

HIGH SPEED RAIL (LONDON - WEST MIDLANDS)

Supplementary Environmental Statement and Additional Provision 2 Environmental Statement

Volume 5 | Technical appendices | Ecology CFAs 23-26

CFA23 | Balsall Common to Hampton-in-Arden

CFA24 | Birmingham Interchange and Chelmsley Wood

CFA25 | Castle Bromwich and Bromford

CFA26 | Washwood Heath to Curzon Street

July 2015

SES and AP2 ES 3.5.5.4

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Volume 5: Technical Appendices

CFA 23 to 26: Supplementary Ecological Baseline Data

Contents

1	Introduction	1
2	Amphibians	2
	2.1 Introduction	2
	2.2 Methodology	2
	2.3 Deviations, constraints and limitations	2
	2.4 Baseline	4
3	Bats	7
	3.1 Introduction	7
	3.2 Methodology	7
	3.3 Deviations, constraints and limitations	7
	3.4 Baseline	8
	3.5 Discussion	11
4	Hazel dormouse	13
	4.1 Introduction	13
	4.2 Methodology	13
	4.3 Deviations, constraints and limitations	13
	4.4 Baseline	14
5	Otter	15
	5.1 Introduction	15
	5.2 Methodology	15
	5.3 Deviations, constraints and limitations	16
	5.4 Baseline	16
6	References	18

List of tables

Table 1: Summary of locations where requirement for amphibian survey was identified but no access was available for survey	2
Table 2: Summary of results from 2014 amphibian presence/absence and population size class estimate surveys	5
Table 3: Bat activity surveys conducted within the Castle Bromwich and Bromford area (CFA25)	9
Table 4: Bat activity transect survey results – Transect 040-BA1-166011	10
Table 5: Methodological details for dormouse nest tube surveys conducted in 2014 within CFA 23 to 26 inclusive	13
Table 6: Summary of watercourses subject to otter survey during 2014	15
Table 7: Summary of holts, potential holts and couches recorded during 2014 surveys of CFA 23 to 26 inclusive	16

1 Introduction

1.1.1 This document is an appendix which forms part of Volume 5 of the Supplementary Environmental Statement (SES) and Additional Provision 2 Environmental Statement (AP2 ES). It details supplementary ecological baseline data collected since the main ES published in November 2013 (the 'main ES') for the following ecological aspects and species:

- amphibians;
- bats;
- hazel dormouse; and
- otter.

1.1.2 The ecological baseline data detailed within this document relates to community forum areas (CFA):

- CFA23: Balsall Common and Hampton-in-Arden;
- CFA24: Birmingham Interchange and Chelmsley Wood;
- CFA25: Castle Bromwich and Bromford; and
- CFA26: Washwood Heath to Curzon Street.

1.1.3 The document should be read in conjunction with the main ES, Volume 2,(CFA reports) Volume 3 (route-wide effects assessment) and Volume 4 (off-route effects assessment) of the SES and AP2 ES. In addition, as it focuses solely on new information obtained since the main ES it should be read in conjunction with the following corresponding Volume 5 Technical Appendices of the main ES:

- Ecological baseline data: amphibians, reptiles and birds (Volume 5, Appendix EC-002-004);
- Ecological baseline data: mammals (Volume 5, Appendix EC-003-004); and
- Register of local level effects (Volume 5, Appendix EC -005-004).

2 Amphibians

2.1 Introduction

1.1.4 This section of the appendix presents details of supplementary ecological baseline data relating to amphibians for the section of the original scheme that will pass through CFAs 23 to 26 inclusive. It should be read in conjunction with the corresponding appendix from the main ES (Volume 5, Appendix EC-002-004).

2.2 Methodology

1.1.5 Details of the standard methodology utilised for amphibian surveys are provided in the Technical Note Ecological Field Survey Methods and Standards, which is included within Volume 5, Appendix EC-002-003 of the main ES.

1.1.1 The scoping and desk study exercises undertaken in 2012/2013 can be found in Volume 5, Appendix EC-002-004 of the main ES. This baseline report focuses solely on supplementary data collected since the main ES.

2.3 Deviations, constraints and limitations

2.3.1 Table 1 provides a summary of those sites which were identified as requiring amphibian survey to inform the main ES, but where no access to the land was available to undertake this work during 2012/13.

Table 1: Summary of locations where requirement for amphibian survey was identified but no access was available for survey

Ecology survey code	Location	OS grid reference	Initial survey prescription based on scoping exercise	CFA	Approximate distance from the original scheme (m) and orientation
EC-04-051-C7	Land south of Berkswell Marsh Site of Special Scientific Interest (SSSI)	SP 22757 79291	Presence/Absence/Population Size Class Assessment	23	12m south
EC-04-051-C6	Land south of Berkswell Marsh SSSI	SP 22805 79529	Presence/Absence/Population Size Class Assessment	23	Within land required
EC-04-052-G4	Mercote Mill Farm	SP 22442 80778	Presence/Absence/Population Size Class Assessment	23	165m north-east
EC-04-053-L1-G2	Pond south-east of Longacre Farm	SP 19434 82861	Presence/Absence/Population Size Class Assessment	24	105m south-west
EC-04-067-l3	Prologis Park	SP 16356 91561	Presence/Absence/Population Size Class Assessment	25	190m east

Survey constraints in the Balsall Common and Hampton-in-Arden area (CFA23)

- 2.3.2 Due to land access restrictions three ponds in the vicinity of SP 22805 79529 could not be surveyed, but the surrounding habitat types suggest that it is possible that they could be used by amphibians including Great Crested Newts (GCN). Only one of the ponds (SES and AP2 ES, Volume 5, Map series EC-04, page 051-C6) is within the land potentially required for construction.
- 2.3.3 Two ponds in the vicinity of SP 22757 79291 (SES and AP2 ES, Volume 5, Map series EC-04, pages 051-C6 and C7) adjacent to Sixteen Acre Wood are surrounded by suitable habitat for GCN but are located 1.3km from the nearest known GCN meta-population at Park Lane/Lavender Hall Lane (040-AA1-150009 and 040-AA1-150007).
- 2.3.4 The pond north-east of A452 Chester Road, in the vicinity of SP 22442 80778 (SES and AP2 ES, Volume 5, Map series EC-04, page 052-G4) forms part of a network of ponds, some of which are located in a quarry, and surrounded by optimal GCN habitat. There are no known populations of GCN nearby.
- 2.3.5 Restrictions in surveying these ponds could have resulted in GCN remaining unrecorded and therefore their presence cannot be ruled out.
- 1.1.1 The three surveyed water bodies in the vicinity of SP 22000 79943 at Marsh Lane (SES and AP2 ES, Volume 5, Map series EC-04, page 052-B7) were subject to deviation from the standard methodology. They were not subject to bottle trapping due to the risk of fish mortality. These ponds were subject to three other survey methods as directed by Ecology Technical Note: Ecological Field Survey Methods and Standards (Volume 5, Appendix CT-001-000/2).

Survey constraints in the Birmingham Interchange and Chelmsley Wood area (CFA24)

- 2.3.6 Due to land access restrictions, one pond in the vicinity of SP 19434 82861 (SES and AP2 ES, Volume 5, Map series EC-04, page 053-L1-G2) could not be surveyed.
- 2.3.7 The pond is over 900m west of the nearest known GCN meta-population at the land west of Pasture Farm (SES and AP2 ES, Volume 5, Map series EC-04, page 053- I7-I8), and is separated from this meta-population by the M42 which is likely to act as a barrier to amphibian movement.
- 2.3.8 The aquatic and surrounding terrestrial habitat types suggest that it is possible that this pond could be used by breeding amphibians including GCN. Restrictions in surveying this pond could have resulted in GCN remaining unrecorded and therefore their presence cannot be ruled out.

Survey constraints in the Castle Bromwich and Bromford area (CFA25)

- 2.3.9 Due to land access restrictions in 2014, one pond at Prologis Park in the vicinity of SP 16356 91561 (SES and AP2 ES, Volume 5, Map series EC-04, page 067-I3) could not be surveyed.

2.3.10 The pond is located 750m north of the nearest known GCN meta-population at Park Hall Site of Importance for Nature Conservation (SINC), and is separated from this meta-population by the River Tame, which is likely to act as a barrier to amphibian movement.

2.3.11 The aquatic and surrounding terrestrial habitat types suggest that it is possible that this pond could be used by breeding amphibians including GCN. Restrictions in surveying this pond could have resulted in GCN remaining unrecorded and therefore their presence cannot be ruled out.

Survey constraints in the Washwood Heath to Curzon Street area (CFA26)

2.3.12 No ponds were identified for survey in CFA26, therefore there were no survey constraints within this CFA.

2.4 Baseline

Field survey

Habitat suitability index/walkover surveys

2.4.1 Following the completion of 2014 walkover surveys, incorporating a Habitat Suitability Index (HSI) survey (where appropriate), no water bodies were scoped out of the assessment.

Presence/absence and population size class estimate surveys

1.1.2 The results of amphibian presence/absence and population size class estimate surveys are detailed within Table 2.

SES and AP2 ES Appendix EC-001-004

Table 2: Summary of results from 2014 amphibian presence/absence and population size class estimate surveys

Ecology survey code	Location	OS grid reference	Survey type	Number of visits completed	First survey visit	Last survey visit	Peak count during single visit with single method					CFA	Approximate distance from the original scheme (m) and orientation
							Great crested newt	Smooth newt	Palmate newt	Common frog	Common toad		
EC-04-052-18	Lincoln Farm, Marsh Lane	SP 21919 79932	P/A (presence/absence)	4	02 April 2014	02 June 2014					50(L)	23	80m west
EC-04-052-17	Lincoln Farm, Marsh Lane	SP 21997 79958	P/A (presence/absence)	4	02 April 2014	02 June 2014					50(L)	23	25m west
EC-04-052-17	Lincoln Farm, Marsh Lane	SP 22047 79949	P/A (presence/absence)	4	02 April 2014	02 June 2014					50(L)	23	20m west

Key:

Bracketed text within species column indicates the relevant population size class for the peak count obtained as follows:

- Great crested newt - (H) = High; (M) = Medium; (L) = Low;
- Smooth and palmate newt - peak count less than 10 = Low (L); peak count 10-100 = Good (G); peak count over 100 = Exceptional (E);
- Common frog - spawn clumps counted less than 50 = Low (L); 50-500 = Good (G); greater than 500 = Exceptional (E); and
- Common toad - peak count of less than 100 = Low (L); peak count 100-1000 = Good (G); peak count greater than 1000 = Exceptional (E).

A full six visits are required in order to obtain a robust population size class assessment. However, an indication of the corresponding size class category is shown here for all peak counts in order to show the minimum size class known to be present at those sites, where the full six visits could not be completed during the time period available for survey.

Desk study

- 2.4.2 No further desk study records were gathered during 2014. For a summary of amphibian data see the main ES, Volume 5, Appendix EC-002-004.

Discussion of combined results

Balsall Common and Hampton-in-Arden (CFA23)

- 2.4.3 The three ponds subject to survey in 2014 are located between 20m and 80m of the land required for the construction of the original scheme. The ponds are located next to scrub and woodland, which provides terrestrial habitat suitable for amphibians.
- 2.4.4 No adult amphibians were recorded during surveys in 2014; only low numbers of toad tadpoles were recorded on the shallow margins of the three ponds. The ponds were stocked for sport fishing and contained little aquatic vegetation cover, therefore amphibians in these ponds are likely to be subject to predation.
- 2.4.5 GCN is assumed to be absent from these ponds.

Birmingham Interchange and Chelmsley Wood (CFA24)

- 2.4.6 No ponds were subject to survey in CFA24 in 2014.

Castle Bromwich and Bromford (CFA25)

- 2.4.7 No ponds were subject to survey in CFA25 in 2014.

Washwood Heath to Curzon Street area (CFA26)

- 2.4.8 No ponds were subject to survey in CFA26 in 2014.

3 Bats

3.1 Introduction

- 1.1.3 This section of the appendix presents details of supplementary ecological baseline data relating to bats for the section of the original scheme that will pass through CFAs 23 to 26 inclusive. It should be read in conjunction with the corresponding appendix from the main ES (Volume 5, Appendix EC-003-004).
- 1.1.4 It should be noted that all details relating to trapping and radio-tracking of bats undertaken at the Berkswell Estate during 2014 are presented within a separate appendix of the main ES (Volume 5, Appendix EC-003-004).

3.2 Methodology

- 1.1.5 Details of the standard methodology utilised for bat surveys are provided in the Technical Note Ecological Field Survey Methods and Standards, which is included within Volume 5, Appendix EC-002-003 of the main ES.
- 1.1.6 The scoping and desk study exercises were undertaken in 2012/2013 and can be found in Volume 5, Appendix EC-003-004 of the main ES. This baseline report focuses solely on supplementary data collected since the main ES.

3.3 Deviations, constraints and limitations

Trees

- 3.3.1 Initial assessment of trees was carried out on trees within the additional areas of land required for the AP2 revised scheme. Further detailed inspections and any subsequent backtracking or emergence surveys will be conducted in 2015 and 2016.

Buildings and structures

- 3.3.2 Initial assessment of one building was carried out on a building within the additional areas of land required for the AP2 revised scheme. Further detailed inspections and any subsequent backtracking or emergence surveys will be conducted in 2015 and 2016.

Activity Surveys

- 3.3.3 Safe access during both survey visits to Parkhall Wood was limited due to steep slopes. Transects were therefore undertaken along the edge of the woodland, at the base of the slope.
- 3.3.4 All British bat species are peripatetic and move between roosting sites both through seasons and within seasons. The absence of bats on a particular occasion does not necessarily rule out their presence at other times.

3.4 Baseline

Balsall Common and Hampton-in-Arden (CFA 23)

Roosting (trees)

- 3.4.1 Eight additional trees with moderate potential to support roosting bats and two trees with high potential to support roosting bats were identified during the 2015 surveys. Further detailed inspections and any subsequent backtracking or emergence surveys will be conducted in 2015 and 2016.

Roosting (building and structures)

- 3.4.2 No buildings or structures were surveyed within this CFA.

Bat activity

- 3.4.3 No bat activity surveys were undertaken within this CFA.

Birmingham Interchange and Chelmsley Wood (CFA24)

Roosting (trees)

- 3.4.4 One tree with moderate potential to support roosting bats was identified during the 2015 surveys. Further detailed inspections and any subsequent backtracking or emergence surveys will be conducted in 2015 and 2016.

Roosting (building and structures)

- 3.4.5 One building (the National Motorcycle Museum complex) with moderate potential to support roosting bats was identified during the 2015 surveys. Further detailed inspections and any subsequent backtracking or emergence surveys conducted will be in 2015 and 2016.

Bat activity

- 3.4.6 No bat activity surveys were undertaken within this CFA.

Castle Bromwich and Bromford (CFA25)

Roosting (trees)

- 3.4.7 No trees were surveyed within this CFA.

Roosting (building and structures)

- 3.4.8 No buildings or structures were surveyed within this CFA.

