

Appendix 11.8: Bat Activity Technical Appendix



LAND NORTH OF BRYN LANE WREXHAM BAT ACTIVITY SURVEY REPORT

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Drawing G9134.024A - Bat Transect Route and Static Detector Locations

Drawing G9134.025A - Bat Transect Survey Results - Visit 1

Drawing G9134.026A - Bat Transect Survey Results - Visit 2

Drawing G9134.027A - Bat Transect Survey Results - Visit 3

Drawing G9134.028A - Bat Transect Survey Results - Visit 4

Drawing G9134.029A - Bat Transect Survey Results - Visit 5

Drawing G9134.030A - Bat Transect Survey Results - Visit 6

1.0 Introduction

1.1 The Environment Partnership (TEP) Ltd was commissioned in October 2021 by Net World Sports, to undertake bat activity surveys at Land North of Bryn Lane, Wrexham (hereby referred to as 'the site'). Ecological surveys are required to support an Environmental Statement that will inform proposals for a commercial development.

1.2 The proposed development is commercial in nature and encompasses:

Detailed Component:

- *Demolition of existing buildings, site clearance and preparation works, including removal of vegetation and reprofiling of topsoil, where necessary;*
- *Construction of a new warehouse unit, providing 33,595 sqm Gross External Area (GEA) for B1c (light industry appropriate in a residential area), B2 (general industrial) and B8 (storage & distribution) uses (Unit 2);*
- *Construction of 8 new smaller units (Units 3-7; 14-16), providing a total of 29,659 sqm GEA for B1c (light industry appropriate in a residential area), B2 (general industrial) and B8 (storage & distribution) uses;*

Outline Component:

- *Construction of up to 72,635 sqm GEA for employment uses (B1c (light industry appropriate in a residential area), B2 (general industrial) and B8 (storage & distribution) uses), ancillary retail/drive thru facilities and potential for a hotel and petrol filling station (A1, A3, C1 or sui generis). The overall quantum of A1, A3, C1 or sui generis use would not exceed 16,150 sqm GEA;*
- *The proposed buildings will be up to 28.5m in height above ground level;*

Site Wide

- *Access and parking provision, including new access junctions, internal roads, service yards and car and HGV parking. Two new junctions are proposed (in detail) providing vehicular access, as well as cycle and pedestrian access, from Bryn Lane/Industrial Estate Road with an additional access road for a substation. Car parking spaces, HGV trailer spaces and HGV lorry spaces are proposed across the application site;*
- *Retention and enhancement of some existing on-site green spaces and provision of landscaping around the application site; and*
- *Implementation of drainage/attenuation measures.*

Site Description

1.3 The site (central grid reference SJ 38614 51101) is approximately 37.21 ha in size and is located to the east of Wrexham in North Wales.

- 1.4 The site is bounded to the south by Bryn Lane and Wrexham Industrial Estate, to the north by Francis Lane, to the west by both Industrial Estate Road and Hugmore Lane (with associated residential properties), and to the east by open agricultural fields. The wider area predominantly comprises urban development to the west associated with Wrexham town centre, with open countryside present to the north and east and industrial estate to the south.
- 1.5 The site location within the context of the wider landscape is illustrated in Figure 1 below.

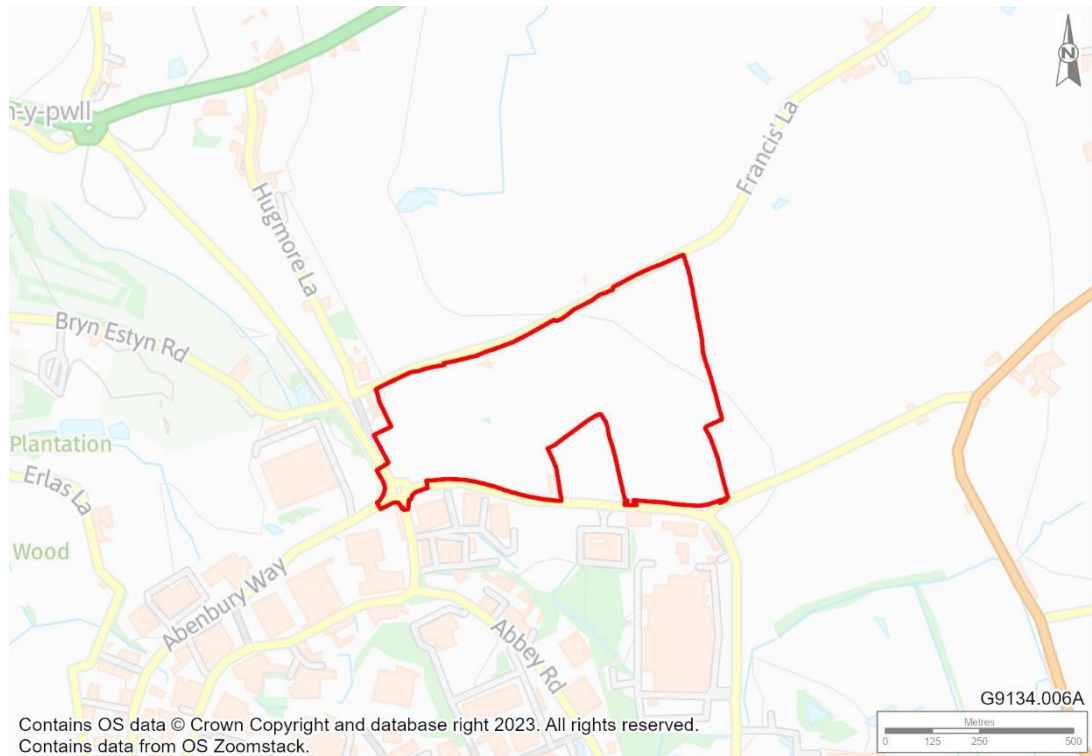


Figure 1: Site location plan

2.0 Legislation and Policy

- 2.1 Bat species and their roost habitat are afforded full protection by the following legislation:

Conservation of Habitats and Species Regulations 2017, as amended by the Conservation of Habitats and Species (Amendments) (EU Exit) Regulations 2019

- 2.2 Species listed under Schedule 2 of the Conservation Regulations 2017¹, referred to as 'European Protected Species' (EPS), including their breeding sites and resting places, are protected under Regulations 42 and 43. This makes it illegal to:

- Deliberately capture, injure or kill any such animal;
- Deliberately disturb such an animal;
- Deliberately take or destroy the eggs of such an animal; and
- Damage or destroy a breeding site or resting place of such an animal.

- 2.3 Under Regulation 55 of the Conservation Regulations 2017 (as amended), licences can be granted by Natural Resources Wales in respect of development to permit activities that would otherwise be unlawful, providing that the following 'three tests' are passed, namely:

- The development is for reasons of overriding public interest (or other purpose prescribed by Regulation 55(2));
- There is no satisfactory alternative (Regulation 55(9)(a); and
- The action authorised will not be detrimental to the maintenance of the population of the site concerned at a favourable conservation status in their natural range (Regulation 55(9)(b)).

- 2.4 Under Regulation 9(1) of the Conservation Regulations 2017 (as amended), competent authorities '*must exercise their functions which are relevant to nature conservation... so as to secure compliance with the requirements of the Directives*'. Regulation 9(3) requires a competent authority, in exercising any of its function, to '*have regard to the requirements of the Directives so far as they be affected by the exercise of those functions*.' Local planning authorities must therefore consider the above three 'tests' when determining if planning permission should be granted for developments likely to cause an offence under the Conservation Regulations.

Wildlife and Countryside Act 1981 (as amended)

- 2.5 The Wildlife and Countryside Act 1981 (WCA) (as amended)² transposes the obligations set out in the Bern Convention³ into national law. The Bern Convention aims to ensure conservation and protection of wild plant and animal species and their natural habitats, particularly where this requires cooperation between contracting parties.

¹ Conservation of Habitats and Species Regulations 2017 (as amended). SI 2017/1012. London: HMSO and The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019 No. 579.

² Wildlife and Countryside Act 1981: Elizabeth II. 1981 Chapter 69. (1981) London: Her Majesty's Stationery Office.

³ Convention on the Conservation of European Wildlife and Natural Habitats. Bern, 19.IX.1979.

- 2.6 Appendix II of the Convention includes animal species (fauna) strictly protected under special legal and management conservation measures, including the ban on capturing, keeping, disturbance, deliberate killing, possession and sale.
- 2.7 The WCA (as amended) is the major legal instrument for wildlife protection in the UK and provides a national level of protection to specific native animals. All bat species are listed in Schedule 5 of the WCA and, in addition to the provisions of the Conservation Regulations 2017, these species are therefore also afforded protection in respect of paragraph 9(4)(b) (disturbance while occupying a place or structure of shelter), paragraph 9(4)(c) (obstruction of access to a place or structure of shelter) and paragraph 9(5) (relating to possession and sale).

Environment (Wales) Act 2016

- 2.8 Under the Environment (Wales) Act (2016), Section 7 requires biodiversity lists to be produced. These lists include types of species which are of "Principle Importance" for the purpose of maintain and enhancing biodiversity in relation to Wales. This list supersedes the duty in Section 42 of the NERC Act 2006.
- 2.9 Bat species listed under Section 7 include Barbastelle bat *Barbastella barbastellus*, Bechstein's bat *Myotis bechsteinii*, Noctule *Nyctalus noctula*, common pipistrelle *Pipistrellus pipistrellus*, soprano pipistrelle *Pipistrellus pygmaeus*, brown long eared bat *Plecotus auritus*, greater horseshoe bat *Rhinolophus ferrumequinum* and lesser horseshoe bat *Rhinolophus hipposideros*.

