



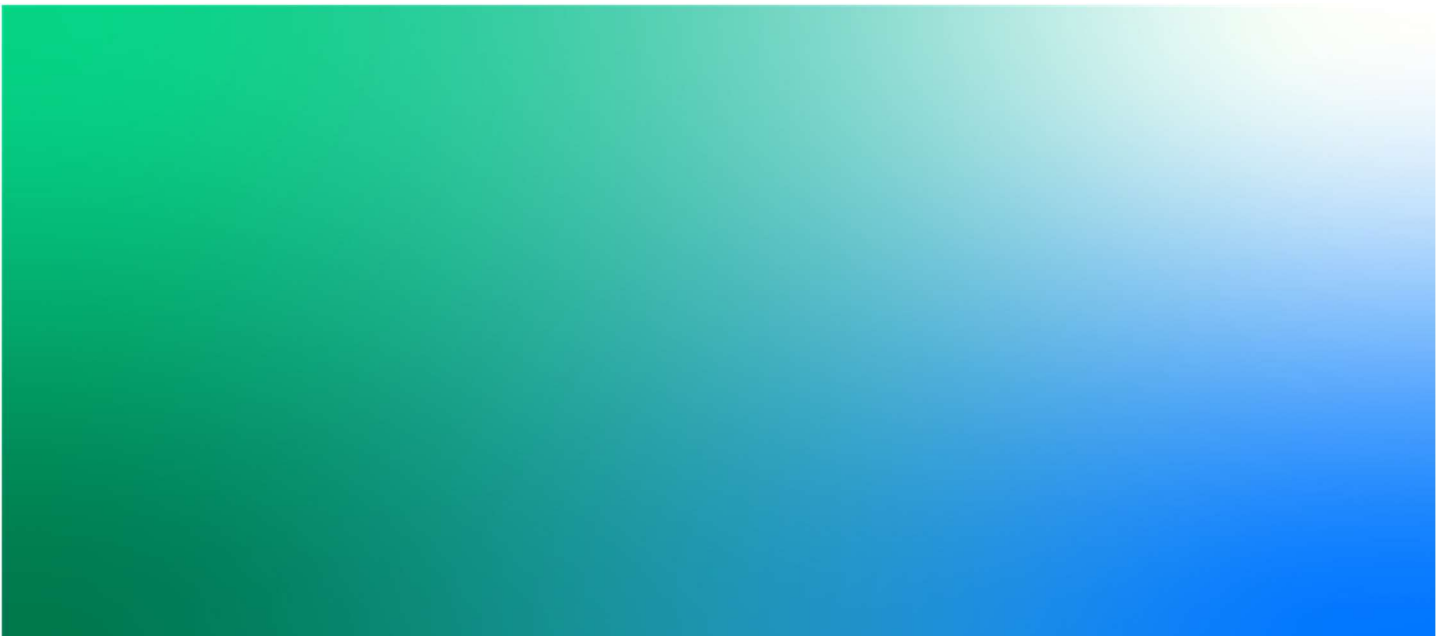
Cottam Parkway Railway Station

Bat Activity Survey Report

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Lancashire County Council



Cottam Parkway Railway Station

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Executive Summary

Jacobs UK Ltd (Jacobs) was commissioned by Lancashire County Council (LCC) to undertake a range of ecological surveys to inform the Cottam Parkway Railway Station Scheme (hereafter referred to as the 'Scheme'). The Scheme will serve the North West Preston Strategic Housing Location. It will comprise a new road to the proposed railway station connecting from Cottam Link Road with a bridge over the Lancaster Canal and a car park to serve the railway station.

As part of the ecological support to inform the Scheme, Jacobs have completed bat surveys which were undertaken between May and October 2020. These bat surveys follow on from the Preliminary Roost Assessment undertaken within spring 2020. The purpose of the surveys was to gather information on the presence or likely absence of bat roosts within the trees and structures and to provide an assessment of bat activity within the Scheme and a 50m buffer area (the survey area).

This information will be used to establish an ecological baseline for bats to inform an Environmental Impact Assessment for the Scheme. This will be presented for planning within an Environmental Statement (ES) which will be submitted for planning consideration in January 2022.

A total of 34 trees of moderate or high potential for bats were subject to climb and inspect surveys and three further trees (T13, T16 and T33) deemed unsuitable for climbing were subject to dusk emergence surveys. No evidence of a bat roost was identified within any tree during both survey types.

A total of 12 structures with low to high bat roost potential were subject to dusk emergence surveys. Bat roosts were confirmed in three structures including: a Daubenton's bat (*Myotis daubentonii*) day roost at Quaker's Bridge; four common pipistrelle (*Pipistrellus pipistrellus*) day roosts at Railway Cottages and a common pipistrelle day roost at Halsall's Farm (Building B1). In addition, a further Daubenton's bat day roost was confirmed within Culvert 2 during three daytime inspections undertaken on this structure. Both Culvert 2 and Quaker's Bridge are also likely to provide suitable conditions for hibernating bats.

Bat activity surveys comprising transect surveys and automated static detector monitoring were undertaken in May, June/July and September. At least five species were recorded during the bat activity surveys including common pipistrelle, soprano pipistrelle (*Pipistrelle pygmaeus*), noctule (*Nyctalus noctula*), *Myotis* species (almost exclusively Daubenton's bat) and brown long-eared bat (*Plecotus auritus*).

Generally, bat activity across the survey area was low and dominated by common pipistrelle. Common pipistrelle activity was characterised by the foraging activity of one to two bats recorded at an infrequent to regular basis. As is typical, common pipistrelle utilise the linear habitats features including treelines, hedgerows, woodland edges and Lancaster Canal. Lancaster Canal supported the most activity with common pipistrelle and Daubenton's bats utilising this waterway for commuting and foraging. Low numbers of noctule were frequently recorded across the Scheme. This species was recorded foraging over the pasture fields. Other species recorded in very low numbers included brown long-eared bat and soprano pipistrelle. The very occasional presence of other *Myotis* species within the Scheme (including whiskered bat (*M. mystacinus*), Brandt's bat (*M. brandtii*) and/or Natterer's bat (*M. nattereri*) is also likely.

Collectively, the bat population within the survey area is considered to be of **District** importance for biodiversity. The biodiversity importance of the population of each bat species recorded within the Scheme ranges from **Less than local** to **District** importance based upon the extent and use of the Scheme by each species.

A robust assessment of the potential impacts on bats and bat roosts associated with the Scheme will be detailed within the Ecology Chapter (Chapter 6) of the ES, along with any prescribed avoidance, mitigation and compensation measures, opportunities for enhancement, requirements for pre and/or post construction monitoring and an assessment of residual impacts (where appropriate).

1. Introduction

1.1 Background

Jacobs UK Ltd (Jacobs) was commissioned by Lancashire County Council (LCC) to provide ecological services to inform the proposed Cottam Parkway Railway Station Scheme (hereafter referred to as the 'Scheme').

The Scheme comprises (but not exhaustively): a road connecting to Cottam Link Road at the Sidgreaves junction roundabout; a bridge over the Lancaster Canal connecting to the railway station; station platforms; buildings and associated structures; a footbridge over the railway; a 250/500 space car park; and associated bridge approach embankments and earthworks. This development is related to the permitted road Schemes of Preston Western Distributor (PWD) and the East West Link Road (EWLR) including Cottam Link Road.

A range of ecological surveys was required in order to inform the design options appraisal and to establish an accurate baseline against which the impacts of the Scheme (both temporary and permanent) could be assessed in line with the Chartered Institute of Ecology and Environmental Management (CIEEM) guidelines for Ecological Impact Assessment (CIEEM, 2018).

This report presents the results of bat activity surveys undertaken by Jacobs' ecologists between May and September 2020 and follows on from the Preliminary Bat Roost Assessment (PRA) (Jacobs, 2020). It is advised that the PRA report be read in conjunction with this report for further background and context. The scope of bat activity survey methods undertaken for the Scheme included climb and inspect surveys, dusk emergence surveys of trees and structures, transect surveys and automated static detector monitoring.

The surveys were undertaken in consideration of the proposed Scheme boundary provided by LCC (LCC Drawing CLM07-DEV-010-01; Dated 10-01-2020) and the walkover notice area/survey exclusion area drawing provided by LCC (LCC Drawing CLM07-DEV-010-03; Dated 16-12-2019). The surveys were conducted within the Scheme and 50m buffer area from the Scheme boundary (i.e. the survey area) shown in Figures 1 to 3 in Appendix A. Further information on the Scheme design was not available at the time of survey/writing.

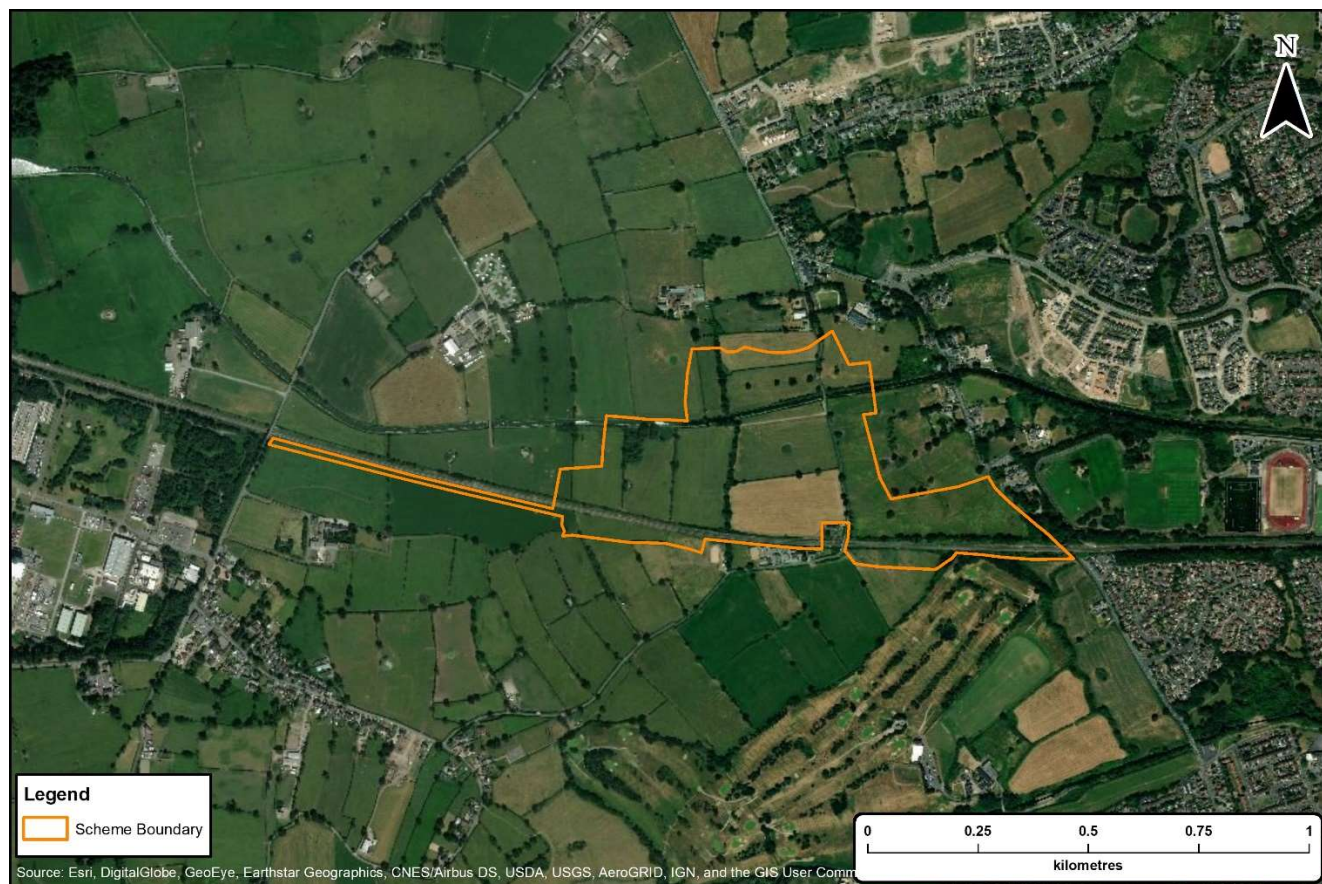
1.2 Site Context

An aerial image of the location of the Scheme is provided in Plate 1.1 below. The Scheme is proposed to be located within a semi-rural area approximately 4km north-west of central Preston and to the immediate south-west of the largely residential area of Cottam. The central grid reference for the site is SD 48714 31645^[1]. Land use within the Scheme largely comprises pasture land used for grazing and/or fodder production. This land is bound by a network of hedgerows and tree lines with occasional small woodlands, small watercourses, waterbodies, farmsteads and dwellings. Both the Lancaster Canal and the Preston to Blackpool rail line run east to west through the Scheme. Sidgreaves Lane leading to Darkinson Lane runs north to south through the centre of the Scheme.

Pasture land dominates much of the wider area, particularly to the west of the Scheme. The eastern boundary of the Scheme is bordered by Lea Road with Westleigh Conference Centre and sports pitches further eastwards; to the south is pasture land with Aston and Lea Golf Club further beyond. To the north is pasture land with both existing and new housing developments further northwards. In addition, the construction of the PWD/Cottam Link Road was also underway along the west and north boundaries of the main Scheme area at the time of survey.

^[1] Ordnance Survey National Grid reference system used throughout the report.

Plate 1.1. Overview of Scheme location



1.3 Aims and Objectives

The primary aim of this report is to present an accurate baseline of data relating to bat roosts in structures and trees as well as bat activity across the survey area in accordance with the relevant good practice survey guidance, planning policies and legislative framework. The key objectives of the assessment were to:

- Provide information on the presence or likely absence of bat roosts in structures and trees within the survey area;
- Provide information on bat activity within the survey area;
- Provide an evaluation of the conservation significance of any confirmed bat roosts;
- Assess the biodiversity value of each bat species population within the survey area and the bat population as a whole;
- Provide sufficient information to inform both the project design and an assessment of potential impacts to bat populations associated with the finalised Scheme so that appropriate mitigation hierarchy can be followed and opportunities for enhancement can be developed; and
- Provide sufficient information to inform potential European Protected Species Mitigation (EPSM) licencing requirements via the appropriate licencing authority (i.e., Natural England).

1.4 Legislative, Planning Policy, and Biodiversity Framework

A summary of the legislation and policy framework for bats is provided below. Further details of the legislative, and biodiversity framework along with information regarding the biology of bats and their habitat requirements is provided in Appendix B.

1.4.1 Legislation

All UK bat species receive full legal protection under Schedules 5 and 6 of the Wildlife and Countryside Act 1981 (as amended) and all are listed as European Protected Species under Schedule 2 of the Conservation of Habitats and Species Regulations 2017 (as amended)¹. In addition, Schedule 12 of the Countryside and Rights of Way (CROW) Act 2000 amends the species provision of the Wildlife and Countryside Act 1981 by strengthening legal protection for threatened species.

The relevant sections of the Wildlife and Countryside Act 1981 (as amended) make it an offence to:

- Intentionally or recklessly damage or destroy any structure or place which any wild animal specified in Schedule 5 uses for shelter or protection;
- Intentionally or recklessly disturb any such animal while it is occupying a structure or place which it uses for shelter or protection; or
- Intentionally or recklessly obstruct access to any structure or place which any such animal uses for shelter or protection.

The relevant sections of the Conservation of Habitats and Species Regulations 2017 (as amended) make it an offence to:

- Deliberately capture, injure or kill any wild animal of a European Protected Species;
- Deliberately disturb² wild animals of any such species; and
- Damage or destroy³ a breeding site or resting place of such an animal.