Bat activity

- 3.4.9 The following bat species were recorded during the bat activity surveys (transect surveys) conducted within Park Hall SINC during 2014:

- common pipistrelle;
- soprano pipistrelle;
- *Nyctalus* sp; and
- *Myotis* sp.

3.4.10 The transect surveys carried out within Park Hall SINC are outlined in Table 3.

Table 3: Bat activity surveys conducted within the Castle Bromwich and Bromford area (CFA25)

Ecology survey code	Transect location	Number of surveys conducted	First survey date	Final survey date	CFA
040-BA1-166011	Park Hall SINC	2	16 June 2014	16 July 2014	25

3.4.11 Bat activity transect results for 040-BA1-166011 are shown in Table 4.

SES and AP2 ES Appendix EC-001-004

Table 4: Bat activity transect survey results – Transect 040-BA1-166011

Ecology survey code	Transect location				Description of habitats covered by transect																
040-BA1-166011	Park Hall SINC				Dominant habitats covered by this transect include broadleaved woodland, marsh/marshy grassland, standing water (including 7 ponds) and running water (River Tame).																
Visit number and date	Weather conditions				Total species passes during transect survey ¹																
	Temp (°C)	Cloud (0-8) ²	Rain (0-5) ³	Wind (0-12) ⁴	Pp	Pp y	Pn	P sp.	Mb	Md	Mn	Mm	Mbr	Mm/Mb	M sp.	Pa	Bb	Nn	NI	Es	Ny/Ep
16 June 2014	16.0 (start) 12.0 (end)	1	0	0	15	8	-	6	-	-	-	-	-	-	7	-	-	-	-	-	10
16 July 2014	19.0 (start) 17.1 (end)	6	0	2	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

¹ Pp - common pipistrelle, P py - soprano pipistrelle, Pn - Nathusius' pipistrelle, P sp. - Pipistrelle bat species, Mb - Bechstein's bat, Md - Daubenton's bat, Mn - Natterer's bat, Mm - whiskered bat, Mbr - Brandt's bat, Mm/Mb - whiskered/ Brandt's bat, M sp - Myotis bat species, Pa - brown long-eared bat, Bb - barbastelle bat, Nn - noctule bat, NI - Leisler's bat, Es - serotine bat, Ny/Ep - *Nyctalus/Eptesicus* bat.

² Cloud cover on a scale of 0-8 where 0 = Sky completely clear, 4 = Sky half cloudy, 8 = Sky completely cloudy.

³ Precipitation intensity on scale of 0-5 where 0 = Dry, 1 = Light drizzle, 2 = Light rain, 3 = Moderate rain, 4 = Heavy rain, 5 = Torrential rain.

⁴ Wind speed score of 0-12 against Beaufort scale where 0 = calm, 2 = light breeze, 4 = Moderate breeze, 6 = strong breeze, 7 = High wind, 9 = Strong gale, 12 = Hurricane

Washwood Heath to Curzon Street area (CFA26)

Roosting (trees)

3.4.12 No trees were surveyed within this CFA.

Roosting (building and structures)

3.4.13 No buildings or structures were surveyed within this CFA.

Bat activity

3.4.14 No bat activity surveys were undertaken within this CFA.

3.5 Discussion

Common pipistrelle

3.5.1 The 2014 transect surveys recorded common pipistrelle as the most frequent species across Park Hall SINC, with maximum passes of 15 and 16 respectively on each visit. Most of the common pipistrelle activity was concentrated around the edge of Parkhill Wood, just south of the large water body in the centre of Park Hall SINC. There was some foraging activity over the grassland to the north-east of Langley Wood.

Soprano pipistrelle

3.5.2 The 2014 transect surveys recorded a low number (total eight passes) of soprano pipistrelle on the first visit, and none on the second visit. The soprano pipistrelle were primarily flying from east to west along the edge of Parkhill Wood, just south of the large water body in the centre of Park Hall SINC.

Nyctalus species

3.5.3 The 2014 transect surveys recorded a low number (total 10 passes) of *Nyctalus* species on the first visit, and none on the second visit. At least six individual bats were observed emerging from Parkhill Wood between 21:40 and 21:44, only 10-14 minutes after sunset. *Nyctalus* species tend to be an early emerging bat species, with the median noctule emergence time five minutes after sunset, and median Leisler's emergence time 18 minutes after sunset⁵. It is therefore possible that these bats are roosting within Parkhill Wood.

Myotis species

3.5.4 The 2014 transect surveys recorded a low number (total seven passes) of *Myotis* species on the first visit, and none on the second visit. *Myotis* species were recorded, foraging occasionally, along the edge of Parkhill Wood, just south of the large water body in the centre of Park Hall SINC.

Other species

3.5.5 No other species were recorded during the two transect surveys undertaken in 2014.

⁵ Jones G. and Rydell J. (1994) *Foraging strategy and predation risk as factors influencing emergence time in echolocating bats*. Philos. Trans. R. Soc. B. Biol. Sci. **346**: 445-455.

Roosts

- 3.5.6 No roosts were confirmed within Park Hall SINC as a result of additional activity surveys undertaken in 2014, however the available evidence (the time of day the species was recorded and the lack of other suitable woodland in the vicinity) suggests that it is possible that there is at least one *Nyctalus* sp. roost in Parkhall Wood.

Habitat use

- 3.5.7 Park Hall SINC provides good quality foraging habitat for bats.
- 3.5.8 Activity surveys undertaken in 2014 further support the evidence reported in the main ES that edge habitats of both Parkhall Wood and Parkhill Wood are key commuting and foraging areas, and also suggest that the edge habitat of Langley Wood is used as a foraging area.
- 3.5.9 The linear dispersal corridors along the base of the wooded embankments provide connectivity with foraging habitats along the River Tame Site of Local Importance for Nature Conservation (SLINC) and across the grassland habitats within the Park Hall SINC itself.

4 Hazel dormouse

4.1 Introduction

4.1.1 This section of the appendix presents details of supplementary ecological baseline data relating to hazel dormouse for the section of the original scheme that will pass through CFAs 23 to 26 inclusive. It should be read in conjunction with the corresponding appendix from the main ES (Volume 5, Appendix EC-003-004).

4.2 Methodology

4.2.1 Details of the standard methodology utilised for hazel dormouse surveys are provided in the Technical Note Ecological Field Survey Methods and Standards, which is included within Volume 5, Appendix EC-002-003 of the main ES.

4.2.2 The scoping and desk study exercises undertaken in 2012/2013 can be found in Volume 5: Appendix EC-003-004 of the main ES. This baseline report focuses solely on supplementary data collected since the main ES.

4.2.3 Details of dormouse survey techniques employed in 2014 are provided in Table 5

Table 5: Methodological details for dormouse nest tube surveys conducted in 2014 within CFA 23 to 26 inclusive

Ecology survey code	Location	Centroid grid reference	Number of tubes deployed	Survey start	Sum of indices of probability ⁶	Map series and sheet number reference
040-HD1-150001	Wood north of Park Lane	SP 236 785	50	April 2013- August 2013; July 2014 – October 2014	23	EC-12-102
040-HD1-151001	Marlowes Wood	SP 233 790	50	April 2013- August 2013; July 2014 – October 2014	30	EC-12-102
040-HD1-152001	Sixteen Acre Wood	SP 228 796	50	April 2013- August 2013; July 2014 – October 2014	30	EC-12-102 and EC-12-103

4.3 Deviations, constraints and limitations

4.3.1 No deviations from the standard methodology were undertaken and no constraints were identified.

⁶ Sum of the index of probability scores obtained for the months tubes were deployed, adjusted based on the number of tubes deployed in comparison with the standard of 50 tubes.

4.4 Baseline

Balsall Common and Hampton-in-Arden (CFA23)

- 4.4.1 A nest tube survey was undertaken at three sites considered potentially suitable for hazel dormouse.
- 4.4.2 A nest tube survey was undertaken at the wood north of Park Lane (040-HD1-150001) during 2013 and 2014, which generated a survey effort score of 32, reflecting a high level of confidence in the survey results. This small wooded block (containing approximately 0.5ha of suitable habitat) was partially connected to the wider landscape. No evidence of dormouse was recorded during the survey and no distinctive dormouse-chewed hazel nuts were recorded.
- 4.4.3 A nest tube survey of Sixteen Acre Wood (040-HD1-152001) was undertaken, with a survey effort score of 32. No evidence of hazel dormouse was recorded. Evidence of wood mouse (*Apodemus sylvaticus*) was recorded within approximately 10% of the tubes. No dormouse-chewed hazel nuts were recorded.
- 4.4.4 A nest tube survey of Marlowes Wood (040-HD1-151001) was undertaken during 2013 and 2014, with a survey effort score of 25. No evidence of hazel dormouse or any other small mammal was recorded. No dormouse-chewed hazel nuts were recorded.

Birmingham Interchange and Chelmsley Wood (CFA24)

- 4.4.5 No sites within this section of the route were considered to be of sufficient quality to support hazel dormouse, and therefore no further surveys were carried out within this area.

Castle Bromwich and Bromford (CFA25)

- 4.4.6 No potentially suitable sites for hazel dormouse were identified within this area, and therefore no further surveys were carried out.

Washwood Heath to Curzon Street area (CFA26)

- 4.4.7 No potentially suitable sites for hazel dormouse were identified within this area, and therefore no further surveys were carried out.

5 Otter

5.1 Introduction

5.1.1 This section of the appendix presents details of supplementary ecological baseline data relating to otter relevant to the section of the original scheme that will pass through CFAs 23 to 26 inclusive. It should be read in conjunction with the corresponding appendix from the main ES (Volume 5, Appendix EC-003-004).

5.2 Methodology

5.2.1 Details of the standard methodology utilised for otter surveys are provided in the Technical Note Ecological Field Survey Methods and Standards, which is included within Volume 5, Appendix EC-002-003 of the main ES.

5.2.2 The scoping and desk study exercises undertaken in 2012/2013 can be found in Volume 5, Appendix EC-003-004 of the main ES. This baseline report focuses solely on supplementary data collected since the main ES.

5.2.3 Water-courses which were subject to otter surveys in 2014 are detailed in Table 6.

Table 6: Summary of watercourses subject to otter survey during 2014

Ecology survey code	Water course or water body name	Feature type	OS grid reference (start and finish)	Level of access within required survey extent	Survey dates	CFA	Approximate distance from the original scheme (m) and orientation
EC-11-106-J3 to H8	Hollywell Brook	Stream	SP 21066 83603 – SP 19933 83656	Moderate	2 September 2014	24	Within land required
EC-11-105a-E2 to EC-11-104-C1	River Blythe	Main river	SP 21433 83092 – SP 22047 82093	Moderate	3 September 2014	23	Within land required
EC-11-105a-F2 to G2	A tributary to the River Blythe	Stream	SP 21509 82924 – SP 21598 82688	Full	3 September 2014	23	10m, east
EC-11-104-C1 to E7	River Blythe	Main river	SP 22023 82053 – SP 21502 81327	Majority	3 September 2014	23	Within land required
EC-11-104-F7 to H8	River Blythe	Main river	SP 21510 81317 – SP 21547 80854	Full	4 August 2014	23	Within land required
EC-11-104-F7 to G9	A tributary to the River Blythe	Stream	SP 21510 81317 – SP 21375 81022	Full	4 August 2014	23	10m, west
EC-11-103-D8 - EC-11-101-A4	Bayleys Brook	Stream	SP 22035 80227 – SP 24127 78419	Moderate	5 August 2014	23	Within land required

5.3 Deviations, constraints and limitations

- 5.3.1 Dense vegetation prevented access to some stretches of watercourse within the areas surveyed, notably along Bayleys Brook east of A452 Kenilworth Road (CFA23), and the River Blythe south of Stonebridge Island Roundabout (CFA23). In these areas, it was estimated that between 25- 50% of the river banks were inaccessible. Field signs may also have been obscured and led to an under recording of otter activity in these areas.

5.4 Baseline

- 5.4.1 A summary of the results of the otter surveys undertaken in 2014 is provided in Table 7.

Table 7: Summary of holts, potential holts and couches recorded during 2014 surveys of CFA 23 to 26 inclusive

Ecology survey code	Watercourse or water body name	OS grid reference	Nature of record	CFA	Approximate distance from original scheme (m) and orientation
040-OT2-152001	Bayleys Brook	SP 22562 79866	Potential holt	23	Within land required
040-OT2-152002	Bayleys Brook	SP 22686 79803	Potential couch	23	50m, east (surrounded by land required)

Balsall Common and Hampton-in-Arden (CFA23)

Bayleys Brook east of A452 Kenilworth Road

- 5.4.2 Several otter spraints, feeding remains, footprints and a slide were found along Bayleys Brook, east of A452 Kenilworth Road.
- 5.4.3 Detailed terrestrial searches identified the presence of a potential holt (SES and AP2 ES, Volume 5, Map series EC-11, page 103-G6) within land required and a potential couch with possible otter footprints close by (SES and AP2 ES, Volume 5, Map series EC-11, page 103-F6) approximately 75m outside the land required for construction. A camera trap was deployed on Bayleys Brook, opposite the potential holt, in August and September 2014; however, the camera trap did not identify this potential holt as active at this stage.
- 5.4.4 The food supply for otter in this area was considered likely to be of high quality, as this stretch was located close to ponds at Marsh Lane Nature Reserve and the pond north-west of Lavender Hall Lane, both of which supported stocks of fish and crayfish.
- 5.4.5 The overall suitability score for potential breeding sites in this area was considered to be 5/5.

River Blythe north of B4102 Meriden Road

- 5.4.6 Otter spraints and feeding remains were recorded along the River Blythe, north of B4102 Meriden Road.

- 5.4.7 Detailed terrestrial searches did not identify any further potential or active holts in addition to those identified in 2013. Dense impenetrable vegetation was present, adjacent to some areas of the river bank, which could conceal potential holts.
- 5.4.8 There was a good potential food supply for otter, which consisted of fish and signal crayfish in the River Blythe.
- 5.4.9 The overall suitability score for potential breeding sites in this area was considered to be 5/5.

River Blythe south of Stonebridge Roundabout

- 5.4.10 An otter spraint was identified along the River Blythe south of Stonebridge Island Roundabout.
- 5.4.11 Otter footprints were identified underneath the bridge at Stonebridge Island Roundabout. These were considered to have been made within a few days prior to the survey.
- 5.4.12 Areas of dense impenetrable scrub and woodland were present adjacent to the river, which provided suitable locations for holts, outside the land required. No potential or active holts were identified in areas which could be accessed.
- 5.4.13 Crayfish and fish in the River Blythe SSSI, and the large ponds nearby, afforded a high quality potential food supply for otter.
- 5.4.14 The overall suitability score for potential breeding sites in this area was considered to be 5/5.