Wrexham Biodiversity Action Plan (2002)

- 2.10 The lesser horseshoe bat is also listed under the Wrexham Local Biodiversity Action Plan (LBAP).
- 2.11 Species identified under the LBAP are 'priority species' included under the UK BAP list of 'priority species' and/or are locally significant 'priority species'. The LBAP is aimed at addressing changes in the distributions of 'priority species' and opportunities that arise for conservation action.

3.0 Methods

- 3.1 The following bat surveys were undertaken in accordance with the Bat Conservation Trust (BCT) Good Practice Guidelines (Collins, 2016⁴).

Activity Transect Surveys

- 3.2 Habitats within the site were reviewed as to their suitability to support foraging and commuting bats during desk-based scoping and during the Extended Phase 1 Habitat Survey in March 2022. Due to the large area of the site (37.21ha), the presence of hedgerows and scrub bordering all the fields within the site and the presence of some connectivity to higher quality foraging habitats within the wider landscape (e.g., woodlands, riparian corridors or pond networks), the site was categorised as having moderate habitat suitability in regard to commuting and foraging bats.
- 3.3 For details of categorisation of foraging and commuting habitats for bats see Table 1.

Table 1: Habitat suitability categorisation descriptions for commuting and foraging bats

Foraging and Commuting Habitat Suitability Category (as per BCT 2016)	Commuting/ Foraging Habitats Descriptions
High	Continuous high-quality habitat that is strongly connected with the wider landscape that is likely to be used regularly by commuting bats (e.g., river valley, vegetated stream, woodland edge, hedgerows with trees) or foraging bats (e.g., broad-leaved woodland, grazed parkland, tree-lined watercourses, or ponds). Site is close to and connected to known roosts.
Moderate	Continuous habitat connected to the wider landscape that could be used by bats for commuting (e.g., lines of trees or scrub or linked back gardens), or for foraging (e.g., trees, scrub, water, grassland).
Low	Habitat that could be used by small numbers of commuting bats (e.g., a gappy hedgerow or an un-vegetated stream) or foraging bats (e.g., a lone tree or small patch of scrub) but which is isolated from the surrounding landscape by other habitat. Suitable but isolated habitat that could be used by small numbers of foraging bats such as a lone tree (not in a parkland situation) or patch of scrub.
Negligible	Negligible features on site likely to be used by commuting or foraging bats. A general lack of linear features and low habitat, structural or floristic diversity.

- 3.4 Sites with moderate habitat suitability in regard to commuting and foraging bats require an activity transect survey to be undertaken during each month of the season (April-October); in appropriate weather conditions.

⁴ Collins, J (ed.) (2016) Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edn). The Bat Conservation Trust, London

- 3.5 Six walked activity transects were completed across the site; one in each month from May 2022 to October 2022. TEP was commissioned for these surveys in May and so no survey was undertaken in April. The transect route was designed to sample the range of habitats present across the site, focussing on those most likely to be affected by the development proposals. The Bat Transect Route and Static Detector Locations Drawing G9134.024A illustrates the pre-defined transect route walked on each survey visit.
- 3.6 Activity transect surveys commenced at sunset and continued for approximately two hours after sunset. The route was reversed on every other visit to reduce sampling bias. Dates, times and start and end conditions for each of the transects completed are summarised in Table 2. Standardised methods of measuring and recording weather parameters were used e.g., cloud cover (oktas) and wind (Beaufort Scale).

Table 2: Survey conditions for activity transect surveys

Date	Start Time	End Time	Sunset	Weather at Start				Weather at End			
				Temp. °C	Rain	Wind ⁵	Cloud ⁶	Temp. °C	Rain	Wind	Cloud Cover
27/05/2022	21:22	23:46	21:22	11	0	2	3	10	0	2	3
24/06/2022	21:41	23:52	21:41	17	0	4	8	14	Light	3	8
29/07/2022	21:11	23:26	21:11	16	0	1	6	16	0	1	8
25/08/2022	20:17	23:32	20:17	16	0	1	1	13	0	0	0
23/09/2022	19:08	21:33	19:08	14	0	1	1	11	Light	1	8
17/10/2022	18:12	20:16	18:12	13	0	1	0	10	0	2	0

- 3.7 The transect was walked at a slow, steady pace by trained TEP surveyors. The transect route was completed twice during each survey. Surveyors carried a full spectrum detector (Elekon Batlogger M) which incorporated a heterodyne detector. Bat passes⁷ during the transect, together with the maximum number of bats observed, the species identified, and any other contextual data such as flight direction, social calling or feeding buzzes were recorded.

⁵ Wind strength is reported using the Beaufort Scale of Wind Force, this scale runs from 0 to 12, information on the conditions experienced during surveys are as follows: 0 – Calm (vertical smoke); 1 – Light Air (slight smoke drift); 2 – Light Breeze (leaves gently rustle).

⁶ Cloud cover is reported in oktas or eighths (i.e. 0 oktas represents the complete absence of cloud, 1 okta cloud cover of 1 eighth or less, and so on to 8 oktas which represents full cloud cover), with the additional convention that 9 oktas represents sky obscured by fog or mist.

⁷ A bat pass is defined as the number of bat calls in a continuous sequence; each sequence or pass is separated by 1 second or more in which no calls are recorded (Hundt, 2012).

Limitations

- 3.8 The first transect was undertaken in May and the April survey was missed. However, the data collected from surveys undertaken in May are considered sufficient to represent the spring period. Furthermore, surveys in April in the north of the UK are often limited due to cold temperatures.
- 3.9 Temperatures were optimal throughout surveys with minimal wind and rain. Where wind was high on visits 1 and 2, it was recorded as short gusts of wind rather than continuous and bats were still recorded throughout. Therefore, there were no weather condition limitations to these surveys.

Static Remote Monitoring

- 3.10 Static monitoring of bat activity within the site was undertaken in conjunction with the activity transect survey visits. Static monitoring provides further information about bat species assemblage and activity levels within the site, complementing the activity transect survey data.
- 3.11 Static remote monitoring bat detectors (Anabat Express, set to night mode) were deployed at two fixed locations within the site, commencing in May 2022. The locations are described in Table 3.
- 3.12 Static monitoring locations are illustrated at the Bat Transect Route and Static Detector Locations Drawing G9134.024A. The static locations were non-random (as micro-siting was determined by habitat and/or potential impacts) and the spread of locations was designed to:
- Confirm the species assemblage using the habitats within the site;
 - Determine the relative activity and spatial distribution of bats across the site; and
 - Identify potential commuting / dispersal corridors.
- 3.13 Each detector was deployed on a monthly basis for a minimum of five consecutive nights. Detectors were deployed with standardised sensitivity settings. Further information regarding deployment locations, survey dates and survey conditions is provided in Table 3 and Table 4. Where detectors were deployed for over five nights, the nights with the most optimal conditions were selected for analysis.

Table 3: Static monitoring locations and recording periods

Static Detector Location	Survey Dates	Description of Location and Orientation of Microphone
A	27.05.22 - 31.05.22	Located within a cluster of mature trees in the west of the site. The trees are located within the centre of the western half of the site within a hedgerow that runs east to west as a boundary of the fields. The microphone faced north into the fields.
	24.06.22 - 28.06.22	
	22.07.22 - 26.07.22	
	25.08.22 – 29.08.22	
	23.09.22 - 27.09.22	

Static Detector Location	Survey Dates	Description of Location and Orientation of Microphone
	14.10.22 – 18.10.22	
B	27.05.22 - 31.05.22	Located within hedgerow in the eastern half of the site, the hedgerow runs north to south as a boundary to the fields with a ditch also present. The microphone faced east into the fields.
	24.06.22 - 28.06.22	
	22.07.22 - 26.07.22	
	02.09.22 – 06.09.22	
	23.09.22 - 27.09.22	
	14.10.22 – 18.10.22	

Table 4: Weather conditions during recording periods

Static Location	Survey Date	Time of Sunset	Time of Sunrise	Recording Time (mins)	Sunset Temp °C	Midnight Temp °C	Sunrise Temp °C	Wind Speed (km/h)	Wind Direction	Rain (hours)	Moon Illuminance (%)
A	27/05/22	21:21	04:56	N/A	16.25	10.25	9.75	10.0	Southeast	0	9%
A	28/05/22	21:23	04:55	N/A	11.75	9.75	9.50	6.0	Northwest	0	4%
A	29/05/22	21:24	04:54	N/A	11.00	9.50	8.00	6.0	East	0	1%
A	30/05/22	21:25	04:53	N/A	10.50	9.50	8.75	3.0	East	0	0%
A	31/05/22	21:26	04:52	N/A	11.50	9.00	9.25	5.0	Southeast	0	1%
B	27/05/22	21:21	04:56	56	16.25	10.25	9.75	10.0	Southeast	0	9%
B	28/05/22	21:23	04:55	57	11.75	9.75	9.50	6.0	Northwest	0	4%
B	29/05/22	21:24	04:54	189	11.00	9.50	8.00	6.0	East	0	1%
B	30/05/22	21:25	04:53	54	10.50	9.50	8.75	3.0	East	0	0%
B	31/05/22	21:26	04:52	58	11.50	9.00	9.25	5.0	Southeast	0	1%
A	24/06/22	21:42	04:46	300	19.50	14.25	11.75	17.0	North	1	20%
A	25/06/22	21:42	04:47	247	15.00	11.25	10.75	18.0	Northwest	1	12%
A	26/06/22	21:42	04:47	331	16.00	14.25	13.25	6.0	Northeast	1	7%
A	27/06/22	21:42	04:48	296	15.25	14.00	12.75	18.0	North	0	3%
A	28/06/22	00:42	04:48	229	14.75	14.50	13.25	12.0	North	1	0%
B	24/06/22	21:42	04:46	354	18.75	15.00	12.25	17.0	North	1	20%
B	25/06/22	21:42	04:47	334	15.00	11.25	10.75	18.0	Northwest	1	12%
B	26/06/22	21:42	04:47	363	16.50	14.75	14.00	6.0	Northeast	1	7%
B	27/06/22	21:42	04:48	367	15.75	14.50	13.50	18.0	North	0	3%