In addition, under this legislation there are offences relating to possession, control, sale, and exchange of bats.

Where it is likely that the Scheme would result in contravention of this legislation, an EPSM licence would be required to allow the works to proceed. As part of this process, the application must meet 'three tests' for licencing under the Conservation of Habitats and Species Regulations 2017 (as amended). Planning guidance and recent case law also require the Local Planning Authority (LPA) to address these three tests when deciding whether to grant planning permission⁴. The three tests are as follows:

- Regulation 55 (2) (e) states that a derogation license can only be issued for preserving 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;
- Regulation 55 (9) (a): that there is no satisfactory alternative; and
- Regulation 55 (9) (b): that the action authorised will not be detrimental to the maintenance of the population of the species concerned at a favourable conservation status in their natural range.

1.4.2 Biodiversity Framework

a) Species of Principal Importance

Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006 requires the Secretary of State to publish a list of habitats and species which are of Principal importance for the conservation of biodiversity in

¹ Until Implementation Period Completion day (31st December 2020) the Conservation of Habitats and Species Regulations 2017 (as amended) will remain in force without any of the amendments relating to Brexit made by The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019.

² The Conservation of Habitats and Species Regulations 2017 (as amended) defines disturbance as an act which would disturb any such species in such a way as to be likely to impair their ability to survive, to breed or to reproduce, or to rear or nurture their young; or in the case of hibernating or migratory species, to hibernate or migrate; or to affect significantly the local distribution or abundance of the species to which they belong.

³ Damage or destruction of a breeding site or resting place is an absolute offence under the Conservation of Habitats and Species Regulations 2017 (as amended) (i.e. it does not have to be deliberately/intentional)

⁴ ODPM Circular 06/2005; *R (Simon Woolley) v Cheshire East Borough Council*, 2009; *R (Morge) v Hampshire County Council*, 2011).

England. There are 56 habitats and 943 species of Principal importance which were initially identified as requiring conservation action under the UK Biodiversity Action Plan (BAP) (Department of the Environment (Northern Ireland), 1994) and which continue to be regarded as priorities under the UK Post-2010 Biodiversity Framework (JNCC and Defra, 2012). The Section 41 list is used to guide decision-makers such as public bodies, including local and regional authorities, in implementing their duty under Section 40 of the NERC Act 2006 "to have regard" to the conservation of biodiversity in England, when carrying out their normal functions. Bat species listed under Section 41 and known to be present within Lancashire comprise soprano pipistrelle (*Pipistrellus pygmaeus*), brown long-eared bat (*Plecotus auritus*) and noctule (*Nyctalus noctula*).

b) Lancashire Biodiversity Action Plan

The Lancashire BAP (2001) contains 11 habitat and 39 species action plans and lists eight bat species on the provisional long list (Lancashire's Biodiversity Partnership, 2001). These species comprise: common pipistrelle (*Pipistrellus pipistrellus*), soprano pipistrelle, brown long-eared bat, whiskered bat (*Myotis mystacinus*), Brandt's bat (*Myotis brandtii*), Natterer's bat (*Myotis nattereri*), Daubenton's bat (*Myotis daubentonii*) and noctule.

The Lancashire Species Action Plan for bats lists several broad bat conservation objectives including:

- Survey and monitor bat populations, their distribution and habitat use in Lancashire;
- Maintain and improve opportunities for bats to roost, feed and hibernate. This includes, safeguarding and creating roosts in buildings, trees and bridges whilst also creating, maintaining and improving foraging habitat;
- Encourage research into aspects of bat ecology relevant to their conservation in Lancashire; and
- Promote bats as a group of flagship species in the Lancashire BAP.

2. Methodology

2.1 Overview

It is advised to read this report in conjunction with the PRA for background and context (Jacobs, 2020). The PRA includes the results of a desk study which comprised an assessment of bat records from Lancashire Environmental Records Network, an assessment of survey data collected for the PWD/EWLR Scheme and a habitat evaluation.

The scope of bat surveys for the structures and trees within the Scheme was based upon recommendations made within the PRA. All surveys were undertaken in consideration of current good practice guidelines, which include the Bat Tree Habitat Key (BTHK, 2018); Surveying for Bats in Trees and Woodland BS 8596 (British Standards Institution, 2015); Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edition) (Collins, 2016); and LD 118 Biodiversity design (Highways England *et al.*, 2020a).

All bat surveys were overseen and/or led by surveyors whom held or were accredited to a Natural England Class 2 licence for bats including:

- Ryan Knight MCIEEM (licence no. 2015-12611-CLS-CLS);
- Stuart Macpherson ACIEEM (accredited on licence no. 2015-12611-CLS-CLS);
- Jack Kellet MCIEEM (licence no. 2015-30244-CLS-CLS);
- Daniel Seaward MCIEEM (licence no. 2017-31532-CLS-CLS); and
- Alicia Logan GradCIEEM (accredited on licence no. 2017-31532-CLS-CLS).

All dusk surveys (i.e., emergence surveys of trees and structures and, transect surveys) were undertaken in suitable weather conditions (i.e., sunset temperatures >10°C, little or no wind and dry conditions or very light/short rain showers).

In addition, all surveys were carried out using a frequency division detector (Batbox Duet) with a separate recording facility (Anabat Express) or an Echo Meter Touch 2 Pro (full spectrum detector) attached to an iPad. All bat recordings made in the field were checked to identify genera or species (where possible) using bat sonogram analysis software (e.g., AnalookW and Kaleidoscope).

2.2 Climb and Inspect Surveys

Climb and inspect surveys of trees were undertaken between May and August 2020. These surveys involved a close visual examination of all potential roost features (PRF) which were identified to have moderate to high bat roost potential during the PRA (Jacobs, 2020). A total of 34 trees were subject to survey comprising nine trees categorised as high potential and 25 trees categorised as moderate potential.

The climb and inspect surveys were undertaken by a team of at least two surveyors per visit. Each surveyor held Unit 206 and 306 (Tree Climbing and Aerial Rescue) City and Guilds NPTC certification and all climbing was carried out in accordance with '*Industry Code of Practice for Arboriculture: Tree Work at Height*' (Arboricultural Association, 2020).

Inspections included the use of tree climbing equipment (e.g. rope and harness) or ladders (if more appropriate) to allow full visual access to each PRF identified during the PRA. Each PRF was inspected with the use of a digital endoscope (Model; Ridgid Seesnake CA-300) and/or torch.

The aims of the climb and inspect surveys were:

- To assess and update the bat roost potential category within the PRF;
- To identify actual presence of roosting bats; and
- To search for evidence of roosting bats within the PRF.

The climb and inspect surveys provided a verification of the bat roost potential category provided during the PRA. This category can remain unchanged or be downgraded or upgraded dependent on the findings of the close visual examination of the PRF during the climb and inspect surveys.

Following the results of the first survey, all trees with an updated bat roost potential category of moderate or above were subject to further climb and inspect surveys. Those with moderate potential were climbed once more and those with high potential were climbed twice more to search for evidence of roosting bats. Where trees required two or more surveys, these surveys were spaced at least two weeks apart.

2.3 Dusk Emergence Surveys

2.3.1 Trees

Dusk emergence surveys were carried out on three trees (T13, T16 and T33) between June and August 2020. These trees could not be climbed due to unsafe climbing conditions. All three trees were of moderate bat roost potential (PRA, Jacobs, 2020) and subject to two dusk emergence surveys each. Dusk emergence surveys began 15 minutes before sunset and continued to at least 1 hour 45 minutes after sunset. The surveyors were suitably positioned to gain clear sightlines of all PRF identified on each tree during the PRA. Field notes made during each survey included: time of any observation, the number of bats emerging (if present), species, behaviour (foraging or commuting) and direction of flight if observed.

2.3.2 Structures

A total of 12 structures were identified as having low to high bat roost potential in the PRA (Jacobs, 2020). These structures were all subject to further survey with the number of surveys on each structure dependent on their bat roost potential in accordance with good practice (Collins, 2016). The surveys were undertaken between May and October 2020.

Dusk emergence surveys began 15 minutes before sunset and continued to at least 1 hour 45 minutes after sunset. The surveyors were suitably positioned to gain clear sightlines of the PRF identified on each structure during the PRA. The number of surveyors deployed on each structure depended on the extent of PRF and the size of each structure. Field notes made during each survey included: time of any observation, the number of bats emerging, species (if present), behaviour (foraging or commuting) and direction of flight if observed.

2.4 Bat Transect Surveys

Two transect routes were designed to cover the Scheme area. These transect routes are referred to as Transect 1 and Transect 2. Table 2.1 provides a description of each transect route.

The transect surveys were completed on three occasions in May, June and September 2020. All transect surveys were undertaken at dusk and continued for at least two hours after sunset for each transect. The date and duration of each transect is provided in Table 2.1.

Two surveyors walked the transect routes at a steady pace, pausing and recording bat activity at pre-determined 'listening points' for five-minute periods along each transect route. Both transects contained seven listening points (T1.1 to T1.7 and T2.1 to T2.7 as shown on Figure 3 in Appendix A). Surveyors recorded species, numbers, flight directions, type of activity and number of passes. One bat pass constituted bat activity within a ten second period with a maximum of 30 bat passes recorded per individual bat over the course of the five minute listening period. Bat activity between transect points was also recorded and described.

Variations in the direction walked and/or starting positions were employed on the transect routes to ensure that the results were not influenced by temporal or spatial variations in bat activity over the course of each survey and to gather a greater picture of bat activity along the entirety of each route. The transect routes were walked twice during every visit.

Figure 3 (Appendix A) provides the walking routes of the transects along with the locations of each listening point. In order to provide an illustration of the levels of bat activity recorded during the transect surveys, bat activity has been represented within Figure 3 using the following categories:

- **Low level irregular activity** (1-2 bats of the same species recorded infrequently);
- **Low level regular activity** (1-2 bats of the same species recorded regularly to constantly);
- **Moderate level irregular activity** (2-4 bats of the same species or 1-2 bats of 2 different species recorded infrequently);
- **Moderate level regular activity** (2-4 bats of the same species or 1-2 bats of 2 different species recorded regularly to constantly);
- **High level irregular activity** (5+ bats of the same species or 1-2 bats of 3+ different species recorded infrequently); and
- **High level regular activity** (5+ of the same species or 1-2 bats of 3+ different species recorded regularly to constantly).

The categories have been designed to provide an overview of bat activity relative to the site and are based upon professional judgement.

Table 2.1: Bat activity transect survey summary and description.

Transect	Survey Dates	Survey Times (Sunset Time)	Transect Description
1	19/05/2020	21:13 – 23:49 (21:13)	Transect 1 was approximately 2.5km in length and focused on linear features and habitats in the north and western sections of the Scheme. The transect route incorporated Lancaster Canal, Sidgreaves Lane and the trees lines, woodland and hedgerows that bound the pasture fields off Sidgreaves Lane.
	25/06/2020	21:46 – 00:24 (21:46)	
	03/09/2020	19:43 – 22:12 (19:43)	
2	19/05/2020	21:13 – 23:44 (21:13)	Transect 2 was approximately 2.4km in length and covered the southern and eastern sections of the survey area, including a footpath alongside the railway line. The eastern extent of the transect ran alongside a mature tree line and then directly adjacent to an area of woodland. The route also incorporated pasture fields, scattered trees, hedgerows, Sidgreaves Lane, a bridge over the railway and Railway Cottages.
	25/06/2020	21:46 – 00:31 (21:46)	
	03/09/2020	19:43 – 22:20 (19:43)	

2.5 Automated Static Detector Surveys

Automated static detectors were deployed at eight locations (labelled SD1 to SD8) over three periods in May, June/July and September 2020. The automated static detectors were positioned on linear features throughout the Scheme that were likely to be of most value to bats (i.e., treelines and hedgerows). The automated static detector surveys were used to supplement the transect survey data and provide a greater level of information on bat activity. The locations of each automated static detector are shown on Figure 3 (Appendix A). Grid reference locations are given in Table 2.2.

For each detector location five consecutive nights of data were selected for analysis, representing the best weather conditions across the monitoring period, to provide the most accurate and comparable data sets. The dates of each monitoring period and the subsequent nights selected for analysis are described in Table 2.2.

Weather data was obtained from the Met Office website (<https://www.metoffice.gov.uk>) with use of the nearest local weather station. Bat calls were analysed using AnalookW bat call analysis software (with use of bat species classifiers) to identify the species present and quantify the number of bat passes recorded for each species per night.

Each file containing a bat call was considered to represent a “bat pass”. A total number of bat passes per night was also calculated as well as the species. Although not synonymous with actual numbers of bats, this information provides an indication of the relative abundance of bat species across a survey area.

Table 2.2 Summary of automated static detector surveys and dates selected for analysis

Static detector	Grid Reference	May	June/July	September
SD1	SD 48834 31672	14-18/05/2020	29/06/2020 – 03/07/2020	18-22/09/2020
SD2	SD 49049 31643	14-18/05/2020	29/06/2020 – 03/07/2020	18-22/09/2020
SD3	SD 48728 31477	14-18/05/2020	29/06/2020 – 03/07/2020	18-22/09/2020
SD4	SD 48860 31435	14-18/05/2020	29/06/2020 – 03/07/2020	18-22/09/2020
SD5	SD 49101 31444	14-18/05/2020	29/06/2020 – 03/07/2020	18-22/09/2020
SD6	SD 49216 31523	14-18/05/2020	29/06/2020 – 03/07/2020	18-22/09/2020
SD7	SD 49285 31307	14-18/05/2020	29/06/2020 – 03/07/2020	18-22/09/2020
SD8	SD 48517 31315	14-18/05/2020	29/06/2020 – 03/07/2020	18-22/09/2020

2.6 Daytime Inspection

A culvert referred to as Culvert 2 (Jacobs, 2020) was discovered and inspected on 26th August 2020. Due to the dense vegetation growth and location (within a steep sided ditch with running water) it was not considered feasible to undertake dusk emergence surveys on this culvert (see 2.8 Limitations). Therefore, the structure was inspected twice more on 18th September and 24th September 2020. During each of the three visits, the stone cavities within the underside of the archway of the culvert were inspected using a torch and digital endoscope.

2.7 Evaluation

Ecological Impact Assessment uses a hierarchical geographic framework to assign importance to ecological features. This is based on an understanding of how the ecological feature may contribute to the conservation status or distribution of the species or habitat at a particular geographic scale. It involves an assessment of the biodiversity importance of ecological features and also involves consideration of other factors that can be attached to ecological features including ecosystem services and natural capital (CIEEM, 2018). The evaluation is based on professional judgement⁵, local knowledge and available data sources. The Lancashire Biological Heritage Site (BHS) selection criteria (Lancashire County Planning Department, 1998) provides criteria to indicate habitats (and some species populations) of **County** importance for biodiversity and this document has been used to inform the evaluation process. Opinions may differ slightly between professionals as to the value of ecological features/biodiversity resources; therefore, a clear explanation is provided to justify how the evaluation category has been assigned.

The new Design Manual for Roads and Bridges (DMRB) LA 108 Biodiversity guidance (Highways England *et al.*, 2020b) and the CIEEM Guidelines for Ecological Impact Assessment in the UK and Ireland; Terrestrial, Freshwater, Coastal and Marine (CIEEM, 2018) recommends that the value/importance of a biodiversity

⁵ Professional judgement requires a trained and appropriately experienced individual to apply their skills and knowledge to reach an informed decision, as per British Standard 42020:2013. Biodiversity - Code of practice for planning and development (The British Standards Institution, 2013).

resource/ecological feature be considered within a defined geographical context. The geographic categories stated in the two sets of guidance differ slightly but are largely comparable (see below).