Birmingham Interchange and Chelmsley Wood (CFA24)

Hollywell Brook adjacent to Middle Bickenhill Lane

- 5.4.15 An otter spraint and feeding remains were found during field surveys on Hollywell Brook, west of the A452 Kenilworth Road, in September 2014.
- 5.4.16 Detailed terrestrial searches were undertaken, but were limited by restricted access as a result of the operation of Stonebridge Quarry. These searches identified dense impenetrable cover in areas immediately adjacent to the river bank, with features present with the potential to conceal holt sites, such as complex tangles of fallen trees and dense vegetation in the woodland. Large areas of sedge bed also provided suitable laying up opportunities for otter.
- 5.4.17 The overall suitability score for potential breeding sites in the area searched was 5/5. The operations of the quarry are likely to cause disturbance to these previously less disturbed areas of suitable habitat. The presence of field signs in 2014 indicates that otters are still actively using Hollywell Brook.

Castle Bromwich and Bromford (CFA25)

- 5.4.18 No watercourses were subject to survey in CFA25 in 2014.

Washwood Heath to Curzon Street area (CFA26)

- 5.4.19 No watercourses were subject to survey in CFA26 in 2014.

6 References

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Volume 5: Technical Appendices

CFA 23 to 26: Summary of changes to ecology baseline data that do not generate new or different significant effects

Contents

1	Introduction	1
	List of tables	
	Table 1 – Summary of changes to ecology baseline data that do not generate new or different significant effects	2

1 Introduction

1.1.1 This document is an appendix which forms part of Volume 5 of the Supplementary Environmental Statement (SES) and Additional Provision 2 Environmental Statement (AP2 ES).

1.1.2 Since September 2013¹ a range of supplementary ecological baseline data has been collected. Table 1 presents a summary of additional ecology baseline survey data collected since September 2013 that does not lead to new or different likely significant environmental effects from those reported within the ES published in November 2013 (i.e. the main ES), for the following community forum area (CFA)

- CFA23: Balsall Common and Hampton-in-Arden;
- CFA24: Birmingham Interchange and Chelmsley Wood;
- CFA25: Castle Bromwich and Bromford; and
- CFA26: Washwood Heath to Curzon Street.

1.1.3 The document should be read in conjunction with Volume 2 (community forum area reports), Volume 3 (route-wide effects assessment) and Volume 4 (off-route effects assessment) of the SES and AP2 ES. Details of all survey work and desk study information gathered since September 2013 which is relevant to this area is provided in Volume 5: Appendix EC-001-00X (Baseline data appendix) and Volume 5 map series EC-04-052, EC-06-135, EC-11-10 and EC-12-102

¹ The date after which it was no longer possible to include survey data for the main ES.

SES and AP2 ES Appendix EC-002-004

Table 1 – Summary of changes to ecology baseline data that do not generate new or different significant effects

CFA (number and name)	Receptor	Document and paragraph reference for relevant baseline information within the main ES	Extract of relevant baseline information reported in the main ES	Relevant additional survey undertaken since main ES	Summary of relevant supplementary ecological information	Changes to construction impacts/effects reported in the main ES	Changes to operational impacts/effects reported in the main ES	Implications for ecology mitigation/ compensation provision reported in the main ES
CFA23: Balsall Common and Hampton-in-Arden	Possible great crested newt population at Lincoln Farm, Marsh Lane	No access available, Volume 5, EC-002-004, Table 1	No baseline information.	Presence/ absence survey of three previously unsurveyed ponds at Lincoln Farm, Marsh Lane.	No great crested newts or adult amphibians were recorded, only a low number of toad tadpoles.	No change	No change	No change
CFA23: Balsall Common and Hampton-in-Arden	River Blythe	Volume 2, CFA 23, paragraph 7.3.19	Otter occurs at low density throughout the area and signs of their presence have been recorded alongside the River Blythe and Bayleys Brook	Otter survey	Otter spraints and feeding remains found.	No change in the temporary significant effect on the conservation status of this species which will be significant at up to local/parish level.	No change	No change
CFA23: Balsall Common and Hampton-in-Arden	A tributary to the River Blythe	Volume 2, CFA 23, paragraph 7.3.19	Otter occurs at low density throughout the area and signs of their presence have been recorded alongside the River Blythe and Bayleys Brook	Otter survey	Otter spraints and feeding remains found.	No change in the temporary significant effect on the conservation status of this species which will be significant at up to local/parish level	No change	No change
CFA23: Balsall Common and Hampton-in-Arden	Bayleys Brook	Volume 2, CFA 23, paragraph 7.3.19	Otter occurs at low density throughout the area and signs of	Otter survey	Potential holt and potential couch recorded. Otter spraints	No change in the temporary significant effect on the	No change	No change

SES and AP2 ES Appendix EC-002-004

Hampton-in-Arden			their presence have been recorded alongside the River Blythe and Bayleys Brook		and feeding remains found.	conservation status of this species which will be significant at up to local/parish level.		
CFA24: Birmingham Interchange and Chelmsley Wood	Hollywell Brook	Volume 2, CFA 24, paragraph 7.3.18	Otter population at River Blythe, Hollywell Brook and adjacent habitats within land required for the construction of the Proposed Scheme.	Otter survey	Otter spraints and feeding remains found.	No change in the temporary significant effect on the conservation status of this species which will be significant at up to local/parish level	No change	No change
CFA25: Castle Bromwich and Bromford	Park Hall SINC	Volume 2, CFA 25, paragraph 7.3.18	A medium sized population of common pipistrelle, a species of principal importance, was recorded foraging and dispersing along the base of the wooded embankments and along the River Tame at Park Hall SINC during the surveys within the land required.	Bat activity transect survey	Foraging activity of mainly common pipistrelle and to a lesser extent nyctalus species and myotis species.	No change to the adverse effect on the conservation status of this the population of common pipistrelle which would be significant at the district/borough level.	No change	No change
CFA25: Castle Bromwich and Bromford	Park Hall SINC	Volume 2, CFA 25, paragraph 7.3.18	Small populations of Myotis sp., Noctule, Leisler's, brown long-eared bat, serotine, soprano pipistrelle and Nyctalus sp, each species of principal importance, were recorded foraging	Bat activity transect survey	Foraging activity of Nyctalus sp., and Myotis sp.	No change to the adverse effect on the conservation status of this the population of Nyctalus sp., and Myotis sp., which would be significant at the local/parish level.	No change	No change

SES and AP2 ES Appendix EC-002-004

			and dispersing along the base of the wooded embankments and along the River Tame at Park Hall SINC during the surveys within the land required. required.					
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Volume 5: Technical Appendices

CFA23 to 26: Register of local level ecological effects

Contents

1	Introduction	1
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List of tables

Table 1: Summary of additional local/parish level adverse effects arising from the construction/operation of the AP2 revised scheme within CFA23 to CFA26 inclusive	2
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1 Introduction

1.1.1 This document is an appendix which forms part of Volume 5 of the Supplementary Environmental Statement (SES) and Additional Provision 2 Environmental Statement (AP2 ES).

1.1.2 Since the main ES published in November 2013 (the 'main ES') a range of supplementary ecological baseline data has been collected. Table 1 provides a summary of additional local/parish level adverse effects on ecological receptors that in light of the new data and/or design changes are considered likely to arise from the construction and operation of the 'AP2 revised scheme', for the following community forum areas (CFA):

- CFA23: Balsall Common and Hampton-in-Arden;
- CFA24: Birmingham Interchange and Chelmsley Wood;
- CFA25: Castle Bromwich and Bromford; and
- CFA26: Washwood Heath to Curzon Street.

1.1.3 The document should be read in conjunction with Volume 2 (CFA reports), Volume 3 (route-wide effects assessment) and Volume 4 (off-route effects assessment) of the SES and AP2 ES. In addition, as this document focuses solely on new information obtained since publication of the main ES, it should be read in conjunction with the corresponding Volume 5 Technical Appendix of the main ES (Volume 5, Appendix EC-005-004).

SES and AP2 ES Volume 2: CFA X to CFA X Supplementary Ecological Baseline Data

Table 1: Summary of additional local/parish level adverse effects arising from the construction/operation of the AP2 revised scheme within CFA23 to CFA26 inclusive

CFA	Arising from SES changes or AP2 amendments?	Habitat, species or species group	Receptor/location	Effect arising from construction or from operation?	Description of effect prior to 'other mitigation'	Effect addressed by mitigation and/or compensation proposed? (Yes/No)
CFA23	SES	Bats	An assemblage of more common bat species represented by common pipistrelle, soprano pipistrelle, brown long eared bat, noctule and Myotis sp within Marlowes Wood.	Construction	Habitat loss and degradation resulting, in particular, from the construction of Park Lane cutting.	Yes
CFA23	SES	Bats	A small population of barbastelle bat which occasionally forage within, and disperse through Marlowes Wood.	Construction	Habitat loss and degradation resulting, in particular, from the construction of Park Lane cutting.	Yes
CFA23	AP2	Shadow Brook	Section of the watercourse within the land required for realignment of Diddington Lane (AP2-023-005).	Construction	Construction activities within the land required for the amendment AP2-023-005 will involve construction of a bridge spanning Shadow Brook. This will result in shading of watercourse habitat and an associated adverse effect on the conservation status of Shadow Brook.	No
CFA23	AP2	Species poor semi-improved and improved grassland	Grassland within the land required for the diversion of Diddington Lane (AP2-023-005)	Construction	Construction activities within the land required for the amendment AP2-023-005 will involve the additional loss of species poor semi-improved and improved grassland.	Yes
CFA26	AP2	Black redstart	Possible population of black redstart within the Freightliner Terminal Depot (AP2-026-006).	Construction	Loss of potential foraging habitat and nesting sites within the land required for the amendment (AP2-026-006)	Yes
CFA26	AP2	Bats	Buildings with potential to	Construction	Loss of habitat of potential value to common bat	Yes

CFA	Arising from SES changes or AP2 amendments?	Habitat, species or species group	Receptor/location	Effect arising from construction or from operation?	Description of effect prior to 'other mitigation'	Effect addressed by mitigation and/or compensation proposed? (Yes/No)
			support roosting bats as well as the loss of habitats of potential value to foraging bats within the land required at Freightliner Terminal Depot (AP2-026-006).		species as a result of the amendment (AP2-026-006).	
CFA26	AP2	Reptiles	Possible small populations of common reptile species within the Freightliner Terminal Depot (AP2-026-006).	Construction	Loss of habitats of potential value to common reptile species as a result of the amendment (AP2-026-006).	Yes

Volume 5: Technical Appendices

CFA23: Bat Trapping/Radio Tracking Study

Contents

1	Introduction	1
	1.1 Background	1
	1.2 Requirement for the 2014 study	2
	1.3 2014 study objectives	3
2	Methodology	5
	2.1 2014 Study area	5
	2.2 Landscape appraisal for barbastelle bats	5
	2.3 Trapping and radio-telemetry surveys	6
	2.4 Dusk emergence on tree roosts	9
	2.5 DNA analysis	9
3	Deviations, constraints and limitations	10
4	Results	11
	4.1 Distribution and diversity of bat species	11
	4.2 Prevalence of breeding bats	15
	4.3 Roosts	18
5	Discussion	20
	5.1 Distribution and diversity of bat species	20
	5.2 Summary	22
	Appendix A: Trapping locations	24
	Appendix B: Acoustic sampling	30
	Appendix C: Bat captures in 2014	32

List of tables

Table 1: Specific mitigation measures of relevance to this study, designed to reduce or compensate for significant ecological effects on bats	1
Table 2: Areas selected for survey within the 2014 study area	5
Table 3: Summary of 2014 dusk emergence surveys	9
Table 4: Summary of bat species trapped during 2014 bat trapping surveys	11

Table 5: Species assemblage and number of bats captured at each trapping site	13
Table 6: Breeding and juvenile bat captures	16
Table 7: Confirmed tree roosts in 2014	19

1 Introduction

1.1 Background

- 1.1.1 The Environmental Statement (ES) (the main ES) for the HS2 hybrid Bill scheme published in 2013 included baseline conditions, impact assessment and mitigation for bat species. The impact assessment relating to Community Forum Area (CFA) 23 'Balsall Common and Hampton-in-Arden', addresses impacts along a 7.8km section of the original scheme in the borough of Solihull.
- 1.1.2 This document reports on the methods and results of bat surveys undertaken in 2014 in the vicinity of Balsall Common and Hampton-in-Arden. The surveys were undertaken to further inform design of the original scheme.
- 1.1.3 The ecological baseline from surveys in 2012 and 2013 recorded ten species of bat within CFA23. This includes barbastelle bat (*Barbastella barbastellus*), one of the rarest of UK bat species¹, which was recorded twice in two locations on the Berkswell Estate, including within in the area of Marlowes Woodland.
- 1.1.4 The main ES for this section of the route² identified potential likely impacts and effects on barbastelle and other bat species because of the risk of habitat severance that will arise from the construction and operation of the original scheme, particularly resulting from loss of woodland at Marlowes Woodland, an area of woodland within the Berkswell Estate. These impacts and effects were only identified as potentially significant owing to the paucity of data, particularly with regard to barbastelle bat. Significant adverse effects on barbastelle bat were therefore considered on a precautionary basis likely to occur in the absence of additional mitigation, as this species is relatively rare and is considered to be sensitive to habitat fragmentation.
- 1.1.5 Additional mitigation measures³ are included as part of the design of the hybrid Bill scheme to avoid or reduce impacts to features of ecological value, including specific mitigation measures designed to reduce or compensate for effects on barbastelle and other bat species. Of relevance to this 2014 study is the habitat creation and habitat enhancement described in Table 1.

Table 1: Specific mitigation measures of relevance to this study, designed to reduce or compensate for potentially significant ecological effects on bats

Mitigation Measure	Description
Creation of approximately 3.8ha of marshy grassland	This will be located to the east of Blythe Bypass embankment and Patrick cutting; Farm Meadow Local Wildlife Site (LWS) to the north of Marsh Lane NR; on the western bank of the River Blythe Site of Special Scientific Interest (SSSI) north of B1402 Meriden Road; and to the north of Sixteen Acre Wood embankment.
Creation of approximately 23ha of broadleaved woodland habitat	The target habitat type is lowland mixed deciduous woodland habitat of principal importance. Areas of woodland creation include Pasture Farm south of Diddington cutting; Patrick embankment; on the proposed embankments of the A452 Kenilworth Road alongside Marsh Lane Nature Reserve; at Marsh Farm; within the Berkswell Estate at Marlowes Woodland and also along the Kenilworth

¹ Bat Conservation Trust (BCT), (2012), *State of the UK's Bats: National Bat Monitoring Programme Population Trends*. BCT, Online.

² Published in 2013.

³ As detailed in the main ES (Volume 2, CFA Report 23, Section 7).