Static Location	Survey Date	Time of Sunset	Time of Sunrise	Recording Time (mins)	Sunset Temp °C	Midnight Temp °C	Sunrise Temp °C	Wind Speed (km/h)	Wind Direction	Rain (hours)	Moon Illuminance (%)
B	28/06/22	00:42	04:48	392	15.50	15.25	14.25	12.0	North	1	0%
A	22/07/22	21:21	05:15	50	17.00	15.75	11.75	7.0	Northwest	1	33%
A	23/07/22	21:20	05:16	386	19.00	17.00	17.50	9.0	Northeast	0	24%
A	24/07/22	21:19	05:18	315	18.25	16.25	15.00	3.0	Northeast	1	17%
A	25/07/22	21:17	05:19	0	15.00	13.75	12.00	6.0	Southeast	1	10%
A	26/07/22	21:16	05:21	0	15.25	12.00	10.00	2.0	South	0	5%
B	22/07/22	21:21	05:15	363	17.50	16.00	11.75	7.0	Northwest	1	33%
B	23/07/22	21:20	05:16	400	19.75	18.00	18.00	9.0	Northeast	0	24%
B	24/07/22	21:19	05:18	405	19.25	17.00	15.50	3.0	Northeast	1	17%
B	25/07/22	21:17	05:19	320	15.25	14.00	12.00	6.0	Southeast	1	10%
B	26/07/22	21:16	05:21	246	14.25	11.00	9.50	2.0	South	0	5%
A	25/08/22	20:17	06:11	501	17.00	12.00	12.75	6.0	Northwest	0	4%
A	26/08/22	20:14	06:13	495	19.50	16.00	15.25	6.0	Southeast	0	1%
A	27/08/22	20:12	06:14	228	18.50	14.50	12.00	6.0	Northwest	0	0%
A	28/08/22	20:10	06:16	527	21.50	18.50	16.50	1.0	South	0	2%
A	29/08/22	20:08	06:18	330	19.25	16.75	12.25	12.0	Southwest	0	5%
B	02/09/22	19:58	06:25	567	20.50	17.75	16.25	6.0	Northwest	0	28%
B	03/09/22	19:56	06:26	579	20.00	17.00	17.25	13.0	Northwest	0	29%
B	04/09/22	19:53	06:28	535	21.25	17.75	14.75	13.0	Northwest	1	50%
B	05/09/22	19:51	06:30	66	19.50	14.00	14.00	7.0	Northwest	1	62%
B	06/09/22	19:49	06:32	568	17.25	15.25	14.25	7.0	Northwest	2	73%
A	23/09/22	19:08	07:01	701	16.75	10.25	9.50	2.0	South	1	7%
A	24/09/22	19:05	07:02	523	13.50	8.00	6.25	1.0	South	1	2%
A	25/09/22	19:03	07:04	532	13.50	13.75	11.50	14.0	Southeast	1	0%
A	26/09/22	19:01	07:06	174	10.75	9.25	9.25	9.0	Southeast	5	1%
A	27/09/22	18:58	07:07	0	10.25	9.50	6.75	2.0	South	5	3%
B	23/09/22	19:08	07:01	553	16.50	10.50	9.50	2.0	South	1	7%
B	24/09/22	19:05	07:02	400	14.00	7.50	6.75	1.0	South	1	2%
B	25/09/22	19:03	07:04	622	13.75	14.50	12.00	14.0	Southeast	1	0%
B	26/09/22	19:01	07:06	600	11.50	9.50	10.00	9.0	Southeast	5	1%
B	27/09/22	18:58	07:07	451	11.00	9.75	7.00	2.0	South	5	3%
A	14/10/22	18:18	07:38	117	15.50	10.00	9.75	9.0	Northeast	1	82%
A	15/10/22	18:16	07:39	N/A	10.75	9.75	7.25	6.0	Northwest	1	73%

Static Location	Survey Date	Time of Sunset	Time of Sunrise	Recording Time (mins)	Sunset Temp °C	Midnight Temp °C	Sunrise Temp °C	Wind Speed (km/h)	Wind Direction	Rain (hours)	Moon Illuminance (%)
A	16/10/22	18:14	07:41	172	12.00	14.25	12.00	6.0	Northwest	0	64%
A	17/10/22	18:12	07:43	0	15.25	9.25	5.25	10.0	North	0	55%
A	18/10/22	18:09	07:45	43	14.00	10.00	12.00	2.0	South	0	45%
B	14/10/22	18:18	07:38	609	17.00	9.50	9.25	9.0	Northeast	1	82%
B	15/10/22	18:16	07:39	155	11.00	9.75	7.00	6.0	Northwest	1	73%
B	16/10/22	18:14	07:41	556	11.50	13.50	11.75	6.0	Northwest	0	64%
B	17/10/22	18:12	07:43	170	15.00	8.25	4.75	10.0	North	0	55%
B	18/10/22	18:09	07:45	106	13.50	9.50	11.25	2.0	South	0	45%

Limitations

- 3.14 Amendments to the red line boundary following the survey mean that a small area in the southwest of the site, comprised of a roundabout and adjacent habitat, was not subject to survey. However, this is not considered to be a significant constraint as the area is considered to be unsuitable for bat activity.
- 3.15 The first static detector monitoring was undertaken in May. This is outside the recommended period of April. It is not considered likely the survey missed a higher assemblage of bat species in the early spring as there were much higher numbers of bats during the summer months across the static detector surveys.
- 3.16 Moon illuminance is measured as a percentage of the moon's disk illuminated when it crosses the local meridian. Moonlight can increase the overall baseline measurement of lux on a site on a clear night by 0.25- 1 lux when full. Moon illuminance was high (>90%) during some of the transect surveys. It is unclear whether moon illuminance has an effect on bat activity however, some bat species are light-phobic and therefore activity by these species could be reduced on nights with high moon illuminance.
- 3.17 Temperatures were below 10°C on some of the static monitoring dates, particularly during the first visit (May 2022) as well as the 5th (September) and 6th (October). This is not considered to be a significant constraint as bat activity was still recorded on all visits at least at one static location and bats are typically active at temperatures above 6°C. Temperatures did fall to 4.75°C during the fourth night of the October visit, however these conditions are again not considered to be a significant constraint as bat activity was still recorded and this is typical of weather conditions during autumn months. Survey data was therefore considered to be representative of bat activity at the site during the autumn season.

- 3.18 Static monitoring periods for Static location A and B during visit 4 were undertaken on different dates due to equipment error. Location B was sampled in early September as opposed to August however, the sample dates are only 4 days apart and weather conditions during each sample period were similar, as such no significant constraint to the survey data is anticipated.
- 3.19 Bat activity was only recorded for 56 minutes on 27/05/22, 57 minutes on 28/05/22, 54 minutes on 30/05/22 and 58 minutes on 31/05/22 at static location B, but no errors were recorded on the log. It is assumed that the short recording is due to the absence of bat activity.
- 3.20 No bat activity was recorded at static location A on any of the five consecutive nights during Visit 1 between 27/05/22 – 31/05/22, but no errors were recorded on the log and the weather was optimal. Therefore, it is assumed that this is due to the absence of bat activity.
- 3.21 Bat activity was only recorded for 50 minutes on 22/07/22 and 0 minutes on both 25/07/22 and 26/07/22 at static location A, but no errors were recorded on the log. It is assumed that the short recording is due to the absence of bat activity.
- 3.22 Bat activity was only recorded for 66 minutes on 05/09/22 at static location B, 174 minutes on 26/09/22 and 0 minutes on 27/09/22 at static location A, but no errors were recorded on the log. It is assumed that the short recording is due to the absence of bat activity.
- 3.23 During visit 6, in October 2022, bat activity recording periods were low across both static locations, but no errors were recorded on the log. It is assumed that the short recording is due to the absence of bat activity. This is typical due to weather conditions during autumn months and so these results are considered to be representative of bat activity at the site during the month of October.
- 3.24 Rain was recorded on some evenings; however, bat activity was still recorded on all visits at least at one static location during these weather conditions and the survey data is therefore considered to be representative of the bat activity at the site.
- 3.25 Wind speed was high during some of the static monitoring periods. This was recorded as gusts rather than continuous wind. The effect of wind speed on bat activity varies depending on the topography of the landscape (Collins, 2016), however bat activity continued to be recorded during these periods and the effect of wind conditions on the data was therefore negligible and does not significantly impair confidence in the interpretation of the baseline data.
- 3.26 Foliage growth in trees throughout the survey period was overcome by the use of microphone extension cables, enabling deployment of the microphones at the edge of the canopy to avoid noise and deflection.

Data Analysis and Species Identification

- 3.27 Data recorded during bat surveys was analysed using Kaleidoscope Pro Analysis software. Data analysis was completed by TEP Consultant Ecologist Emma Hickson and TEP Assistant Ecologist Eleanor Millington.