Therefore, the value/importance of biodiversity resources within the survey area was assessed according to the following defined geographical framework as per current CIEEM and Highways England guidance⁶.

- International and European (International or European).
- National (UK or National).
- Regional (Regional) e.g. North-West England.
- Metropolitan, County, Vice County or other local authority-wide area (County or equivalent authority) e.g. Lancashire.
- River Basin District (CIEEM only). District is used herein as a geographic frame of reference e.g. Preston.
- Estuary System/Coastal cell (CIEEM only).
- Local (Local) (e.g. within 2km of the Scheme).
- Less than local.

In addition to the geographical framework, where identified, each individual bat roost was assigned a value in terms of its conservation significance in accordance with Figure 4 (*Guidelines for proportionate mitigation conservation*) of the Bat Mitigation Guidelines (Mitchell-Jones, 2004).

2.8 Limitations

The findings of this report represent the professional opinion of qualified ecologists and do not constitute professional legal advice. The client may wish to seek professional legal interpretation of the relevant wildlife legislation cited in this document.

2.8.1 COVID-19

The scope of ecological surveys for the Scheme was designed prior to the COVID-19 outbreak and this scope had to be slightly adjusted to factor in local and national restrictions relating to the pandemic. As a result, all bat activity surveys were undertaken at dusk rather than a combination of dusk and dawn surveys (which would be the standard approach in accordance with good practice guidance recommendations (Collins, 2016)). Only dusk surveys were undertaken as the surveys had to be organised without a reliance on overnight accommodation. Due consideration has been given to the '*Guidance on Ecological Survey and Assessment in the UK During the Covid-19 Outbreak*' (CIEEM, 2020) and it can be confirmed that aside from this slight adjustment of the survey method, the COVID-19 pandemic was not a significant limitation to achieving the aims of the bat activity surveys.

2.8.2 Culvert Inspection

Survey effort for Culvert 2 deviated from the standard guidance as this structure was only discovered in late August 2020 and standard dusk emergence survey methods were not considered feasible for this structure given the location within a relatively steep sided water-filled ditch surrounded by dense vegetation cover. Therefore, endoscopic and torchlight surveys were undertaken to gather additional information on this culvert. The culvert could be inspected thoroughly, and bat roosts were identified (see 3. Results). Given that a full visual inspection was undertaken on three occasions and sufficient results were obtained, the adjusted survey approach for the culvert is not considered to be a significant limitation.

2.8.3 Dusk Emergence Surveys

The dusk emergence survey of Park Dene (private dwelling) was carried out relatively late in the bat survey season on the 24th September 2020. This survey was cancelled twice (once due to access issues and once due to poor weather). The property was assessed as having low potential; therefore, one survey is typically undertaken

⁶ The CIEEM (2018) value is given first with the corresponding Highways England *et al.* (2020) value given in brackets where applicable.

to provide sufficient information to conclude the likely absence of a bat roost. It can be confirmed that multiple dusk emergence surveys were undertaken at Halsall's Farm which was immediately adjacent to Park Dene and provided background information of bat activity within this location. In addition, the property will not be directly impacted by the Scheme. Overall, the survey of Park Dene was not considered to be a significant limitation to achieving the aims of the bat activity surveys.

2.8.4 Transect Surveys

No limitations to the transect surveys were encountered.

2.8.5 Automated Static Detector Survey

In June, the automated static detectors were deployed for a period of ten days. However, this period coincided with unseasonal wet weather with rain occurring on most nights. To overcome this potential limitation, the detectors were redeployed and sufficient data was captured in late June/early July.

2.8.6 Bat Call Analysis

Species identification by sonogram is limited (to a certain extent) by similarities in call structure. In addition, all bats can modulate their calls according to the habitats they are navigating, their behaviour and the information they require at the time. This imposes limitations on reliable analysis particularly in the genera *Myotis*. *Myotis* bat species in Lancashire are likely to be either Daubenton's bat, Natterer's bat, whiskered bat or Brandt's bat. Although their distribution is currently poorly understood, Alcaethoe bat (*Myotis alcathoe*) is thought to be extremely rare in Lancashire and much less likely to be present within the survey area.

Based on the known call parameters of the species flying within a similar environment, the majority of *Myotis* species calls were identified to be Daubenton's bats. This is supported by observations of their flight characteristics recorded during the transect surveys. The foraging range of Daubenton's bats are also strongly associated with the water environment (i.e. most calls were recorded along the canal). However, several *Myotis* bat calls recorded during the automated static detector surveys were not identifiable to species level and therefore, the presence of low numbers of other *Myotis* species listed above cannot be discounted.

2.8.7 Bats and Trees

It is important to note that bat roosts in trees are highly transitory in nature and the results of this assessment reflect the baseline conditions at the specific time of survey only. No evidence has been collected to provide an indication of the presence of bats roosts in any trees subject to survey; however, it is extremely difficult to provide conclusive evidence of the absence of a bat roost in a tree. Collins (2016) notes:

"Due to the limitations (of bat surveys of tree roosts) and from what is known about the ecology of tree-roosting bats, it is arguable that all trees with bat roosting potential should be considered part of a resource that will be used at one time or another by tree-roosting bats in order to determine the extent of impacts. Survey work on individual trees may confirm presence but is unlikely to conclusively confirm absence".

A precautionary approach will be applied during the interpretation of results in consideration of this factor and further guidance including the need for further surveys and/or appropriate mitigation is to be fully detailed in the Ecology Chapter (Chapter 6) of the ES.

3. Results

3.1 Climb and Inspect Surveys

No evidence of a bat roost was identified during the climb and inspect surveys. A total of 34 trees were subject to climb and inspect surveys and a further three trees (T13, T16 and T33) were deemed unsuitable for climb surveys so received dusk emergence surveys (see Section 3.2.1).

After the first climb and inspect survey, the potential of each tree to support roosting bats was re-categorised based on the findings of the survey using torch and/or endoscope. A total of six trees were categorised as high bat roost potential and 22 trees with moderate bat roost potential. The remaining six trees were re-classified as low bat roost potential and not subject to any further inspections (i.e. T5, T17, T36, T37, T52 and T56).

Following the first climb and inspect survey, the six high potential trees were subject to a further two surveys and the 22 moderate potential trees one additional survey.

The results of the climb and inspect surveys are presented in Table 3.1. Full survey details are presented in Table C.1 (Appendix C) and Figure 1 (Appendix A).

Table 3.1: Summary of Climb and Inspect Survey Results

Tree ID	Species (common name)	Grid Reference	Preliminary Bat Roost Potential	1st Climb & Inspect Survey	2nd Climb & Inspect Survey	3rd Climb & Inspect Survey
T1	Ash	SD4924431472	High	Moderate	No evidence	-
T2	Sycamore	SD4923331474	Moderate	Moderate	No evidence	-
T4	Oak	SD4922531485	Moderate	Moderate	No evidence	-
T5	Ash	SD4921531513	Moderate	Low	-	-
T7	Ash	SD4921731520	High	High	No evidence	No evidence
T8	Ash	SD4921731525	Moderate	Moderate	No evidence	-
T9	Beech	SD4921331525	Moderate	Moderate	No evidence	-
T10	Beech	SD4920831540	High	Moderate	No evidence	-
T15	Oak	SD4931131428	Moderate	Moderate	No evidence	-
T17	Oak	SD4921031356	Moderate	Low	-	-
T19	Oak	SD4928331415	Moderate	High	No evidence	No evidence
T22	Oak	SD4883231658	High	High	No evidence	No evidence
T23	Oak	SD4883731625	Moderate	Moderate	No evidence	-
T26	Oak	SD4957031313	High	High	No evidence	No evidence
T31	Beech	SD4951931353	Moderate	Moderate	No evidence	-
T32	Horse chestnut	SD4956331349	Moderate	High	No evidence	No evidence
T34	Horse chestnut	SD4957831336	High	High	No evidence	No evidence
T35	Horse chestnut	SD4957331340	Moderate	Moderate	No evidence	-
T36	Beech	SD4960731316	Moderate	Low	-	-
T37	Beech	SD4959431321	Moderate	Low	-	-

Tree ID	Species (common name)	Grid Reference	Preliminary Bat Roost Potential	1st Climb & Inspect Survey	2nd Climb & Inspect Survey	3rd Climb & Inspect Survey
T38	Oak	SD4922131676	Moderate	Moderate	No evidence	-
T39	Ash	SD4922631696	High	Moderate	No evidence	-
T40	Oak	SD4920431731	Moderate	Moderate	No evidence	-
T44	Oak	SD4909031544	Moderate	Moderate	No evidence	-
T45	Oak	SD4910331440	Moderate	Moderate	No evidence	-
T50	Oak	SD4900931448	Moderate	Moderate	No evidence	-
T52	Ash	SD4884531358	Moderate	Low	-	-
T53	Oak	SD4886231428	Moderate	Moderate	No evidence	-
T54	Sycamore	SD4886331513	High	Moderate	No evidence	-
T55	Oak	SD4895931654	High	Moderate	No evidence	-
T56	Oak	SD4898731663	Moderate	Low	-	-
T57	Sycamore	SD4919631603	Moderate	Moderate	No evidence	-
T58	Sycamore	SD4921531578	Moderate	Moderate	No evidence	-
T59	Oak	SD4922231581	Moderate	Moderate	No evidence	-

3.2 Dusk Emergence Surveys

3.2.1 Trees

No evidence of a bat roost was identified during the dusk emergence surveys on trees T13, T16 and T33. Table 3.2 provides a summary of the results of the dusk emergence surveys.

Table 3.2 Summary of Dusk Emergence Surveys on Trees

Tree	Grid Reference	Details of Survey Visit		Results Summary
		1 st Visit	2 nd Visit	
T13	SD4921731567	02/06/2020 Sunset: 21:32 Start: 21.15 Finish: 23.32 Sunset temp: 17°C Wind (Beaufort scale) ⁷ 1 Cloud: 100% Rain: Light drizzle 21.50-21.55	23/06/2020 Sunset: 21:46 Start: 21:31 Finish: 23:40 Sunset temp: 20°C Wind: 1 Cloud: 10% Rain: None	No emergence recorded. Foraging and commuting common pipistrelle and noctule recorded on both survey visits.
T16	SD4930731362	23/06/2020 Sunset: 21:46 Start: 21:31 Finish: 23.35 Sunset temp: 20°C	22/07/2020 Sunset: 21:24 Start: 21:06 Finish: 23:07 Sunset temp: 16°C	No emergence recorded. Frequent passes of noctule and common pipistrelle on both survey visits. One brown long-eared bat pass.

⁷ The Beaufort scale is an empirical measure (numbering 0 to 12) used to describe wind intensity based on observed conditions.

		Wind: 1 Cloud: 10% Rain: 0	Wind: 2 Cloud: 100% Rain: Light drizzle at start of survey. Moderate rain shower at 22:25 for 10 mins.	
T33	SD4955 531349	02/06/2020 Sunset: 21:33 Start: 21.15 Finish: 23.18 Sunset temp: 16°C Wind: 1 Cloud: 85% Rain: Light drizzle at 21.49 – 22.10.	24/06/2020 Sunset: 21:46 Start: 21.31 Finish: 23.31 Sunset temp: 22°C Wind: 1 Cloud: 0% Rain: None	No emergence recorded. Foraging activity of common pipistrelle, noctule, <i>Myotis</i> sp. and one brown long-eared bat recorded across both surveys.

3.2.2 Dusk Emergence Surveys – Structures

The PRA (Jacobs, 2020) identified a total of 12 structures with low to high bat roost potential. Table 3.3 summarises the results of the dusk emergence surveys of these structures. The following bat roosts were confirmed:

- Quaker's Bridge - Daubenton's bat day roost (two bats);
- Railway Cottages - Four common pipistrelle day roosts (one bat per roost); and
- Halsall's Farm (Building B1) - Common pipistrelle day roost (two bats).

Detailed results and photographs of the confirmed roosts are provided in Appendix D and the locations of the structures in which bat roosts were confirmed are illustrated in Figure 2 (Appendix A).

Table 3.3: Summary of Dusk Emergence Surveys for Structures

Structure and Grid Reference	Bat Roost Potential	Details of Survey Visit			Results Summary
Quaker's Bridge SD4906 431633	High	28/05/2020 Sunset: 21:27 Start: 21:12 Finish: 22:27 Sunset temp: 20°C Wind: 1 Cloud: 10% Rain: None	24/06/2020 Sunset: 21:46 Start: 21:31 Finish: 23:31 Sunset temp: 24°C Wind: 1 Cloud: 0% Rain: None	22/07/2020 Sunset: 21:24 Start: 21:06 Finish: 23:07 Sunset temp: 16°C Wind: 1 Cloud: 100% Rain: Light rain at start of survey.	Confirmed as Daubenton's bat day roost (two bats). On the second visit, two Daubenton's bats emerged from missing stonework on the underside of bridge at 22:38 and 23:07 (Photograph 1). Emergence flight lines continued along the canal to the west. No emergence recorded on the first or third visits. The roosting surface is stone and the has an entrance of no more than 5cm x 3cm, the internal dimensions could not be inspected due to the roosts position above water. High levels of <i>Myotis</i> species (almost exclusively Daubenton's) foraging

Structure and Grid Reference	Bat Roost Potential	Details of Survey Visit			Results Summary
					activity as well as moderate common pipistrelle and noctule activity were recorded.
Railway Cottages SD4908 531333	High	11/06/2020 Sunset: 21:41 Start: 21:26 Finish: 23:20 Sunset temp: 13°C Wind: 4 Cloud: 100% Rain: Light rain between 22:30 – 22:45	09/07/2020 Sunset: 21:39 Start: 21:24 Finish: 23:24 Sunset temp: 13°C Wind: 1 Cloud: 100% Rain: Moderate showers between 21:50 – 22:20	18/08/2020 Sunset: 20:33 Start: 20:18 Finish: 22:18 Sunset temp: 16°C Wind: 0 Cloud: 10% Rain: None	Four common pipistrelle day roosts confirmed (one bat per roost) The first visit recorded a single common pipistrelle emergence from under the overhanging eaves on the eastern elevation at 21:45 (Photograph 2). The second visit recorded; a single common pipistrelle emergence from the same place as the first visit at 21:46 (Photograph 2); a single common pipistrelle emergence from under the bargeboard on the eastern elevation at 22:02 (Photograph 3) and then a re-entry in to the same place at 22:03; a single common pipistrelle emergence from under the eaves on the northern elevation at 22:05 (Photograph 4) and then a re-entry in to the same place at 23:00. The third visit recorded a single common pipistrelle emergence from under the bargeboard on the northern elevation at 21:00 (Photograph 5). Emergence flight lines continued on to the railway line to the west or the hedgerows to the east.
Railway Cottages: Garage 1 (G1) SD4906 331340	Low	16/07/2020 Sunset: 21:32 Start: 21:16 Finish: 23:17 Sunset temp: 17°C Wind: 1 Cloud: 90% Rain: None	-	-	No bat roosts recorded. Low level of common pipistrelle activity. Commuting bats recorded moving east to west along the railway line.
Railway Cottages:	Low	22/07/2020 Sunset: 21:23 Start: 21:08	-	-	No bat roosts recorded. Low level of common pipistrelle activity.


