bat at 21:40 (18 minutes after sunset) and a soprano pipistrelle at 21:44 (22 minutes after sunset) both at location L1. The noctule was observed commuting high over the River Thames to the north with the soprano pipistrelle seen to fly past the bridge from a northerly direction. In addition, to these species, common pipistrelles and *Myotis* bats (classified as Daubenton's bats given the call parameters and observed flight patterns) were also recorded. The earliest common pipistrelle bat was recorded at 21:56 (34 minutes after sunset) with the earliest Daubenton's bat recorded at 22:09 (47 minutes after sunset).
- 4.3.2 Both soprano and common pipistrelles commonly roost within buildings and built structures (Dietz *et al.*, 2009) though they also regularly roost within trees. Both common and soprano pipistrelle bats typically emerge between 10 and 30 minutes after sunset (Russ, 2012). Given the timing of these calls it is likely that roosts are relatively close by, possibly within nearby woodland to the north/north-west.
- 4.3.3 Noctule bats primarily roost within cavities in trees and generally emerge from their roosts between 0 and 26 minutes after sunset and return to the roost at or very close to sunrise (Russ, 1999). The timing of the first recorded noctule call during the emergence survey was 18 minutes after sunset which indicates that there could also be a roost close by. It is worth noting that the noctule bat is a fast flying species reaching speeds of up to 50 kmph (BCT, 2010) suggesting that the roost could still be a considerable distance from the Application Site.

- 4.3.4 Daubenton's bats typically roosts in tree holes and bat boxes but also in cracks in bridges and more rarely in buildings. Roosts of small numbers of individual males are also found in underground channels (Dietz *et al.*, 2009). This species typically emerges from its roost between 30 minutes and 50 minutes after sunset (Russ, 2012). The timing of the first call during the survey (47 minutes after sunset) suggests that a roost is close to the bridge but as the bat was initially observed flying from a northerly direction, it is likely to be roosting within trees in the woodland further along the River Thames.
- 4.3.5 Incidental bat activity close to the bridge was generally high, particularly at surveyor location L1 which is shielded from lighting on the eastern side of the Kennet. This is unsurprising as the River Kennet and Thames and associated bankside trees and vegetation provide high quality foraging habitat for this species group. Further details regarding the use of the Application Site by bats is provided in subsequent sections of this report. The raw surveys data is included within Appendix F.

4.4 Dusk Emergence and Dawn Return to Roost Surveys 2016 - G115, T88 and T91

- 4.4.1 No bats were observed returning to roost within any of the poplar trees within G115 during the dawn return to roost survey in early August. Activity was low with only a small number of common and soprano pipistrelles recorded during the survey visit. The latest of these (a common pipistrelle bat) was recorded at 04:59 (34 minutes before sunrise) flying in a southerly direction through the woodland towards the rail corridor. The night vision video camera supporting this survey was focussed on a group of woodpecker holes on the northernmost tree. No bats were observed in association with these holes; however, a wren *Troglodytes troglodytes* was observed using this complex of holes as a night roost (see Photograph 2 in Appendix B). The presence of roosting birds indicates that these woodpecker holes were not in use by bats at the time of survey, which is supported by the survey data.
- 4.4.2 No bats were recorded emerging from trees T88 and T91 during the dusk surveys conducted in late August. The earliest recorded bat calls were a soprano pipistrelle recorded at 20:46 (35 minutes after sunset) and a noctule bat commuting overhead at 20:59 (48 minutes after sunrise). The timing of these calls suggests that these bats are not roosting particularly close to these trees. The night vision camera also did not record evidence of any "quieter" bat species (*Plecotus* sp. etc.) within the tree canopies. Appendix F contains the raw survey data from these surveys.

4.5 Activity Transect Survey Results 2016

- 4.5.1 At least five species of bats were recorded over both of the activity transect surveys. The confirmed species or species groups include:
- *Myotis* sp. (likely Daubenton's bat given recorded call parameters and observed flight behaviour);
 - Noctule;
 - Soprano pipistrelle;
 - Common pipistrelle; and
 - Nathusius' pipistrelle
- 4.5.2 The calls recorded during the transect surveys between May and September are summarised in Appendix D: Bat Activity Survey Results. Locations of bats encountered during the transect surveys are shown on Figure 5, which displays all calls recorded during the manual activity transects across the survey period.

- 4.5.3 The results in Figure 5 show that activity levels were highest along the River Thames and adjacent to woodland/tree-lines which is to be expected as this constitutes high quality foraging and commuting habitats for bats. The table contained within Appendix D (Table 5) shows that activity peaked during May and July which is likely the result of bats intensively foraging prior to the maternity period and to replenish fat reserves in May (following hibernation). This may also be a result of this year's cohort adding to the number of bats using the Application Site, as young bats become independent by July-August (Mitchell-Jones, 2004).
- 4.5.4 Soprano pipistrelle and common pipistrelle bat calls made up the majority of the calls recorded (73.83% of total activity), including pipistrelle bats calling at 50kHz which is unsurprising as both species are common and widespread throughout the UK. Both of these species were recorded throughout the transect route, though higher numbers of soprano pipistrelle bats were noted. A likely reason for this is put forward in Section 4.9.
- 4.5.5 The second most frequently recorded species was the noctule bat which was recorded foraging along the River Thames during most survey visits. Higher levels of activity from this species were also noted along the southern boundary of the Application Site, particularly in the south-west close to the Network Rail compounds where the bats were foraging on invertebrates attracted to the lighting along the edge of the compound. This species (as well as pipistrelle and Leisler's bats) can tolerate high levels of lighting and are known to use lighting as a foraging resource (feeding upon invertebrates attracted to the lights) (Rich and Longcore, 2005).
- 4.5.6 Of the remaining species encountered only a very small number of calls were recorded. An interpretation of this data in relation to each species/species group is provided in Section 4.9 below where the data obtained from the automated static detectors is fully explored.

4.6 Automated Static Detector Surveys 2016

- 4.6.1 A total of at least eight bat species (a slightly larger assemblage to that recorded during the walked transects) were recorded within the Application Site during the periods of static detector monitoring. These species were as follows:
- Common pipistrelle;
 - Soprano pipistrelle;
 - Nathusius pipistrelle;
 - Noctule;
 - Leisler's;
 - *Nyctalus* sp. (either Noctule or Leisler's bat);
 - *Myotis* sp.;
 - Serotine; and
 - Barbastelle
- 4.6.2 The data recorded during the static monitoring periods for all months are summarised in Appendix E: Automated Static Detector Survey Results.

4.7 Activity Transect Survey Results 2018

- 4.7.1 At least four species of bats were recorded over the activity transect surveys. The confirmed species or species groups include:
- Noctule;
 - Soprano pipistrelle;
 - Common pipistrelle; and
 - Barbastelle.
- 4.7.2 The calls recorded during the transect surveys between August and October 2018 are summarised in Appendix G: Bat Activity Survey Results 2018. Locations of bats encountered during the transect surveys are shown on Figure 6 which displays all calls recorded during the manual activity transects across the survey period.
- 4.7.3 In contrast to the data gained in 2016, a smaller assemblage of bats was recorded during the activity transects undertaken in late summer/autumn 2018 (note: the data collated in 2018 is not directly comparable to 2016 given the shorter survey period and the use of a different type of bat detector to collect data). Activity levels were highest in August which was likely to be the result of this year's young adding to the number of bats using the Application Site, as young bats become independent by July-August (Mitchell-Jones, 2004).
- 4.7.4 As shown in Appendix G and Figure 6, in contrast to surveys undertaken in 2016, noctule bats made up the bulk of activity accounting for 49.05% of calls with noctule bat activity focussed along the southern-western boundary of the Application Site, close to the Network Rail compounds where the bats were again observed foraging on invertebrates attracted to the lighting along the edge of the compound. As in 2016, activity was highest along the River Thames and adjacent to woodland/tree-lines (high quality foraging and commuting habitats for bats).
- 4.7.5 As in 2016, higher levels of soprano pipistrelle activity in comparison to common pipistrelle activity were recorded (see possible reasons for this Section 4.9). Activity was low in the vicinity of the Tesco car-park (likely due to higher lighting levels and a lack of good quality foraging habitat) and lowest in the eastern extent of the Application Site where the transect route followed Thames Valley Park Drive. A possible reason for this is the extremely bright lighting levels resulting from the use of LED street-lighting in this location.
- 4.7.6 A single barbastelle bat pass (with three associated soundfiles – see Appendix G) was recorded in the October surveys, with the presence of this rare species discussed further in Section 4.9.

4.8 Automated Static Detector Survey Results 2018

- 4.8.1 A total of at least seven bat species were recorded within the Application Site during the periods of static detector monitoring in 2018. These species were as follows:
- Common pipistrelle;
 - Soprano pipistrelle;
 - Nathusius pipistrelle;
 - Noctule;
 - *Nyctalus* sp. (either Noctule or Leisler's bat);

- *Myotis* sp.;
- Serotine; and
- Barbastelle.

4.8.2 The data recorded during the static monitoring periods for all months are summarised in Appendix H: Automated Static Detector Survey Results – 2018.

4.9 Interpretation of Activity Survey and Automated Static Detector Data

General Levels of Bat Activity

- 4.9.1 Automated bat data results from 2016 show that activity levels were highest in May with 1,500 calls (46.77% of all calls recorded). This is likely a result of bats undertaking increased foraging activity in preparation for the maternity period. Activity levels were also high in both August and September with 618 and 635 calls (19.27% and 19.80% of all calls recorded respectively). As mentioned in Section 4.5, this is likely to be due to the presence of this year's young adding to the number of bats using the Application Site as young bats become independent by July-August (Mitchell-Jones, 2004).
- 4.9.2 In 2016, activity levels were higher at detector S1 (2186 calls, 68.16% of calls) in comparison to S2 (1,021 calls, 31.84% of calls) despite detector S1 being located slightly further from the River Thames than S2. The woodland in which detector S1 was sited provides good quality foraging and commuting habitat in its own right, which likely accounts for these high levels of activity.
- 4.9.3 In 2018, activity levels at the static detector locations were highest in August with 1,079 calls (72.56% of all calls recorded). Activity levels were higher in August 2018 in comparison to August 2016 but in contrast were much lower between September 2018 and 2016. Activity levels in October 2018 were slightly higher than in October 2016, possibly due to milder weather conditions.
- 4.9.4 In 2018, activity levels were only slightly higher at detector S1 (51.18% of calls) than S2 (48.82% of calls) with the woodland habitat surrounding detector S1 and the River Thames close to S2 continuing to provide a good quality foraging and commuting resource.

Pipistrelle bats

- 4.9.5 The data in Appendix E from 2016 shows that the majority of all calls recorded (67.48%) were produced by common pipistrelles and soprano pipistrelles (including calls from undetermined pipistrelle species calling at around 50 kHz (either common or soprano pipistrelles)). This high proportion of calls is to be expected as both species are common and widespread throughout the UK (Dietz *et al.*, 2009). A higher number of calls from common pipistrelle bats was recorded as opposed to soprano pipistrelle bats (1,256 calls in comparison to 787 calls). This data differs from that recorded during the activity transect surveys and a possible reason for this is the locations where detectors were sited (in woodland/scrub habitats as rather than adjacent to the water courses). Soprano pipistrelle bats are more of a specialist in their habitat preferences being more strongly dependent on riparian forests, lowlands and water bodies of any size, in particular still waters (Dietz *et al.*, 2009 and Russ, 2012). This ecological trait likely explains why soprano pipistrelle bat activity was especially recorded at the riverside during the activity transect. Common pipistrelle bats have very general habitat requirements being found in virtually all habitat types in the UK (Dietz *et al.*, 2009) and are more likely to exploit the woodland/scrub habitats where the detectors were sited. Both common and soprano pipistrelles rarely forage over open landscapes as this increases their susceptibility to predation (Dietz *et al.*, 2009, Verboom & Spoelstra, 1999). This accords with the survey results as pipistrelles tended to be recorded close to linear features (hedgerows/treelines) rather than within open landscapes.