- 3.28 Activity transect survey data was automatically geo-referenced and digitally mapped using GIS. Each species is colour coded and flight directions are provided where behaviour was observed.
- 3.29 For the purposes of presentation, data has been transformed to calculate Bat Activity Indices (BAI). For the majority of datasets and statistical analysis the BAI represents bat registrations per hour (brh), to account for different night lengths throughout the recording periods.
- 3.30 BAIs quantify the amount of use bats make of an area i.e., activity levels, not abundance. Consistency has been achieved throughout the static monitoring periods in regard to detector model, sensitivity and calibration, position and orientation and also subsequent sonogram analysis. High confidence can therefore be placed in the relative activity levels presented.

Limitations

- 3.31 Bats vary their calls dependent on the habitats they fly in and on their activity (commuting, foraging, social interaction, etc.). It is not always possible to identify bat calls to species level owing to the overlap of call parameters between some species and/or poor-quality recordings (e.g., brief and distant passes). *Myotis* species have overlapping call characteristics and it is therefore not always possible to identify these bats to species level with good confidence. In these cases, it is accepted that species are identified to genus level or group level (e.g., *Myotis* species, *Myotis/Plecotus* and *Nyctalus/Eptesicus*) (Russ, 2012⁸). Where call parameters are inconclusive the species has been labelled as 'unidentified'. This ensures the dataset is interpreted accurately and transparently.
- 3.32 The detectability of some bat species, such as *Plecotus* sp. is lower than that of, for example, *Nyctalus* sp. and *Pipistrellus* sp.. The echolocation calls of *Plecotus* sp. are comparatively more difficult to detect with bat detectors, and their particular hunting strategies take them into less open habitats, where survey transect routes may not venture. Careful interpretation has been applied when comparing survey results across species to account for this limitation.

⁸ Russ, J. (ed.), (2012). British Bat Calls: A Guide to Species Identification. Pelargic Publishing, Exeter.

4.0 Evaluation Method

- 4.1 For the purposes of this assessment and of assigning value to bats, the guidance set out in Wray et. al. 2010⁹ has been followed.
- 4.2 The guidance provided by Wray et. al. (2010) includes a framework for identifying the importance of bats in the landscapes through the evaluation of bat roosts and habitats. Applying this framework, bat roosts can be valued according to species rarity (Table 5) and roost status (Table 6).

Table 5: Species rarity in England (adapted from Wray et al. 2010)

Rarity	Species
Common (Population over 100,000)	Common pipistrelle <i>Pipistrellus pipistrellus</i> Soprano pipistrelle <i>Pipistrellus pygmaeus</i> Brown long-eared <i>Plecotus auritus</i>
Rarer (Population 10,000 to 100,000)	Lesser horseshoe <i>Rhinolophus hipposideros</i> Daubenton's <i>Myotis daubentonii</i> Natterer's <i>Myotis nattereri</i> Whiskered <i>Myotis mystacinus</i> Brandt's <i>Myotis brandti</i> Leisler's <i>Nyctalus leisleri</i> Noctule <i>Nyctalus noctula</i> Serotine <i>Eptesicus serotinus</i> Nathusius' pipistrelle <i>Pipistrellus nathusii</i>
Rarest (Population under 10,000)	Greater horseshoe <i>Rhinolophus ferrumequinum</i> Bechstein's <i>Myotis bechsteinii</i> Barbastelle <i>Barbastella barbastellus</i> Grey long-eared <i>Plecotus austriacus</i> Alcathoe <i>Myotis alcathoe</i> Greater mouse-eared <i>Myotis myotis</i>

Table 6: Valuation of roosts

Geographic Scale of Importance	Roost Type
Negligible	-
Site	-
Local	Feeding perches (common species); Individual bats (common species); Small numbers of non-breeding bats (common species); Mating sites (common species).

⁹ Wray, S., Wells, D., Long, E., Mitchell-Jones, T (2010) Valuing Bats in Ecological Impact Assessment. IEEM In-Practice. Number 70 (December 2010). Pp. 23-25

Geographic Scale of Importance	Roost Type
County	Maternity sites (common species); Small numbers of hibernating bats (common and rarer species); Feeding perches (rarer/rarest species); Individual bats (rarer/rarest species); Small numbers of non-breeding bats (rarer/rarest species).
Regional	Mating sites (rarer/rarest species) including well used swarming sites; Maternity sites (rarer species); Hibernation sites (rarest species); Significant hibernation sites for rare/rarest species or all species assemblages.
National	Maternity sites (rarest species); Sites meeting Sites of Special Scientific Interest (SSSI) guidelines based on bats.
International	Special Area of Conservation (SAC) sites with bats as qualifying species.

- 4.3 Wray et al. (2010) identifies a numerical scoring system which can be applied to commuting habitat (Table 7) and foraging habitat (Table 8). The score derived from these evaluations is then applied to the geographical scale proposed by the CIEEM EcIA guidelines (Table 9).

Table 7: Valuing commuting habitat for bats

Species (Score)		Number Of Bats (Score)		Roosts/Potential Roosts Nearby (Score)		Type and Complexity of Linear Features (Score)	
Common	2	Individual bats	5	None.	1	Absence of (other) linear features.	1
Rarer	5	Small number of bats	10	Small numbers.	3	Un-vegetated fences and large field sizes.	2
Rarest	20	Large number of bats	20	Moderate number/unknown.	4	Walls, gappy or flailed hedgerows, isolated well-grown hedgerows, and moderate field size.	3
				Large number of roosts, or close to a SSSI for the species.	5	Well-grown and well-connected hedgerows, small field size.	4
				Close to or within a SAC for the species.	20	Complex network of mature well-established hedgerows, small fields and rivers/streams.	5

Table 8: Valuing foraging habitat for bats

Species (Score)		Number Of Bats (Score)		Roosts/Potential Roosts Nearby (Score)		Type and Complexity of Features (Score)	
Common	2	Individual bats	5	None.	1	Industrial or other site without established vegetation.	1
Rarer	5	Small number of bats	10	Small numbers.	3	Suburban areas or intensive arable land.	2
Rarest	20	Large number of bats	20	Moderate number/unknown.	4	Isolated woodland patches, less intensive arable and/or small towns and villages.	3
				Large number of roosts, or close to a SSSI for the species.	5	Larger or connected woodland blocks, mixed agriculture, and small villages/hamlets.	4
				Close to or within a SAC for the species.	20	Mosaic of pasture, woodlands and wetland areas.	5

Table 9: Scoring system for commuting and foraging habitats

Score	Geographic Value
1 – 10	Not important
11 – 20	Local
21 – 30	County
31 – 40	Regional
41 – 50	National

5.0 Results

Activity Transect Surveys

- 5.1 The results of the activity transect surveys are illustrated on the Bat Transect Survey Results Drawings G9134.025A-030A.

Bat Species Assemblage

- 5.2 Figure 2 summarises the percentage composition of the species assemblage and the data label represents the mean BAI (bats registrations per hour) recorded over the six activity transect surveys.

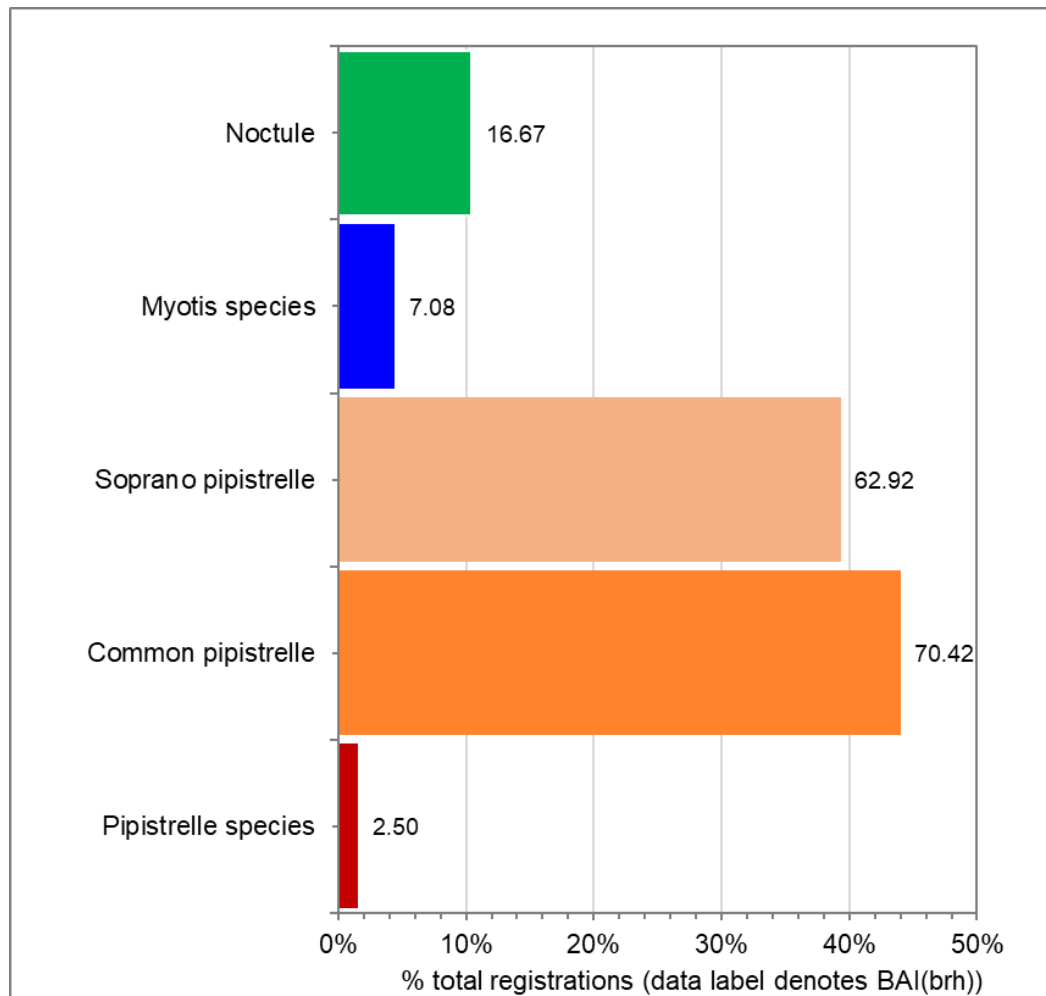


Figure 2: Species assemblage recorded – mean representation across all activity transect surveys

- 5.3 An assemblage of at least four species was recorded during the activity transect surveys. Common pipistrelle produced 44% of the contacts recorded during activity transect surveys, followed by soprano pipistrelle contributing 39.3% of contacts. Noctule bats produced 10.4% of the calls recorded during the surveys and Myotis species 4.4%. 1.6% of the calls recorded were unidentified pipistrelle species.