	Greenway. These new areas of woodland habitat will connect and help maintain the integrity of remaining areas of woodland, including those within and adjacent to Berkswell Estate.
Approximately 5.8km of native species-rich hedgerow will be planted	New hedgerows will be planted in various appropriate locations, including alongside the Kenilworth Greenway; Park Lane cutting; and the realigned sections of Park Lane and Kenilworth Road dual carriageway. These new lengths of hedgerow will link existing sections and restore part of the hedgerow network.
Creation of approximately 10ha of neutral grassland habitat	Neutral grassland will be planted on the proposed south-west facing embankment on the existing A452 Kenilworth Road; alongside Marsh Lane NR, east of Park Lane cutting and at Beechwood Farm embankment
Two footpath overbridges with dense hedgerow planting	At Park Lane cutting, habitat connections through the landscape will be provided with dense hedgerow planting across the cutting itself, supported by the structures of the proposed Footpath M214 overbridge and Footpath M215 overbridge. To facilitate this, Footpath M214 overbridge will be approximately 20m wide and Footpath M215 overbridge will be approximately 18m wide. The objective will be to provide habitat along and across the route which provides sufficient shelter for barbastelle bat.

1.1.6 The scope of the study reported in the main ES primarily comprised the standard range of surveys described in the Technical Note HS2 Ecological Surveys: Field Survey Methods and Standards which is included as an appendix to the Scope and Methodology Report Addendum (Volume 5: Appendix CT-001-000/2 of the main ES), though also included a limited number of radion tracking surveys.

1.1.7 Radio-tracking surveys for bats were also proposed for several locations including the Berkswell Estate but, due to land access restrictions in 2013, it was only possible to complete these alongside the River Blythe SSSI. The 2014 study of woodlands reported in this document extends the geographical extent of land (predominantly woodland) in and around the Berkswell Estate and Berkswell Marsh SSSI which was surveyed using trapping and radio-tracking methods, supported by acoustic surveys.

1.2 Requirement for the 2014 study

1.2.1 The 2014 survey work reported in this document was undertaken to improve general understanding of the bat assemblage in the vicinity of the Berkswell Estate and Marlowes Woodland, but in particular to establish whether a core breeding colony of barbastellenbat is present in this location.

1.2.2 The barbastelle bat is a rare species throughout its United Kingdom (UK) range. The widespread use of bat detectors and sound analysis software has greatly improved detection of this species and has consolidated our understanding of this species' known range, though there are relatively few known roosts. The presence of barbastelle bat within CFA23 has been established from a very low number of bat calls recorded on a static detector in 2103 in mixed plantation woodland just north of Marlowes Woodland and a static detector at the large pond located between The Bogs and The Roughs woodland. Both of these locations are within the Berkswell Estate.

- 1.2.3 The barbastelle bat is primarily a woodland species and prefers woodland habitats for roosting and foraging⁴. Woodland fragmentation is thought to be a significant cause of population declines in the UK and throughout Europe. Barbastelle bats have large home ranges and individuals are known to travel up to 20km to reach foraging areas. As a consequence, individual bats of this species can be widespread in a locality and will often be detected beyond the core woodland area used by the colony (hereafter referred to as the 'colony core' woodland or area). The colony core woodland area can be considered as the extent of woodland habitat which provides the network of roosts used by a breeding colony during the course of a summer season. Conservation interventions for barbastelle bats should therefore target the protection and enhancement of preferred foraging habitats within 7km of colony core woodland areas where nursery roosts are located⁵. It is therefore necessary to consider roosting, commuting and foraging behaviour of barbastelle bats when undertaking monitoring to review the requirements identified within the main ES, particularly to review whether there is a barbastelle bat colony that could be significantly affected by the original scheme, or if there is only low level activity (by individual bats).
- 1.2.4 Most UK species of bat are best adapted to wooded landscapes and the mosaic of woodland and riparian habitats as are present CFA23. As well as the presence of the barbastelle bat, static recorder and transect surveys undertaken in 2013 recorded scarce bat species including populations of serotine bat and Leisler's bat (*Nyctalus leisleri*), which are rarer species in the UK. Registrations of *Myotis* bat species were regularly recorded on bat detectors deployed in woodlands. The genus *Myotis* sp. includes rare and uncommon bat species, but it is not possible to identify to species level with sufficient accuracy from bat detector recordings.

1.3 2014 study objectives

- 1.3.1 The 2014 study has two key objectives:
- primary objective: review the presence and breeding status of barbastelle bats, focused on Marlowes Woodland and land within and around the Berkswell Estate; an
 - secondary objective: refine understanding of the assemblage of bats (particularly scarce and uncommon species), focused on Marlowes Woodland and land within and around the Berkswell Estate.
- 1.3.2 The study approach and methods were developed with the following specific aims, which support the objectives:

Barbastelle bat

- provide further baseline information on barbastelle bats including roosting, commuting and foraging behaviour within the study area, and especially level of use of woodland habitats that will be affected by the original scheme.

⁴ Lacki M.J., Hayes J.P. and Kurta A., (2007) *Bats in Forests: Conservation and Management*. The Hopkins University Press, Baltimore.

⁵ Zeale M.R., Davidson-Watts I. and Jones G., (2012) *Home range use and habitat selection by barbastelle bats (Barbastella barbastellus): implications for conservation*. *Journal of Mammalogy*, vol 93(4): 1110-1118.

Other scarce and uncommon bat species

- confirm the identification of bat species from the genus *Myotis*, and;
- review the diversity and status (e.g. confirmed breeding colonies) of bat species using woodlands that will be directly impacted through habitat loss, or isolation due to habitat fragmentation.

- 1.3.3 The field surveys commenced in May 2014 with a Natural England licence for mist netting and harp trapping all bat species in woodlands in the study area (defined in section 2.1) and radio-tracking up to five barbastelle bats per month (May-September 2014). Following the findings of trapping surveys between May and July 2014, the licence was amended to include radio-tracking of breeding or post breeding bats, or juvenile bats of Daubenton's (*Myotis daubentonii*), whiskered (*M. mystacinus*), Brandt's (*M. brandtii*), Natterer's (*M. nattereri*), Leisler's or noctule (*Nyctalus noctula*) in August and September, for the purpose of finding breeding roosts. The amendment permitted radio-tracking one individual of each species per month. These species are referred to as 'target species' for the radio-tracking study. This reflects changes to the objectives of the study made in line with the results collected between May and July 2014, and identification of the need to gain additional data relating the the wider assemblage of bats present within the Baerkswell Estate.
- 1.3.4 This report also includes recommendations for ongoing monitoring of local bat populations.

2 Methodology

2.1 2014 Study area

2.1.1 The 2014 study required further survey of woodlands where barbastelle bats were recorded at Marlowes Woodland and the large pond on the Berkswell Estate. The study area encompasses survey areas 1 to 5 (see map EC-21-023 in SES and AP2 ES Volume 5, Ecology Map Book).

2.2 Landscape appraisal for barbastelle bats

2.2.1 Ordnance Survey (OS) mapping and aerial photographs, and databases on ancient woodland inventory sites held by Natural England⁶ were inspected by experienced bat workers to identify blocks of woodland with the potential to support a colony core area for barbastelle bats within CFA23. Consideration was given to known habitat selection by barbastelle bats, which includes their preference for structurally rich woodland and riparian habitats, likely availability of tree roosts in old and damaged trees, and the extent and connectivity of woodlands⁷.

2.2.2 The desk based landscape appraisal was followed by a 'ground-truthing' exercise with a site visit on 1 April 2014 to assess habitat connectivity between woodland blocks where barbastelle bats were recorded in 2013. Consideration was given to the age structure of woodlands and potential flight routes for barbastelle bats between key habitat areas. The site visit allowed the lead surveyor and licence holder to gain an understanding of land use and how barbastelle bats may move through the landscape. The site visit also identified suitable locations for trapping using mist nets and harp traps.

2.2.3 Table 2 summarises the areas selected for further survey, based on the 'ground-truthing' exercise. These areas are shown on EC-21-023 in SES and AP2 ES Volume 5, Ecology Map Book.

Table 2: Areas selected for survey within the 2014 study area

Area no.	Map reference for trapping location	Area name	Central grid reference
1	040-BA4-150001	Marlowes Woodland (south)	SP 23352 79053
	040-BA4-151001	Marlowes Woodland (north)	SP 23403 79322
	040-BA4-150002	Garden Wood	SP 23860 79449
	040-BA4-151002	Sixteen Acre Wood	SP 22804 79616
2	040-BA4-150003	The Roughs	SP 23972 78794
	040-BA4-149001	Bayley's Brook (Ram Hall)	SP 24378 77990
3	040-BA4-154001	Stonebridge Golf Course	SP 22227 82506

⁶ www.magic.gov.uk

⁷ Zeale M.R., Davidson-Watts I. and Jones G., (2012) *Home range use and habitat selection by barbastelle bats (Barbastella barbastellus): implications for conservation*. Journal of Mammalogy. Vol 93(4): 1110-1118.

4	040-BA4-153001	Siden Hill Wood	SP 21294 80586
	040-BA4-153002	Marsh Lane NR	SP 21682 80354
	040-BA4-152001	CEMEX Quarry	SP 22418 80281
5*	n/a – no trapping undertaken in this location.	Meriden Shafts	SP 26116 83221

2.2.4 Woodlands⁸ in and around the Berkswell Estate (survey area 1 in Table 2) were the focus of the study as this is where barbastelle calls were recorded in 2013. Woodlands in four other areas were also sampled to search for barbastelle bats and provide context to the study of the woodlands in and around the Berkswell Estate. Woodlands in survey areas 2-4 were selected for trapping and acoustic sampling surveys because of:

- a. their suitability to support a colony core area for this species in proximity to the original scheme; and
- b. their connectivity the Berkswell Estate (and the location of previous barbastelle bat records).

2.2.5 Woodlands within survey area 5 were acoustically sampled from public rights of way (PRoW) by walked transect, due to access restrictions for trapping.

2.3 Trapping and radio-telemetry surveys

Overview

2.3.1 The trapping survey effort expended between May and September 2014 was considered sufficient to determine presence or likely absence of a breeding colony of barbastelle bat in Marlowes Woodland. If captured, barbastelle bats would have been tracked to estimate home ranges, activity patterns, habitat use and roost locations.

2.3.2 The trapping of other bat species provided a record of the species assemblage within Marlowes Woodland and surrounding woodlands. Trapping bats so that animals can be identified to species level in the hand is essential to identify *Myotis* species, which are acoustically similar (when recorded by bat detector). Capturing bats in the hand also allows the breeding status of adult female bats and for the presence of juvenile bats to be recorded. The presence of breeding animals and juveniles provides evidence that the woodland supports maternity colonies of bats. Radio-tracking female and juvenile bats (other than barbastelle bats) was used to locate maternity roosts.

2.3.3 Trapping and radio-tracking methods were undertaken under licence from Natural England. DNA analysis of droppings from animals captured was also used to confirm species identification of some species that could not be differentiated in the hand, specifically whiskered and Brandt's bats.

⁸ For the purpose of this study, the term 'woodlands' refers to woodland blocks and wooded habitats (such as stream corridors) that were surveyed.

Trapping

- 2.3.4 Avinet and Ecotone bat mist nets (ranging from 2m-18m in length) and Austbat 4m² double lined harp traps were deployed in woodlands within the study area for between four and six nights per trapping session from May to September (inclusive), to trap free flying bats. Details are provided in Appendix A. Nets were selected at the appropriate size to fully span the 'gaps' in the woodland across which trapping took place.
- 2.3.5 Trapping locations are shown on map EC-22-001 to 004 in SES and AP2 ES Volume 5, Ecology Map Book. Priority areas were considered to be woodlands on the Berkswell Estate, which are within survey area 1 (see map EC-21-023 in SES and AP2 ES Volume 5, Ecology Map Book), as they cover the area where barbastelle bats were detected in 2013 and because it was considered to provide a suitable woodland resource for a barbastelle colony core area. Four to six different trapping sites were sampled each calendar month within the study area, the details of which are given in Appendix A. Marlowes Woodland was surveyed each month because this is a recorded (2013) location of barbastelle bats. Surrounding woodlands were sampled according to their proximity to, and connectivity with, Marlowes Woodland and the quality of the woodland for barbastelle bats.
- 2.3.6 The trapping and acoustic sampling results were reviewed on a monthly basis and the findings informed the approach for the subsequent month's trapping surveys. Woodlands with higher catch rates and diverse assemblage of bat species were considered for survey during the following month. Woodlands with lower catch rates and species diversity were considered as lower priority in terms of the scheduling of survey for the following month. The woodlands could be categorised as requiring further survey or removed from the study. This process focused effort on woodlands that are most likely to be used by barbastelle bats as well as those supporting more diverse bat assemblages. It also allowed for minimum survey requirements to be met in other woodland areas where catch rates were found to be lower.
- 2.3.7 Marlowes Woodland and Garden Wood supported the best quality woodland habitats for barbastelle bat, with mature, structurally diverse, broadleaved woodland (including ancient woodland). These woodlands received the greatest level of survey effort. Siden Hill Wood, which also includes ancient woodland, but is relatively isolated within the agricultural landscape, was surveyed on three occasions. Other woodlands in the study area supported younger woodland with poorer structure for bats and were therefore considered less suitable for barbastelle bats. These woodlands were surveyed only one to two times over the course of the study.
- 2.3.8 Three Sussex Autobat acoustic lures (University of Sussex) were used to improve catch efficiency in open woodland⁹. The Sussex Autobat emits synthesised barbastelle, noctule, *Myotis* and nathusius pipistrelle (*Pipistrellus nathusii*) echolocation calls and barbastelle social calls. Lures were placed next to mist nets or harp traps and could be moved between traps on nights when more than three

⁹ Hill D. A. and Greenaway F.G., (2005) *Effectiveness of an acoustic lure for surveying bats in British woodlands*. Mammal Review, **35**, 116-122.

trapping locations where selected. The lures were not used within 50m of active and occupied breeding roosts.

- 2.3.9 Captured bats were examined to determine species, sex, breeding status and, where appropriate, selected for radio tracking. Trapping surveys started at dusk and continued to approximately 2am, depending on capture success, bat activity and weather conditions.

Radio telemetry to locate tree roosts

- 2.3.10 Captured bats (of the target species) were fitted with lightweight Biotrack PicoPip Ag317 radio transmitter tags (Biotrack Ltd), weighing less than 5% of the weight of the bat. Lactating bats were tagged if they met the target weight and were in good condition. Bats were examined to assess their reproductive condition and general health, and released within 30-60 minutes of capture, once the glue attaching the transmitter had cured sufficiently.
- 2.3.11 The females were selected for tagging depending on their reproductive condition and size. Heavily pregnant females were avoided. Typically, the first target animals caught that were of suitable size to carry a radio transmitter were tagged. If more than one animal of the same species was being held, the larger (heavier) animal was selected to reduce possible adverse effects of carrying the transmitter mass.
- 2.3.12 Tagged bats were tracked using a Sika receiver (Biotrack Ltd) and three or five-element Yagi antenna (Biotrack Ltd) following on foot or by vehicle. On release, bats were followed using the ‘homing-in’ method¹⁰ by which the surveyor closely follows the bat. Homing-in refers to the process of finding the location of the bat by tracking the source of the signal to the vicinity of the tree using the radio direction finding equipment.
- 2.3.13 Surveyors followed the bats over several hours after release. If the bat returned to a roost, a 10-figure grid reference fix using a global positioning system (GPS) was taken. Surveyors then returned to site the next day to locate the tree roost using the homing-in method whilst the bat was in its day roost. Tree roosts were mapped on digitised 1:25,000 scale OS maps.
- 2.3.14 Barbastelle bats were not caught during the study and therefore radio-tracking methods for detailed investigation on habitat preference and the home range of this species was not required for this study.