- 4.9.6 In 2018, common pipistrelle and soprano pipistrelle bats were the second most frequently recorded species with the number of soprano pipistrelle bat calls being higher than common pipistrelle calls in 2018 (34.02% to 21.99% respectively). These results showed that the habitats on-site including the adjacent River Thames continued to provide a valuable foraging and commuting resource for these species.
- 4.9.7 During the 2016 automated detector surveys, a number of confirmed and possible Nathusius' pipistrelle bat *Pipistrellus nathusii* echolocation calls (calls ranging between 39 kHz and 41 kHz) were recorded (3.93% of all recorded echolocation calls). The majority of these echolocation calls were recorded at static detector S1 during the September and October survey periods. Smaller numbers of calls were recorded during May with only three calls in total recorded during June, July and August.
- 4.9.8 Like other species of pipistrelle, this bat tends to predominantly forage along linear structures (Dietz *et al.*, 2009) but also forages over woodland rides, paths and meadows, flying at an average height of 4-15 m above the ground (Russ, 1999). Nathusius' pipistrelles are also known to migrate seasonally between maternity and hibernation sites, with migration to hibernation sites occurring in the autumn (September and October) (Dietz *et al.*, 2009). This species is known to migrate across Europe (Dietz *et al.*, 2009). On 23rd September 2013 a Nathusius' pipistrelle was identified in the Netherlands with an identity ring that was fitted in the UK proving that this species does migrate between the UK and mainland Europe (BCT website). It is thought that this species may migrate to the UK to exploit foraging habitats and avoid harsh climatic winter conditions in north-eastern Europe, or it is possible that bats hibernating in south-western Europe come to the UK to breed and migrate back to south-west Europe to hibernate in the autumn (Russ *et al.*, 2001). The data gathered during 2016 suggests that the Nathusius' pipistrelle activity recorded is indicative of low numbers of Nathusius' pipistrelle bats passing through and using the Application Site on a very occasional basis. Given the timing of the calls recorded from this species it is considered that the River Thames and River Kennet are used by this species as a commuting feature and foraging resource during migration.
- 4.9.9 Nathusius' pipistrelle bats and bats calling at 40kHz (2.22% of all calls) were also recorded during the static detector surveys undertaken in October 2018. These October recordings further add weight to the hypothesis that these bats are using the River Thames and River Kennet as a commuting feature and foraging resource during autumn migration.

Noctule

- 4.9.10 During the 2016 surveys, the second most recorded species (after pipistrelles) was the noctule bat *Nyctalus noctula*; with noctule bat activity constituting 27.69% of all recorded echolocation calls. This species was recorded at both static detector locations with activity higher at detector S1. Noctule bats are found in a range of habitat types including deciduous woodland, parkland and pasture (Russ, 2012) and often forage over water-bodies (Dietz *et al.*, 2009). This species typically forages between 2.5 km-4 km (up to a maximum of 25 km) from a roost (Dietz *et al.*, 2009). The timing of the data suggests that noctule bats were recorded close to sunset and sunrise as they flew over the detector to reach foraging opportunities within the woodland and along the nearby watercourses. Some calls recorded were from before sunset indicating that a roost of this species is likely to be in close proximity to the Application Site.
- 4.9.11 In 2018, a higher proportion of the total numbers of calls recorded was attributable to noctule bats (40.22% of all calls). Again, this species was recorded at both detector locations with higher activity levels at detector S1. The 2018 data shows that the Application Site continues to be of value to foraging and commuting noctule bats.

Myotis bats

- 4.9.12 The third most recorded species/species group during the 2016 static detector surveys (behind pipistrelle bats and noctule bats) were the *Myotis* bats, however, this species group only accounted for 0.47% of all calls recorded during the static detector surveys (15 calls in total). As stated in the methods section of this report, species of the genus *Myotis* were grouped together as many of the species have overlapping call parameters, making specific identification problematic (Collins, 2016). However, the parameters of the calls associated with this suite of surveys are indicative of Daubenton's bats (as observed during the activity transect and dusk emergence survey on the bridge). Daubenton's bats tend to forage close to the surface of water where they prey upon non-biting midges and other small Dipterans (two-winged flies) (Dietz *et al.*, 2009). As such the River Thames and River Kennet adjacent to the MRT East Site provide a suitable foraging resource for bats of this species.
- 4.9.13 Similar numbers of *Myotis* bat calls were recorded in 2018 (10 calls) to 2016 (15 calls) showing the Application Site continues to be of similar level value to this genus of bats.

Leisler's

- 4.9.14 A small number of Leisler's bat *Nyctalus leisleri* calls (3 calls, 0.09% of calls) were recorded in September 2016. This species is typically associated with parkland, cattle pastures, meadows, tree crowns and water-bodies. This species is also known to forage around streetlights (Russ, 2012). Foraging activity for this species typically occurs up to a distance of 4 km from a roost site (Dietz *et al.*, 2009).
- 4.9.15 Like the Nathusius' pipistrelle and noctule bat, this species is also known to seasonally cover long distances with flights up to 1,500 km recorded in Europe (Dietz *et al.*, 2009). It is considered that Leisler's bats are sedentary in the UK (Dietz *et al.*, 2009); however, this species is more than capable of migrating across the UK to suitable hibernation roosts and could pass through and forage on the stretch of the Rivers Thames and Kennet adjacent to the Application Site during the course of this travel. This is a possible explanation for the calls being recorded during the September survey only.
- 4.9.16 No Leisler's bats were recorded during the 2018 suite of surveys. This data combined with the data from 2016 shows that the Application Site is of limited value to this species.

Nyctalus bats

- 4.9.17 A total of seven calls in 2016 (0.22% of calls) and 5 calls in 2018 (0.34% of calls) were made by indeterminate bats from the genus *Nyctalus*. These calls were too short in duration (too brief) or within clutter where the overlapping call parameters between species are too similar to allow reliable analysis to species level.

Serotine

- 4.9.18 Serotine bat *Eptesicus serotinus* activity made up 0.09% (three calls) of all echolocation calls and was recorded at static detector S1 in August and September 2016. In 2018 only two calls from this species were recorded (both in August). This species is known to feed along woodland edge habitat, hedgerows, parkland and pasture. This species also hunts above streetlights (Russ, 2012) and can forage considerable distances from its roosting site but tends to forage between distances of 4.5 km and 12 km (Dietz *et al.*, 2009). It is evident that this species utilises the Application Site as a foraging resource very occasionally, however, the results of the static detector surveys indicate that the Application Site is of minimal value to this species as a foraging/commuting resource.

Barbastelle

- 4.9.19 A single barbastelle bat *Barbastella barbastellus* call was recorded in both 2016 and 2018. The barbastelle is considered to be rare in Britain, and only sparsely distributed through its range in Europe (Altringham, 2003). Its characteristic short and directional echolocation call (Denzinger *et al.*, 2001), and fast and far-travelling flight (Dietz *et al.*, 2009) are likely to reduce detection levels. This species tends to forage in woodland where its summer roost sites are usually associated with splits and cracks in trees or occur beneath raised bark (Dietz *et al.*, 2009).
- 4.9.20 This species tends to emerge from a roost between 25 and 60 minutes after sunset (Russ, 2012). The barbastelle has a strong aversion to well-lit areas; however, it emerges early to enable it to cover the large distances separating their roosting and foraging areas during the relatively short summer nights. In 2016 the single call was recorded 4 hours and 55 minutes after sunset and in 2018 it was 52 minutes after sunset. This suggests that this bat was commuting through the Application Site between roosting and foraging areas (with roosting potentially nearby), with the river corridor of the Thames likely to provide good quality foraging habitat for this species. The data collated during 2016 and 2018 suggests that it is unlikely that the Application Site itself is of value to barbastelle bats given the limited numbers of calls recorded.
- 4.9.21 The foraging area for this species covers an area of approximately 8.8 ha around the roost (Dietz, *et al.*, 2009). For male barbastelle bats, the peak foraging period/metabolic demand is likely to be in autumn and early winter, coinciding with mating activity (Greenaway, 2004). The recording of a barbastelle in September 2016 and October 2018 is likely the result of a single male bat increasing foraging range to maximise energy levels in preparation for mating and/or hibernation.
- 4.9.22 Example sonograms from bats recorded during the activity transect and automated static detector surveys are provided within Appendix F.

4.10 Summary of Results and Interpretation of Results

- 4.10.1 As outlined above, in 2016, no bats were observed roosting within the railway bridge adjacent to the Application Site. Furthermore, no bats were observed roosting within on-site trees although the potential for their future use by roosting bats remains.
- 4.10.2 The assemblage of bats recorded during the activity surveys (transect surveys and automated static detector surveys) in 2016 was dominated by common and widespread species of bats, with activity focussed along the River Thames and adjacent to woodland/tree-lines. This assemblage is likely to be typical of the wider urban and riparian landscape in which the Application Site is located.
- 4.10.3 Similar trends were observed in 2018, though slightly higher numbers of noctule bats were recorded in comparison to common and soprano pipistrelle bats. The noctule is considered to have a widespread distribution within the county (Berkshire Bat Group) and therefore given its local distribution and ecology it is unsurprising that this species readily utilises the habitats on and around the Application Site as a foraging and commuting resource. As in 2016, very small numbers of rare bat species (Nathusius' pipistrelle and barbastelle bat) were recorded, though the survey data indicates that the Application Site is unlikely to constitute a core portion of their foraging, roosting or commuting habitat.

4.11 Legislative Considerations

- 4.11.1 Both bats and their roosts are afforded protection under the Conservation of Species and Habitats Regulations 2017 (as amended) and the Wildlife and Countryside Act 1981 (as amended). In broad terms these pieces of legislation jointly mean that the animals themselves are protected against killing, injury, taking (capture) and disturbance. In addition, their places

of shelter are protected against damage, destruction and obstruction. Several species are also classified as Species of Principal Importance (SPIs), including soprano pipistrelle and noctule which were both recorded on site during this suite of surveys. SPI species are included on a list drawn up in response to the requirements of Section 41 of the Natural Environment and Rural Communities (NERC) Act, 2006 and are considered a priority for the conservation of biodiversity in England (see Appendix A).

5 Conclusion

- 5.1.1 The bat surveys undertaken for the Application Site in 2016 and 2018 confirmed that the Application Site provides a foraging and commuting resource for an assemblage of at least eight species of bat. Roosting within trees and the bridge was found to be absent in 2016.

References

- Altringham, J (2003) *British Bats*. Harper Collins Publishers
- Altringham, J (2008) *Bat ecology and Mitigation: Report to the Public Inquiry on the A350 Westbury Bypass*. White Horse Alliance, Neston, Wiltshire.
- Bat Conservation Trust (2010) *Noctule bat Nyctalus noctula* – BCT Publication. BCT
- Bat Conservation Trust (2012) *Encouraging Bat – A Guide for Bat-friendly Gardening and Living*.
- Bat Conservation Trust and Institute of Lighting Engineers (ILE) (2008) *Bats and Lighting in the UK. Bats and the Built Environment Series. Version 2, May 2009*.
- Bat Conservation Trust (2014) *Artificial Lighting and Wildlife – Interim Guidance: Recommendations to help minimise the impact of artificial lighting*
- Collins, J. (ed.) (2016) *Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edn)*. The Bat Conservation Trust, London.
- Denzinger et al (2001) Echolocation by the Barbastelle bat *Barbastella barbastellus*. *Journal of Comparative Physiology A: Neuroethology, Sensory, Neural, and Behavioural Physiology* Vol **187**, 7, 521-528
- Dietz et al. (2009) *Bats of Britain Europe and Northern Africa*. A&C Black.
- Greenaway, F (2004) *Advice for the management of flight lines and foraging habitats of the barbastelle bat Barbastella barbastellus*. English Nature Report R657. English Nature.
- Kerth, G & Melber, M (2009) Species-specific barrier effects of a motorway on the habitat use of two threatened forest-living bat species. *Biological Conservation* **142**: 270-279
- Mitchell-Jones, A.J (2004) *Bat Mitigation Guidelines*. English Nature.
- Natural England (undated) Explanatory note on S41 England Biodiversity List (www.naturalengland.org.uk)
- Paunović, M., Karapandža, B., Ivanović, S. (2011). Bats and Environmental Impact Assessment – Methodological guidelines for environmental impact assessment and strategic environmental impact assessment. *Wildlife Conservation Society “MUSTELA”*, 1-142, Belgrade.
- Peter Brett Associates (2016) *East Reading MRT – Preliminary Ecological Appraisal*
- Reading Borough Council (2015): Reading Borough Local Development Framework: Core Strategy. Adopted January 2008, with alterations adopted 27th January 2015. Accessed: <http://www.reading.gov.uk/media/1046/Core-Strategy-Adopted-January-2008/pdf/Core-Strategy-Adopted-Jan08-Altered-Jan15.pdf>
- Rich, C & Longcore, T (2005) *The Ecological Consequences of Artificial Night Lighting*. Island Press
- Russ, J (1999) *The Bats of Britain and Ireland: Echolocation Calls, Sound Analysis and Species Identification*. Alana Ecology Ltd.
- Russ, J (2001). The Status of Nathusius' pipistrelle (*Pipistrellus nathusii*) in the British Isles. *Journal of Zoology London*. 254, 91-100.
- Russ, J (2012) *British Bat Calls a Guide to Species Identification*. Pelagic Publishing.