Seasonal Variation in Activity

- 5.4 Figure 3 illustrates the species assemblage BAI (bats registrations per hour) and species diversity by survey visit. There is a significant variation in the bat assemblage BAI between activity transect survey visits ($\chi^2=0$, $df=2$, $P<0.01$) with a positive correlation of number of species throughout the year and the highest recorded BAI during visit 3 (July) and visit 5 (September).

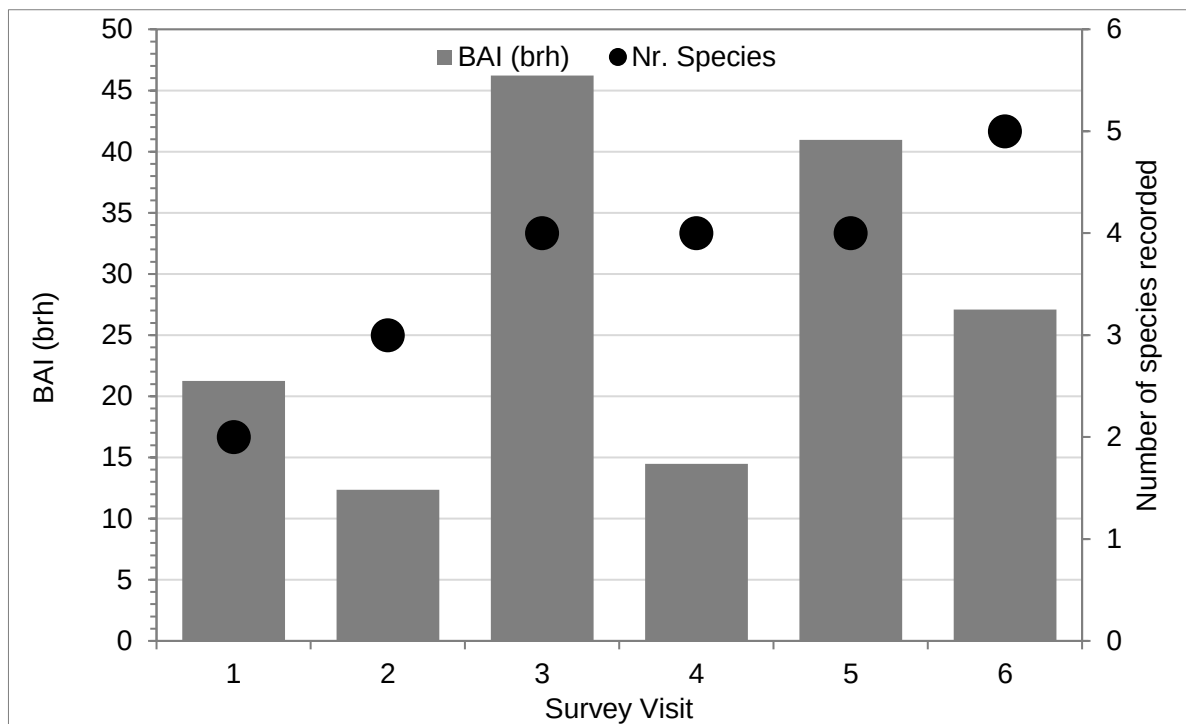


Figure 3: Species assemblage by activity transect survey visit

Spatial Variation in Activity

- 5.5 Bat activity was recorded across the site throughout the six activity transect surveys however, activity was predominantly noted along boundary features including the hedgerows and ditches and around the area of semi-improved grassland in the northeast of the site.
- 5.6 The highest levels of activity were noted during the July and September activity transect surveys with foraging observed along the boundary hedgerows, particularly in the west and the south east hedgerow on the east of the site and the ditches and tree lines in the centre of the site, north of the farm buildings. The spatial distributions of species recorded during the activity transect surveys are illustrated on Drawings G9134.025A-030A.

Foraging

- 5.7 Foraging activity, indicated by circular flight lines in Drawings G9134.025A-030A, was recorded frequently along the transect during each survey. Foraging was recorded by common pipistrelle, soprano pipistrelle and noctule bats. Over 66% of the total passes were recorded as pipistrelle species feeding buzzes; this finding is not surprising given the relative abundance of these species during each transect survey. Noctule foraging was recorded on average in 2.3% of the files analysed. The highest percentage of foraging was recorded in May, July and September with less in June and August. The key focal areas where foraging was recorded included the western hedgerows, central ditches and trees lines as well as hedgerows in the south east and the semi-improved grassland area.

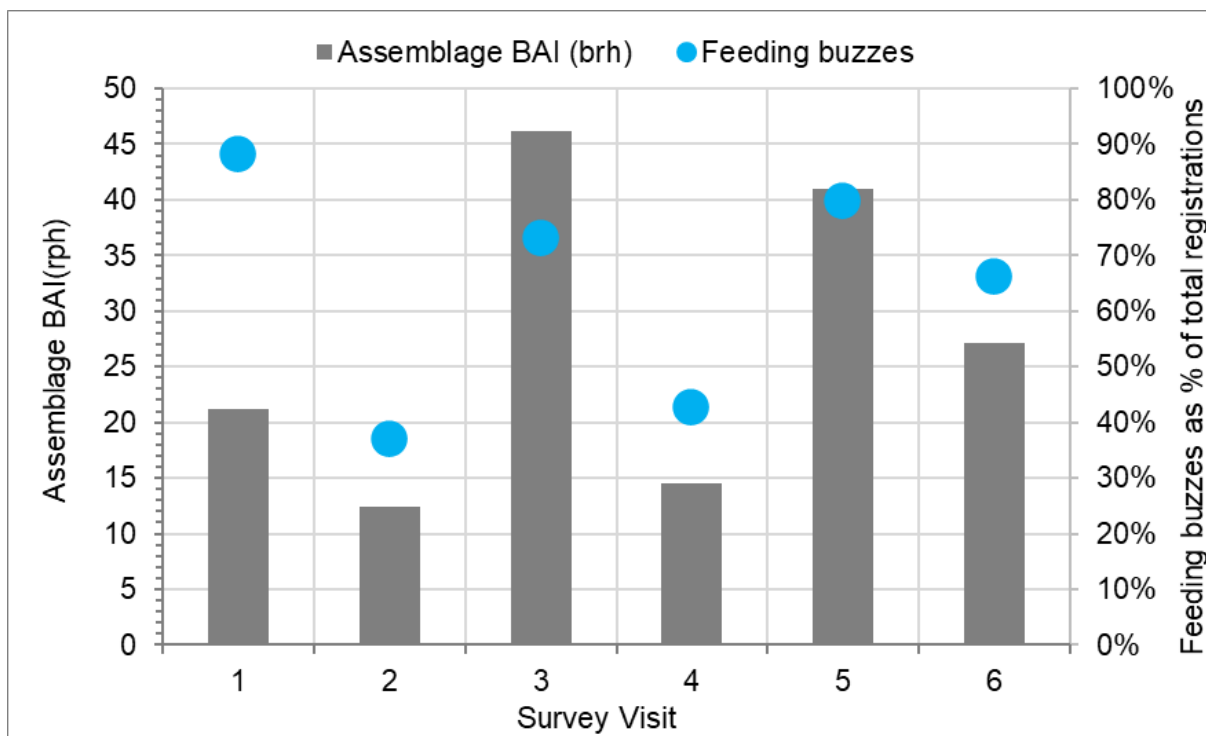


Figure 4: Foraging calls by activity transect survey visit

Social

- 5.8 Only 4.2% of the total calls recorded across all six transect visits were social calls. Soprano pipistrelles accounted for the highest percentage of social calls with 2.6% and common pipistrelles then had 1.3%. 0.3% of calls were recorded as a pipistrelle species social call.

Static Remote Monitoring

Bat Species Assemblage

- 5.9 Figure 5 illustrates the overall bat assemblage recorded from data analysed. A total of 2,970 bat passes were recorded across the two static monitoring detector locations during the six monitoring periods. An assemblage of at least five species was recorded similar to those recorded during the transect surveys: common pipistrelles, soprano pipistrelles, myotis species and noctule bats, with the addition of brown long eared bats.