Acoustic sampling

- 2.3.15 Acoustic sampling was undertaken to search for barbastelle bats within woodlands of the study area. The acoustic sampling provided supporting data on the presence, or likely absence of barbastelle bats, and was used as an aid to determine subsequent trapping locations. The areas of woodland sampled are shown on EC-22-001 to 004 in SES and AP2 ES Volume 5, Ecology Map Book.

¹⁰ White G. C. and Garrott R.A., (1990) *Analysis of wildlife radio-tracking data*. Academic Press, San Diego, California.

- 2.3.16 Two Elekon Batlogger M detectors were used as static recorders and, on each survey night, were placed in nearby locations to the trapping site to record bat activity. The Elekon Batlogger M has a built in GPS receiver and every recording is referenced by the coordinates of the surveyor's position, allowing the approximate location of a bat to be obtained.
- 2.3.17 Woodlands were also sampled by taking walked transects through the survey area. Between one and two transects were used to sample the surrounding woodland. Transects commenced once the trapping sites had been set up and typically lasted between one and two hours. When surveyors were not assisting with the trapping, random sampling by taking short transect walks was often undertaken throughout the night. Surveyors used Elekon Batlogger M bat detectors to record bat activity between May and September 2014, as listed in Appendix B.
- 2.3.18 The acoustic sampling survey recordings were analysed for barbastelle bat calls only, using BatExplorer software (version 1.10), developed by Elekon.

2.4 Dusk emergence on tree roosts

- 2.4.1 Tree roosts found by the radio-tracking survey in 2014 were surveyed to record the number of bats occupying the roost. It should be noted that no barbastelle bats were radio-tracked and the tree roosts identified do support this species.
- 2.4.2 Dusk emergence watches on two trees were undertaken in August and September, the details of which are given in Table 3. The location of trees is shown on map EC-23-023 in SES and AP2 ES Volume 5, Ecology Map Book.

Table 3: Summary of 2014 dusk emergence surveys

Map ref	Central grid reference	Date	Sunset	Survey period		No. of Surveyors
040-BT3-150023	SP 23501 78910	19 August 2014	20:23	19:55	21:20	2
040-BT3-153087	SP 21270 80681	2 September 2014	19:53	19:30	20:40	4

2.5 DNA analysis

- 2.5.1 In May, six samples of droppings were collected from whiskered or Brandt's bats for DNA analysis to confirm species identification. The samples were collected from two bats captured in Marlowes Woodland (south) (on the 19 May 2014) and four bats captured in Garden Wood (on the 23 May 2014). Samples were sent to Warwick University for analysis.
- 2.5.2 Captured animals were held in a clean, cloth bag to collect fresh droppings. A check was made to ensure there were no faeces before animals were placed in the bag that could cause cross contamination. Animals were held for no more than 30 minutes before release. The droppings were then transferred to a sterile plastic vial that was sealed whilst on site, before being posted to the University of Warwick.
- 2.5.3 Bats identified through DNA analysis of their droppings are shown in Appendix C.

3 Deviations, constraints and limitations

- 3.1.1 One tag fitted to a Daubenton's bat was faulty. The transmitter worked intermittently between the 1 and 4 September 2014. The approximate location of the bat roost was recorded on the 4 September 2014, but the erratic signal hindered the survey and it was not possible to locate the exact position of the roost.
- 3.1.2 Although there were land access delays to Stonebridge Golf course, Marsh Lane NR and Siden Hill Wood, which influenced survey timings, a proportionate level of survey was achieved overall, based on the results from these woodlands (i.e. sufficient survey was undertaken given the likelihood of barbastelle).
- 3.1.3 Restricted access to Meriden Shafts prevented trapping effort in this woodland. Although the study cannot confirm the absence of a barbastelle bat population in these woods, the study area coverage of woodlands closer to the route is comprehensive. The study can therefore confirm with confidence the probable absence of a colony core area for barbastelle bats in the locality of Marlowes Woodland and the area of the Berkswell Estate affected by the original scheme.
- 3.1.4 It is acknowledged that trapping and lure techniques may be more likely to capture/record some species than others, though there is no published data available to correct this bias. This is not considered to be a significant limitation as a combination of methods has been used for the survey work to date.

4 Results

4.1 Distribution and diversity of bat species

Barbastelle bat

- 4.1.1 Barbastelle bats were not captured during the 2014 trapping surveys, and acoustic sampling in 2014 did not record barbastelle bats within the study area.

Assemblage of bat species

- 4.1.2 The 2014 trapping surveys recorded nine bat species across surveys areas 1-4, during May to September 2014. The bat species trapped during the study are outlined in Table 4. The presence of both Brandt's and whiskered bats were confirmed from DNA analysis of droppings. Table 4: Summary of bat species trapped during 2014 bat trapping surveys

Table 4: Summary of bat species trapped during 2014 bat trapping surveys

Common name	Scientific name
Common pipistrelle	<i>Pipistrellus pipistrellus</i>
Soprano pipistrelle	<i>Pipistrellus pygmaeus</i>
Brown long-eared	<i>Plecotus auritus</i>
Daubenton's	<i>Myotis daubentonii</i>
Natterer's	<i>Myotis nattereri</i>
Whiskered	<i>Myotis mystacinus</i>
Brandt's	<i>Myotis brandtii</i>
Noctule	<i>Nyctalus noctula</i>
Leisler's	<i>Nyctalus leisleri</i>

- 4.1.3 The compositions of bat species assemblages recorded in each woodland are detailed in Table 5. The greatest diversity of species was recorded from Marlowes Woodland, with all nine species occurring in both the north and south parts.
- 4.1.4 Soprano pipistrelle bats were the most frequently caught species, accounting for 38% of the total number of bats caught. They were captured at all the locations other than The Roughs. There was however, only one trapping session in The Roughs, and the level of trapping effort at this location is likely to be the reason soprano pipistrelle bats were not detected in the woodland (rather than the species being confirmed as absent).
- 4.1.5 Daubenton's bats were caught from eight of the 10 trapping locations. This species accounted for 15.5% of the total number of bats caught. Both Daubenton's bat and

soprano pipistrelle bat are known to show an affiliation^{11, 12 and 13} with wetland habitats and their roosts are often close to water. Several of the trapping sites were close to wetlands, including the large pond on the Berkswell Estate, pools at Marsh Lane NR, ponds and lakes at Stonebridge Golf Course, watercourses through the landscape such as Bayley's Brook and the River Blythe.

- 4.1.6 Natterer's bat was the most frequently caught *Myotis* species after Daubenton's bat. Both species occur in all the woodlands in survey area 1. The capture rate, over the study, of these two *Myotis* species is noticeably higher than capture rates (during the study) for whiskered and Brandt's bats (which together account for 6.5% of the total number of bats caught). Whiskered and Brandt's bats occur in Marlowes Woodland and Garden Wood and appear to be widespread on the Berkswell Estate.
- 4.1.7 Brown long-eared bats were caught from eight of the ten trapping locations, with the capture rate over the study indicating that this species is widespread. Brown long-eared bats account for 10.8% of the total number of bats caught.
- 4.1.8 Common pipistrelle bats were considerably less frequently caught than soprano pipistrelle bats and were caught at six of the ten trapping locations. However, bat detector surveys in 2013 confirm that the species is widespread in the study area.
- 4.1.9 The study does not allow direct comparison between trapping locations because of the variation in survey effort between woodlands, however there were lower capture rates (and bat activity) during the study in The Roughs and the CEMEX Quarry woodlands. For this reason, further sampling effort of these woodlands was given low priority (for the objectives of this study).

¹¹ Davidson-Watts I.F. and Jones G., (2006) *Differences in foraging behaviour between Pipistrellus pipistrellus (Schreber, 1774) and Pipistrellus pygmaeus (Leach, 1825)*. Journal of Zoology 268: 55-62.

¹² Altringham J.D., (2003) *British Bats*. Harpers Collins, London.

¹³ Parsons K. N. & Jones G. (2003) *Dispersion and habitat use by Myotis daubentonii and Myotis nattereri during the swarming season: implications for conservation*. Animal Conservation, 6, 283-290.

SES and AP2 ES Appendix – EC-004-004

Table 5: Species assemblage and number of bats captured at each trapping site

Map ref	Location	No. of trapping sessions	Species										Total number of species
			Pp	Ppy	Pa	Md	Mn	Mmy	Mb	Mmy/Mb	Nn	Nl	
040-BA4-150001	Marlowes Woodland (south)	5	0-8/visit (total 10)	1-13/visit (total 28)	0-5/visit (total 14)	0-6/visit (total 12)	0-7/visit (total 18)	0-2/visit (total 3)	0-1/visit (total 2)	0-3/visit (total 3)	0-3/visit (total 5)	0-3/visit (total 3)	9
040-BA4-151001	Marlowes Woodland (north)	4	0-5/visit (total 7)	4-12/visit (total 30)	0-2/visit (total 3)	1-5/visit (total 12)	1-5/visit (total 14)	0-2/visit (total 2)	0-1/visit (total 1)	0-2/visit (total 2)	0-2/visit (total 3)	1-2/visit (total 5)	9
040-BA4-150002	Garden Wood	4	0-6/visit (total 7)	1-7/visit (total 18)	0-5/visit (total 10)	0-3/visit (total 5)	0-2/visit (total 4)	-	-	0-4/visit (total 4)	0-2/visit (total 2)	-	7
040-BA4-151002	Sixteen Acre Wood	2	-	1-8/visit (total 9)	0-2/visit (total 2)	0-1/visit (total 1)	0-2/visit (total 2)	0-1/visit (total 1)	-	-	-	-	5
040-BA4-150003	The Roughs	1	total 3	-	total 1	-	-	-	-	-	-	-	2
040-BA4-149001	Bayley's Brook (Ram Hall)	2	2/visit (total 4)	0-4/visit (total 4)	0-3/visit (total 3)	0-3/visit (total 3)	-	0-1/visit (total 1)	-	-	-	-	5
040-BA4-154001	Stonebridge Golf Course	1	-	total 22	-	total 5	-	-	total 2	-	-	-	3
040-BA4-153001	Siden Hill Wood	3	0-2/visit (total 3)	0-6/visit (total 11)	0-2/visit (total 3)	0-9/visit (total 13)	0-3/visit (total 3)	-	-	0-1/visit (total 1)	0-1/visit (total 2)	-	7
040-BA4-	Marsh Lane NR	2	-	4-7/visit	-	0-4/visit	-	-	-	0-1/visit	-	-	3

SES and AP2 ES Appendix – EC-004-004

153002				(total 11)		(total 4)				(total 1)			
040-BA4-152001	CEMEX Quarry	1	-	total 1	total 2	-	total 8	-	-	-	-	-	3
	Total number of bat captures		34	134	38	55	49	7	5	11	12	8	

Key:

Psp (*Pipistrelle* sp.); Pp (*P. pipistrellus*); Ppy (*P. pygmaeus*); Pn (*P. nathusii*); Pa (*Plecotus auritus*); Msp (*Myotis* sp.); Md (*M. daubentonii*); Mn (*M. nattereri*); Nn (*Nyctalus noctula*); NI (*N. leisleri*); Nsp/Esp (*Nyctalus* sp./*Eptesicus* sp.); and Bb (*Barbastella barbastellus*).

4.2 Prevalence of breeding bats

- 4.2.1 The baseline in the main ES for evaluation of habitats and features for bats has been established from the diversity and status of species, and their distribution within CFA23. The conservation importance of a woodland is dependent on the relationship a species has to an area, and the presence of breeding animals provides evidence of colony core areas. The study did not identify the presence of barbastelle bats in the vicinity of CFA23, but did identify the presence of a diverse assemblage of breeding bats in the area.
- 4.2.2 Table 6 presents data on the number of breeding bats and juveniles captured at each location. The use of woodlands by pregnant, lactating or post-lactating females provides evidence of the importance of a woodland habitat in the vicinity of a maternity roost. The presence of maternity roosts in trees within the woodlands is discussed in section 4.3.
- 4.2.3 Marlowes Woodland (north and south) support breeding populations of all nine species that were recorded in the woodland. Breeding females from six species were recorded, whilst juveniles (only) of Daubenton's, Whiskered and Leisler's bats were caught. Marlowes is an area used by most, if not all, of the known local bat colonies in the area.
- 4.2.4 Garden Wood supports breeding colonies of five species and it is likely that the surrounding parkland habitat is also important, and there is good connectivity between Garden Wood and Marlowes Woodland. The connectivity between woodlands and the landscape pattern around Garden Wood is likely to have a positive influence on the abundance and diversity of bats.
- 4.2.5 Five bat species recorded at Siden Hill Wood include breeding females and juveniles and the woodland appears to be particularly valuable for Daubenton's bats, noctule bats and possibly soprano pipistrelle bats. Field observations during the trapping survey indicate a possible Daubenton's maternity roost in a tree (close to the trapping site). A noctule maternity roost in a tree was also confirmed through the radio-tracking study (see section 4.3).
- 4.2.6 Marsh Lane NR and Stonebridge Golf Course support colonies of soprano pipistrelle bats. As previously discussed, the wetland habitat at these locations is likely to be why this species was recorded in high numbers and breeding at the sites.
- 4.2.7 The CEMEX Quarry woodland supports a relatively low diversity of bat species, but does appear to support a breeding colony of Natterer's bats.
- 4.2.8 The details of all bats captured during the study are provided in Appendix C.
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SES and AP2 ES Appendix – EC-004-004

Table 6: Breeding and juvenile bat captures

Map ref.	Location	Common pipistrelle			Soprano pipistrelle			Brown long-eared			Daubenton's			Natterer's		
		Total	BF	Juv	Total	BF	Juv	Total	BF	Juv	Total	BF	Juv	Total	BF	Juv
040-BA4-150001	Marlowes Woodland (south)	10	1(PL)	5(F)	28	2(L) 1(PL)	9(F) 1(M)	14	2(P) 2(L) 1(PL)	1(M)	12	0	8(F) 1(M)	18	2(P) 2(L) 2(PL)	4(F)
040-BA4-151001	Marlowes Woodland (north)	7	2(P) 1(L) 1(PL)	0	30	2(P)	1(M) 3(F)	3	0	1(M)	12	0	2(M) 3(F)	14	3(P) 1(PL)	2(F)
040-BA4-150002	Garden Wood	7	2(P)	0	18	3(L) 1PL	6(F) 1(M)	10	2(PL)	2(F) 2(M)	5	0	2(M)	4	1(PL)	0
040-BA4-151002	Sixteen Acre Wood	-	-	-	9	0	4(F) 2(M)	2	1(L)	0	1	0	1(F)	2	0	0
040-BA4-150003	The Roughs	3	1(P)	0	-	-	-	1	0	0	-	-	-	-	-	-
040-BA4-149001	Bayley's Brook (Ram Hall)	4	0	0	4	0	0	3	3(PL)	0	3	0	0	-	-	-
040-BA4-154001	Stonebridge Golf Course	-	-	-	22	7(L)	2(F) 2(M)	-	-	-	5	0	4(F) 1(M)	-	-	-
040-BA4-153001	Siden Hill Wood	3	1(L)	0	11	0	5(F) 2(M)	3	0	0	13	2(L)	2(F) 4(M)	3	1(PL)	1(M)
040-BA4-153002	Marsh Lane NR	-	-	-	11	1(P) 2(L) 2(PL)	0	-	-	-	4	3(L)	0	-	-	-