Structure and Grid Reference	Bat Roost Potential	Details of Survey Visit			Results Summary
Garage 2 (G2) SD4910 231325		Finish: 23:09 Sunset temp: 16°C Wind: 2 Cloud: 100% Rain: Light rain throughout most of the survey.			
Park Dene SD4903 931272	Low	24/09/2020 Sunset: 19:03 Start: 18:48 Finish: 20:48 Sunset temp: 10°C Wind: 1 Cloud: 100% Rain: 0	-	-	No bat roosts recorded. Low level of common pipistrelle activity.
Halsall's Farm – B1 SD4901 031272	High	04/06/2020 Sunset: 21:35 Start: 21:20 Finish: 23:35 Sunset temp: 13°C Wind: 3 Cloud: 70% Rain: 0	21/07/2020 Sunset: 21:25 Start: 21:10 Finish: 23:10 Sunset temp: 20°C Wind: 0 Cloud: 60% Rain: 0	16/09/2020 Sunset: 19:23 Start: 19:08 Finish: 21:08 Sunset temp: 14°C Wind: 2 Cloud: 100% Rain: 0	Confirmed as common pipistrelle day roost (two bats). No roosts were recorded on the first or third visits. The second visit recorded the emergence of two common pipistrelle from under roof verge tiles on the western elevation at 21:01 (Photograph 6). Low to moderate levels of common pipistrelle and noctule activity were recorded throughout the surveys.
Halsall's Farm – B2 SD 48999 31261	Low	09/06/2020 Sunset: 21:40 Start: 21:25 Finish: 23:10 Sunset temp: 16°C Wind: 1 Cloud: 98% Rain: 0	-	-	No bat roosts recorded. Low levels of common pipistrelle and noctule activity recorded.
Halsall's Farm – B3	Moderate	04/06/2020 Sunset: 21:35 Start: 21:20 Finish: 23:35	21/07/2020 Sunset: 21:25 Start: 21:10 Finish: 23:10	-	No bat roosts recorded. Low levels of common pipistrelle and noctule activity recorded.

Structure and Grid Reference	Bat Roost Potential	Details of Survey Visit			Results Summary
SD 48997 31271		Sunset temp: 13°C Wind: 3 Cloud: 70% Rain: 0	Sunset temp: 20°C Wind: 0 Cloud: 60% Rain: 0		
Halsall's Farm – B4 SD 48997 31283	Low	10/06/2020 Sunset: 21:40 Start: 21:25 Finish: 23:20 Sunset temp: 13°C Wind: 3 Cloud: 80% Rain: 0	-	-	No bat roosts recorded. Low levels of common pipistrelle and noctule activity recorded.
Ashfield Lodge – Garage SD 49541 31395	Low	18/08/2020 Sunset: 20:33 Start: 20:17 Finish: 22:17 Sunset temp: 17°C Wind: 0 Cloud: 5% Rain: 0	-	-	No bat roosts recorded. Constant common pipistrelle activity throughout survey.
Ashfield Lodge – Bungalow SD 49527 31401	Low	18/08/2020 Sunset: 20:33 Start: 20:17 Finish: 22:17 Sunset temp: 17°C Wind: 0 Cloud: 5% Rain: 0	-	-	No bat roosts recorded. Constant common pipistrelle activity throughout survey.
Lea Road Railway Bridge SD 49614 31284	Low	13/08/2020 Sunset: 20:44 Start: 20:29 Finish: 22:19 Sunset temp: 26°C Wind: 2 Cloud: 20% Rain: 0	-	-	No bat roosts recorded. Occasional common pipistrelle flew under the bridge.

3.3 Culvert Inspection

Table 3.4 provides the results of the inspection of Culvert 2 (SD 48868 31569). The location and results from the inspection of Culvert 2 is provided in Appendix A, Figure 2.

Table 3.4: Results of Inspection

Date	Timings/Weather	Result of Inspection	Photograph
26/08/2020	Time: 13:00 Temperature: 13°C Wind: 3 Cloud: 80% Rain: 0	A single Daubenton's bat roosting in the stonework underneath the culvert. The roosting surface is stone and the size of the roost is no more than 15cm x 4cm x 3cm. Artificial lighting around the culvert is absent.	n/a
18/09/2020	Time: 15:00 Temperature: 9°C Wind: 2 Cloud: 90% Rain: 0	No bats recorded.	n/a
24/09/2020	Time: 13:30 Temperature: 12°C Wind: 2 Cloud: 70% Rain: 0	Two Daubenton's bats recorded roosting in the stonework underneath the culvert. Photo showing one bat.	

3.4 Transect Surveys

A summary of the results for all transect surveys is provided below, with detailed survey information for each transect survey provided Tables E.1 and E.2 (Appendix E) and Figure 3 (Appendix A).

3.4.1 Transect 1

Overall, bat activity was low across the whole transect and dominated by common pipistrelle with relatively low use by noctule and Myotis sp. The total passes recorded over the three visits were 172. Typically, activity comprised one to two bats foraging on an occasional to frequent basis.

The data suggest that the highest levels of activity on Transect 1 were at listening points T1.6 (85 passes), T1.4 (27 passes), T1.2 (23 passes) and T1.7 (22 passes). Listening points T1.6, T1.7 and T1.4 lie in close proximity to the canal which was noted to be the most optimal foraging resource within the survey area. T1.2 lies in close proximity to the railway line.

The highest number of bats observed within any single period was five, recorded at T1.6. These bats were foraging up and down the canal and included three common pipistrelle, two noctules and one Myotis sp. This location recorded the highest level of activity during surveys at Transect 1.

The remaining listening points across the survey visits recorded lower numbers of passes. The lowest levels or absence of bat activity were in areas of open pasture with limited linear features present.

3.4.2 Transect 2

Bat activity was also relatively low across the whole transect and dominated by common pipistrelle followed by noctule and just a single pass by *Myotis* sp. The total passes recorded over the three visits were 143.

The data suggest that the highest levels of activity on Transect 2 were at listening points T2.1 (52 passes), T2.3 (24 passes) and T2.5 (32 passes). Listening points T2.1 and T2.3 lie to the south of the survey area, along a mature tree line immediately north of the existing railway line. Listening point T2.5 lies along a mature hedgerow with trees within the centre of the survey area. This hedgerow is well connected to the Lancaster Canal (140m to the north). The data suggest that the main areas of activity are habitats which provide sheltered foraging opportunities and commuting links to the wider area. The majority of listening points recorded just one or two bats during each listening period.

The highest number of bats observed was four common pipistrelle, recorded between listening points T2.5 and T2.6 foraging in the tree line by the railway bridge adjacent to Railway Cottages.

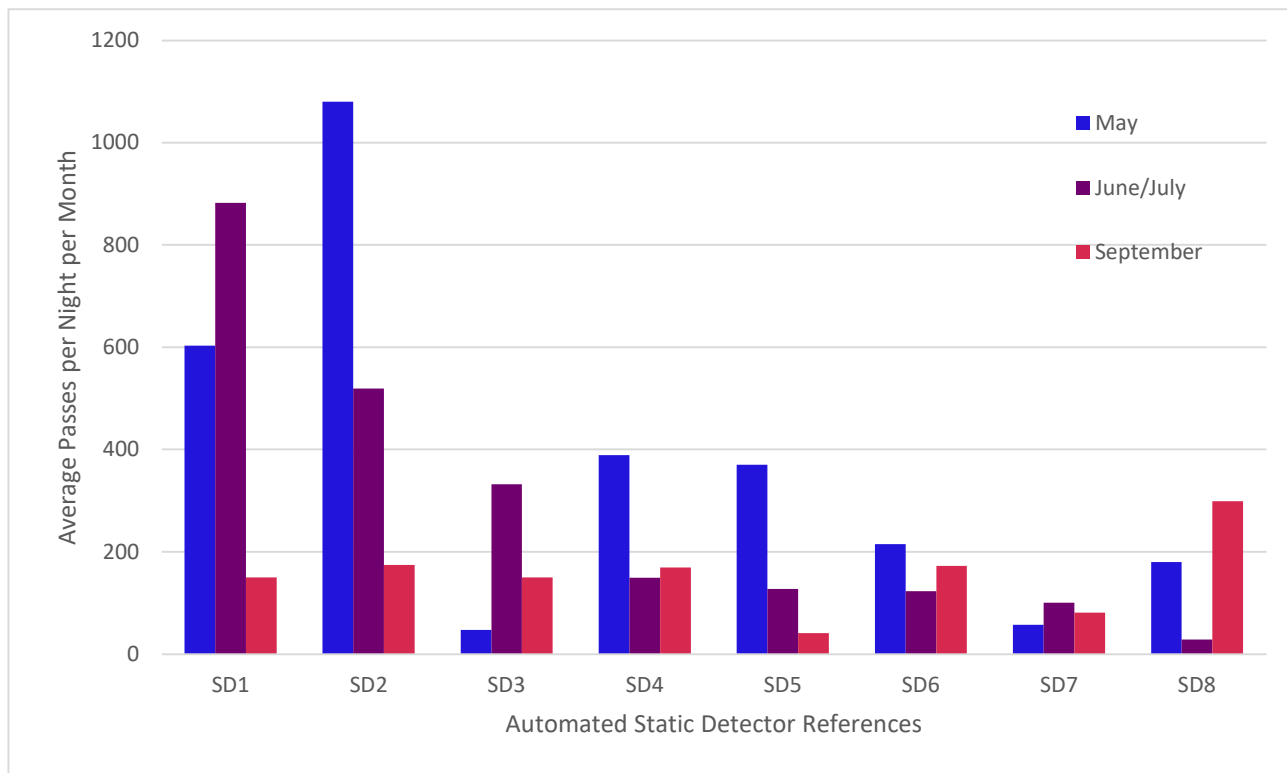
The remaining listening points across the survey visits recorded low numbers of passes. This indicates these areas are used for commuting or occasional foraging. The lowest levels or absence of bat activity were in areas of horse pasture devoid of any hedgerows or trees (for example, just a single common pipistrelle was recorded at listening point T2.6 (3 passes)).

3.4.3 Automated Static Detector Surveys

The locations of the automated static detectors are shown in Figure 3 (Appendix A). The weather data for the analysed nights is provided alongside detailed results in Tables F.1-F.3 (Appendix F). The results from each location are summarised in graphs 3.1-3.4.

Graph 3.1 shows SD1 and SD2 recorded the most passes with May and June/July experiencing the highest levels of activity but levelling off to a similar number of passes as the other detectors during September. SD1 was located on a mature treeline with direct connectivity to Lancaster Canal and SD2 was located immediately adjacent to the canal (Appendix A, Figure 3). Lancaster Canal was the most optimal foraging habitat for bats within the survey area. SD2 and to a lesser extent SD1 recorded more *Myotis* sp. passes (almost exclusively Daubenton's) which is a reflection of the proximity of SD1 and SD2 to the canal.

SD3 to SD8 recorded lower numbers of passes across the survey area and activity appeared to be relatively similar for these detectors. The automated static detectors recorded the most passes in May (14,708), followed by June (8,139) and September (6,161).

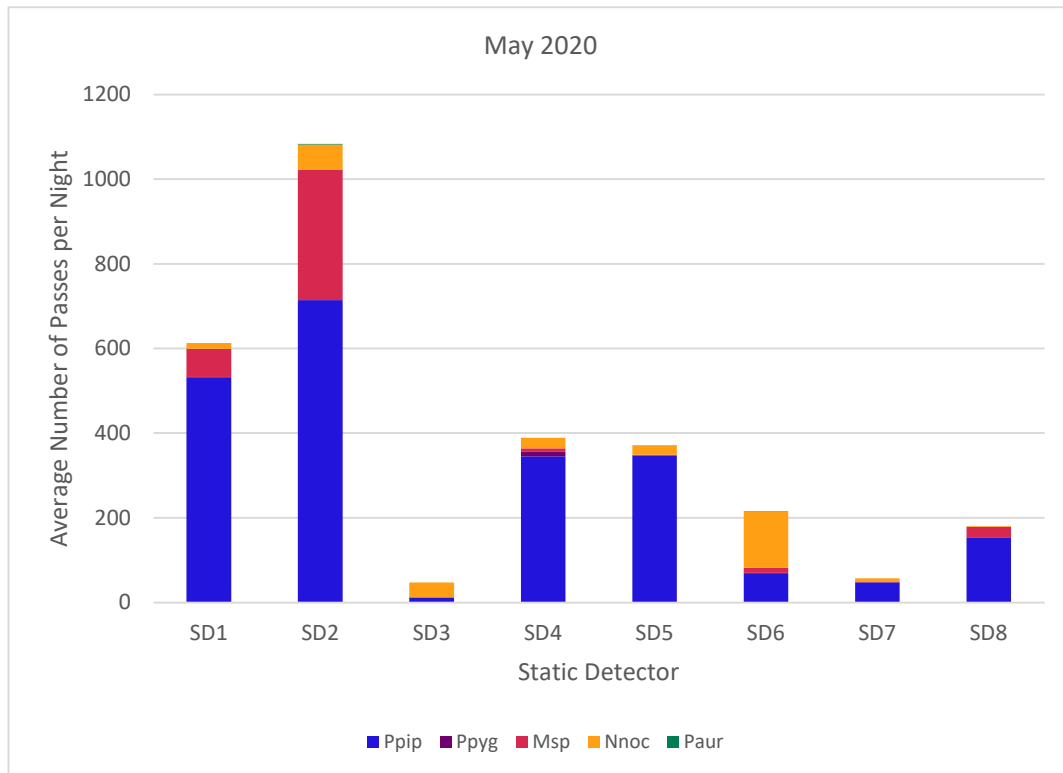
Graph 3.1: Average Total Passes per Night per Month

Graphs 3.2 – 3.4 provide a month by month summary of bat activity for each species. As is shown in Graph 3.1, SD1 and SD2 recorded a notable number of passes in May and June/July. Common pipistrelle were the most abundant species followed by *Myotis* sp., noctule, brown long-eared bat and soprano pipistrelle respectively.

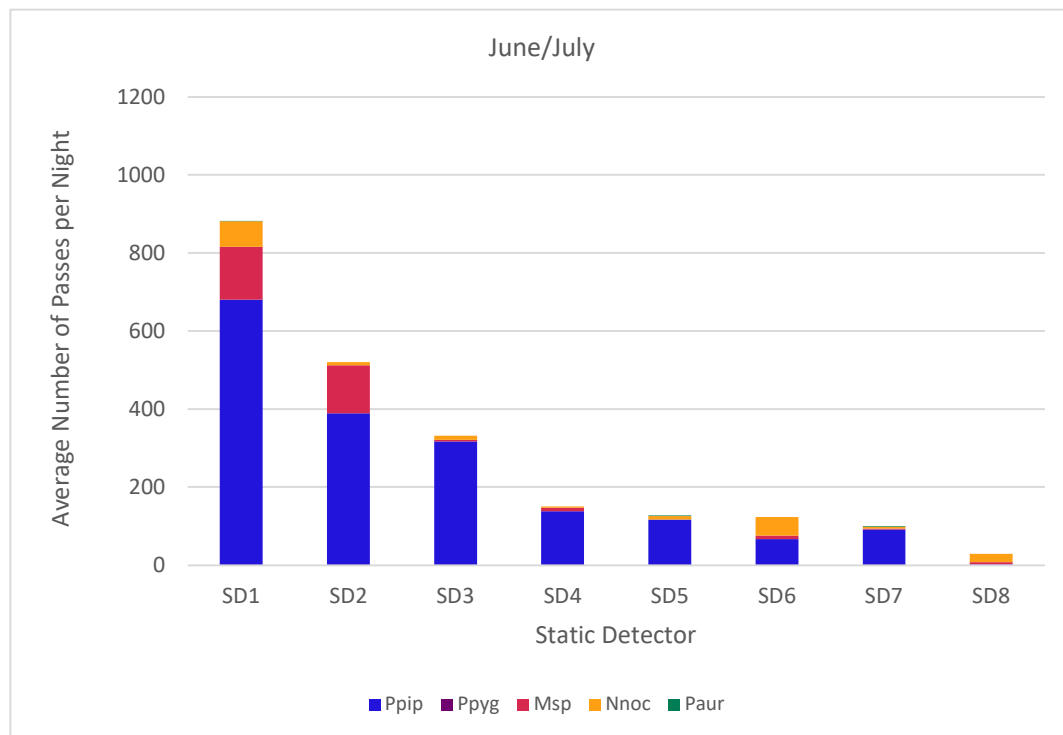
Noctules were recorded by all detectors. Higher numbers of noctule passes were recorded at SD6 during each deployment and surpassed common pipistrelle passes in the May survey.