Tree Environmental Practice (2016) *East Reading MRT – Tre Survey BS5837 - 2012*

Verboom, B & Spoelstra, K. (2009) Effects of food abundance and wind on the use of tree lines by an insectivorous bat, *Pipistrellus pipistrellus* *Canadian Journal of Zoology*, **77(9)**: 1393-1401

Wokingham Borough Council (2010): Wokingham Borough Local Development Framework – Adopted Core Strategy Development Plan Document. Adopted January 2010. Accessed:
<http://www.wokingham.gov.uk/planning-and-building-control/planning-policy/key-planning-documents/>

Figures

Figure 1. Site Location Plan

Figure 2: Surveyor Locations

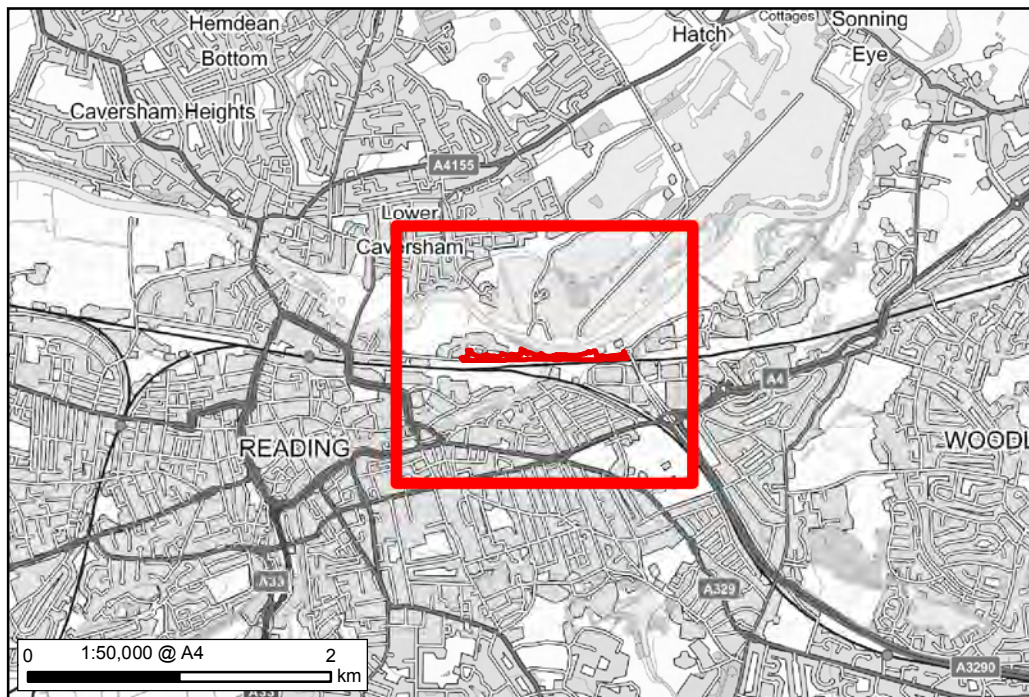
Figure 3a: Activity Transect Route and Automated Static Detector Locations 2016

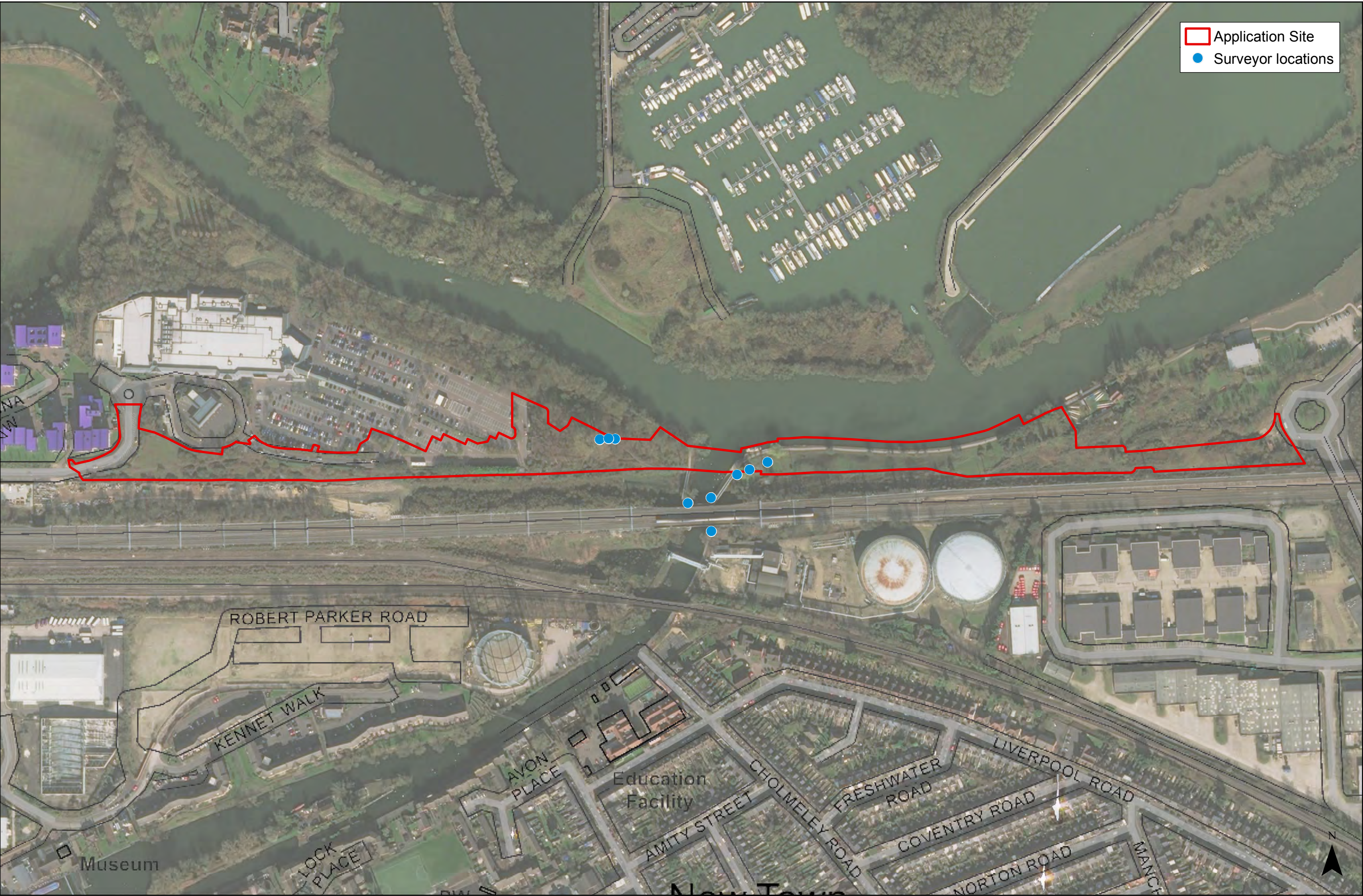
Figure 3b: Activity Transect Route and Automated Static Detector Locations 2018

Figure 4: Ground Level Tree Assessment Results

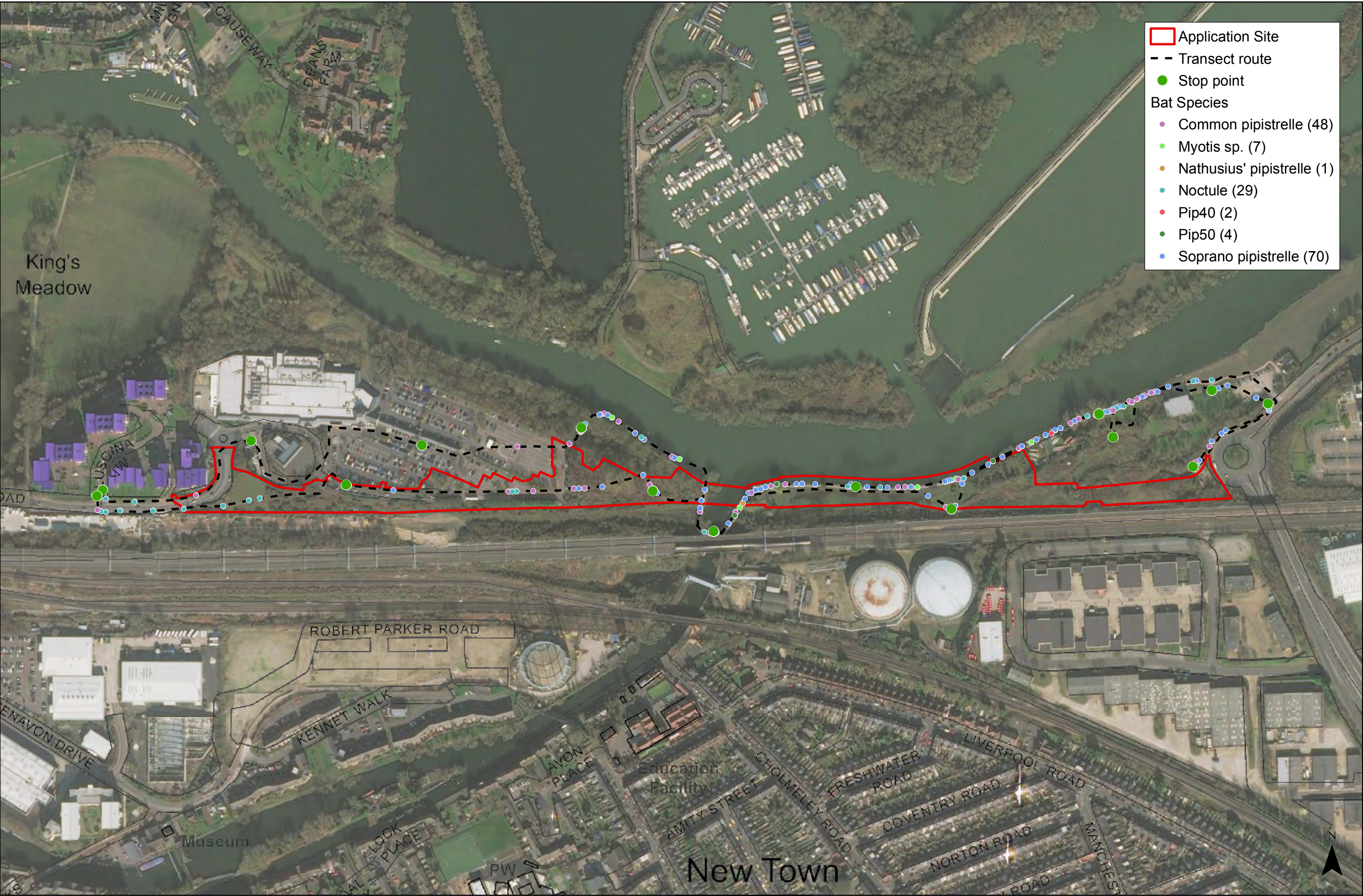
Figure 5: Activity Transect Survey Results 2016