SES and AP2 ES Appendix – EC-004-004

040-BA4-152001	CEMEX Quarry	-	-	-	1	0	1(F)	2	0	1(F)	-	-	-	8	4(L)	1(F) 3(M)
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Map ref.	Location	Whiskered			Brandt's			Whiskered/Brandt			Noctule			Leisler's		
		Total	BF	Juv	Total	BF	Juv	Total	BF	Juv	Total	BF	Juv	Total	BF	Juv
040-BA4-150001	Marlowes Woodland (south)	3	0	1(M)	2	1(P) 1(PL)	0	3	1(L)	0	5	1(PL)	2(F) 1(M)	3	0	1(M)
040-BA4-151001	Marlowes Woodland (north)	2	0	0	1	0	0	2	2(L)	0	3	1(PL)	0	5	0	2(M)
040-BA4-150002	Garden Wood	-	-	-	-	-	-	4	0	0	2	0	0	-	-	-
040-BA4-151002	Sixteen Acre Wood	1	0	0	-	-	-	-	-	-	-	-	-	-	-	-
040-BA4-150003	The Roughs	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
040-BA4-149001	Bayley's Brook (Ram Hall)	1	0	0	-	-	-	-	-	-	-	-	-	-	-	-
040-BA4-154001	Stonebridge Golf Course	-	-	-	2	0	1(F) 1(M)	-	-	-	-	-	-	-	-	-
040-BA4-153001	Siden Hill Wood	-	-	-	-	-	-	1	0	0	2	0	1(M)	-	-	-
040-BA4-153002	Marsh Lane NR	-	-	-	-	-	-	1	0	0	-	-	-	-	-	-
040-BA4-152001	CEMEX Quarry	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Key

Total – sum of all the bats caught, including males and non-breeding females.

(F) – Female, (M) – Male / BF – Breeding Female. Juv – Juvenile. / (P) – Pregnant, (L) – Lactating, (PL) - Post lactating.

4.3 Roosts

- 4.3.1 Baseline data on bat roosts published in the main ES identified 11 tree roosts in CFA23, of which ten were small roosts that support between one and three solitary bats and were assessed as being summer roosts. This includes a solitary common pipistrelle bat that roosted in an oak tree (at OS grid reference SP 23237 79565) in Sixteen Acre Wood (survey area 1). A possible mating roost of 12 common pipistrelle bats was located just north of the B4102 Meriden Road, and west of the River Blythe SSSI (at OS grid reference SP 21328 81414).
- 4.3.2 In 2014, four bats were captured and fitted with radio-tags for the purpose of finding maternity roosts. Of the four bats tagged:
- a breeding female Daubenton's bat (040-BT3-150024 on map EC-23-023 in SES and AP2 ES Volume 5, Ecology Map Book) and juvenile male Natterer's bat (040-BT3-150023 on map EC-23-023) were confirmed roosting in separate trees at Marlowes Woodland south (possible maternity roosts);
 - a noctule maternity roost was located at Siden Hill Wood (040-BT3-153087 on map EC-23-023); and
 - a juvenile male Leisler's bat was recorded roosting on, or close to the existing main line railway (040-BT3-150022 on map EC-23-023) west of Marlowes Woodland (a possible maternity roost).
- 4.3.3 Details of all roosts discovered in 2014 are given in Table 7, and their location is shown on map EC-23-023. This also includes incidental records of:
- a soprano pipistrelle roost (040-BT3-151020 on map EC-23-023) that was recorded during trapping at Marlowes Woodland (on 19 May 2014); and
 - a roost, thought to be brown long-eared (040-BT3-150021 on map EC-23-023), recorded during a walked transect carrying out acoustic sampling (on 21 May 2014).

SES and AP2 ES Appendix – EC-004-004

Table 7: Confirmed tree roosts in 2014

Map ref	Location	Central grid reference	Species	Count	Date of count	Roost Description	Notes
040-BT3-150021	Lavender Hall Lane	SP 24188 78615	(Unconfirmed) brown long-eared	n/a	21 May 2014	Veteran oak with numerous dead branches and cavities.	Incidental record. Surveyors saw bat emerge, but did not hear it, so assumed it was a brown long-eared bat roost.
040-BT3-150022	Mainline Railway	Approx. SP 236 782	Leisler's	n/a	19 August 2014	n/a	Roost discovered from radio-tracking a juvenile male bat. The bat roost is outside the study area. It is considered to be a possible maternity roost.
040-BT3-150023	Marlowes Woodland (south)	SP 23477 78900	Natterer's	n/a	18/ 19 August 2014	Cavity in the trunk of the tree.	Roost discovered from radio-tracking a post-lactating female. The dusk watch on the tree failed to count the number of bats, but the tree has been assessed as a possible maternity roost.
040-BT3-150024	Marlowes Woodland (south)	Approx. SP 234 789	Daubenton's	n/a	4 September 2014	n/a	Roost discovered from radio-tracking a breeding female to a group of trees in Marlowes Woodland (south). The exact location of the roost was not discovered because the radio transmitter was working intermittently between the 01-04 September, which hampered efforts to find the roost.
040-BT3-151020	Marlowes Woodland (north)	SP 23323 79179	Soprano pipistrelle	3	19 May 2014	Cavity hole on south side of the trunk	Incidental record of a small roost. No information available on the breeding status of bats in the roost. Given the number of bats it could be a small breeding roost such as a satellite maternity roost, or non-breeding bats.
040-BT3-153087	Siden Hill Wood	SP 21254 80728	Noctule	18	2 September 2014	Cavity hole on east side of tree	Roost discovered from radio-tracking a juvenile male. Tree supports a maternity roost.

4.3.4 Further details of the bats that were tagged are given in Appendix C.

5 Discussion

5.1 Distribution and diversity of bat species

Barbastelle bat

- 5.1.1 The primary objective of the study in 2014 was to collect sufficient information to inform a review of the status of barbastelle bat.
- 5.1.2 Barbastelle bats were only detected by acoustic surveys (static bat detectors) on two occasions during the 2013 survey session and no records were made during the more extensive and prolonged acoustic or trapping sessions in 2014. The study can conclude the probable absence of a colony core area for barbastelle bats in the locality of Marlowes Woodland and the area of Berkswell Estate affected by the Proposed (hybrid Bill) Scheme.
- 5.1.3 Given this species is known to travel large distances of up to 20km between roosting sites and foraging/mating areas/sites and has home ranges of several hundred¹⁴ km², the 2013 records are consistent with low numbers of barbastelle bat transiting the area to summer roosting sites.

Assemblage of bat species

- 5.1.4 The 2014 study has provided greater resolution with regard to the species composition of the assemblage of bats within the study area than was possible in 2013. The assemblage is very similar to that reported in the main ES, though serotine was not recorded in 2014.
- 5.1.5 In considering the function of habitats within the study area for bats it is meaningful to consider the bat species assemblage, as opposed to individual species. Whilst each species has some specific habitat requirements, they have a number of ecological and conservation needs in common; all British bats are insectivorous and are best adapted for foraging in a landscape that is a mosaic of woodland, still and slow-moving water and open areas of grass and heath¹⁵.
- 5.1.6 The parkland and woodland within the Berkswell Estate supports a diverse assemblage of bats, with the 2013 and 2014 studies confirming that it supports at least nine species of bat. The 2014 study established that the woodlands are breeding areas for the nine species that were captured in that year. Breeding females have the highest energetic costs and therefore breeding roosts are selected in areas with good quality foraging habitat close to the roost (with good quality foraging habitat within a few hundred metres of the roost also being important for juveniles).
- 5.1.7 Woodlands within the study area are within a landscape that is fragmented by major roads and urban conurbations. Connectivity for bats between woodlands appears to be reliant on a relatively low number of corridors, with the River Blythe and associated

¹⁴ Zeale M.R., Davidson-Watts I. and Jones G., (2012) *Home range use and habitat selection by barbastelle bats (Barbastella barbastellus): implications for conservation*. Journal of Mammalogy. Vol 93(4): 1110-1118.

¹⁵ Altringham J.D., (2003) *British Bats*. Harpers Collins, London.

wetlands providing a significant linear route north – south through the Balsall Common & Hampton-in-Arden area (CFA23). The woodland habitats within the Berkswell Estate provide connectivity through a predominantly arable countryside, and are a link in the landscape with woodlands to the north-east of Meriden and the River Blythe corridor to the west.

- 5.1.8 The woodlands within the Berkswell Estate are therefore considered to be an integral part of a permeable landscape for bats. The location, condition and structure of woodland at Marlowes Woodland means it is considered to have a stronger influence on conservation status of bat species than other woodlands within the Berkswell Estate, and could represent a 'hub' of bat activity, attracting bats from surrounding smaller woodlands. Marlowes Woodland is likely to be a core area within the territory of less common species such as whiskered, Brandt's and Leisler's bats, supporting maternity roosts in trees (as shown by the radio tracking); the presence of breeding females and juveniles illustrates the function the woodland has in maintaining the local bat populations, particularly species with a strong affiliation with tree roosts.
- 5.1.9 Within the study area, there are a number of other woodland areas and landscape features which are considered likely to exert relatively greater influence on the conservation status (local populations) of species within the assemblage (including uncommon species) than in other woodlands in the area, namely:
- Siden Hill Wood, which supports seven species of bat, including whiskered/Brandt's (an uncommon species). There is evidence of breeding by five of the seven species captured, including two species that are considered less common (noctule and Natterer's bat). Siden Hill Wood supports a noctule breeding roost (and anecdotal evidence from field observations indicates there is possibly also a Daubenton's breeding roost);
 - Bayley's Brook, which is a linear landscape feature with linkages for movement by bats through the Berkswell Estate. Five bat species were recorded along the watercourse, including the uncommon whiskered bat. There is evidence that the habitat is used by the local breeding population of brown long-eared bat;
 - CEMEX Quarry woodland, where three species of bat were recorded from one night's trapping, including a breeding soprano pipistrelle bat. Relatively high numbers of Natterer's bats (a less common species) were also recorded in the woodland;
 - Marsh Lane NR, which supports three species of bat including the uncommon whiskered/Brandt's bat. The wetland habitats appear to support breeding populations of soprano pipistrelle and Daubenton's bats. Both these species have an affiliation with wetland habitats; and
 - Stonebridge Golf Course, which supports three species of bat, all of which show use by breeding animals. The uncommon Brandt's bat was recorded as well as high numbers of soprano pipistrelle bat.

5.2 Summary

- 5.2.1 The study in 2014 has not revealed any new locations or types of impact on bats arising from construction or operation of the original scheme.
- 5.2.2 The trapping and tracking work undertaken in and around Marlowes and the wider study area around the Berkswell Estate has however enabled a review of the status of barbastelle, and also provided greater resolution on the species composition of the assemblage of bats using the network of woodland and riparian habitats that is crossed by the original scheme. In terms of areas affected by direct impacts of the original scheme, the 2014 study has highlighted the function of woodland at Marlowes Woodland in supporting a number of breeding species of bat.
- 5.2.3 The 2014 study provides additional baseline data that can form the basis for defining the pre-construction baseline and focusing future monitoring on the key issues, the effectiveness of mitigation and residual impacts of the original scheme.
- 5.2.4 It is recommended that monitoring should continue in the period prior to construction. Surveys during this time should capture data that can be normalised by undertaking repeatable surveys over multiple years. A 'normalised baseline' will provide a robust set of data against which the effect of the original scheme and effectiveness of the mitigation can be assessed.
- 5.2.5 Anecdotal evidence from field observations suggests that there may be seasonal movement between woodlands. The normalised baseline should provide a better understanding on how bats are using the woodlands and provide guidance on the detailed landscape design and management for bats, to maximise the efficacy of mitigation measures implemented with the scheme. It will also provide a reliable monitoring platform against which key objectives can be identified.
- 5.2.6 Further monitoring should consider:
- trapping woodlands to establish a normalised baseline for Marlowes Woodland and Garden Wood in particular, because these woodlands had the highest catch rates and diversity of species on the Berkswell Estate, which will provide good data for monitoring the effects of the original scheme;
 - radio-tracking to find breeding roosts of uncommon species, especially those that use difficult to find roosts in trees, advancing the work in 2014 to find tree roosts of uncommon species prior to construction; and
 - acoustic surveys for continued monitoring of barbastelle bat activity.

Appendix A: Trapping locations

SES and AP2 ES Appendix – EC-004-004

Table 1: Trapping locations

Survey area	Map ref	Woodland	Date	Trapping locations ¹⁶	Method of catching	Weather ¹⁷
1	040-BA4-150001	Marlowes Woodland (south)	19 May 2014	SP 23402 78870	Mist net	Temperature: 9-14C
				SP 23361 78847	Harp trap	Wind: 2
				SP 23312 78928	Harp trap	PPT ¹⁸ : None
				SP 23434 78909	Mist net and harp trap	
			26 June 2014	SP 23402 78870	Mist net	Temperature: 12-14C
				SP 23361 78847	Harp trap	Wind: 2
				SP 23312 78928	Harp trap	PPT: Light rain
				SP 23434 78909	Mist net and harp trap	
			22 July 2014	SP 23366 78853	Harp trap	Temperature: 15-16C
				SP 23407 78867	Mist net	Wind: 1
				SP 23387 78944	Mist net	PPT: None
				SP 23427 78991	Two mist nets in a 'v' configuration	
			18 August 2014	SP 23366 78853	Harp trap	Temperature: 12.7C
				SP 23407 78867	Mist net	Wind: 2
				SP 23387 78944	Mist net	PPT: None
				SP 23427 78991	Two mist nets in a 'v' configuration	
31 August	SP 23366 78853	Harp trap	Temperature:16-18C			

¹⁶ OS grid reference of approximate trapping location

¹⁷ Temperature in Celsius; Wind given as Beaufort scale, 0 = calm, 1 = light air, 2 = light breeze.