Brown long-eared bats were recorded at detectors SD1, SD2, SD5, SD6 and SD7 in very low numbers and are likely just commuting or single foraging passes. Soprano pipistrelle were recorded in very low numbers across the site.

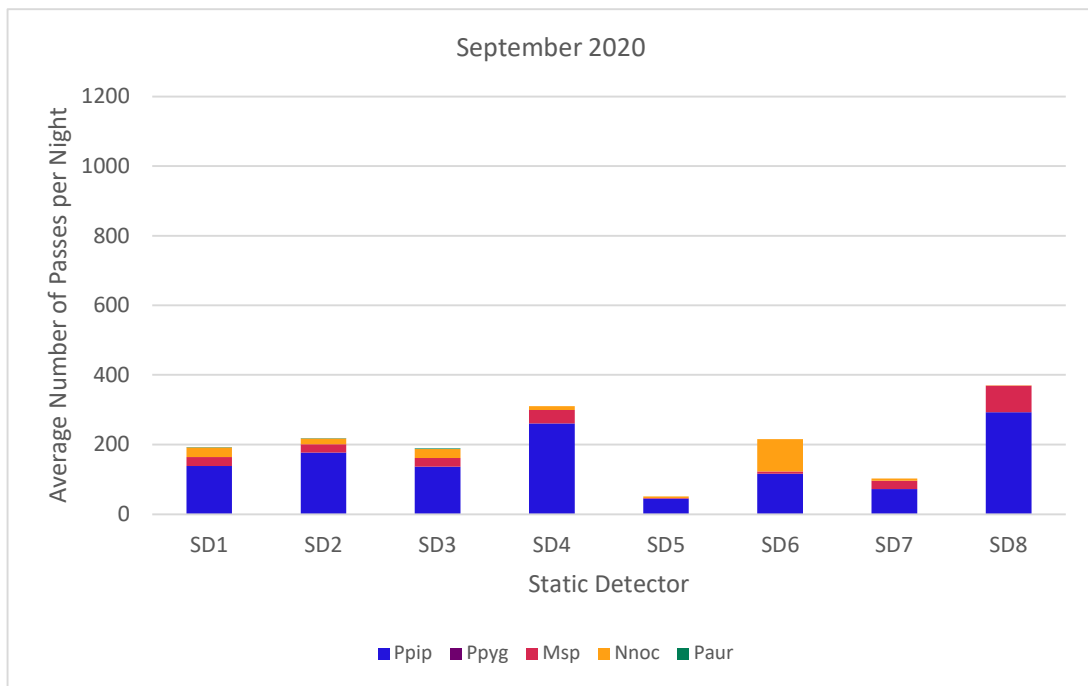
Graph 3.2: Average Species Passes per Night – May 2020



Graph 3.3: Average Species Passes per Night – June/July 2020



Graph 3.4: Average Species Passes per Night – September 2020



4. Evaluation

4.1 Bat Roosts

4.1.1 Culvert 2

Culvert 2 supports a Daubenton's bat day roost, comprising a maximum count of two bats. The roost was located underneath the culvert in between the stonework. The roost is characterised with a high degree of confidence as a day roost (for males or non-breeding females).

The gaps within the stonework, particularly those with deeper recesses, provide suitable hibernation conditions. Based on a precautionary principle, and without detailed survey information it has been assumed that the culvert will support Daubenton's bat over the hibernation period. The combined use of the culvert as a day and hibernation feature suggests that the Daubenton's bat roosts are of a moderate conservation significance (Mitchell-Jones, 2004).

4.1.2 Quaker's Bridge

Quaker's Bridge supports a Daubenton's bat day roost, comprising two bats (Appendix A, Figure 1). The roost was located in a single gap within the stonework on the underside of the archway (Appendix D, Photograph 1). The roost is characterised with a high degree of confidence as a day roost. The single gap within the stonework may provide suitable hibernation conditions.

It should be noted that a blue tit (*Cyanistes caeruleus*) was recorded roosting within this gap as observed during a wintering bird survey. Birds such as blue tit can outcompete and displace bats from roost sites (BTHK, 2018). Based on a precautionary principle, and without detailed survey information it has been assumed that the culvert will support Daubenton's bat over the hibernation period. The combined use of the culvert as a day and hibernation feature suggests that the Daubenton's bat roosts are of a moderate conservation significance (Mitchell-Jones, 2004).

4.1.3 Railway Cottages

Railway Cottages supports four common pipistrelle day roosts, each comprising a maximum of one bat (Appendix A, Figure 2). It is likely that the same bats are switching roosts around the property over the course of the main survey season (May to September). All of the roosts were recorded underneath the eaves or bargeboard, where there is a gap between the brick wall and roof tiles (Appendix D, Photographs 2-5). Currently, artificial lighting around the site is minimal. Consequently, each roost both collectively and individually is assessed as being of **low** nature conservation significance (Mitchell-Jones, 2004). Such roosting features are not typically associated with hibernation use; however, common pipistrelle do utilise a wide variety of roost types over winter. Overall, the use of Railway Cottages as a hibernation roost is considered unlikely.

4.1.4 Halsall's Farm – B1

Halsall's Farm - B1 supports a common pipistrelle day roost comprising two bats (Appendix A, Figure 2). The roost was recorded underneath the verge roof tiles on the western elevation (Appendix D, Photograph 6). Currently, artificial lighting around the site is moderate to high with some external security lights fitted around the farmstead. The roost is assessed as being of low nature conservation significance (Mitchell-Jones, 2004). Such roosting features are not typically associated with hibernation use; however, common pipistrelle do utilise a wide variety of roost types over winter. Overall, the use of Building B1 as a hibernation roost is considered unlikely.

4.2 Bat Activity

The results from the transect and static detector surveys largely align with common pipistrelle being the most recorded species by a significant margin. Common pipistrelle activity was characterised by the foraging activity of one to two bats recorded at infrequent to regular basis. As is typical, common pipistrelle utilise the linear habitats features including treelines, hedgerows, woodland edges and the canal. Lancaster Canal appeared to

support the most activity with common pipistrelle and Daubenton's bats utilising this waterway for commuting and foraging.

Commuting and foraging activity of one to two noctule bats were commonly recorded across the survey area. Noctule were typically recorded in hawking flights over the grazed pasture across the survey area. Whilst activity was commonly recorded and widespread, a higher proportion of the noctule activity was regularly recorded at SD6 as well as SD1 and SD2. No significant observations (in terms of numbers or commuting flight lines) were observed although noctule appeared to favour foraging over the horse grazed pasture within the locality of SD6.

Daubenton's bats were commonly recorded on the canal with numbers of bat generally limited to one or two bats. The confirmed Daubenton's bat roosts within both Quaker's Bridge and Culvert 2 are located on the canal or immediately adjacent and the canal provides an immediate commuting and foraging linkage for these roosts. The bat activity surveys also recorded low numbers of Myotis bats which could not be defined to species level. The very occasional presence of other Myotis species such as whiskered bats, Brandt's bats or Natterer's bats within the survey area is considered likely. As with common pipistrelle, Myotis bats will use the linear habitats within the area.

Very low levels of brown long-eared bat passes were recorded but the collected data does suggest the utilisation of the site by low numbers with no particular area of notable activity.

Soprano pipistrelle was found to be largely absent from the survey area with only seven passes recorded in total which is considered a very low prevalence of this species as compared to regional and national populations.

4.3 Biodiversity Importance

At least five species were recorded during the bat surveys undertaken within the Scheme including common pipistrelle, soprano pipistrelle, noctule, Myotis species and brown long-eared bat. Table 4.1 provides context to the findings and an evaluation of the importance of the bat populations recorded. The Myotis species recorded within the survey area was almost exclusively Daubenton's bats. However, a very low prevalence of other Myotis species (whiskered/Brandt's bats or Natterer's bats) is also likely and has been taken into account within the evaluation.

Population data is adapted from the National Bat Monitoring Programme Annual Report 2019 (Bat Conservation Trust, 2020), the desk study results from the PRA and the site survey results. This evaluation also takes into account the common pipistrelle bat roosts recorded at Railway Cottages and Halsall's Farm along with the Daubenton's roosts recorded at Quaker's Bridge and Culvert 2.

There have been significant historical declines in bat populations dating back to at least the start of the 20th century (Bat Conservation Trust, 2020). Currently indications from the bat monitoring programme are that this decline is being arrested and even reversed which is likely due to current legislation and conservation action. Some species shown to have a stable population trend including Daubenton's bat, whiskered/Brandt's bat, noctule, and brown long-eared bat. In addition, species considered to have increased in comparison to the baseline year of monitoring (1999) include Natterer's bat⁸ and common pipistrelle. There is also provisional evidence that the population of soprano pipistrelle may have increased in comparison to the baseline year.

At a county level, under Lancashire Biological Heritage Site selection criteria Ma1(b), any site which regularly supports a roost of any species of bat, as included in Schedule 5 of the Wildlife and Countryside Act 1981 (as amended) should be put forward for consideration of a BHS (Lancashire County Planning Department, 1998). It should be noted that this does not extend to roosts located within domestic or industrial structures. However, consideration may be given to certain types of artificial structures including culverts and bridges. Therefore, this consideration for BHS site selection is compliant as the Daubenton's bat roosts are located within Culvert 2 and Quaker's Bridge. The BHS selection criteria also suggests that any type of roost (nursery, hibernation, etc.) may be selected. It must be noted that the guidelines for BHS selection criteria was first published in 1998 and bat

⁸ The population trend for Natterer's bat should be treated with caution until the effect of this species' roost switching behaviour on the Roost Count trend is better understood (Bat Conservation Trust, 2020).

roosts and their locations were much less understood and under recorded. In accordance with widely adopted guidance (Mitchell-Jones, 2004), greater conservation significance is given to roosts of rare and rarest species along with the type of roosts (i.e., maternity roosts are generally the most significant); therefore the type of roost (day and hibernation) and conservation significance of the national and local population has also to be factored in when considering the importance of the Daubenton's bat population within the survey area.

Collectively, the bat population within the survey area is considered to be of **Local/District** importance for biodiversity. Table 4.1 sets out the biodiversity importance of the population of each bat species recorded within the survey area and takes into account the considerations listed above.

Table 4.1 Conservation Status and Evaluation of the Bat Populations Recorded within the Survey Area

Species	UK Conservation Status	County and Local Distribution	Site Activity	Biodiversity Importance
Common pipistrelle	Widespread and common	Common pipistrelle are the most common species found within Lancashire and at the local level. Many activity and roost records provided by Lancashire Environment Record Network.	The most prevalent species recorded during all surveys. Day roosts of common pipistrelle recorded at Halsall's Farm and Railway Cottages.	Local
Daubenton's bat	Widespread and common	Poor distribution data available at a county and local level. All Myotis populations likely to be reflective of the UK population trends.	Frequently recorded on Lancaster Canal. Lancaster Canal provides an important foraging and commuting linkage for this species. Two day/hibernation roosts located within the survey area.	District
Noctule	Widespread and common	Poor distribution data available at a county and local level. County and local distribution may be reflective of the UK population trends although the relatively lower woodland coverage in Lancashire may lead to a more localised distribution.	Low numbers frequently recorded across the survey area.	Local
Brown long-eared bat	Widespread and common.	Relatively widespread and common at a county level. Several records provided by LERN.	Very low number of records. Partly attributed to low detectability rate.	Local
Soprano pipistrelle	Widespread and common	Poor distribution data available at a county and local level. County and local distribution may be reflective of the UK population trends	Recorded very rarely with seven passes only.	Less than Local

Species	UK Conservation Status	County and Local Distribution	Site Activity	Biodiversity Importance
		although the relatively lower woodland coverage in Lancashire may lead to a more localised distribution.		
Other Myotis species.	Natterer's and whiskered/Brandt's UK wide populations uncommon but widespread with stable populations	Poor distribution data available at a county and local level. County and local distribution may reflective of the UK population trends although the relatively lower woodland coverage in Lancashire may lead to a more localised distribution.	A number of Myotis species bat could not be attributed to Daubenton's bat; therefore, low levels of other Myotis species assumed.	Less than Local

5. Conclusions and Recommendations

5.1 Bat Roosts

5.1.1 Trees

No active tree roosts were recorded during the climb and inspect surveys or dusk emergence surveys of trees within the Scheme. However, as bat roosts are known to be highly transient in nature, standard mitigation measures will be required for any works which have the potential to affect any trees with bat roost potential.

5.1.2 Structures

The following bat roosts were confirmed to be present in the following structures:

- Quaker's Bridge - Daubenton's bat day roost (two bats).
- Railway Cottages - Four common pipistrelle day roosts (one bat per roost).
- Halsall's Farm (Building B1) - Common pipistrelle day roost (two bats).
- Culvert 2 - Two Daubenton's bat day roosts (one bat per roost).

Due to the structural conditions present, Culvert 2 and Quaker's Bridge are assumed to support hibernating roosts. No evidence of a bat roost was located within the other structures subject to survey (G1, G2, Park Dene, Halsall's Farm B2 - B4, Ashfield Lodge Garage, Ashfield Lodge Bungalow and Lea Road Railway Bridge) and based on these findings, it can be concluded that bat roosts were likely absent from these structures.

5.2 Bat Activity

Generally, bat activity across the survey area was low. Lancaster Canal appeared to support the most activity with common pipistrelle and Daubenton's bats utilising this waterway for commuting and foraging. Common pipistrelle were the most recorded species by a significant margin. Commuting and foraging activity of one to two noctule bats were commonly recorded across the survey area. Noctule were typically recorded foraging over the pasture across the survey area.

Daubenton's bats were commonly recorded on the canal with numbers of bat generally limited to one to two bats. The bat activity surveys also recorded low numbers of Myotis bats which could not be defined to species level. The very occasional presence of other Myotis species such as whiskered bats, Brandt's bats or Natterer's bats within the survey area is considered likely.

Very low levels of data were collected for brown long-eared bats but the collected data does suggest the utilisation of the site by low numbers with no particular area of notable activity.

Soprano pipistrelle was found to be largely absent from the survey area with only seven passes recorded in total.

5.3 General

Discussions are ongoing with regards to the Scheme design proposals and the impacts that the proposals will have on the bat roosts and the distribution and levels of bat activity identified within the survey area. The Scheme needs to apply the mitigation hierarchy and consider all design alternatives which avoid and minimise impacts to bats and their roosts. This process will need to be fully documented if an EPSM licence is required.

A robust assessment of the potential effects on bats associated with the Scheme is to be detailed within the Ecology Chapter (Chapter 6) of the ES, along with any prescribed avoidance, mitigation and compensation measures, opportunities for enhancement, requirements for pre and/or post construction monitoring and an assessment of residual impacts (where appropriate).