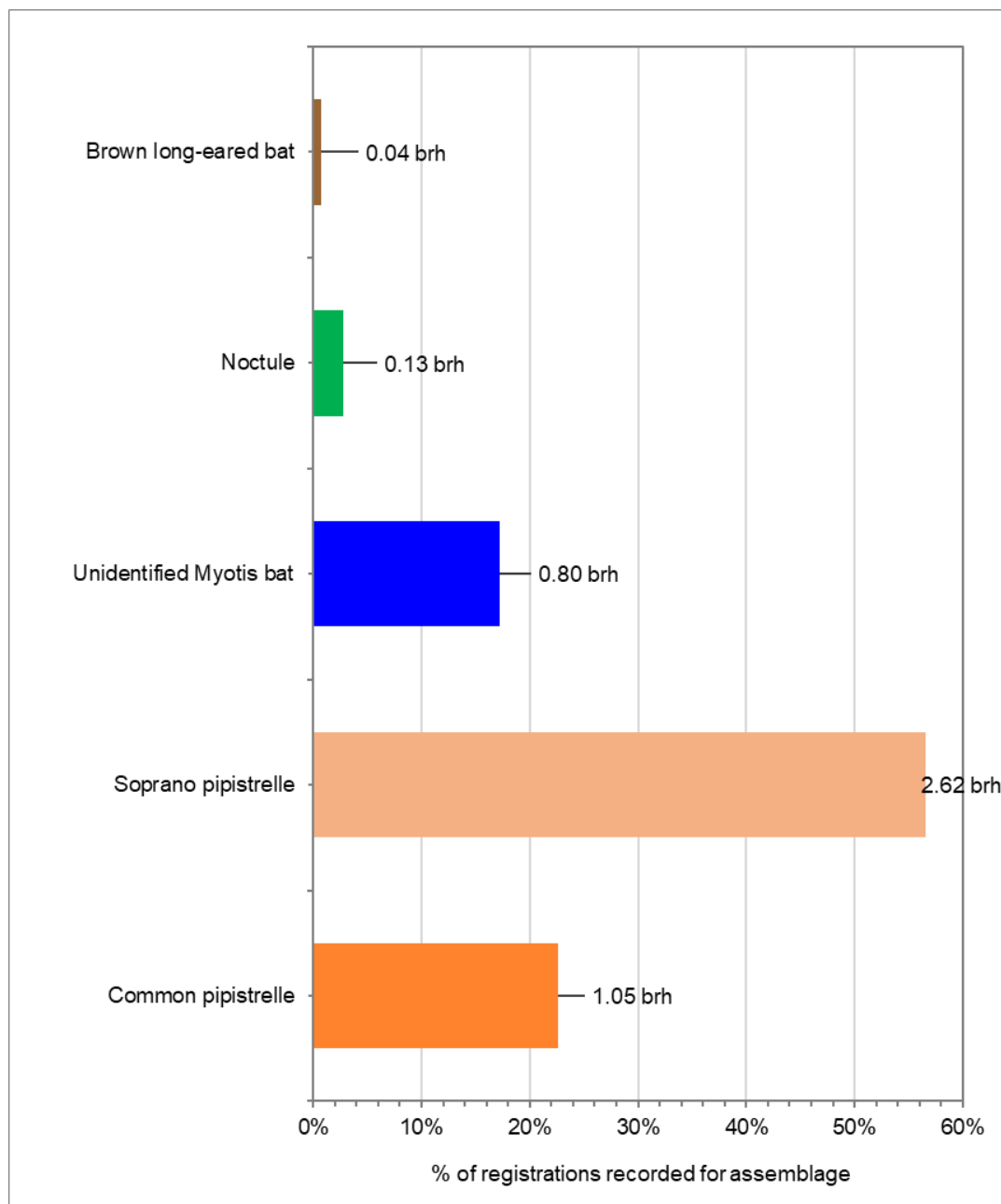


Figure 5: Species assemblage recorded during static remote monitoring

Seasonal Variation in Activity

- 5.10 Figure 6 summarises the BAI combined across the two static monitoring detector locations during each monitoring period. The highest activity levels were recorded during the fifth visit (September), with a BAI of 9.96 brh. The overall BAI was similar during the other visits with BAI ranging from 0.82 (October) to 6.85 (June). There was no significant variation in the bat assemblage BAI between survey visits ($\chi^2 = 11.544$ $P > 0.05$).

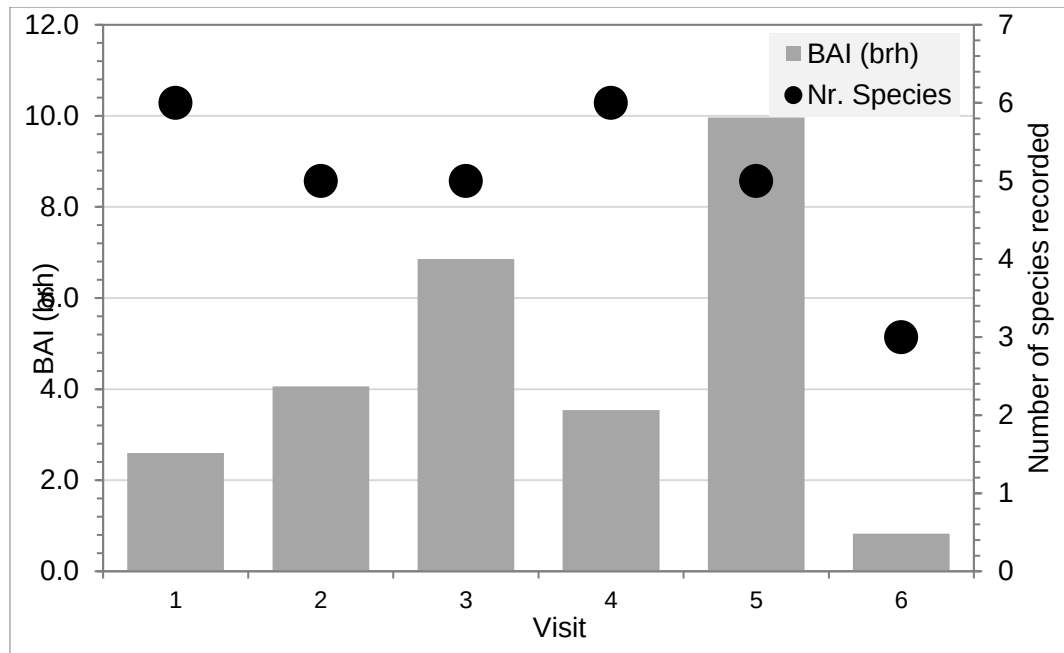


Figure 6: Seasonal variation in activity recorded during static monitoring at the site

Spatial Variation in Activity

- 5.11 Figure 7 shows the species assemblage BAI and species diversity by static monitoring detector location. There is not a significant variation in bat assemblage BAI or species diversity between static monitoring detector locations although the average BAI at location B was higher than location A, 7.96 BAI and 1.29 BAI respectively ($\chi^2 = 4.788$, $P > 0.05$).

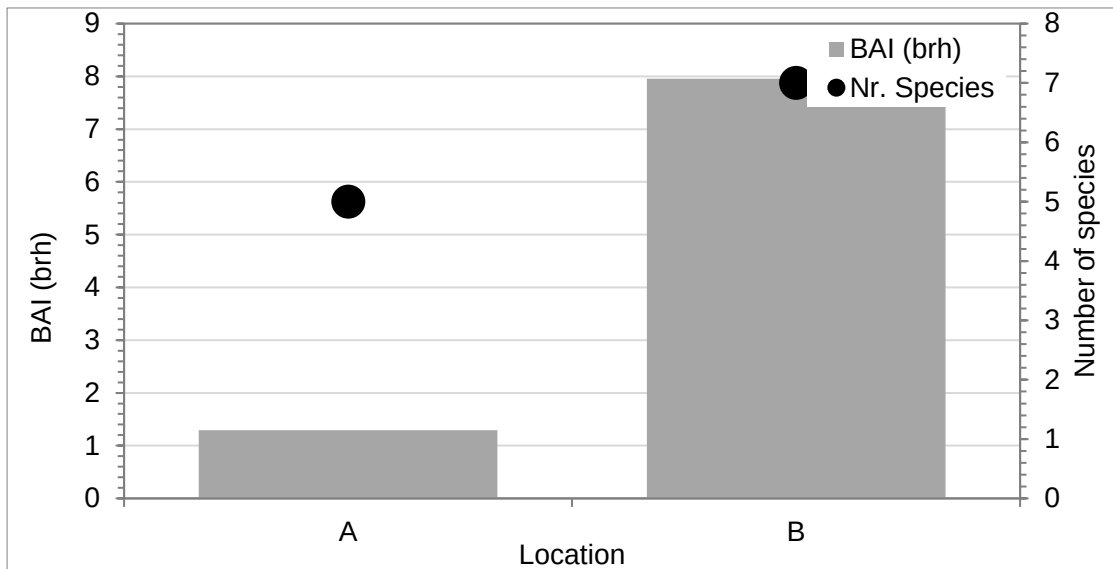


Figure 7: Species assemblage by location during static remote monitoring surveys

Social

- 5.12 Only 0.2% of the total calls recorded across all six static monitoring periods were social calls. Soprano pipistrelles accounted for all of the social calls recorded with the highest number during the August visit, mostly at location B.