¹⁸ Precipitation

SES and AP2 ES Appendix – EC-004-004

		2014	SP 23407 78867	Mist net	Wind: 0
			SP 23427 78991	Two mist nets in a 'v' configuration	PPT: None
040-BA4-151001	Marlowes Woodland (north)	20 May 2014	SP 23383 79255	Mist net	Temperature: 8-14C
			SP 23394 79290	Harp trap	Wind: 1
			SP 23328 79196	Mist net	PPT: None
			SP 23317 79185	Harp trap	
			SP 23429 79156	Harp trap	
		24 June 2014	SP 23383 79255	Mist net	Temperature: 13-14C
			SP 23394 79290	Mist net	Wind: 2
			SP 23328 79196	Mist net	PPT: None
			SP 23317 79185	Harp trap	
		19 August 2014	SP 23383 79255	Mist net	Temperature: 13
			SP 23394 79290	Mist net	Wind: 1
			SP 23328 79196	Mist net	PPT: None
			SP 23429 79156	Mist net	
		1 September 2014	SP 23383 79255	Mist net	Temperature: 14-15C
			SP 23394 79290	Mist net	Wind: 1
			SP 23328 79196	Mist net	PPT: None
SP 23429 79156	Mist net				
040-BA4-	Garden Wood	23 May 2014	SP 23883 79497	Mist net	Temperature: 9-12C
			SP 23900 79496	Harp trap	Wind: 2

SES and AP2 ES Appendix – EC-004-004

150002				SP 23908 79527	Mist net	PPT: None
				SP 23909 79490	Harp trap	
			23 June 2014	SP 23917 79405	Mist net	Temperature: 15.5-17C
				SP 23921 79441	Mist net	Wind: 1
				SP 23938 79468	Harp trap	PPT: None
				SP 23951 79515	Mist net	
				SP 23942 79502	Mist net	
			17 August 2014	SP 23953 79486	Mist net	Temperature:13.8C
				SP 23898 79457	Mist net	Wind: 1
				SP 23908 79397	Mist net	PPT: None
				SP 23914 79391	Harp trap	
			5 September 2014	SP 23849 79484	Mist net	Temperature: 14-16C
				SP 23898 79457	Mist net	Wind: 1
				SP 23908 79397	Harp trap	PPT: None
			040-BA4-151002	Sixteen Acre Wood	23 July 2014	SP 22779 79561
SP 22694 79592	Mist net	Wind: 1 PPT: None				
20 August 2014	SP 22779 79561	Two mist nets			Temperature: 14C	
	SP 22694 79592	Mist net			Wind: 0 PPT: None	
2	040-BA4-	The Roughs	21 May 2014	SP 23965 78832	Two mist nets	Temperature: 16C
				SP 23974 78810	Mist net	Wind: 1

SES and AP2 ES Appendix – EC-004-004

	150003			SP 23969 78718	Mist net	PPT: None
	040-BA4-149001	Bayley's Brook (Ram Hall)	22 May 2014	SP 24378 77990	Mist net	Temperature:15C
				SP 24379 77987	Mist net	Wind: 2
				SP 24389 77940	Mist net	PPT: Heavy showers by midnight
			3 September 2014	SP 24378 77990	Mist net	Temperature: 17.5-19C
				SP 24379 77987	Mist net	Wind: 0
				SP 24389 77940	Mist net	PPT: None
3	040-BA4-154001	Stonebridge Golf Course	25 July 2014	SP 22327 82108	Harp trap	Temperature: 16-19C Wind: 2 PPT: None
4	040-BA4-153001	Siden Hill Wood	30 June 2014	SP 21344 80640	Mist net	Temperature: 16C
				SP 21339 80661	Mist net	Wind: 1
				SP 21306 80706	Mist net	PPT: None
				SP 21254 80690	Mist net	
			21 August 2014	SP 21344 80640	Mist net	Temperature: 14C
				SP 21339 80661	Mist net	Wind: 0
				SP 21306 80706	Mist net	PPT: None
				SP 21254 80690	Mist net	
			2 September 2014	SP 21344 80640	Mist net	Temperature: 18C
				SP 21339 80661	Mist net	Wind: 1
				SP 21306 80706	Mist net	PPT: None

SES and AP2 ES Appendix – EC-004-004

			SP 21254 80690	Mist net	
040-BA4-153002	Marsh Lane Nature Reserve	25 June 2014	SP 21682 80354	Mist net	Temperature: 17C
			SP 21666 80359	5m high mist net	Wind: 1
			SP 21660 80385	Mist net	PPT: None
			SP 21657 80385	Harp trap	
		4 September 2014	SP 21653 80359	Harp trap	Temperature: 18.5-19C
			SP 21670 80359	5m high mist net	Wind: 1
			SP 21694 80345	Mist Net	PPT: None
040-BA4-152001	CEMEX Quarry	24 July 2014	SP 22345 80310	Two mist nets	Temperature: 18-20C
			SP 22371 80323	Mist net	Wind: 1
			SP 22355 82147	Mist net	PPT: None
			SP 22375 82140	Mist net	

Appendix B: Acoustic sampling

Static recorders monitored bat activity on each of the 25 survey nights. Woodlands were sampled by taking walked transects through the survey area, on the dates and at the locations outlined in this appendix.

Table 1: dates and locations of walked transects

Date	Woodlands sampled
19 May 2014	Marlowes Woodland
20 May 2014	Marlowes Woodland The Bogs
21 May 2014	The Roughs
22 May 2014	Bayley's Brook
23 May 2014	Garden Wood
23 June 2014	Garden Wood Close Wood
24 June 2014	Sixteen Acre Wood The Bogs Birchley Hays Wood
25 June 2014	Meriden Shafts
22 July 2014	Marlowes Woodland The Bogs Sixteen Acre Wood Stonebridge Golf Course (north)
23 July 2014	Sixteen Acre Wood CEMEX Quarry
24 July 2014	Meriden Shafts
25 July 2014	Meriden Shafts
17 August 2014	Garden Wood
18 August 2014	Marlowes Woodland
19 August 2014	Marlowes Woodland Sixteen Acre Wood
31 August 2014	Marlowes Woodland
1 September 2014	Marlowes Woodland Sixteen Acre Wood
4 September 2014	Marsh Lane
5 September 2014	Garden Wood

Appendix C: Bat captures in 2014

SES and AP2 ES Appendix – EC-004-004

Table 1: Trapping session 1: May 2014

Date	Location	Time	Species	Common name	Sex	Age	Breeding status	Notes
19 May 2014	Marlowes Woodland (south)	21:35	Ppy	Soprano pipistrelle	m	a		
		22:00	Mn	Natterer's	f	a		
		22:30	Mn	Natterer's	f	a	P	
		22:35	Ppy	Soprano pipistrelle	m	a		
		22:40	Mn	Natterer's	f	a	P	
		22:50	Mn	Natterer's	f	a		
		23:00	Pp	Common pipistrelle	m	a		
		23:05	Ppy	Soprano pipistrelle	m	a		
		23:05	Md	Daubenton's	m	a		
		23:25	Msp	Whiskered/Brandt's	f	a		Whiskered confirmed by DNA analysis
		23:25	Ppy	Soprano pipistrelle	m	a		
		23:30	Ppy	Soprano pipistrelle	m	a		
		23:30	Pa	Brown long-eared	f	a	P	
		23:30	Pa	Brown long-eared	f	a	P	
		01:00	Md	Daubenton's	m	a		
		01:30	Ppy	Soprano pipistrelle	m	a		
		01:30	Ppy	Soprano pipistrelle	m	a		
		01:40	Msp	Whiskered/Brandt's	f	a	P	Brandt's confirmed by DNA analysis
03:00	Ppy	Soprano pipistrelle	m	a				
20 May 2014	Marlowes Woodland (north)	21:25	Ppy	Soprano pipistrelle	m	a		
		21:28	Ppy	Soprano pipistrelle	m	a		
		21:35	Ppy	Soprano pipistrelle	m	a		
		21:40	Pp	Common pipistrelle	f	a		
		21:40	Ppy	Soprano pipistrelle	m	a		
		21:45	Ppy	Soprano pipistrelle	m	a		
		21:50	Ppy	Soprano pipistrelle	m	a		
		21:55	Md	Daubenton's	m	a		
		21:56	Mn	Natterer's	f	a	P	

SES and AP2 ES Appendix – EC-004-004

		21:56	Mn	Natterer's	f	a	P	
		21:56	Mn	Natterer's	f	a		
		21:58	Mn	Natterer's	m	a		
		21:59	Ppy	Soprano pipistrelle	m	a		
		22:00	Ppy	Soprano pipistrelle	f	a	P	
		22:05	Md	Daubenton's	m	a		
		22:05	Mn	Natterer's	f	a	P	
		22:30	Pp	Common pipistrelle	m	a		
		22:30	Ppy	Soprano pipistrelle	m	a		
		22:34	Ppy	Soprano pipistrelle	m	a		
		22:34	Pp	Common pipistrelle	f	a	P	
		23:05	Nl	Leisler's	m	a		
		23:05	Pp	Common pipistrelle	f	a	P	
		23:45	Pp	Common pipistrelle	m	a		
		00:32	Md	Daubenton's	f	a		
		00:42	Ppy	Soprano pipistrelle	m	a		
		01:10	Ppy	Soprano pipistrelle	m	a		
21 May 2014	The Roughts	23:00	Pp	Common pipistrelle	f	a	P	
		23:02	Pp	Common pipistrelle	m	a		
		23:05	Pa	Brown long-eared	m	a		
		23:20	Pp	Common pipistrelle	m	a		
22 May 2014	Bayley's Brook (Ram Hall)	21:45	Md	Daubenton's	m	a		
		21:47	Pp	Common pipistrelle	f	a		
		21:48	Md	Daubenton's	m	a		
		22:15	Pp	Common pipistrelle	f	a		
		23:01	Md	Daubenton's	m	a		
23 May 2014	Garden Wood	21:20	Pp	Common pipistrelle	f	a		
		21:22	Pp	Common pipistrelle	f	a		
		21:25	Pp	Common pipistrelle	m	a		
		21:30	Pp	Common pipistrelle	f	a	P	
		22:10	Pp	Common pipistrelle	f	a		
		22:15	Ppy	Soprano pipistrelle	m	a		
		22:20	Msp	Whiskered/Brandt's	f	a		Brandt's

SES and AP2 ES Appendix – EC-004-004

						confirmed by DNA analysis
22:20	Msp	Whiskered/Brandt's	f	a	P	Brandt's confirmed by DNA analysis
22:25	Msp	Whiskered/Brandt's	m	a		Whiskered confirmed by DNA analysis
23:05	Pp	Common pipistrelle	f	a	P	
23:55	Msp	Whiskered/Brandt's	m	a		
23:55	Mn	Natterer's	m	a		
23:59	Msp	Whiskered/Brandt's	f	a		Brandt's confirmed by DNA analysis

SES and AP2 ES Appendix – EC-004-004

Table 2: Trapping session 2: June 2014

Date	Location	Time	Species	Common name	Sex	Age	Breeding status	Notes
23 June 2014	Garden Wood	22:00	Ppy	Soprano pipistrelle	f	a	L	
		22:25	Ppy	Soprano pipistrelle	f	a	L	
		22:25	Pa	Brown long-eared	m	a		
		22:40	Pp	Common pipistrelle	m	a		
		22:55	Md	Daubenton's	m	a		
		23:00	Mn	Natterer's	m	a		
		23:15	Nn	Noctule	m	a		
		00:30	Ppy	Soprano pipistrelle	f	a	L	
		00:45	Md	Daubenton's	m	a		
		01:00	Ppy	Soprano pipistrelle	m	a		
		02:05	Nn	Noctule	m	a		
24 June 2014	Marlowes Woodland (north)	22:25	Md	Daubenton's	f	a	NB	
		22:30	Ppy	Soprano pipistrelle	m	a		
		22:40	Mn	Natterer's	f	a	NB	
		22:45	Msp	Whiskered/Brandt's	f	a	L	
		23:20	Ppy	Soprano pipistrelle	f	a	P	
		23:30	Nn	Noctule	m	a		
		00:15	Nl	Leisler's	m	a		
		00:35	Msp	Whiskered/Brandt's	f	a	L	
		00:45	Mn	Natterer's	f	a	NB	
		01:00	Mn	Natterer's	m	a		
		01:10	Ppy	Soprano pipistrelle	m	a	NB	
		01:15	Ppy	Soprano pipistrelle	f	a	NB	
		01:20	Ppy	Soprano pipistrelle	m	a		
		01:25	Pp	Common pipistrelle	f	a	L	
25 June 2014	Marsh Lane Nature Reserve	22:20	Md	Daubenton's	f	a	L	
		22:25	Ppy	Soprano pipistrelle	m	a		
		22:30	Ppy	Soprano pipistrelle	f	a	L	
		22:40	Ppy	Soprano pipistrelle	m	a		
		23:00	Md	Daubenton's	m	a		
		23:05	Ppy	Soprano pipistrelle	m	a		

SES and AP2 ES Appendix – EC-004-004

Date	Location	Time	Species	Common name	Sex	Age	Breeding status	Notes
		23:15	Msp	Whiskered/Brandt's	m	a		
		23:40	Ppy	Soprano pipistrelle	m	a		
		00:10	Md	Daubenton's	f	a	L	
		00:20	Ppy	Soprano pipistrelle	f	a	L	
		00:30	Md	Daubenton's	f	a	L	
		00:45	Ppy	Soprano pipistrelle	f	a	P	
26 June 2014	Marlowes Woodland (south)	22:15	Ppy	Soprano pipistrelle	m	a		
		22:20	Msp	Whiskered/Brandt's	m	a		
		22:35	Ppy	Soprano pipistrelle	m	a		
		22:45	Ppy	Soprano pipistrelle	m	a		
		23:00	Msp	Whiskered/Brandt's	f	a	L	
30 June 2014	Siden Hill Wood	23:05	Msp	Whiskered/Brandt's	m	a		
		23:25	Md	Daubenton's	f	a		
		23:35	Md	Daubenton's	m	j		
		00:05	Md	Daubenton's	m	j		
		00:20	Md	Daubenton's	f	j		
		00:20	Nn	Noctule	m	a		
		00:25	Md	Daubenton's	m	j		
		00:30	Md	Daubenton's	m	j		
		00:45	Md	Daubenton's	f	a		
		00:50	Md	Daubenton's	f	a	L	
		01:20	Pp	Common pipistrelle	f	a	L	
		01:20	Md	Daubenton's	f	a	L	

SES and AP2 ES Appendix – EC-004-004

Table 3: Trapping session 3: July 2014

Date	Location	Time	Species	Common name	Sex	Age	Breeding status	Notes
22 July 2014	Marlowes Woodland (south)	21:15	Ppy	Soprano pipistrelle	m	a		
		21:55	Mn	Natterer's	f	a	NB	
		22:20	Pa	Brown long-eared	f	a	NB	
		22:20	Mn	Natterer's	m	a		
		22:25	Pa	Brown long-eared	f	a	L	
		22:30	Pa	Brown long-eared	f	a	L	
		22:50	Nn	Noctule	m	a		
		23:10	Md	Daubenton's	f	j		
		23:18	Pa	Brown long-eared	m	a		
		00:25	Pp	Common pipistrelle	f	j		
		00:30	Mn	Natterer's	f	a	L	
		00:37	Mn	Natterer's	f	j		
		01:00	Mn	Natterer's	f	a	L	
		01:00	Mn	Natterer's	f	j		
		01:25	Mm	Whiskered	m	a		
		01:30	Ppy	Soprano pipistrelle	f	a	L	
		02:10	Mm	Whiskered	m	j		
		02:10	Ppy	Soprano pipistrelle	f	a	L	
		02:12	Mn	Natterer's	m	a		
		02:12	Msp	Whiskered/ Brandt's	m	a		
23 July 2014	Sixteen Acre Wood	22:15	Mm	Whiskered	m	a		
		22:25	Mn	Natterer's	f	a	NB	
		22:30	Pa	Brown long-eared	f	a	L	
		22:45	Ppy	Soprano pipistrelle	m	j		
		22:45	Ppy	Soprano pipistrelle		a		Bat escaped from net
		22:45	Pa	Brown long-eared	m	a		
		22:55	Ppy	Soprano pipistrelle	f	j		
		22:55	Ppy	Soprano pipistrelle		a		Bat escaped from net
		23:10	Ppy	Soprano pipistrelle	f	j		