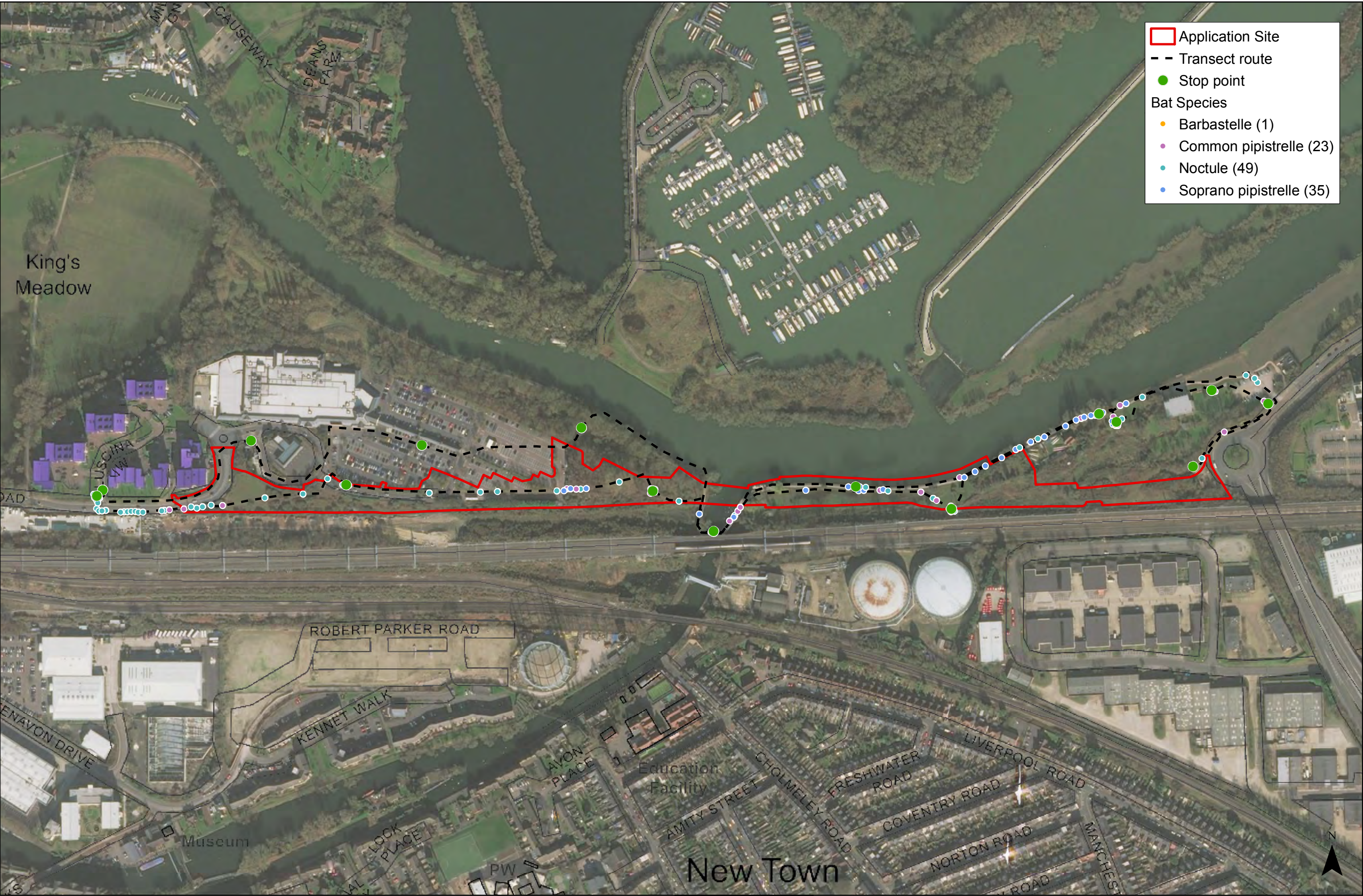
Figure 6: Activity Transect Survey Results 2018