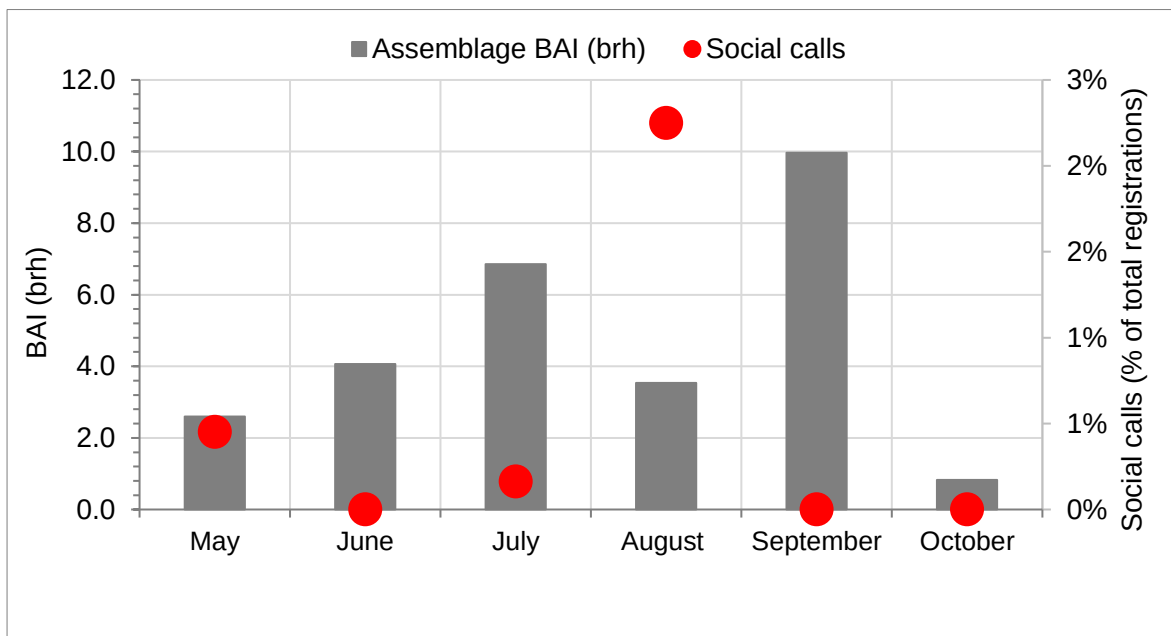


Figure 8: Seasonal variation in social calls recorded during static monitoring surveys

6.0 Evaluation

Foraging and Commuting Habitat

- 6.1 Based on data analysis, the evaluation of the site is of Local importance for commuting and foraging common and soprano pipistrelle, myotis bats, noctule bats and brown long-eared bats. Tables 10 and 11 summarise this evaluation for commuting and foraging bats respectively, applying the framework set out in Chapter 4.0.

Table 10: Evaluation of the site for commuting bats

Species (Score)	Number Of Bats (Score)	Roosts/Potential Roosts Nearby (Score)	Type And Complexity of Linear Features (Score)	Value (Score)
Common pipistrelle (2)	Small number of bats (10)	Small numbers (3)	Well-grown and well-connected hedgerows, small field size. (4)	Local (19)
Soprano pipistrelle (2)	Small number of bats (10)	Small numbers (3)	Well-grown and well-connected hedgerows, small field size. (4)	Local (19)
Myotis species (5)	Individual bats (5)	Small numbers (3)	Well-grown and well-connected hedgerows, small field size. (4)	Local (17)
Noctule (5)	Individual bats (5)	Small numbers (3)	Well-grown and well-connected hedgerows, small field size. (4)	Local (17)
Brown long-eared (2)	Individual bats (5)	Small numbers (3)	Well-grown and well-connected hedgerows, small field size. (4)	Local (14)

Table 11: Evaluation of the site for foraging bats

Species (Score)	Number Of Bats (Score)	Roosts/Potential Roosts Nearby (Score)	Type And Complexity of Features (Score)	Value (Score)
Common pipistrelle (2)	Small number of bats (10)	Small numbers (3)	Isolated woodland patches, less intensive arable and/or small towns and villages. (3)	Local (18)
Soprano pipistrelle (2)	Small number of bats (10)	Small numbers (3)	Isolated woodland patches, less intensive arable and/or small towns and villages. (3)	Local (18)
Myotis species (5)	Individual bats (5)	Small numbers (3)	Isolated woodland patches, less intensive arable and/or small towns and villages. (3)	Local (16)
Noctule (5)	Individual bats (5)	Small numbers (3)	Isolated woodland patches, less intensive arable and/or small towns and villages. (3)	Local (16)

Species (Score)	Number Of Bats (Score)	Roosts/Potential Roosts Nearby (Score)	Type And Complexity of Features (Score)	Value (Score)
Brown long-eared (2)	Individual bats (5)	Small numbers (3)	Isolated woodland patches, less intensive arable and/or small towns and villages. (3)	Local (13)

- 6.2 The species assemblage recorded reflects the habitat types sampled. High activity levels of common pipistrelle and soprano pipistrelle are illustrative of the flexible habitat requirements of this species.
- 6.3 Moderate levels of activity were recorded across the site though foraging and commuting activity was frequently associated with more floristically diverse habitat including the parcels of semi-improved grassland and hedgerows. The hedgerows, ditches and mature trees on site are important for foraging and commuting bats of the recorded species.
- 6.4 Bat activity levels were higher during the survey undertaken in the summer months compared to the earlier and later visits. There was significant variation in the bat assemblage BAI between seasonal visits, which would suggest the site is of most importance for supporting foraging and commuting bats during June, July and August than in the spring and autumn months.

7.0 Conclusions

Foraging and Commuting Habitat

- 7.1 The habitats on site offer suitability for foraging and commuting bats. Activity transect and static remote monitoring surveys found bat activity was predominantly concentrated along linear features such as ditches and hedgerows with overall activity levels being moderate across the site. The hedgerow boundaries, as well as the ditches and treelines are of value to foraging and commuting bats within the locality.
- 7.2 Loss of habitats within the site will impact foraging and commuting bats within the locality. Maintaining and enhancing connectivity across the site, and to further green space to the north and west with green corridors such as hedgerows and scattered trees will be important for maintaining the favourable conservation status of local bat populations.
- 7.3 The site currently has limited lighting around the boundaries and no lighting within. Increased lighting created as a result of development proposals will impact bats foraging and commuting within the locality and around the site.

8.0 Recommendations

- 8.1 The impacts of the proposed development and proposed mitigation are assessed in the accompanying ES Chapter (TEP Report Ref: 9134.011).
- 8.2 Provision of dark corridors along hedgerows and treelines within and around the site will maintain connectivity within the site, particularly to the most valuable habitats for bats (e.g., grassland, scrub and linear boundary features). Artificial lighting can prevent bats from using commuting routes and using roosts due to disturbance. Artificial lighting can also cause congregation of prey under lighting therefore reducing availability for more light sensitive species such as *Myotis* species and brown long-eared.
- 8.3 Where lighting is required within the development, a sensitive lighting scheme will be implemented to avoid indirect impacts of lighting on nocturnal and crepuscular species, on retained and created habitats identified as important commuting/ foraging routes for bats. New lighting, where required, will be designed in line with the Institution of Lighting Professionals Guidance Note 08/18: Bats and Artificial Lighting in the UK. There are four key lighting design principles:
 - Use of unnecessary lighting should be avoided.
 - Spatial spread of lighting including on the horizontal and vertical plane should be minimised and account for primary and reflected light sources.
 - Timing and duration of lighting should be designed to ensure luminaires are reduced at times of predicted low use and change with the seasons.
 - Intensity of lighting should be kept as low as possible whilst meeting the objectives of the intended function.
 - Colour of lighting should take into account the sensitivity of the ecological features on site. Light sources selected should emit zero ultra-violet light whenever possible.
- 8.4 A lighting scheme which is compliant with the above guidance can be secured by way of appropriately worded planning condition.

DRAWINGS

- Drawing G9134.024A - Bat Transect Route and Static Detector Locations**
- Drawing G9134.025A - Bat Transect Survey Results - Visit 1**
- Drawing G9134.026A - Bat Transect Survey Results - Visit 2**
- Drawing G9134.027A - Bat Transect Survey Results - Visit 3**
- Drawing G9134.028A - Bat Transect Survey Results - Visit 4**
- Drawing G9134.029A - Bat Transect Survey Results - Visit 5**
- Drawing G9134.030A - Bat Transect Survey Results - Visit 6**



KEY

-  Site boundary
-  Static detector
-  Transect route

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A	Site boundary update	SP	AE	17/04/2023
Rev	Description	Drawn	Approved	Date

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Project
Land North of Bryn Lane, Wrexham

Title
Bat Transect Route and Static Detector Locations

Drawing Number
G9134.024A

Drawn	Checked	Approved	Scale	Date
AR	MK	SD	1:3,500 @ A3	17/04/2023



- KEY**
- Site boundary
 - Common pipistrelle
 - Common pipistrelle social call
 - Common pipistrelle feeding buzz
 - Soprano pipistrelle
 - Soprano pipistrelle social call
 - Soprano pipistrelle feeding buzz
 - Pipistrelle species feeding buzz
 - Bat flightline (colour denotes bat species)

Note:
Multiple bat records in the same location may obscure some results from display on the map.