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Appendix A. Figures

Figure 1 – Climb and Inspect Survey Results

Figure 2 – Confirmed Roosts

Figure 3 – Transect Results and Static Detector Locations

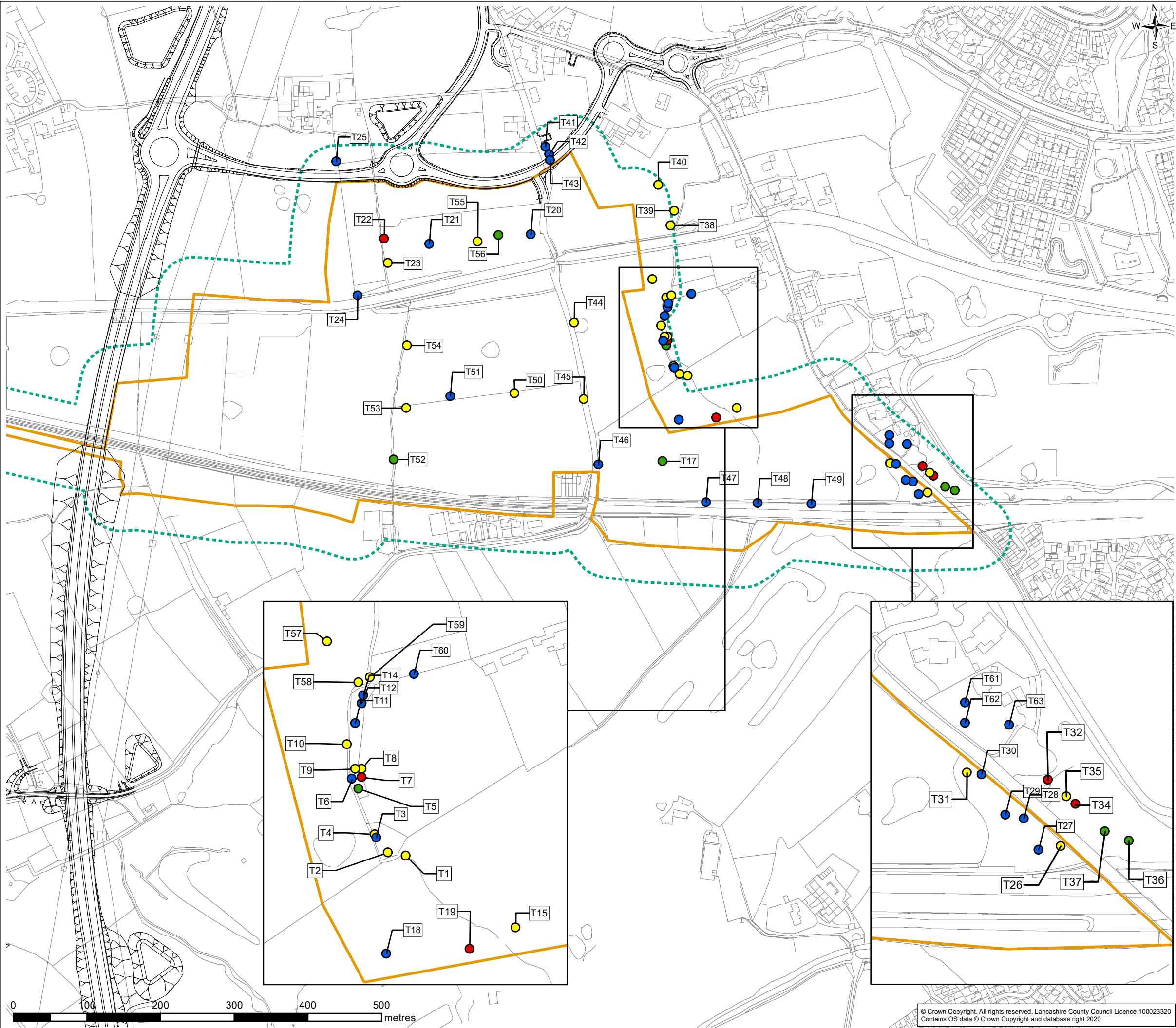



FIGURE 1

- Legend
- PWD Route
 - Scheme Boundary
 - - - 50m Buffer from the Scheme Boundary
- Bat Roost Potential Category**
- High Bat Roost Potential
 - Moderate Bat Roost Potential
 - Low Bat Roost Potential
 - Low Bat Roost Potential (Preliminary Roost Assessment)



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<div>Drawing Title</div> <div>CLIMB AND INSPECT SURVEY RESULTS</div>						
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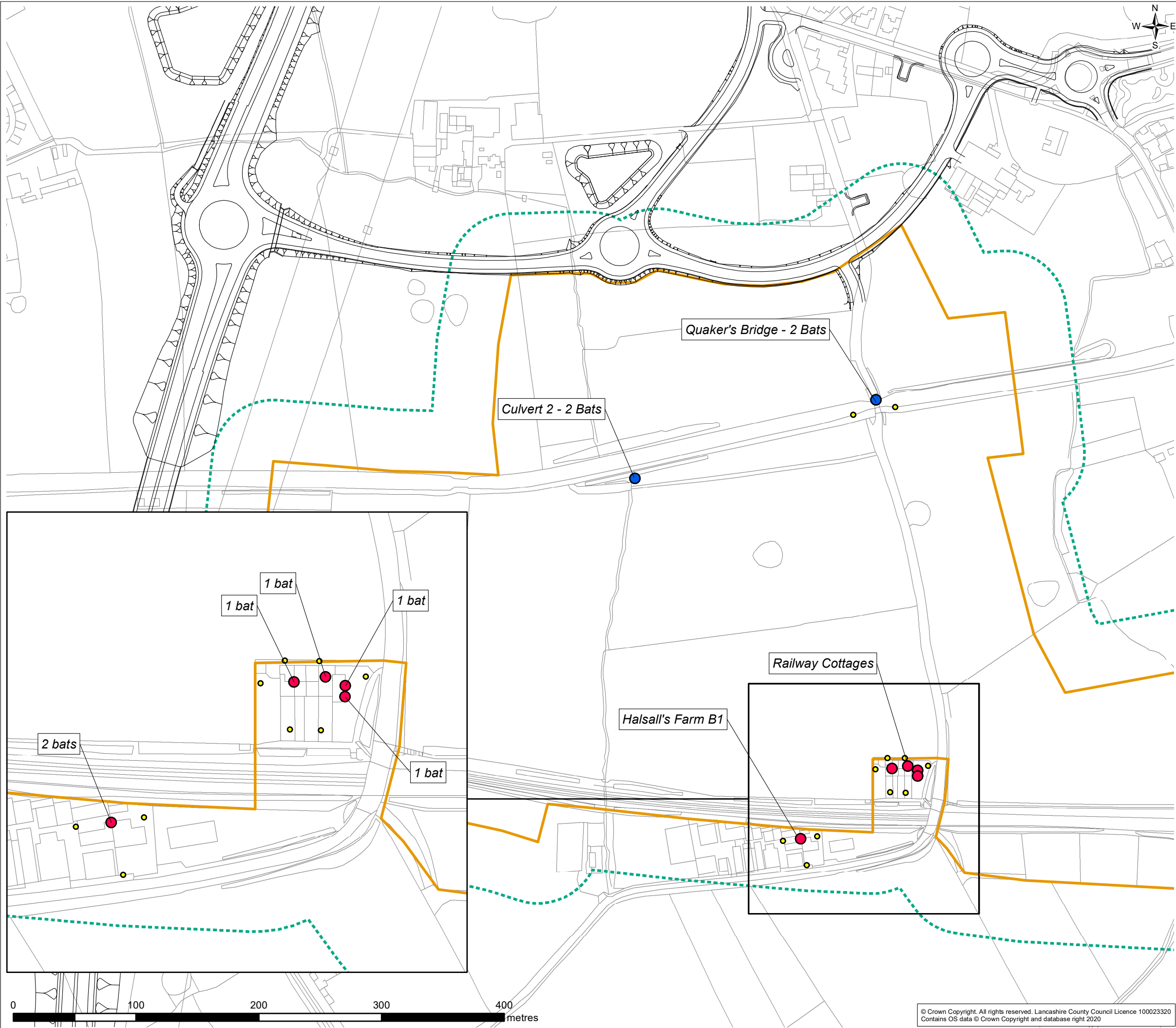


FIGURE 2

- Legend**
- PWD Route
 - ▭ Scheme Boundary
 - ⋯ 50m Buffer from the Scheme Boundary
- Species**
- Common Pipistrelle
 - Daubenton's Bat
 - Surveyor Position





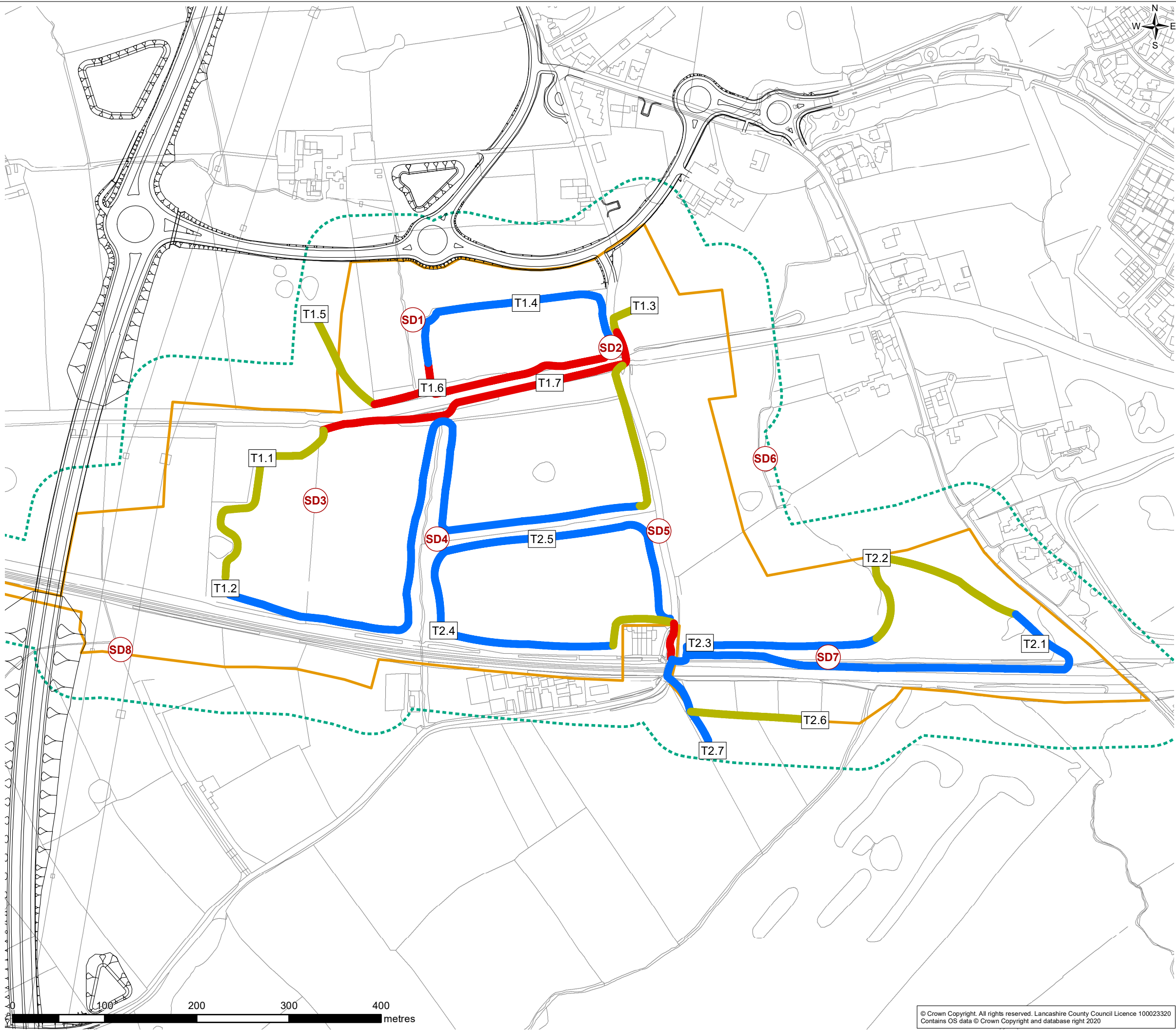
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FIGURE 3

- Legend
- PWD Route
 - Scheme Boundary
 - 50m Buffer from the Scheme Boundary
 - Static Detector Location
 - Listening Points
 - Bat Activity Level
 - Low Level Irregular Activity
 - Low Level Regular Activity
 - Moderate Regular Activity



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Appendix B. Bat Ecology and Legislation

Summary of Biology and Habitat Requirements

Bats have evolved a number of behavioural, physiological and morphological features connected with their ability to fly and their nocturnal activity patterns (Kunz, 1982). British bats are entirely insectivorous and have a complex sonar system known as echolocation that enables them to find their insect prey and navigate around their environment at night. Echolocation involves emitting a rapid series of high frequency calls and then interpreting the returning echoes to build up a picture of their surroundings.

Bats' habitat requirements vary widely both at an individual and species level. Certain features such as woodland edges and freshwater pools support the highest densities of insects and are therefore often focal points for foraging bats (Walsh and Harris, 1996a; Walsh and Harris, 1996b). Natterer's bat (*Myotis nattereri*) and brown long-eared bat (*Plecotus auritus*) for example mainly forage in woodland environments whilst Daubenton's bat (*Myotis daubentonii*) forage chiefly in areas associated with water. Pipistrelle (*Pipistrellus* spp.), noctule (*Nyctalus noctule*), Brandt's (*Myotis brandtii*), whiskered (*Myotis mystacinus*), serotine (*Eptesicus serotinus*) and Leisler's bats (*Nyctalus leisleri*) are generalist in their feeding strategies and forage around water bodies, woodlands, hedgerows and pasture (Altringham, 2003).

Bats use natural and man-made landmarks to navigate between roosts and foraging habitat (Schofield and Mitchell-Jones, 2003). Of importance are linear habitat features such as rivers, hedgerows and woodland edges as well as minor unlit roads or roads with hedgerows or tree lines. Distances that bats travel between roosts and foraging areas are variable both within and between species. For example; brown long-eared bats generally forage within 1 – 2 km of a roost, whereas pipistrelles generally forage within 3 – 4 km of a roost and a Leisler's may forage up to 14 km from its roost (Hundt, 2012).

Bats use different types of roosts at different times of the year and different roosts within the breeding season. Bats hibernate between late October and March in an unexposed roost with a stable temperature, typically a cave, mine, cellar or tunnel. Around March, bats emerge from hibernation sites and move to their summer roosts, typically within man-made structures or suitable crevices in trees. Some of these roosts are used regularly (i.e. every summer) and for substantial periods of time, whereas others serve as 'transitional roosts' being used for only one or two days every year or temporarily (e.g. for one season only). Births occur during the summer months (June to August). The numbers of bats using roosts can vary from a single bat to hundreds of bats in a nursery colony or hibernation site (Altringham, 2003). Mating takes place between late August and early December, either at the winter hibernating site or at autumn mating sites.

Legislation and Policy Framework

Bats and their resting places (e.g. bat roosts) are protected under the Wildlife and Countryside Act 1981 (as amended) by the Countryside and Rights of Way (CROW) Act 2000, and the Conservation of Habitats and Species Regulations 2017 (as amended).

The Conservation of Habitats and Species Regulations 2017 (as amended) transpose the European Union's 'Habitats Directive' (Council Directive 92/43/EEC) on the Conservation of Natural Habitats and of Wild Fauna and Flora (EC Habitats Directive) into UK law. The Regulations provide for the designation and protection of 'European Sites', the protection of 'European Protected Species' (EPS), and the adaptation of planning and other controls for the protection of European Sites. Bats and other EPS are listed on Schedule 2 of the Conservation of Habitats and Species Regulations 2017 (as amended).