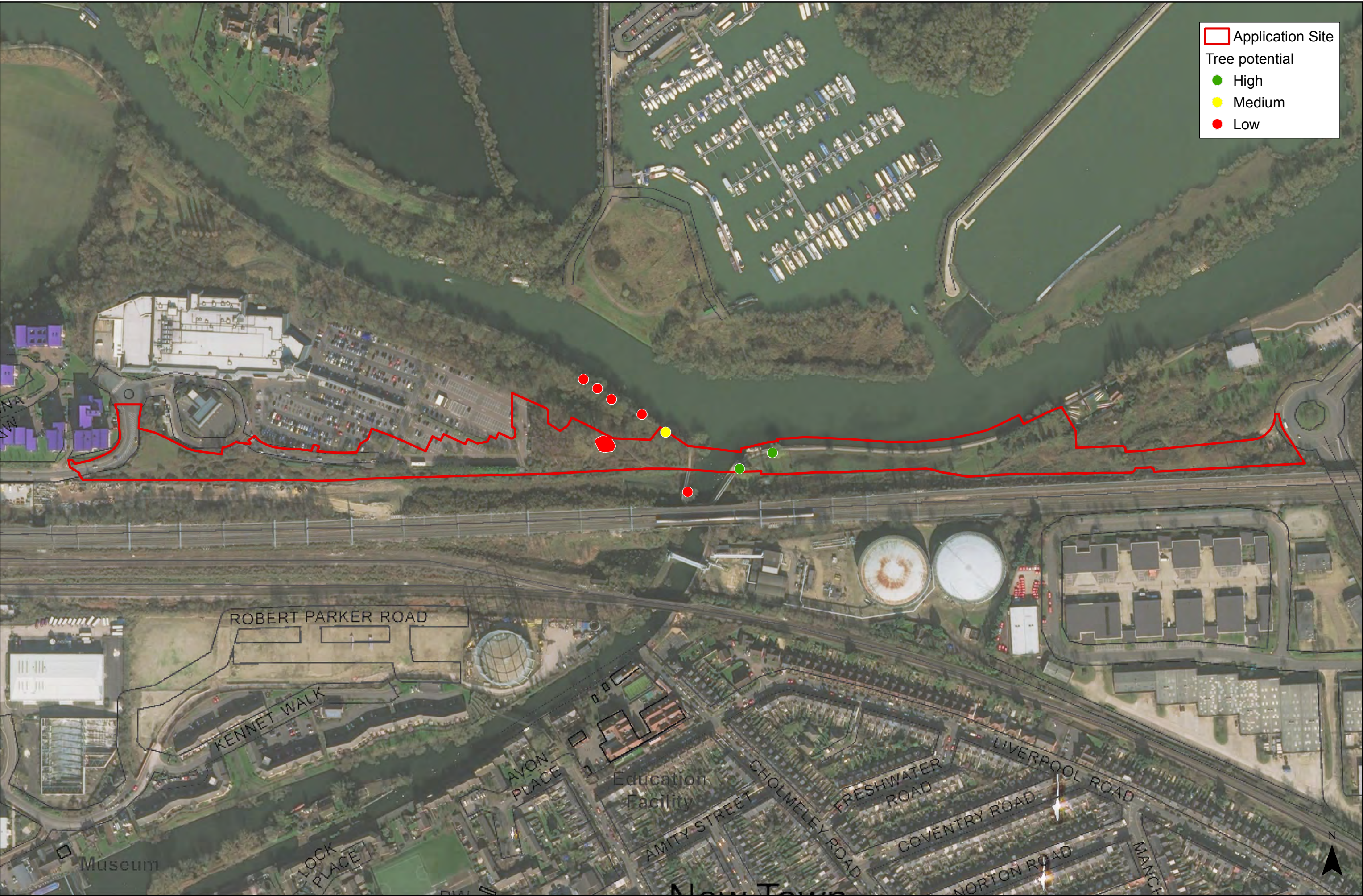


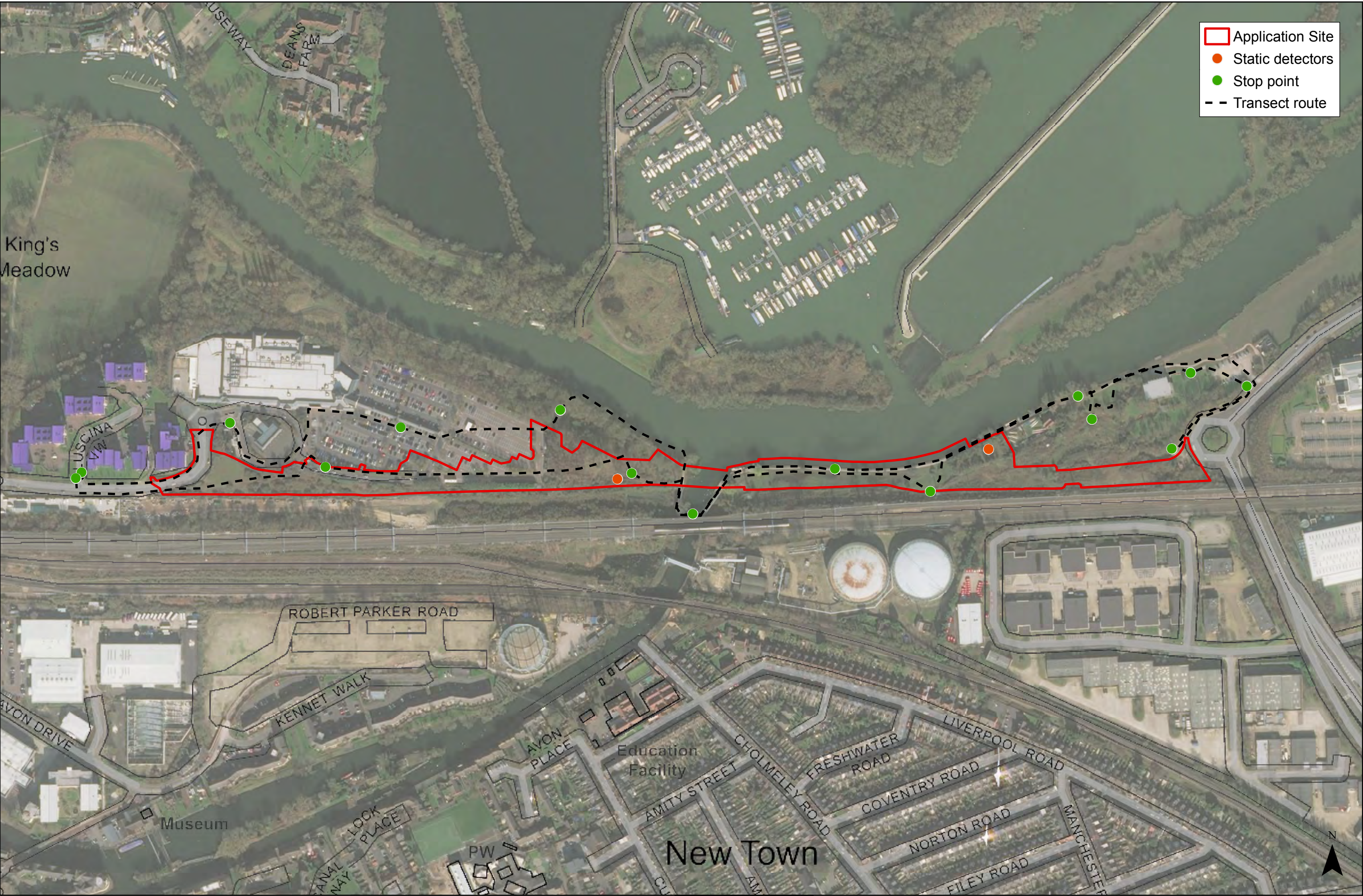


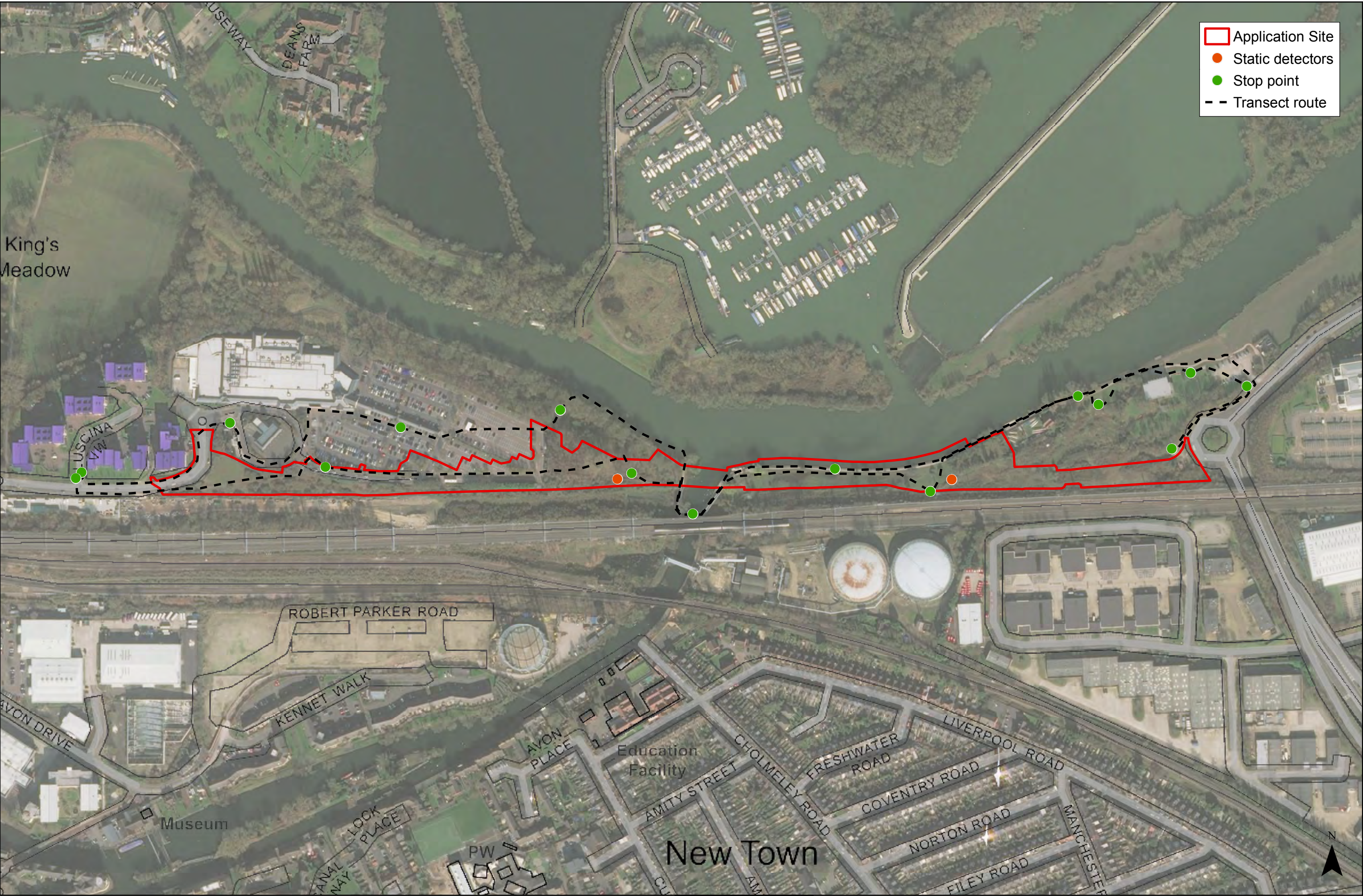
- Application Site
- Surveyor locations











- Application Site
- Static detectors
- Stop point
- Transect route

Appendix A Summary of Relevant Legislation

A.1 European Legislation

- A.1.1 The original (1994) “*Habitat Regulations*” transposed the EC Habitats Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora (Council Directive 92/43/EEC) into national law. The Conservation of Habitats and Species Regulations 2017 consolidates the various amendments that have been made to the Regulations.
- A.1.2 “*European protected species*” (EPS) are those which are present on Schedule 2 of the Conservation of Habitats and Species Regulations 2017; this includes all UK bats. These species are subject to the provisions of Regulation 41 of those Regulations. All EPS are also protected under the Wildlife and Countryside Act 1981 (as amended). Taken together, these pieces of legislation make it an offence to:
- Intentionally or deliberately capture, injure or kill any wild animal included amongst these species
 - Possess or control any live or dead specimens or any part of, or anything derived from these species
 - deliberately disturb wild animals of any such species
 - deliberately take or destroy the eggs of such an animal, or
 - intentionally, deliberately or recklessly damage or destroy a breeding site or resting place of such an animal, or obstruct access to such a place
- A.1.3 For the purposes of paragraph (c), disturbance of animals includes in particular any disturbance which is likely—
- to impair their ability to survive, to breed or reproduce, or to rear or nurture their young,
 - or in the case of animals of a hibernating or migratory species, to hibernate or migrate; or
 - to affect significantly the local distribution or abundance of the species to which they belong.
- A.1.4 Although the law provides strict protection to these species, it also allows this protection to be set aside (derogation) through the issuing of licences. The licences in England are currently determined by Natural England (NE) for development works. In accordance with the requirements of the Regulations (2017), a licence can only be issued where the following requirements are satisfied:
- The proposal is necessary ‘*to preserve public health or public safety or other imperative reasons of overriding public interest including those of a social or economic nature and beneficial consequences of primary importance for the environment*’
 - ‘*There is no satisfactory alternative*’
 - The proposals ‘*will not be detrimental to the maintenance of the population of the species concerned at a favourable conservation status in their natural range*’.

Appendix B Photographs

Photograph 1: Tree Group G115 showing a selection of the woodpecker holes present



Photograph 2: A wren observed using one of the woodpecker holes as a night roost.



Appendix C Ground Level Tree Assessment Results

Table 4: Ground Level Tree Assessment Results 2016

Tree/Tree Group No.	Species	Height (m)	Stem count	DBH (cm)	Crown clearance height (m)	Life stage	Physical condition	Retention category	Roosting features	Bat Rooting Potential
T53	Smooth leaved elm <i>Ulmus minor</i>	8.0	2	35	3	Mature	Poor	C	Dense ivy cover	Low
T88	Weeping willow <i>Salix x sepulcralis</i>	16	1	102	2	Mature	Fair	B	Multiple rot holes	High
T91	Weeping willow <i>Salix x sepulcralis</i>	15	1	97	2	Mature	Fair	B	Dense ivy, deadwood in canopy and some rot holes	High
G115	Railway poplar <i>Populus x Canadensis</i> "Aurea" x 3 trees	29	1	94	0	Mature	Fair	B	Dead wood and woodpecker holes	High
T136	Horse chestnut <i>Aesculus hippocastanum</i>	15	2	80	2	Mature	Poor	U	Rot holes and cavities close to ground level	Low
T146	Ash <i>Fraxinus excelsior</i>	24	1	90	5	Early mature	Fair	C	Small cavity on trunk and some lifted bark	Low
T151	Horse chestnut <i>Aesculus hippocastanum</i>	24	1	88	1	Mature	-	B	Small split in trunk and lifted bark	Low
T153	Horse chestnut <i>Aesculus hippocastanum</i>	25	1	70	1	Mature	Good	A	Rot hole	Low

Tree/Tree Group No.	Species	Height (m)	Stem count	DBH (cm)	Crown clearance height (m)	Life stage	Physical condition	Retention category	Roosting features	Bat Rooting Potential
T163	Horse chestnut <i>Aesculus hippocastanum</i>	24	1	103	2	Mature	Poor	U	Rot hole and cavity close to ground	Moderate
T180	Crack willow <i>Salix fragilis</i>	16	1	76	3	Early mature	Fair	C	Open cavity in trunk 1 m from ground level	Low

Appendix D Bat Activity Survey Results - 2016

Table 5: Bat Species Recorded (and number of soundfiles) during the Walked Transect

Month	<i>Myotis</i> spp.	Noctule	Common pipistrelle/ Nathusius pipistrelle (40kHz)	Common pipistrelle	Soprano pipistrelle	Common pipistrelle/ Soprano pipistrelle (50kHz)	Nathusius' pipistrelle	Grand Total
May	3	23	1	52	81	16	4	180
June	2	0	0	26	37	9	0	74
July (Dusk)	0	32	0	11	20	2	0	65
July (Dawn)	0	31	0	25	56	6	0	118
August	4	13	1	9	20	0	0	47
September	0	37	0	10	42	4	0	93
Grand Total	9	136	2	133	256	37	4	577
% Total	1.56	23.57	0.35	23.05	44.37	6.41	1.96	100

Appendix E Automated Static Detector Survey Results - 2016

Table 6: Automated Static Detector Survey Results

Season	Species												
	Detector	<i>Myotis</i> sp.	Noctule	<i>Nyctalus</i> sp.	Serotine	<i>Nathusius</i> 'p ipistrelle	Common pipistrelle/ <i>Nathusius</i> pipistrelle (40kHz)	Common pipistrelle	Common pipistrelle/ soprano pipistrelle (50kHz)	Soprano pipistrelle	Barbastelle	Leisler's	Grand Total
May	S1	1	54	0	0	9	5	688	55	241	0	0	1053
	S2	4	77	0	0	2	4	237	17	106	0	0	447
May Total		5	131	0	0	11	9	925	72	347	0	0	1500
June	S1	3	34	0	0	1	1	77	1	16	0	0	133
	S2	0	69	0	0	0	2	28	5	5	0	0	109
June Total		3	103	0	0	1	3	105	6	21	0	0	242
July	S1	0	17	0	0	0	1	10	0	6	0	0	34
	S2	0	30	0	0	0	0	0	0	2	0	0	32
July Total		0	47	0	0	0	1	10	0	8	0	0	66
August	S1	3	295	4	2	2	1	89	6	93	0	0	495
	S2	2	68	0	0	0	0	17	4	32	0	0	123
August Total		5	363	4	2	2	1	106	10	125	0	0	618
September	S1	1	136	2	1	40	9	58	19	149	1	1	417
	S2	1	99	1	0	20	4	22	12	57	0	2	218
September Total		2	235	3	1	60	13	80	31	206	1	3	635
October	S1	0	4	0	0	20	1	18	1	10	0	0	54
	S2	0	5	0	0	1	3	12	1	70	0	0	92
October Total		0	9	0	0	21	4	30	2	80	0	0	146
Grand Total		15	888	7	3	95	31	1256	121	787	1	3	3207
Percentage (of total)		0.47	27.69	0.22	0.09	2.96	0.97	39.17	3.77	24.54	0.03	0.09	100

Appendix F Dusk Emergence/Dawn Re-entry Survey 2016 Results

F.1 Detailed Survey Data

Table 7: Dusk Survey Location L1, 14th June 2016, Ed Austin

Time	Species	Number of Passes	Time before/after Sunset (hours and minutes)	Emerge/Return to Roost (Y/N)
21:40	Noctule	2	00:18	N
21:44	Pip55	1	00:22	N
21:48	Pip55	9	00:26	N
21:49	Pip55	6	00:27	N
21:50	Pip55	6	00:28	N
21:51	Pip55	8	00:29	N
21:52	Pip55	5	00:30	N
21:53	Pip55	5	00:31	N
21:54	Pip55	4	00:32	N
21:55	Pip55	5	00:33	N
21:56	Pip45	1	00:34	N
21:56	Pip50	3	00:34	N
21:56	Pip55	1	00:34	N
21:57	Pip50	1	00:35	N
21:57	Pip55	2	00:35	N
22:00	Pip50	1	00:38	N
22:02	Pip55	1	00:40	N
22:04	Pip55	1	00:42	N
22:05	Pip55	1	00:43	N
22:06	Pip45	3	00:44	N
22:06	Pip55	4	00:44	N
22:07	Pip45	5	00:45	N
22:07	Pip50	2	00:45	N
22:07	Pip55	3	00:45	N
22:08	Pip45	4	00:46	N
22:08	Pip50	2	00:46	N
22:08	Pip55	1	00:46	N
22:09	Myotis	2	00:47	N
22:09	Noctule	2	00:47	N
22:09	Pip45	5	00:47	N
22:09	Pip55	2	00:47	N
22:10	Pip55	1	00:48	N
22:11	Pip55	3	00:49	N
22:12	Myotis	3	00:50	N
22:12	Pip45	1	00:50	N
22:12	Pip55	7	00:50	N
22:13	Myotis	3	00:51	N

Time	Species	Number of Passes	Time before/after Sunset (hours and minutes)	Emerge/Return to Roost (Y/N)
22:13	Pip45	7	00:51	N
22:13	Pip55	2	00:51	N
22:14	Myotis	2	00:52	N
22:14	Pip45	6	00:52	N
22:14	Pip55	5	00:52	N
22:15	Myotis	4	00:53	N
22:15	Pip45	4	00:53	N
22:15	Pip55	4	00:53	N
22:16	Myotis	3	00:54	N
22:16	Pip45	3	00:54	N
22:16	Pip55	6	00:54	N
22:17	Myotis	3	00:55	N
22:17	Pip45	3	00:55	N
22:17	Pip55	4	00:55	N
22:18	Myotis	3	00:56	N
22:18	Pip45	5	00:56	N
22:18	Pip55	6	00:56	N
22:19	Myotis	4	00:57	N
22:19	Pip45	6	00:57	N
22:19	Pip55	5	00:57	N
22:20	Myotis	2	00:58	N
22:20	Pip45	6	00:58	N
22:20	Pip55	3	00:58	N
22:21	Myotis	2	00:59	N
22:21	Pip45	4	00:59	N
22:21	Pip55	4	00:59	N
22:22	Myotis	1	01:00	N
22:22	Pip45	7	01:00	N
22:22	Pip55	8	01:00	N
22:23	Myotis	1	01:01	N
22:23	Pip45	3	01:01	N
22:23	Pip55	8	01:01	N
22:24	Myotis	3	01:02	N
22:24	Pip45	2	01:02	N
22:24	Pip55	8	01:02	N
22:25	Myotis	2	01:03	N
22:25	Pip45	3	01:03	N
22:25	Pip55	5	01:03	N
22:26	Myotis	1	01:04	N
22:26	Noctule	1	01:04	N
22:26	Pip45	1	01:04	N
22:26	Pip55	9	01:04	N
22:27	Pip45	2	01:05	N
22:27	Pip50	2	01:05	N
22:27	Pip55	7	01:05	N
22:28	Myotis	2	01:06	N