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Rev	Description	Drawn	Approved	Date



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Project
Land North of Bryn Lane, Wrexham

Title
**Bat Transect Survey
Visit 1 - 27th May 2022**

Drawing Number
G9134.025A

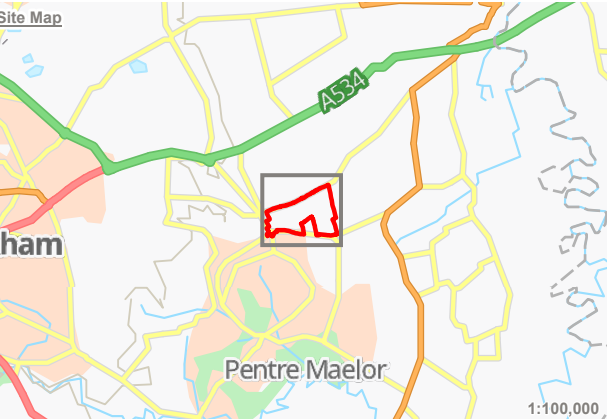
Drawn	Checked	Approved	Scale	Date
ET	CB	AW	1:3,500 @ A3	17/04/2023



- KEY**
- Site boundary
 - Common pipistrelle
 - Common pipistrelle feeding buzz
 - Soprano pipistrelle
 - Soprano pipistrelle feeding buzz
 - Noctule
 - Bat flightline (colour denotes bat species)

Note:
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A	Site boundary update	SP	AE	17/04/2023
Rev	Description	Drawn	Approved	Date



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Project
Land North of Bryn Lane, Wrexham

Title
**Bat Transect Survey
Visit 2 - 24th June 2022**

Drawing Number
G9134.026A

Drawn	Checked	Approved	Scale	Date
ET	CB	AW	1:3,500 @ A3	17/04/2023



- KEY**
- Site boundary
 - Common pipistrelle
 - Common pipistrelle feeding buzz
 - Soprano pipistrelle
 - Soprano pipistrelle feeding buzz
 - Myotis species
 - Noctule
 - Noctule feeding buzz
 - Bat flightline (colour denotes bat species)

Note:
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A	Site boundary update	SP	AE	17/04/2023
Rev	Description	Drawn	Approved	Date



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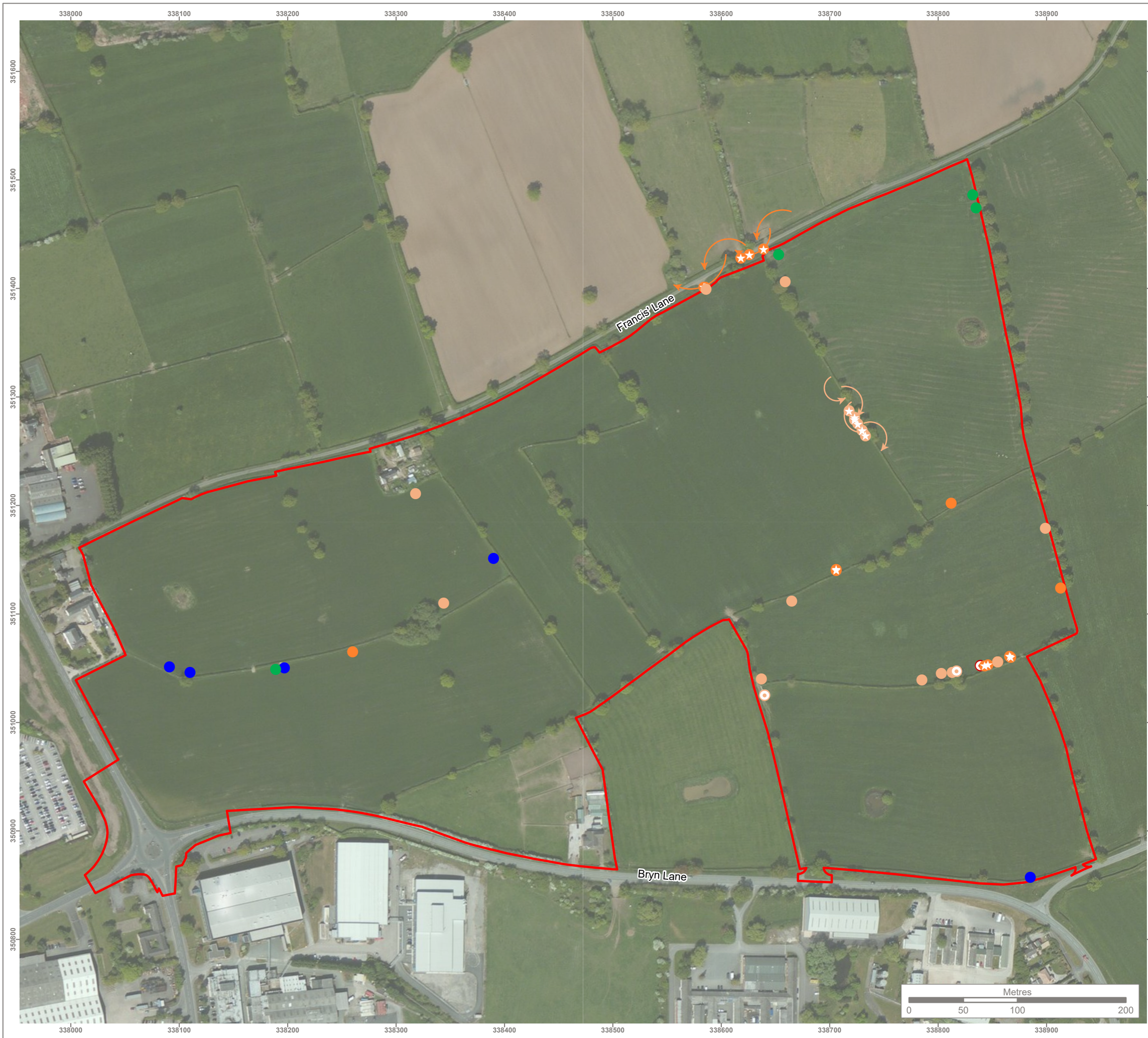
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Project
Land North of Bryn Lane, Wrexham

Title
**Bat Transect Survey
Visit 3 - 29th July 2022**

Drawing Number
G9134.027A

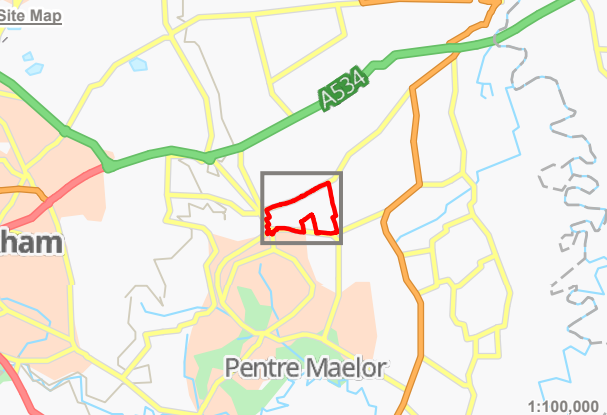
Drawn	Checked	Approved	Scale	Date
ET	CB	AW	1:3,500 @ A3	17/04/2023



- KEY**
- Site boundary
 - Common pipistrelle
 - Common pipistrelle feeding buzz
 - Soprano pipistrelle
 - Soprano pipistrelle social call
 - Soprano pipistrelle feeding buzz
 - Pipistrelle species social call
 - Myotis species
 - Noctule
 - Bat flightline (colour denotes bat species)

Note:
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A	Site boundary update	SP	AE	17/04/2023
Rev	Description	Drawn	Approved	Date



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Project
Land North of Bryn Lane, Wrexham

Title
**Bat Transect Survey
Visit 4 - 25th August 2022**

Drawing Number
G9134.028A

Drawn	Checked	Approved	Scale	Date
ET	CB	AW	1:3,500 @ A3	17/04/2023



- KEY**
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 - Common pipistrelle
 - Common pipistrelle social call
 - Common pipistrelle feeding buzz
 - Soprano pipistrelle
 - Soprano pipistrelle social call
 - Soprano pipistrelle feeding buzz
 - Pipistrelle species
 - Myotis species
 - Noctule
 - Bat flightline (colour denotes bat species)

Note:
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A	Site boundary update	SP	AE	17/04/2023
Rev	Description	Drawn	Approved	Date



THE ENVIRONMENT PARTNERSHIP

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Tel 01925 844004 e-mail tep@tep.uk.com www.tep.uk.com

Project
Land North of Bryn Lane, Wrexham

Title
Bat Transect Survey
Visit 5 - 23th September 2022

Drawing Number
G9134.029A

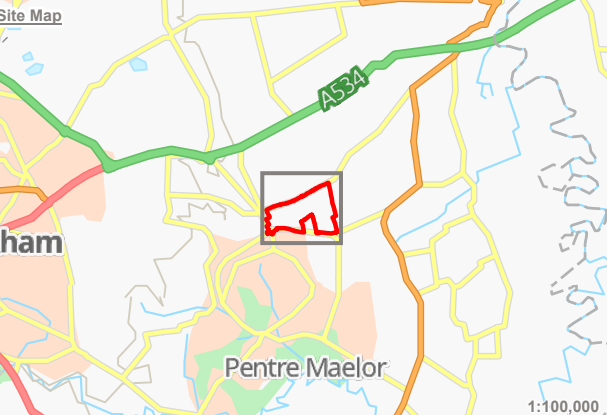
Drawn	Checked	Approved	Scale	Date
ET	CB	AW	1:3,500 @ A3	17/04/2023



- KEY**
- Site boundary
 - Common pipistrelle
 - Common pipistrelle social call
 - Common pipistrelle feeding buzz
 - Soprano pipistrelle
 - Soprano pipistrelle feeding buzz
 - Brown long-eared bat
 - Myotis species
 - Noctule
 - Noctule feeding buzz
 - Bat flightline (colour denotes bat species)

Note:
Multiple bat records in the same location may obscure some results from display on the map.

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Project
Land North of Bryn Lane, Wrexham

Title
**Bat Transect Survey
Visit 6 - 17th October 2022**

Drawing Number
G9134.030A

Drawn	Checked	Approved	Scale	Date
ET	CB	AW	1:3,500 @ A3	17/04/2023



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