Under the Wildlife and Countryside Act 1981 (as amended) it is an offence to:

- Intentionally kill, injure or take certain animals listed on Schedule 5 (including bats)
- Intentionally or recklessly damage or destroy any structure or place which any wild animal listed on Schedule 5 (including bats) uses for shelter or protection;

- Intentionally or recklessly disturb any such animal (including bats) while it is occupying a structure or place which it uses for shelter or protection; or
- Intentionally or recklessly obstruct access to any structure or place which any such animal (including bats) uses for shelter or protection.

In addition, under this legislation there are offences relating to sale, possession and control of wild animals listed in Schedule 5.

Under the Conservation of Habitats and Species Regulations 2017 (as amended) it is an offence to:

- Deliberately capture, injure or kill any wild animal listed as a EPS (including bats);
- Deliberately disturb wild animals of any such species in such a way as to be likely:
 - To impair their ability:
 - i) to survive, to breed or reproduce, or to rear or nurture their young, or;
 - ii) 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.
- Deliberately take or destroy the eggs of such an animal, or;
- Damage or destroy a breeding site or resting place of such an animal.

In addition, under this legislation there are offences relating to possession, control sale and exchange of an EPS.

National Planning Policy

National Planning Policy Framework 2018 (NPPF) and Section 40 of the Natural Environment and Rural Communities Act 2006 (NERC), places a duty on all public bodies including local planning authorities to consider habitats and species of Principal Importance listed in Section 41 of the NERC Act and Priority Species/Habitats within Biodiversity Action Plans when considering a planning application.

It is recognised by the NPPF that the planning system should contribute to and enhance the natural and local environment by protecting and enhancing valued landscapes, recognising the benefits of ecosystem services, minimising impacts on biodiversity and providing net gain where possible by establishing coherent and resilient wildlife networks. Furthermore, it prevents both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by, soil, air, water or noise pollution or land instability.

When determining planning applications, local planning authorities should aim to conserve and enhance biodiversity by applying the following:

- If significant harm from a development cannot be avoided, mitigated or compensated, then planning should be refused;
- Development within or outside SSSIs should not normally be permitted;
- Development proposals where the primary objective is to conserve or enhance biodiversity should be permitted as should those that encourage opportunities to incorporate biodiversity; and
- Development that would result in deterioration of irreplaceable habitats (such as ancient woodland etc.) should be refused unless the benefits outweigh the loss.

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Appendix C. Climb and Inspect Survey Results

Table C.1: Climb and Inspect Survey Results and Dates of Surveys

Tree Ref.	Species (common name)	Grid Ref.	Preliminary Roost Assessment (PRA) Results	Bat Roost Potential (PRA)	1 st Survey	Climb and Inspect Results	Bat Roost Potential (Climb and Inspect)	2 nd Survey	Results	3 rd Survey	Results
T1	Ash	SD4924 431472	PRF1: Knot hole on main stem. 6m high. SW aspect. PRF2: Rot hole within lower branch. 5m high. S aspect. PRF3: Rot hole within lower branch. 4m high. SW aspect.	High	04/06/20	PRF1: Not recessed. PRF2: Small cavity (150mm) in rot wood within branch. PRF3: Rot wood superficial only - no crevice present.	Moderate	19/06/20	No evidence	-	-
T2	Sycamore	SD4923 331474	PRF1: 3 connected rot cavities/rams horns on main stem. Between 7-10m high. All aspects.	Moderate	04/06/20	Squirrel use throughout. Upper cavity was enlarged knot hole which extended downwards by 350mm. Mid cavity extended downwards by 400mm - squirrel use evident. Lower cavity had a depth of 400mm with lots of slugs present.	Moderate	19/06/20	No evidence	-	-
T4	Oak	SD4922 531485	PRF1: Rot wood on branch with desiccation fissures. 4 m high. SW aspect.	Moderate	04/06/20	Minor shallow crevices, 20mm wide and of varying lengths. Potentially suitable for 1-2 bats.	Moderate	19/06/20	No evidence	-	-
T5	Ash	SD4921 531513	PRF1: 2 knot holes on same branch. 8m high. East aspect. PRF2: x 1 knot hole on main stem 6m. East aspect.	Moderate	04/06/20	No knot holes were sufficiently recessed for use by bats.	Low	-	-	-	-
T7	Ash	SD4921 731520	PRF1: Enlarged (by squirrel) rot hole on branch. 7m high. SE aspect. PRF2: Squirrel hole on main stem. 7m high. E aspect. PRF3: knot hole on limb. 15m high. E aspect.	High	04/06/20	PRF1: Squirrel present and feature not searched. PRF2: Squirrel droppings and bedding filling cavity. PRF3: Squirrel use evident again. All suitable cavities when not used by squirrel.	High	19/06/20	Squirrel present	10/07/20	No evidence
T8	Ash	SD4921 731525	PRF1: Rams horns with large rot cavity appears to connect to further hole just above.	Moderate	04/06/20	PRF1: Bird nesting material filling most of cavity and wood appeared blackened from	Moderate	19/06/20	No evidence	-	-

Tree Ref.	Species (common name)	Grid Ref.	Preliminary Roost Assessment (PRA) Results	Bat Roost Potential (PRA)	1 st Survey	Climb and Inspect Results	Bat Roost Potential (Climb and Inspect)	2 nd Survey	Results	3 rd Survey	Results
			4m high. E aspect. PRF2: rot cavity in branch 6m height. NE aspect.			lighting strike. PRF2: Feature not recessed.					
T9	Beech	SD4921 331525	PRF1: Main stem with rot wood cavity on upper part of tree. 3.5 to 4m high. NE aspect.	Moderate	04/06/20	All cavities fairly exposed and damp. No narrowing crevices present.	Moderate	19/06/20	No evidence	-	-
T10	Beech.	SD4920 831540	PRF1: Series of connected rot holes/rams horns on upper part of main stem. 3 to 5m high. E and S aspect.	High	04/06/20	Cavities fairly exposed and damp. Possibly suitable for 1-2 bats.	Moderate	19/06/20	No evidence	-	-
T15	Oak	SD4931 131428	PRF1: rot hole on limb. 4m high. SW aspect. PRF2: 2nd rot hole on end of same limb. 4m high. SW aspect. PRF3: Tear out and rot hole on main stem. 8m high. S aspect. Tree fairly isolated but adjacent to a small watercourse.	Moderate	19/06/20	PRF1: Dry cavity. Extended inwards along branch for 150-200mm. PRF2: Small dry pocket present, extending inwards by 100mm. Both features suitable for 1-2 bats. PRF3: No cavity present.	Moderate	10/07/20	Cobwebs filling both PRF1 and 2.	-	-
T17	Oak	SD4921 031356	PRF1: Rot hole in limb at 7m high leading to a larger rot hole immediately above. S aspect.	Moderate	04/06/20	All features superficial with no recessed crevices present.	Low	-	-	-	-
T19	Oak	SD4928 331415	PRF1: Longitudinal split within hazard beam with tear out facing upwards. 3.5m high. East facing branch. PRF2: Small knot hole on smaller stem. 6m high. S aspect.	Moderate	04/06/20	PRF1: Extensive cavity within 800mm split - open on either side so exposed; however split narrows further along stem with suitable crevice for multiple bats. PRF2: Not recessed.	High	19/06/20	No evidence	10/07/20	No evidence
T22	Oak	SD4883 231658	3 separate knot holes. PRF1: Enlarged (by squirrel) knot hole on limb. 5m high. E aspect. PRF2: Knot hole on	High	12/05/20	3 features all high potential - holes enlarged by squirrel. PRF1: Extends through limb by 500mm. Slugs present where	High	17/06/20	No evidence	10/07/2020	No evidence

Tree Ref.	Species (common name)	Grid Ref.	Preliminary Roost Assessment (PRA) Results	Bat Roost Potential (PRA)	1 st Survey	Climb and Inspect Results	Bat Roost Potential (Climb and Inspect)	2 nd Survey	Results	3 rd Survey	Results
			branch. 4m high. E aspect. PRF3: Knot hole on upper limb 12m high. E aspect.			feature narrows. PRF2: Dry cavity extending through limb around 450mm. Blue tit nest in one 10m east. PRF3: Blue tit nest present - not fully inspected.					
T23	Oak	SD4883 731625	PRF1: Partly healed tear out 5m above bottom of ditch. E aspect. PRF2: Deadwood from remains of large fallen limb. Some ivy cladding and raised bark. 3m high. S aspect. All appeared superficial with no crevices.	Moderate	12/05/20	PRF1 & PRF2: Features not recessed. However narrow cavity found under tear out on limb above watercourse (PRF3). 4 height. SW aspect. Suitable for 1-2 bats.	Moderate	17/06/20	No evidence	-	-
T26	Oak	SD4957 031313	PRF1: Potential crevices within snapped off limb. 7m high. S aspect. PRF2: Cavity within large snapped limb 10m high. N aspect.	High	05/06/20	PRF1: Small crevice between healed wood and rot wood. Extending by 50mm x 100mm. Suitable for 1-2 bats. PRF2: Split within snapped wood extending inwards by 100mm.	High	10/07/20	PRF1: Wet feature - less suitable. PRF2: None.	26/08/20	No evidence
T31	Beech	SD4951 931353	PRF1: Knot hole leading into heartwood towards base of tree. 1.5 m high. S aspect. Endoscopic examination required only.	Moderate	05/06/20	PRF1: Heartwood rotted out leaving extensive cavity from 1-5m to 2m. Feature low to the ground so maybe more suitable as a transitional/hibernation.	Moderate	10/07/20	No evidence	-	-
T32	Horse chestnut	SD4956 331349	PRF1: Cavity in snapped limb on western aspect of tree. 6m high. W aspect. PRF2: Cavity in snapped limb 8m height. W aspect. PRF3: Two adjacent knot hole. 7m high. E aspect.	Moderate	05/06/20	PRF1: Squirrel present within gnawed out cavity in snapped limb. PRF2: Squirrel use evident. Dry feature - 400mm depth. PRF3: Wren nest present in lower knot hole. Upper knot hole not recessed.	High	26/08/20	No evidence	-	No evidence
T34	Horse chestnut	SD4957 831336	PRF1: Rot hole on large branch on southern aspect of tree with cavity leading into	High	05/06/20	All PRF enlarged by squirrel and all leading into extensive cavity within main stem. Extends	High	10/07/20	No evidence	26/06/20	No evidence

Tree Ref.	Species (common name)	Grid Ref.	Preliminary Roost Assessment (PRA) Results	Bat Roost Potential (PRA)	1 st Survey	Climb and Inspect Results	Bat Roost Potential (Climb and Inspect)	2 nd Survey	Results	3 rd Survey	Results
			stem. Approx. 4m high. PRF2: Rot hole with deep cavity leading into heartwood. Extensive cavity in main stem. 2.5m high. N aspect.			upwards by 800mm and narrows.					
T35	Horse chestnut	SD4957 331340	PRF1: Squirrel hole on main stem leading into heartwood. 2m high. S aspect. PRF2: Smaller rot hole with bird nesting material at base. Gap narrows to a dry crevice. 1.5m high. W aspect.	Moderate	05/06/20	PRF1: Extends downwards by 200mm and upwards by 400mm. Slugs present and feature fairly damp. PRF2: Dry features extending upwards by 150mm. Birds nest filling much of cavity.	Moderate	10/07/20	No evidence	26/08/20	-
T36	Beech	SD4960 731316	PRF1: Knot hole in branch. 12m high. N aspect. Unable to accurately see if cavity is recessed.	Moderate	19/06/20	PRF1: Feature not recessed.	Low	-	-	-	-
T37	Beech	SD4959 431321	PRF1: Series of 4 knot holes on main stem. Between 5-8m high. W and S aspect.	Moderate	19/06/20	PRF1: All features too shallow for use by bats.	Low	-	-	-	-
T38	Oak	SD4922 131676	PRF1: Linear cavity on branch. 8m high. N aspect.	Moderate	17/06/20	PRF1: Cavity was split on either side (direct sight through split to other side) so fairly exposed. However, it did narrow upwards leaving potential crevice for 1-2 bats.	Moderate	10/07/20	No evidence	-	-
T39	Ash	SD4922 631696	PRF1: Rot wood cavity in branch. Approx. 5m. NW aspect. PRF2: Minor rot hole further along same branch. Did not appear recessed.	High	17/06/20	PRF1: Small pocket extending to around 150mm. Suitable for 1-2 bats. PRF2: Not recessed – Moderate.	Moderate	10/07/20	No evidence	-	-
T40	Oak	SD4920 431731	PRF1: Large open cavity in main stem which may narrow. 4m high. S aspect. PRF2: Smaller cavity in main	Moderate	17/06/20	PRF1: Cavity was exposed though there was a small narrowing on the upper side - 100 to 150mm deep. PRF2:	Moderate	10/07/20	No evidence		-

Tree Ref.	Species (common name)	Grid Ref.	Preliminary Roost Assessment (PRA) Results	Bat Roost Potential (PRA)	1 st Survey	Climb and Inspect Results	Bat Roost Potential (Climb and Inspect)	2 nd Survey	Results	3 rd Survey	Results
			stem. 4.5m high. SE aspect. Isolated tree within field.			Extensive cavity leading upwards by 400mm and downwards by 300mm into heartwood. Old birds' nest at bottom.					
T44	Oak	SD4909 031544	PRF1: Small rot hole in branch. 5m high. W aspect.	Moderate	05/06/20	PRF1: Circular opening around 40mm diameter. Extends upwards through branch by 300mm+. Dry cavity but slugs present.	Moderate	10/07/20	No evidence	-	-
T45	Oak	SD4910 331440	PRF1: Damaged section of roadside tree, possibly from HGV. Potential split within main stem. 7m high. E aspect.	Moderate	12/05/20	PRF1: Slight crevice under healed wood. Main feature is narrow (20mm) split extending inwards into branch leaving small narrow pocket for 1-2 bats.	Moderate	17/06/20	No evidence	-	-
T50	Oak	SD4900 931448	PRF1: Cavity within dead wood on branch. Approx. 4m high. S aspect.	Moderate	12/05/20	Confirmed small recess suitable for 1-2 bats. Upward facing so exposed to weather but dry at time of survey.	Moderate	17/06/20	No evidence	-	-
T52	Ash	SD4884 531358	PRF1: 2 knot holes in overhanging branches. Between 7-10m high. E aspect.	Moderate	12/05/20	PRF1: Knot holes not recessed.	Low	-	-	-	-
T53	Oak	SD4886 231428	PRF1: Dead wood cavity and rot feature on branch. 5-7m high. S aspect.	Moderate	12/05/20	PRF1: Small cavity in dead wood, potentially suitable for 1-2 bats.	Moderate	17/06/20	No evidence	-	-
T54	Sycamore	SD4886 331513	PRF1: Tear out in main stem. Potential cavity at top of tear out. 8m high. N aspect.	High	12/05/20	PRF1: Small, narrowing crevice above tear out. Extending upwards by 100mm. Potentially suitable for 1-2 bats.	Moderate	17/06/20	No evidence	-	-
T55	Oak	SD4895 931654	PRF1: Extensive damage in main stem from base upwards to 5m. Exposed heart wood throughout and several crevices underneath.	High	12/05/20	PRF1: Some small crevice opportunities present within deadwood that may potentially support 1-2 bats.	Moderate	17/06/20	No evidence	-	-