SES and AP2 ES Appendix – EC-004-004

Date	Location	Time	Species	Common name	Sex	Age	Breeding status	Notes
		23:15	Ppy	Soprano pipistrelle	m	j		
		23:15	Mn	Natterer's	m	a		
		23:45	Ppy	Soprano pipistrelle	f	j		
		23:45	Ppy	Soprano pipistrelle	f	j		
24 July 2014	CEMEX Quarry	21:55	Mn	Natterer's	f	a	L	
		22:00	Mn	Natterer's	f	j		
		22:05	Mn	Natterer's	f	a	L	
		22:15	Mn	Natterer's	m	j		
		22:16	Mn	Natterer's	m	j		
		22:18	Mn	Natterer's	f	a	L	
		22:24	Mn	Natterer's	m	j		
		22:32	Mn	Natterer's	f	a	L	
		22:42	Pa	Brown long-eared	f	j		
		00:10	Pa	Brown long-eared	m	a		
		00:30	Ppy	Soprano pipistrelle	f	j		
25 July 2014	Stonebridge Golf Course	22:05	Ppy	Soprano pipistrelle	f	j		
		22:05	Md	Daubenton's	f	j		
		22:06	Md	Daubenton's	m	j		
		22:07	Ppy	Soprano pipistrelle	f	a	NB	
		22:08	Ppy	Soprano pipistrelle	f	a	NB	
		22:09	Md	Daubenton's	f	j		
		22:10	Md	Daubenton's	f	j		
		22:11	Ppy	Soprano pipistrelle	f	a	NB	
		22:12	Ppy	Soprano pipistrelle	f	a	NB	
		22:13	Ppy	Soprano pipistrelle	f	a	NB	
		22:14	Ppy	Soprano pipistrelle	m	j		
		22:15	Ppy	Soprano pipistrelle	m	j		
		22:16	Ppy	Soprano pipistrelle	m	a		
		22:17	Ppy	Soprano pipistrelle	m	a		
		22:20	Ppy	Soprano pipistrelle	f	a	L	
		22:22	Ppy	Soprano pipistrelle	f	a	L	
		22:24	Ppy	Soprano pipistrelle	f	a	L	

SES and AP2 ES Appendix – EC-004-004

Date	Location	Time	Species	Common name	Sex	Age	Breeding status	Notes
		22:24	Ppy	Soprano pipistrelle	f	a	L	
		22:24	Ppy	Soprano pipistrelle	f	a	L	
		22:25	Ppy	Soprano pipistrelle	f	a	L	
		22:25	Ppy	Soprano pipistrelle	f	a	L	
		22:40	Ppy	Soprano pipistrelle	f	a	NB	
		23:15	Mb	Brandts	m	j		
		23:20	Mb	Brandts	f	j		
		23:25	Ppy	Soprano pipistrelle	f	a	NB	
		23:50	Md	Daubenton's	f	j		
		23:52	Ppy	Soprano pipistrelle	f	j		
		00:08	Ppy	Soprano pipistrelle	f	a	NB	
		00:25	Ppy	Soprano pipistrelle	m	a		

SES and AP2 ES Appendix – EC-004-004

Table 4: Trapping session 4: August 2014

Date	Location	Time	Species	Common name	Sex	Age	Breeding status	Notes
17 August 2014	Garden Wood	21:50	Pa	Brown long-eared	m	a		
		21:50	Ppy	Soprano pipistrelle	f	j		
		22:50	Ppy	Soprano pipistrelle	f	j		
		23:10	Ppy	Soprano pipistrelle	f	a	PL	
		23:10	Ppy	Soprano pipistrelle	f	j		
		23:25	Pa	Brown long-eared	m	j		
		23:45	Pa	Brown long-eared	f	a	PL	
		23:45	Pa	Brown long-eared	f	a	PL	
		23:45	Ppy	Soprano pipistrelle	f	j		
		00:05	Pa	Brown long-eared	m	j		
		00:30	Ppy	Soprano pipistrelle	m	j		
		00:35	Ppy	Soprano pipistrelle	f	j		
18 August 2014	Marlowes Woodland (south)	21:10	Md	Daubenton's	m	j		
		21:12	Md	Daubenton's	f	j		
		21:15	Md	Daubenton's	f	j		
		21:15	Md	Daubenton's	f	j		
		21:15	Pa	Brown long-eared	m	a		
		21:25	Mn	Natterer's	f	j		
		21:27	Mn	Natterer's	f	a	PL	
		22:00	Mn	Natterer's	f	a	PL	1st tagged bat. Weight of bat 8.5g.
		22:01	Pp	Common pipistrelle	f	j		
		22:20	Pp	Common pipistrelle	f	a	PL	
		22:20	Pp	Common pipistrelle	f	a		
		22:20	Pp	Common pipistrelle	f	a		
		22:40	Nn	Noctule	f	j		
		22:45	Pp	Common pipistrelle	f	j		
		22:45	Pp	Common pipistrelle	f	j		
		23:15	Mn	Natterer's	f	j		
23:20	Md	Daubenton's	f	j				

SES and AP2 ES Appendix – EC-004-004

		23:25	Pa	Brown long-eared	m	a		
		23:40	Pp	Common pipistrelle	f	j		
		00:30	Ppy	Soprano pipistrelle	m	a		
		01:00	Pp	Common pipistrelle	m	a		
		01:15	Mn	Natterer's	f	a		
		01:15	Mn	Natterer's	f	a		
		01:15	Md	Daubenton's	f	j		
		01:18	Mn	Natterer's	m	a		
		01:40	Pa	Brown long-eared	m	a		
		01:58	Pa	Brown long-eared	m	a		
		02:40	Pa	Brown long-eared	f	a		
19 August 2014	Marlowes Woodland (north)	20:55	Nl	Leisler's	m	a		2nd tagged Bat. Weight of bat gg.
		21:00	Md	Daubenton's	m	a		
		21:00	Ppy	Soprano pipistrelle	f	j		
		21:15	Md	Daubenton's	m	a		
		21:30	Md	Daubenton's	m	j		
		00:00	Ppy	Soprano pipistrelle	m	a		
		22:25	Ppy	Soprano pipistrelle	m	j		
		23:45	Mn	Natterer's	f	a	NB	
		23:45	Mn	Natterer's	f	a	PL	
		23:46	Pa	Brown long-eared	f	a	NB	
		00:15	Mn	Natterer's	f	j		
		00:15	Mn	Natterer's	f	j		
		00:40	Ppy	Soprano pipistrelle	m	a		
		01:05	Mn	Natterer's	f	a		
		01:05	Pa	Brown long-eared	f	a		
20 August 2014	Sixteen Acre Wood	21:35	Md	Daubenton's	f	j		
		22:50	Ppy	Soprano pipistrelle	m	a		
21 August 2014	Siden Hill Wood	21:25	Ppy	Soprano pipistrelle	f	j		
		21:25	Mn	Natterer's	m	a		
		21:55	Mn	Natterer's	m	j		

SES and AP2 ES Appendix – EC-004-004

22:05	Pp	Common pipistrelle	m	a		
22:30	Ppy	Soprano pipistrelle	m	j		
22:30	Ppy	Soprano pipistrelle	f	j		
22:30	Psp	Pipistrelle sp.				
22:35	Pa	Brown long-eared	m	a		
22:50	Ppy	Soprano pipistrelle	f	j		
22:50	Ppy	Soprano pipistrelle	f	j		
23:05	Ppy	Soprano pipistrelle	m	j		
23:25	Md	Daubenton's	f	a	NB	
00:10	Mn	Natterer's	f	a	PL	

SES and AP2 ES Appendix – EC-004-004

Table 5: Trapping session 5: September 2014

Date	Location	Time	Species	Common name	Sex	Age	Breeding status	Notes
31 August 2014	Marlowes Woodland (south)	20:10	Ppy	Soprano pipistrelle	m	a		
		20:11	Ppy	Soprano pipistrelle	f	j		
		20:35	Md	Daubenton's	f	j		
		20:40	Md	Daubenton's	f	j		
		20:55	Md	Daubenton's	f	a	NB	
		21:30	Ppy	Soprano pipistrelle	f	j		
		21:30	Ppy	Soprano pipistrelle	m	j		
		21:45	Pa	Brown long-eared	m	j		
		22:05	Nl	Leisler's	m	j		
		22:30	Ppy	Soprano pipistrelle	f	j		
		22:40	Pa	Brown long-eared	f	a	PL	
		22:45	Pp	Soprano pipistrelle	F	J		3rd tagged bat (tag 845). Weight of bat 30g.
		22:45	Nn	Noctule	m	j		
		00:15	Ppy	Soprano pipistrelle	f	j		
		00:15	Ppy	Soprano pipistrelle	f	j		
		00:15	Ppy	Soprano pipistrelle	f	j		
		00:15	Ppy	Soprano pipistrelle	f	j		
		00:15	Ppy	Soprano pipistrelle	f	j		
		00:20	Ppy	Soprano pipistrelle	f	a	PL	
		00:20	Mb	Brandt's	f	a	PL	
		00:45	Nn	Noctule	f	a	PL	
		00:45	Nn	Noctule	f	j		
		01:00	Nl	Leisler's	m	a		
01:00	Nl	Leisler's	f	a				
01:20	Pa	Brown long-eared	f	a	NB			
01:20	Ppy	Soprano pipistrelle	f	a	NB			
1 September 2014	Marlowes Woodland (north)	20:47	Md	Daubenton's	m	j		
		20:47	Md	Daubenton's	f	j		
		20:47	Md	Daubenton's	f	j		

SES and AP2 ES Appendix – EC-004-004

		20:47	Md	Daubenton's	f	j		
		20:47	Md	Daubenton's	f	a	NB	4th tagged bat (tag 3850). Weight of bat 8g.
		21:10	Nn	Noctule	m	a		
		21:18	Mb	Brandt's	m	a	M	
		21:24	Ppy	Soprano pipistrelle	m	a		
		21:24	Pp	Common pipistrelle	f	a	PL	
		21:26	Ppy	Soprano pipistrelle	f	j		
		21:33	Nl	Leisler's	m	j		
		21:30	Mm	Whiskered	m	a	M	
		22:02	Nn	Noctule	f	a	PL	
		22:15	Nl	Leisler's	f	a		
		22:15	Ppy	Soprano pipistrelle	m	a		
		22:15	Ppy	Soprano pipistrelle	f	a	NB	
		22:30	Ppy	Soprano pipistrelle	f	a	NB	
		22:30	Mm	Whiskered	f	a	NB	
		22:40	Ppy	Soprano pipistrelle	f	a		
		22:50	Ppy	Soprano pipistrelle	f	a		
		22:55	Ppy	Soprano pipistrelle				
		23:08	Ppy	Soprano pipistrelle	f	j		
		23:08	Pa	Brown long-eared	m	j		
		23:30	Mn	Natterer's	f	a	NB	
2 September 2014	Siden Hill Wood	20:25	Ppy	Soprano pipistrelle	m	a	M	
		21:25	Ppy	Soprano pipistrelle	f	j		
		21:30	Md	Daubenton's	f	j		Large bat at 12g
		21:45	Md	Daubenton's	f	a		
		21:46	Md	Daubenton's	f	a		
		22:00	Pa	Brown long-eared	f	a		
		22:12	Ppy	Soprano pipistrelle	m	a	M	
		22:20	Ppy	Soprano pipistrelle	f	a		
		22:30	Ppy	Soprano pipistrelle	f	a		
		23:08	Nn	Noctule	m	j		

SES and AP2 ES Appendix – EC-004-004

		23:20	Pa	Brown long-eared	m	a		
3 September 2014	Bayley's Brook (Ram Hall)	20:20	Ppy	Soprano pipistrelle	f	a		
		20:35	Pp	Common pipistrelle	f	a		
		21:00	Pa	Brown long-eared	f	a	PL	
		21:45	Mm	Whiskered	m	a		
		21:55	Ppy	Soprano pipistrelle	m	a		
		22:10	Pa	Brown long-eared	f	a	PL	
		22:45	Pp	Common pipistrelle	f	a	NB	
		23:00	Ppy	Soprano pipistrelle	m	a		
		23:00	Ppy	Soprano pipistrelle	f	a	NB	
		23:25	Pa	Brown long-eared	f	a	PL	
4 September 2014	Marsh Lane Nature Reserve	20:25	Ppy	Soprano pipistrelle	f			
		20:25	Ppy	Soprano pipistrelle	f			
		20:28	Ppy	Soprano pipistrelle	f	a	PL	
		20:28	Ppy	Soprano pipistrelle	f	a	PL	
5 September 2014	Garden Wood	20:10	Ppy	Soprano pipistrelle	f	a	NB	
		20:15	Ppy	Soprano pipistrelle	m	a		
		20:25	Md	Daubenton's	m	j		
		20:30	Md	Daubenton's	f	a	NB	
		20:55	Mn	Natterer's	f	a	NB	
		21:20	Pa	Brown long-eared	m	a		
		21:21	Pa	Brown long-eared	m	a		
		21:22	Ppy	Soprano pipistrelle	m	a		
		21:35	Md	Daubenton's	m	j		
		21:40	Ppy	Soprano pipistrelle	f	j		
		22:00	Pa	Brown long-eared	f	j		
		22:10	Pp	Common pipistrelle	m	a		
		22:40	Pa	Brown long-eared	f	a		
		23:25	Mn	Natterer's	f	a	PL	
		23:25	Ppy	Soprano pipistrelle	m	a		
23:30	Ppy	Soprano pipistrelle	f	a				

SES and AP2 ES Appendix – EC-004-004

Key:

Psp (*Pipistrelle* sp.); Pp (*P. pipistrellus*); Ppy (*P. pygmaeus*); Pn (*P. nathusii*); Pa (*Plecotus auritus*); Msp (*Myotis* sp); Md (*M. daubentonii*); Mn (*M. nattereri*); Nn (*Nyctalus noctula*); Es (*Eptesicus serotinus*); Nl (*N. leisleri*); Nsp/Esp (*Nyctalus* sp./ *Eptesicus* sp.); and Bb (*Barbastella barbastellus*).

m = male, f = female

a = adult, j = juvenile

M = mating, P = pregnant, PL = post-lactating, NB = non-breeding

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