Time	Species	Number of Passes	Time before/after Sunset (hours and minutes)	Emerge/Return to Roost (Y/N)
22:28	Pip45	2	01:06	N
22:28	Pip50	3	01:06	N
22:28	Pip55	4	01:06	N
22:29	Myotis	3	01:07	N
22:29	Pip45	1	01:07	N
22:29	Pip55	8	01:07	N
22:30	Myotis	2	01:08	N
22:30	Pip45	1	01:08	N
22:30	Pip50	1	01:08	N
22:30	Pip55	7	01:08	N
22:31	Myotis	2	01:09	N
22:31	Pip45	2	01:09	N
22:31	Pip50	1	01:09	N
22:31	Pip55	6	01:09	N
22:32	Myotis	2	01:10	N
22:32	Pip45	7	01:10	N
22:32	Pip55	3	01:10	N
22:33	Myotis	2	01:11	N
22:33	Pip45	5	01:11	N
22:33	Pip55	1	01:11	N
22:34	Myotis	4	01:12	N
22:34	Pip45	6	01:12	N
22:34	Pip55	6	01:12	N
22:35	Myotis	2	01:13	N
22:35	Pip45	4	01:13	N
22:35	Pip55	4	01:13	N
22:36	Myotis	2	01:14	N
22:36	Pip45	6	01:14	N
22:36	Pip55	1	01:14	N
22:37	Myotis	2	01:15	N
22:37	Pip45	8	01:15	N
22:37	Pip55	1	01:15	N
22:38	Myotis	5	01:16	N
22:38	Pip45	5	01:16	N
22:39	Myotis	2	01:17	N
22:39	Pip45	8	01:17	N
22:40	Myotis	1	01:18	N
22:40	Pip45	5	01:18	N
22:40	Pip55	1	01:18	N
22:41	Myotis	2	01:19	N
22:41	Pip45	5	01:19	N
22:41	Pip55	1	01:19	N
22:42	Myotis	2	01:20	N
22:42	Pip45	6	01:20	N
22:42	Pip55	1	01:20	N
22:44	Myotis	2	01:22	N

Time	Species	Number of Passes	Time before/after Sunset (hours and minutes)	Emerge/Return to Roost (Y/N)
22:44	Pip45	2	01:22	N
22:44	Pip50	2	01:22	N
22:44	Pip55	2	01:22	N
22:45	Myotis	1	01:23	N
22:45	Pip45	3	01:23	N
22:45	Pip55	3	01:23	N
22:46	Myotis	3	01:24	N
22:46	Pip45	8	01:24	N
22:46	Pip50	1	01:24	N
22:47	Myotis	2	01:25	N
22:47	Pip45	9	01:25	N
22:48	Myotis	2	01:26	N
22:48	Pip45	8	01:26	N
22:48	Pip55	2	01:26	N
22:49	Myotis	2	01:27	N
22:49	Pip45	9	01:27	N
22:49	Pip55	1	01:27	N
22:50	Myotis	1	01:28	N
22:50	Pip45	4	01:28	N
22:51	Myotis	2	01:29	N
22:51	Pip45	4	01:29	N
22:53	Myotis	3	01:31	N
22:53	Pip45	4	01:31	N
22:54	Myotis	5	01:32	N
22:54	Pip45	1	01:32	N
22:55	Myotis	2	01:33	N
22:55	Pip45	6	01:33	N
22:56	Pip45	7	01:34	N
22:56	Pip55	1	01:34	N
22:57	Myotis	2	01:35	N
22:57	Pip45	9	01:35	N
22:58	Myotis	3	01:36	N
22:58	Pip45	3	01:36	N
22:58	Pip55	1	01:36	N
22:59	Myotis	1	01:37	N
22:59	Pip45	5	01:37	N
23:00	Myotis	1	01:38	N
23:00	Pip45	8	01:38	N
23:01	Myotis	1	01:39	N

Table 8: Dusk Survey L2 14th June 2016, Natalie White

Time	Species	Number of Passes	Time before/after Sunset (hours and minutes)	Emerge/Return to Roost (Y/N)
21:43	Noctule	1	00:21	N
21:44	Noctule	1	00:22	N
21:47	Noctule	1	00:25	N
21:48	Noctule	1	00:26	N

Time	Species	Number of Passes	Time before/after Sunset (hours and minutes)	Emerge/Return to Roost (Y/N)
21:53	Pip55	1	00:31	N
21:55	Noctule	1	00:33	N
21:58	Noctule	2	00:36	N
21:58	Pip55	1	00:36	N
21:59	Noctule	1	00:37	N
22:00	Noctule	2	00:38	N
22:02	Noctule	1	00:40	N
22:03	Noctule	1	00:41	N
22:04	Noctule	1	00:42	N
22:05	Noctule	2	00:43	N
22:08	Noctule	1	00:46	N
22:10	Noctule	2	00:48	N
22:12	Noctule	3	00:50	N
22:13	Noctule	3	00:51	N
22:13	Pip45	3	00:51	N
22:14	Noctule	1	00:52	N
22:15	Myotis	2	00:53	N
22:15	Noctule	1	00:53	N
22:16	Noctule	2	00:54	N
22:17	Noctule	3	00:55	N
22:19	Myotis	2	00:57	N
22:21	Myotis	2	00:59	N
22:21	Pip45	1	00:59	N
22:21	Pip55	1	00:59	N
22:22	Myotis	2	01:00	N
22:22	Pip55	1	01:00	N
22:23	Myotis	2	01:01	N
22:23	Pip45	1	01:01	N
22:23	Pip55	1	01:01	N
22:24	Myotis	1	01:02	N
22:24	Noctule	1	01:02	N
22:25	Noctule	2	01:03	N
22:25	Pip45	1	01:03	N
22:26	Noctule	1	01:04	N
22:27	Pip45	1	01:05	N
22:27	Pip55	1	01:05	N
22:28	Pip45	1	01:06	N
22:29	Myotis	2	01:07	N
22:29	Pip45	1	01:07	N
22:30	Noctule	2	01:08	N
22:31	Pip45	2	01:09	N
22:32	Pip45	2	01:10	N
22:32	Pip55	3	01:10	N
22:33	Myotis	1	01:11	N
22:33	Pip45	2	01:11	N
22:33	Pip55	1	01:11	N
22:34	Pip55	3	01:12	N
22:35	Pip55	1	01:13	N
22:36	Pip45	1	01:14	N
22:36	Pip55	1	01:14	N
22:37	Pip55	1	01:15	N
22:38	Myotis	2	01:16	N
22:39	Pip45	1	01:17	N
22:41	Pip55	1	01:19	N
22:43	Myotis	1	01:21	N
22:43	Pip50	1	01:21	N
22:44	Myotis	1	01:22	N
22:45	Myotis	1	01:23	N

Time	Species	Number of Passes	Time before/after Sunset (hours and minutes)	Emerge/Return to Roost (Y/N)
22:45	Pip40	1	01:23	N
22:46	Pip45	1	01:24	N
22:47	Myotis	1	01:25	N
22:49	Pip45	2	01:27	N
22:50	Myotis	2	01:28	N
22:50	Pip45	3	01:28	N
22:51	Myotis	1	01:29	N
22:51	Pip45	2	01:29	N
22:52	Pip45	1	01:30	N
22:52	Pip55	1	01:30	N
22:53	Myotis	1	01:31	N
22:54	Pip45	1	01:32	N
22:55	Myotis	3	01:33	N
22:55	Pip45	1	01:33	N
22:56	Pip45	1	01:34	N
22:57	Myotis	1	01:35	N
22:59	Myotis	1	01:37	N
22:59	Pip45	2	01:37	N
23:00	Pip55	1	01:38	N
23:01	Myotis	1	01:39	N
23:01	Pip45	2	01:39	N
23:02	Pip45	1	01:40	N
23:03	Pip45	1	01:41	N
23:04	Pip45	1	01:42	N
23:04	Pip55	1	01:42	N
23:05	Pip45	4	01:43	N
23:06	Pip45	3	01:44	N
23:07	Pip45	1	01:45	N

Table 9: Dusk Survey L3 14th June 2016, Stephen Foot

Time	Species	Number of Passes	Time before/after Sunset (hours and minutes)	Emerge/Return to Roost (Y/N)
21:57	Pip55	1	00:35	N
22:12	Pip45	3	00:50	N
22:12	Pip50	2	00:50	N
22:12	Pip55	3	00:50	N
22:13	Myotis	1	00:51	N
22:13	Noctule	2	00:51	N
22:13	Pip45	1	00:51	N
22:13	Pip55	1	00:51	N
22:14	Myotis	4	00:52	N
22:14	Pip45	2	00:52	N
22:14	Pip50	1	00:52	N
22:14	Pip55	1	00:52	N
22:15	Myotis	1	00:53	N
22:15	Pip45	1	00:53	N
22:15	Pip55	4	00:53	N
22:16	Pip45	1	00:54	N
22:16	Pip55	2	00:54	N
22:17	Myotis	3	00:55	N
22:17	Pip45	4	00:55	N
22:18	Myotis	3	00:56	N

Time	Species	Number of Passes	Time before/after Sunset (hours and minutes)	Emerge/Return to Roost (Y/N)
22:18	Pip45	1	00:56	N
22:18	Pip55	1	00:56	N
22:19	Myotis	2	00:57	N
22:19	Pip45	3	00:57	N
22:19	Pip55	1	00:57	N
22:20	Myotis	2	00:58	N
22:21	Pip45	1	00:59	N
22:22	Myotis	1	01:00	N
22:22	Pip45	1	01:00	N
22:22	Pip55	2	01:00	N
22:23	Myotis	1	01:01	N
22:25	Myotis	1	01:03	N
22:25	Pip45	1	01:03	N
22:25	Pip55	1	01:03	N
22:26	Myotis	2	01:04	N
22:26	Noctule	1	01:04	N
22:26	Pip45	3	01:04	N
22:26	Pip55	1	01:04	N
22:27	Myotis	1	01:05	N
22:27	Pip55	4	01:05	N
22:28	Noctule	3	01:06	N
22:28	Pip45	1	01:06	N
22:28	Pip50	1	01:06	N
22:28	Pip55	4	01:06	N
22:29	Pip55	2	01:07	N
22:30	Pip55	4	01:08	N
22:31	Noctule	1	01:09	N
22:31	Pip55	4	01:09	N
22:32	Pip50	1	01:10	N
22:34	Pip50	1	01:12	N
22:35	Pip45	1	01:13	N
22:39	Pip45	1	01:17	N
22:44	Pip55	1	01:22	N
22:45	Pip55	1	01:23	N
22:49	Pip45	2	01:27	N
22:49	Pip50	2	01:27	N
22:49	Pip55	1	01:27	N
22:50	Pip45	2	01:28	N
22:51	Pip45	5	01:29	N
22:52	Myotis	1	01:30	N
22:52	Pip45	5	01:30	N
22:54	Pip45	4	01:32	N
22:55	Pip45	4	01:33	N
22:58	Pip45	1	01:36	N
22:59	Pip45	1	01:37	N
23:00	Pip45	5	01:38	N

Time	Species	Number of Passes	Time before/after Sunset (hours and minutes)	Emerge/Return to Roost (Y/N)
23:00	Pip55	1	01:38	N
23:01	Pip45	4	01:39	N
23:02	Pip45	7	01:40	N
23:03	Pip45	3	01:41	N
23:04	Pip45	5	01:42	N
23:05	Pip45	5	01:43	N

Table 10: Tree Group G115 Dawn Survey 4th August 2016, Stephen Foot

Time	Species	Number of Passes	Time before/after Sunset (hours and minutes)	Emerge/Return to Roost (Y/N)
04:03	Pip45	1	01:30	N
04:11	Pip55	1	01:22	N
04:21	Pip45	2	01:12	N

Table 11: Tree Group G115 Dawn Survey 4th August 2016, Ed Austin

Time	Species	Number of Passes	Time before/after Sunset (hours and minutes)	Emerge/Return to Roost (Y/N)
03:47	Pip55	1	01:46	N
03:56	Pip55	1	01:37	N
04:03	Pip45	2	01:30	N
04:10	Pip55	1	01:23	N
04:20	Pip45	2	01:13	N
04:53	Pip45	1	00:40	N
04:59	Pip45	1	00:34	N