Tree Ref.	Species (common name)	Grid Ref.	Preliminary Roost Assessment (PRA) Results	Bat Roost Potential (PRA)	1 st Survey	Climb and Inspect Results	Bat Roost Potential (Climb and Inspect)	2 nd Survey	Results	3 rd Survey	Results
T56	Oak	SD4898 731663	PRF1: Flush cut with small rot wood hole. 3m. W aspect. PRF2: Split limb off main trunk. 5m high. S aspect.	Moderate	12/05/20	PRF1: Feature not suitably recessed. PRF2: Feature not suitably recessed.	Low	-	-	-	-
T57	Sycamore	SD4919 631603	PRF1: Knot hole cavity on main stem. 4m high. NW aspect.	Moderate	04/06/20	PRF1: Dry recessed features. Extending upwards by 400mm.	Moderate	19/06/20	No evidence	-	-
T58	Sycamore	SD4921 531578	PRF1: Rot hole cavity on main stem. 4m high. W aspect.	Moderate	04/06/20	PRF1: Dry recessed feature which extends upwards through the tree before narrowing at 300mm.	Moderate	19/06/20	No evidence		-
T59	Oak	SD4922 231581	PRF1: Knot hole on branch. 4m high. S aspect. PRF2: Dead wood fissures on main stem - all appear to be shallow. 2-3m high. All aspects.	Moderate	04/06/20	PRF1: Not recessed. PRF2: Several shallow cracks around main stem which may support 1-2 transitory bats.	Moderate	19/06/20	No evidence		-

Appendix D. Dusk Emergence Results and Photos – Structures

Photograph 1: Quaker Bridge – Daubenton's bat day roost comprising two bats (Visit 2)



Photograph 2: Railway Cottages – Common pipistrelle day roost emergence point (Visit 1 and Visit 2)



Photograph 3: Railway Cottages – Common pipistrelle day roost emergence and re-entry point (Visit 2)



Photograph 4: Railway Cottages – Common pipistrelle day roost emergence and re-entry point (Visit 2)



Photograph 5: Railway Cottages – Common pipistrelle day roost emergence point (Visit 3)



Photograph 6: Halsall's Farm B1 – Common pipistrelle day roost emergence point (Visit 2)



Appendix E. Bat Transect Survey Results

Table E1: Transect 1 Results

Listening Point	Habitat	19 th May 20 - Start temp: 14°C, end temp: 11°C; no rainfall and calm.					25 th June 20 - Start temp: 24°C, end temp: 16°C; dry with light wind and ~5% cloud. 21:46 – 00:31					3 rd September 20 - Start temp: 18°C, end temp: 16°C; light rain at 20:35 and intermittent until 21:20.					Total Passes
		P.pip	M.sp	N.Noc	Total	Notes	P.pip	M.sp	N.Noc	Total	Notes	P.pip	M.sp	N.Noc	Notes	Total	
T1.1	Woodland hedge, pasture	6	0	0	6	2 common pip foraging	1	0	0	1	1 common pip forage at LP	2	0	0	1 common pip commuting	2	9
T1.2	Railway, hedge, pasture	3	0	0	3	1 common pip foraging	17	0	0	17	1 common pip forage	3	0	0	1 common pip foraging	3	23
T1.3	Pasture, hedge	0	0	0	0	No activity	0	0	0	0	No activity	1	0	1	1 common pip commuting. 1 noctule commuting	2	2
T1.4	Hedge, scattered tree, pasture	1	0	6	7	1 noctule foraging. 1 common pip commute	2	0	0	2	1 common pip foraging	18	0	0	1 common pip foraging	18	27
T1.5	Pasture	4	0	0	4	1 common pip foraging	0	0	0	0	No activity	0	0	0	No activity	0	4
T1.6	Tree line, canal, pasture	41	1	11	53	3 common pip foraging. 2 noctule forage. 1 Myotis sp. commute.	2	0	1	3	1 noctule commute. 2 common pip commute	22	7	0	1 common pip foraging. 1 Myotis sp. foraging	29	85
T1.7	Canal, hedge, pasture	7	1	0	8	1 common pip forage. 1 Myotis sp. – commute.	7	2	0	9	3 common pip forage. 1 Myotis foraging	3	0	2	1 common pip commuting. 1 noctule commuting	5	22
Totals		62	2	17	81		29	2	1	32		49	7	3		59	172

Table E2: Transect 2 Results

Listening Point	Habitat	19 th May 20 - Start temp: 14°C, end temp: 11°C; no rainfall and calm. 21:13 – 23:44					25 th June 20 - Start temp: 24°C, end temp: 16°C; dry with light wind and ~5% cloud. 21:46 – 00:31.					3 rd September 20 - Start temp: 18°C, end temp: 16°C; light rain at 20:35 and intermittent until 21:20. 19:43-22:20					Total Passes
		P.pip	M.s p	N.No c	Notes	Total	P.pip	M.s p	N.No c	Notes	Total	P.pip	M.s p	N.No c	Notes	Total	
T2.1	Woodland edge, pasture	1	0	2	1 noctule foraging. 1 common pip commuting.	3	13	0	0	Max. count 2 common pips foraging	13	36	0	0	2 common pip foraging	36	52
T2.2	Scattered trees, pasture	2	0	0	1 common pip foraging near railway bridge	2	1	0	0	1 common pip commute	1	5	0	1	1 noctule and 1 common pip commuting.	6	9
T2.3	Railway, tree line, road, cottages	3	0	0	1 common pip foraging along tree canopy/railway	3	15	1	0	Max count of 2 common pips foraging along hedge. Four bat foraging in trees by cottages (not during count)	16	5	0	0	1 common pip foraging	5	24
T2.4	Railway, hedge, tree line	2	0	0	1 common pip foraging around tree canopy	2	2	0	0	2 common pip commuting	2	1	0	0	1 common pip commute	1	5
T2.5	Hedgerow, pasture	6	0	0	1 common pip foraging along hedgerow	6	2	0	0	1 common pip commute	2	24	0	0	2 common pip foraging	24	32
T2.6	Pasture	2	0	0	1 common pip commute.	2	0	0	0	No activity	0	1	0	0	1 common pip commuting	1	3
T2.7	Hedge, Pasture, Road	2	0	0	2 common pips, foraging around Railway Cottages.	2	0	0	0	No activity	0	7	0	9	1 noctule foraging and 1 common pip foraging	16	18
Totals		18	0	2		22	33	1	0		34	79	0	10	-	89	143

Appendix F. Static Detector Survey Results

Table F1: Automated Static Bat Detectors Detailed Survey Results - May

Static Detector	Date	Minimum Overnight Temp (°C)	Average Overnight Rainfall (mm)	Species					Total Bat Passes Per Night
				Common Pipistrelle	Soprano Pipistrelle	Myotis bat species	Noctule	Brown Long-Eared Bat	
S1	14/05/2020	7.2	0	45	0	0	4	0	49
	15/05/2020	7.2	0	568	1	6	15	0	590
	16/05/2020	10	0	973	0	275	12	0	1260
	17/05/2020	11	0	976	0	46	10	0	1032
	18/05/2020	12.04	0	54	0	2	31	0	87
S2	14/05/2020	7.2	0	225	0	26	12	1	264
	15/05/2020	7.2	0	412	0	31	42	0	485
	16/05/2020	10	0	1288	0	745	40	0	2073
	17/05/2020	11	0	977	0	641	100	0	1718
	18/05/2020	12.04	0	668	0	104	85	1	858
S3	14/05/2020	7.2	0	21	0	3	99	0	123
	15/05/2020	7.2	0	3	0	1	20	0	24
	16/05/2020	10	0	13	0	1	33	0	47
	17/05/2020	11	0	3	0	0	17	0	20
	18/05/2020	12.04	0	13	0	1	8	0	22
S4	14/05/2020	7.2	0	145	11	4	21	0	181
	15/05/2020	7.2	0	252	3	3	34	0	292
	16/05/2020	10	0	754	10	9	17	0	790
	17/05/2020	11	0	411	23	15	25	0	474
	18/05/2020	12.04	0	162	8	8	30	0	208

Static Detector	Date	Minimum Overnight Temp (°C)	Average Overnight Rainfall (mm)	Species					Total Bat Passes Per Night
				Common Pipistrelle	Soprano Pipistrelle	Myotis bat species	Noctule	Brown Long-Eared Bat	
S5	14/05/2020	7.2	0	63	0	1	7	0	71
	15/05/2020	7.2	0	141	0	2	7	3	153
	16/05/2020	10	0	744	0	2	48	0	794
	17/05/2020	11	0	420	0	3	27	1	451
	18/05/2020	12.04	0	365	0	2	16	0	383
S6	14/05/2020	7.2	0	25	2	2	15	1	45
	15/05/2020	7.2	0	65	1	1	113	0	180
	16/05/2020	10	0	169	1	24	200	0	394
	17/05/2020	11	0	86	0	12	234	0	332
	18/05/2020	12.04	0	0	0	19	103	1	123
S7	14/05/2020	7.2	0	6	1	1	2	0	10
	15/05/2020	7.2	0	14	1	0	4	0	19
	16/05/2020	10	0	53	0	1	10	0	64
	17/05/2020	11	0	86	0	1	11	0	98
	18/05/2020	12.04	0	76	0	4	15	0	95
S8	14/05/2020	7.2	0	0	0	1	0	0	1
	15/05/2020	7.2	0	85	0	7	0	0	92
	16/05/2020	10	0	451	0	53	0	0	504
	17/05/2020	11	0	184	0	51	0	0	235
	18/05/2020	12.04	0	49	0	15	3	0	67

Table F2: Automated Static Bat Detectors Detailed Survey Results – June/July

Static Detector	Date	Minimum Overnight Temperature (°C)	Average Overnight Rainfall (mm)	Species					Total Bat Passes Per Night
				Common Pipistrelle	Soprano Pipistrelle	Myotis bat species	Noctule	Brown Long-Eared Bat	
S1	29/06/2020	13.17	193	1551	0	99	132	0	1782
	30/06/2020	12	55	70	0	72	86	1	229
	01/07/2020	13.92	50	85	0	14	36	0	135
	02/07/2020	12	198	41	0	3	125	0	169
	03/07/2020	12	20	35	0	3	1	0	39
S2	29/06/2020	13.17	193	626	0	310	0	0	936
	30/06/2020	12	55	538	0	156	31	0	725
	01/07/2020	13.92	50	336	0	23	0	0	359
	02/07/2020	12	198	461	0	38	11	5	515
	03/07/2020	12	20	7	0	0	0	3	10
S3	29/06/2020	13.17	193	773	0	8	5	0	786
	30/06/2020	12	55	3	0	1	31	0	35
	01/07/2020	13.92	50	10	0	4	8	0	22
	02/07/2020	12	198	1	0	0	12	0	13
	03/07/2020	12	20	2	0	1	0	0	3
S4	29/06/2020	13.17	193	262	0	22	2	0	271
	30/06/2020	12	55	221	0	9	2	0	188
	01/07/2020	13.92	50	68	0	4	3	0	75
	02/07/2020	12	198	17	0	0	0	0	17
	03/07/2020	12	20	16	0	0	0	0	16
S5	29/06/2020	13.17	193	7	0	0	15	0	271
	30/06/2020	12	55	271	0	0	19	0	188
	01/07/2020	13.92	50	188	0	0	2	3	193

Static Detector	Date	Minimum Overnight Temperature (°C)	Average Overnight Rainfall (mm)	Species					Total Bat Passes Per Night
				Common Pipistrelle	Soprano Pipistrelle	Myotis bat species	Noctule	Brown Long-Eared Bat	
	02/07/2020	12	198	115	0	3	2	1	121
	03/07/2020	12	20	4	0	0	0	0	4
S6	29/06/2020	13.17	193	22	0	0	14	0	271
	30/06/2020	12	55	128	0	11	78	0	188
	01/07/2020	13.92	50	106	0	25	94	0	225
	02/07/2020	12	198	101	0	3	40	3	147
	03/07/2020	12	20	6	0	0	0	0	6
S7	29/06/2020	13.17	193	131	0	4	2	0	271
	30/06/2020	12	55	18	0	1	7	2	188
	01/07/2020	13.92	50	43	0	7	8	0	58
	02/07/2020	12	198	53	0	14	0	1	68
	03/07/2020	12	20	134	0	4	0	0	138
S8	29/06/2020	13.17	193	2	0	0	0	0	271
	30/06/2020	12	55	0	0	21	24	0	188
	01/07/2020	13.92	50	4	0	3	0	0	7
	02/07/2020	12	198	7	0	1	0	0	8
	03/07/2020	12	20	3	0	0	0	0	3

Table F3: Automated Static Bat Detectors Detailed Survey Results - September

Static Detector	Date	Minimum Overnight Temp (°C)	Average Overnight Rainfall (mm)	Species					Total Bat Passes Per Night
				Common Pipistrelle	Soprano Pipistrelle	Myotis bat species	Noctule	Brown Long-Eared Bat	
S1	18/09/2020	8	0	2	0	0	20	0	22
	19/09/2020	10	0	4	0	8	32	0	44
	20/09/2020	9	0	19	0	4	25	0	48
	21/09/2020	7	0	49	0	8	24	1	82
	22/09/2020	8	0	479	0	70	25	2	576
S2	18/09/2020	8	0	192	0	62	13	2	269
	19/09/2020	10	0	326	0	29	14	1	370
	20/09/2020	9	0	99	0	23	12	1	135
	21/09/2020	7	0	54	0	32	18	0	104
	22/09/2020	8	0	227	0	13	19	1	260
S3	18/09/2020	8	0	2	0	0	20	0	22
	19/09/2020	10	0	4	0	8	32	0	44
	20/09/2020	9	0	19	0	4	25	0	48
	21/09/2020	7	0	49	0	8	24	1	82
	22/09/2020	8	0	470	0	80	25	2	577
S4	18/09/2020	8	0	48	0	4	12	0	64
	19/09/2020	10	0	403	0	94	18	0	515
	20/09/2020	9	0	85	0	12	11	0	108
	21/09/2020	7	0	39	0	21	13	0	73
	22/09/2020	8	0	114	0	30	3	0	147
S5	18/09/2020	8	0	149	0	2	18	0	169
	19/09/2020	10	0	88	0	8	8	0	104
	20/09/2020	9	0	75	0	1	5	0	81

Static Detector	Date	Minimum Overnight Temp (°C)	Average Overnight Rainfall (mm)	Species					Total Bat Passes Per Night
				Common Pipistrelle	Soprano Pipistrelle	Myotis bat species	Noctule	Brown Long-Eared Bat	
	21/09/2020	7	0	11	0	0	4	0	15
	22/09/2020	8	0	2	0	0	4	0	6
S6	18/09/2020	8	0	72	0	1	55	0	128
	19/09/2020	10	0	88	0	5	57	0	150
	20/09/2020	9	0	94	0	5	34	0	133
	21/09/2020	7	0	44	0	2	156	0	202
	22/09/2020	8	0	239	0	13	124	0	376
S7	18/09/2020	8	0	9	0	3	0	0	12
	19/09/2020	10	0	7	0	5	0	0	12
	20/09/2020	9	0	7	0	6	5	0	18
	21/09/2020	7	0	8	0	11	10	0	29
	22/09/2020	8	0	267	0	73	7	0	347
S8	18/09/2020	8	0	797	0	57	5	0	859
	19/09/2020	10	0	796	0	69	1	0	866
	20/09/2020	9	0	280	0	162	1	0	443
	21/09/2020	7	0	54	0	69	0	0	123
	22/09/2020	8	0	40	0	3	0	0	43