Table 12: Tree T88 Dusk Survey 22nd August 2016, Stephen Foot

Time	Species	Number of Passes	Time before/after Sunset (hours and minutes)	Emerge/Return to Roost (Y/N)
21:13	Noctule	1	01:02	N
21:14	Pip55	2	01:03	N
21:18	Pip50	2	01:07	N
21:20	Pip55	1	01:09	N
21:24	Pip50	1	01:13	N
21:48	Noctule	1	01:37	N
21:49	Noctule	1	01:38	N

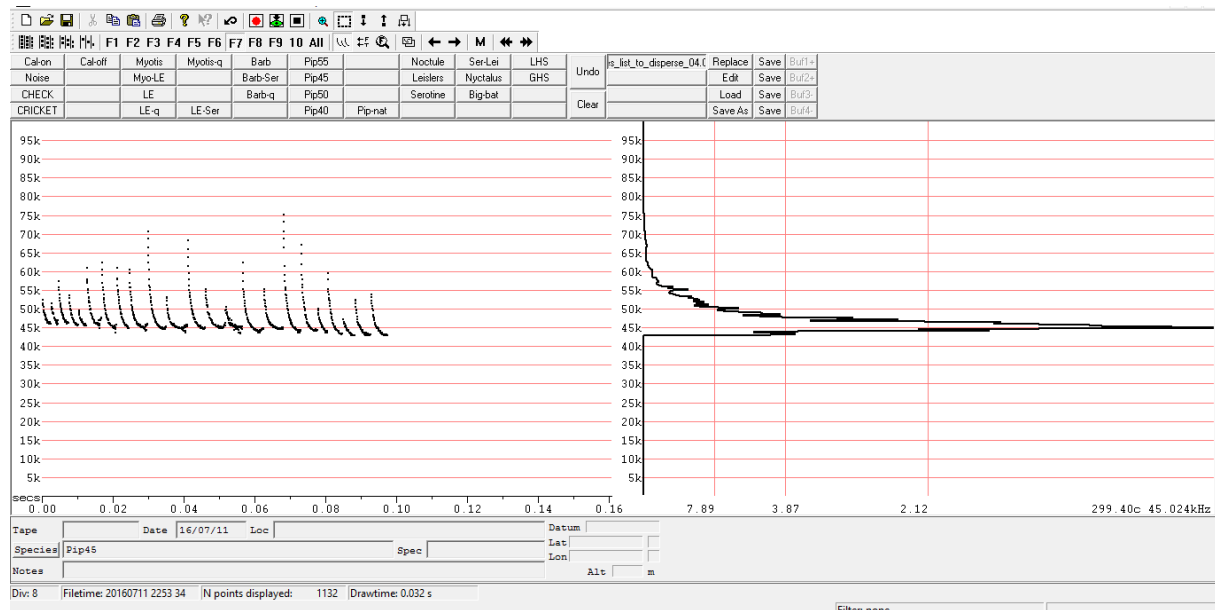
Table 13: Tree T91 Dusk Survey 22nd August 2016, Ed Austin

Time	Species	Number of Passes	Time before/after Sunset (hours and minutes)	Emerge/Return to Roost (Y/N)
20:46	Pip55	1	00:35	N
20:59	Noctule	1	00:48	N
20:59	Noctule	1	00:48	N
20:59	Noctule	1	00:48	N
20:59	Noctule	1	00:48	N
20:59	Noctule	1	00:48	N
20:59	Noctule	1	00:48	N
20:59	Noctule	1	00:48	N
20:59	Noctule	1	00:48	N
20:59	Noctule	1	00:48	N
21:02	Pip55	1	00:51	N
21:04	Pip55	1	00:53	N
21:04	Pip55	1	00:53	N

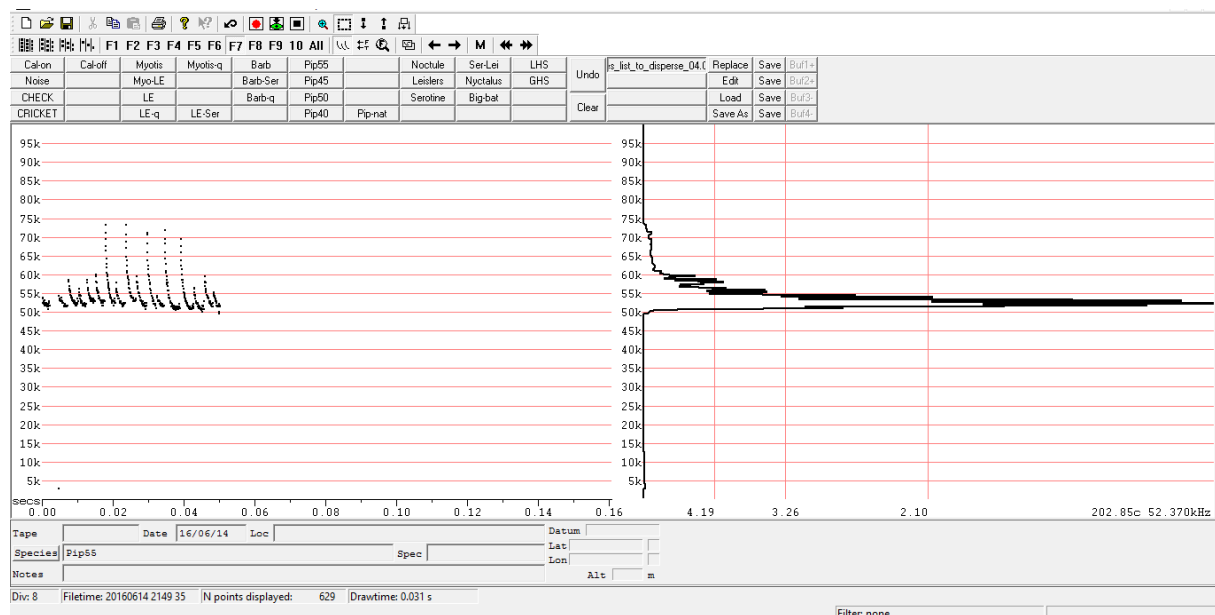
Time	Species	Number of Passes	Time before/after Sunset (hours and minutes)	Emerge/Return to Roost (Y/N)
21:10	Noctule	1	00:59	N
21:10	Noctule	1	00:59	N
21:12	Noctule	1	01:01	N
21:12	Noctule	1	01:01	N
21:13	Noctule	1	01:02	N
21:13	Noctule	1	01:02	N
21:13	Noctule	1	01:02	N
21:13	Noctule	1	01:02	N
21:14	Pip55	1	01:03	N
21:14	Pip55	1	01:03	N
21:17	Pip55	1	01:06	N
21:17	Pip55	1	01:06	N
21:21	Pip55	1	01:10	N
21:21	Noctule	1	01:10	N
21:21	Noctule	1	01:10	N
21:22	Pip55	1	01:11	N
21:22	Pip55	1	01:11	N
21:24	Noctule	1	01:13	N
21:24	Pip55	1	01:13	N
21:24	Pip55	1	01:13	N
21:24	Pip55	1	01:13	N
21:26	Noctule	1	01:15	N
21:27	Noctule	1	01:16	N
21:28	Pip45	1	01:17	N
21:31	Pip45	1	01:20	N
21:33	Pip-Nat	1	01:22	N
21:33	Pip-Nat	1	01:22	N
21:40	Pip55	1	01:29	N
21:42	Noctule	1	01:31	N
21:42	Noctule	1	01:31	N
21:48	Noctule	1	01:37	N
21:48	Noctule	1	01:37	N
21:48	Noctule	1	01:37	N
21:51	Pip55	1	01:40	N
21:52	Noctule	1	01:41	N
21:52	Pip55	1	01:41	N
21:52	Pip55	1	01:41	N
21:54	Pip55	1	01:43	N

F.2 Example Sonograms of Species Recorded

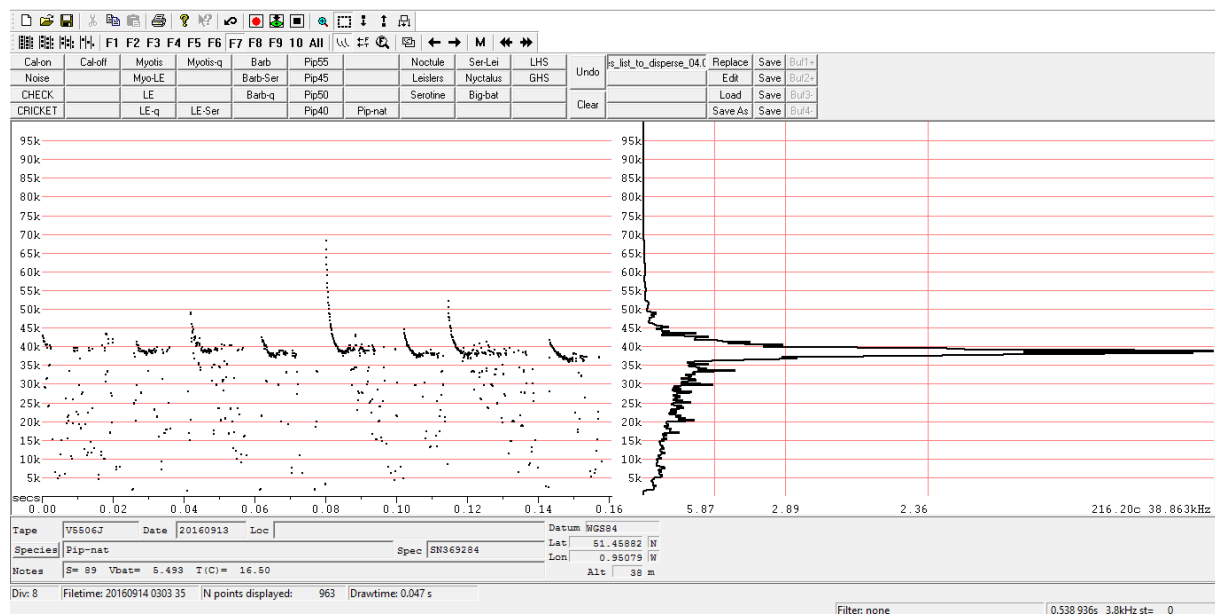
Common pipistrelle recorded during the dusk activity transect survey on 11th July 2016



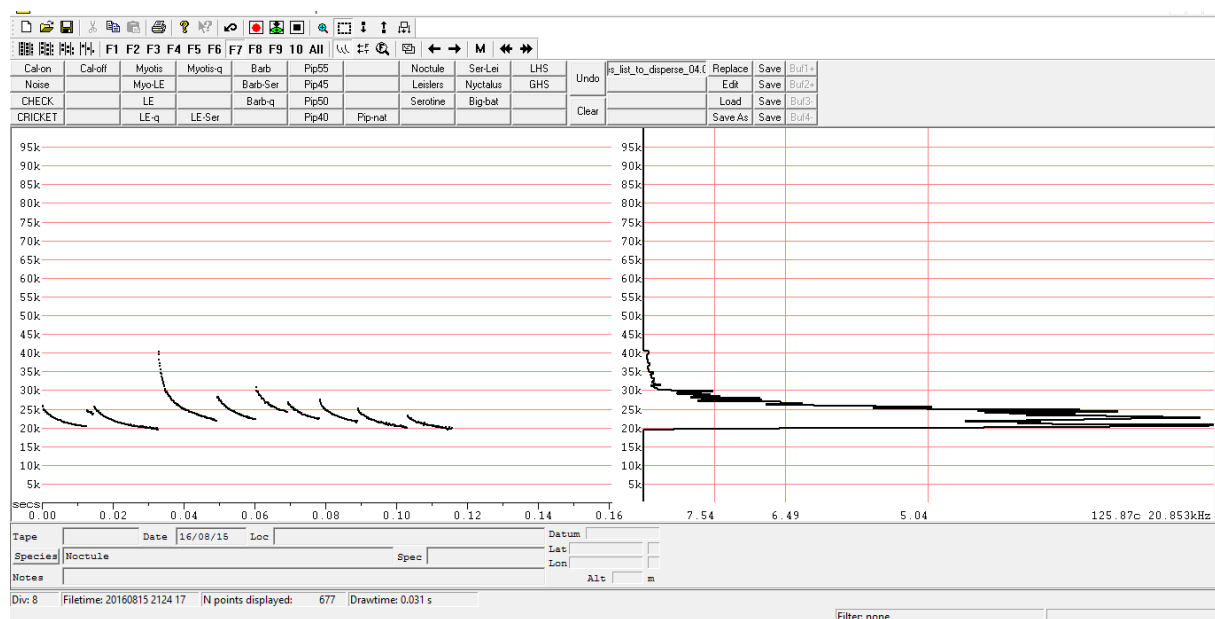
Soprano pipistrelle recorded during the dusk emergence survey of the bridge on 14th June 2016



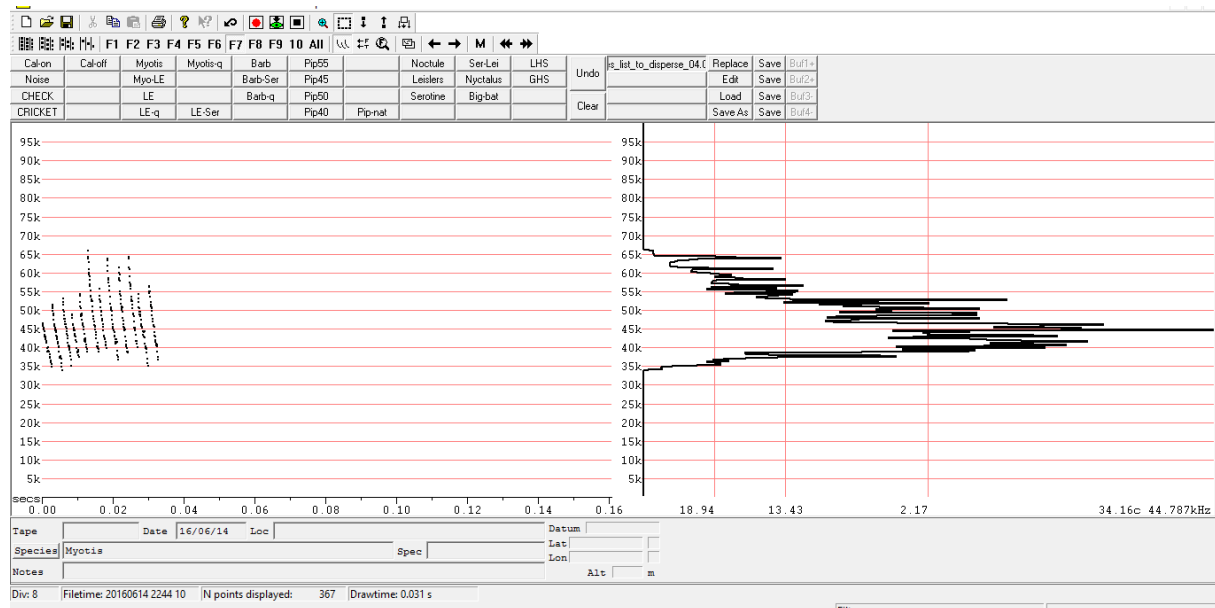
Nathusius' pipistrelle recorded at detector S1 during the September 2016 suite of surveys



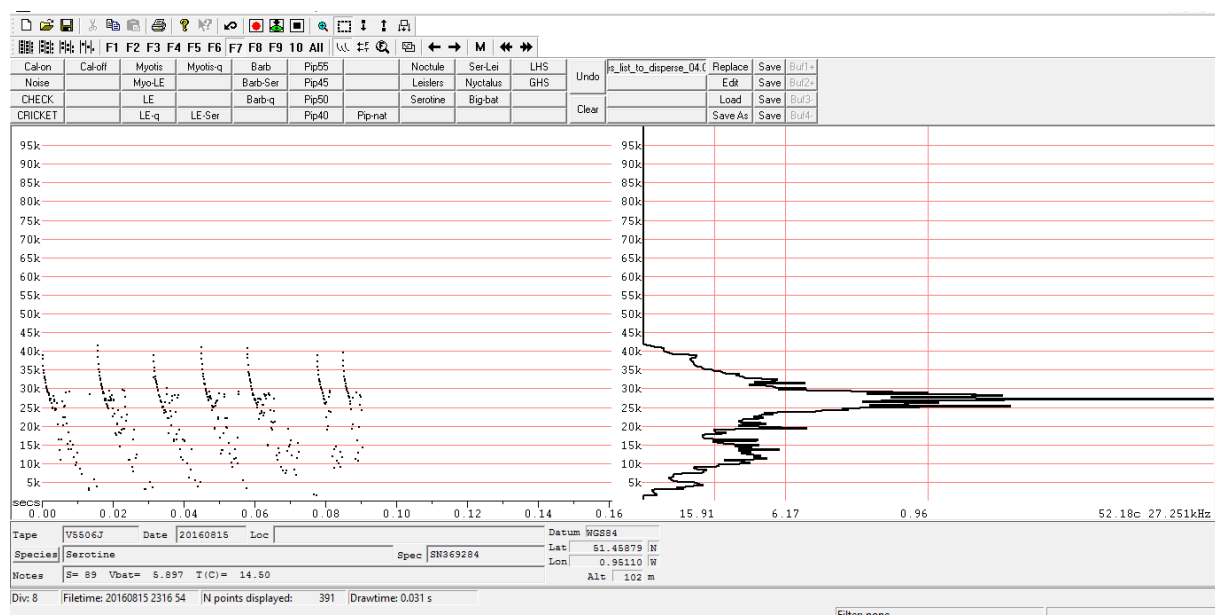
Noctule bat recorded foraging over street lights on dusk activity transect in August 2016



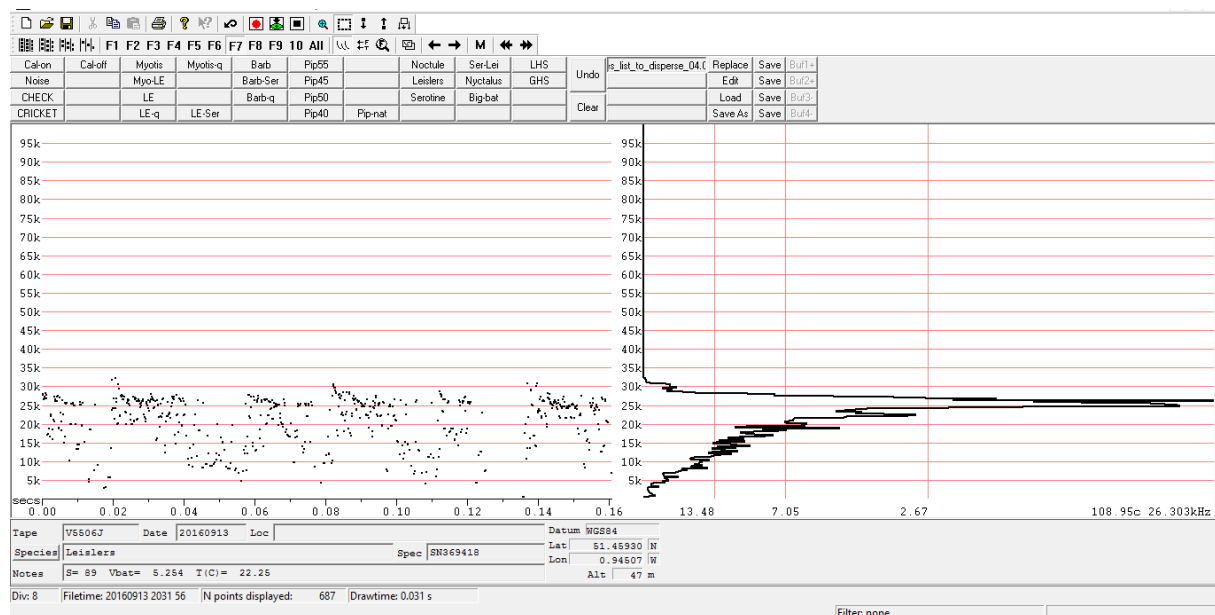
Myotis sp. (Daubenton's bat given observed flight patterns and call parameters) recorded during dusk emergence survey on 14th June 2016.



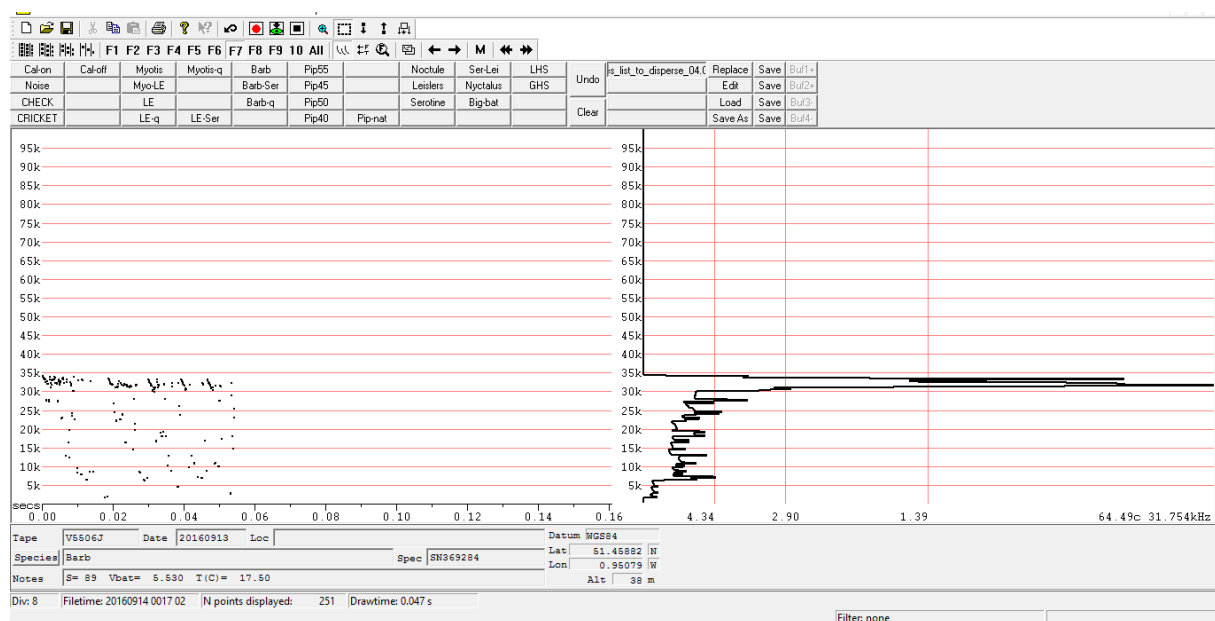
Serotine recorded at static detector S1 in August 2016



Leisler's bat recorded at detector S2 during the September 2016 suite of surveys



Barbastelle recorded at static detector S2 during the September 2016 suite of surveys



Appendix G Bat Activity Survey Results 2018

Table 14: Bat Species Recorded (and number of soundfiles) during the Walked Transects in 2018

Month	Noctule	Common pipistrelle	Soprano pipistrelle	Barbastelle	Grand Total
August	158	15	39	0	212
September	43	32	57	0	132
October	31	40	55	3	129
Grand Total	232	87	151	3	473
% Total	49.05	18.39	31.92	0.63	100

Appendix H Automated Static Detector Survey Results - 2018

Table 15: Automated Static Detector Survey Results

Season	Species												Average Soundfiles recorded per night
	Detector	<i>Myotis</i> sp.	Noctule	<i>Nyctalus</i> sp.	Serotine	<i>Nathusius</i> 'p ipistrelle	Common pipistrelle/ <i>Nathusius</i> pipistrelle (40kHz)	Common pipistrelle	Common pipistrelle/ soprano pipistrelle (50kHz)	Soprano pipistrelle	Barbastelle	Grand Total	
August	S1	1	490	3	0	0	0	44	0	18	0	556	111.2
	S2	3	56	2	2	0	0	99	5	356	0	523	104.6
August Total		4	363	5	2	0	0	143	5	374	0	1079	215.8
September	S1	1	29	0	0	0	0	2	0	3	0	35	7
	S2	2	17	0	0	0	0	36	0	56	0	111	22.2
September Total		3	46	0	0	0	0	38	0	59	0	146	29.2
October	S1	2	3	0	0	14	18	94	0	39	0	170	34
	S2	1	3	0	0	0	1	52	0	34	1	92	18.4
October Total		3	6	0	0	14	19	146	0	73	1	262	52.4
Grand Total		10	598	5	2	14	19	327	5	506	1	1487	
Percentage (of total)		0.67	40.22	0.34	0.13	0.94	1.28	21.99	0.34	34.02	0.07	100	