

A47/A11 Thickthorn Junction

Scheme Number: TR010037

Volume 6

6.3 Environmental Statement Appendices **Appendix 8.8 – Bat Roost and Crossing Point** **Survey Report**

APFP Regulation 5(2)(a)

Planning Act 2008

Infrastructure Planning (Applications: Prescribed
Forms and Procedure) Regulations 2009

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Infrastructure Planning

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(Applications: Prescribed Forms and
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The A47/A11 Thickthorn Junction
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ENVIRONMENTAL STATEMENT APPENDICES
Appendix 8.8 – Bat Roost and Crossing Point Survey Report

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1. Introduction

1.1. Background

- 1.1.1. Sweco UK Ltd was commissioned to undertake update preliminary ground level roost assessment and dusk emergence and dawn re-entry roost surveys, and initial crossing point surveys at the A47/A11 Thickthorn Junction, hereafter referred to as 'the site'. This is to inform the Environmental Statement (ES) Chapter 8, Biodiversity for the Proposed Scheme at A47/A11 Thickthorn Junction (TR010037/APP/6.1) [\(APP-045\)](#).
- 1.1.2. This report details the results of the update from 2017 and 2018 of preliminary ground level roost assessments, bat dusk emergence/dawn re-entry roost surveys and crossing point surveys undertaken at the site in July and August 2020, assesses impacts upon bats as a result of the Proposed Scheme and subsequently proposes mitigation.

1.2. Proposed scheme description

- 1.2.1. The A47/A11 Thickthorn Junction is located on the south-western edge of Norwich, at national grid reference TG 18424 05483, and provides access to the A47 via the A11 for Eaton, Cringleford, Hethersett and Wymondham.
- 1.2.2. The Proposed Scheme improvements will:
- Improve accessibility to and around the region, reducing congestion and delays so encouraging more reliable journey times
 - Improve safety performance for all road users – drivers, public transport users, cyclists, horse riders and pedestrians
 - Provide alternative access to local roads
 - Protect the environment by minimising adverse impacts and, where possible, deliver benefits
 - Support economic growth in the Peterborough, Norwich, Cambridge and Great Yarmouth areas, improving overall road capacity
- 1.2.3. The aims and objectives of the Proposed Scheme are to:
- create a new connector road from the A11 to the A47
 - improve the existing Thickthorn Junction roundabout
 - create a new link road between Cantley Lane South and the B1172 Norwich Road
 - create a new Cantley Lane Footbridge (Cringleford) across the A47 for walkers, cyclists and horse riders

2. Ecological background

2.1. Previous studies

Desk study

- 2.1.1. A desk study conducted as part of the previously undertaken Preliminary Ecological Appraisal (PEA) in 2016 identified no Special Areas of Conservation (SACs) designated for bats within 30km of the site (AECOM, 2016). Eaton Chalk Pit Site of Special Scientific Interest (SSSI) approximately 2.3km north east of the scheme with no direct ecological connection, is designated for caves which provide a hibernation site for three species of bat (Daubenton's bat *Myotis daubentonii*; natterer's bat *M. nattereri* and brown long-eared bat *Plecotus auritus*), the local populations of which potentially use the A47/A11 Thickthorn Junction site during summer for foraging, commuting or roosting (AECOM, 2016). Records obtained during the desk study include records of roosting bats nearby and foraging and commuting bats within the site (AECOM, 2016).

Extended Phase 1 habitat survey

- 2.1.2. An extended Phase 1 habitat survey was previously undertaken in 2016 of the site and up to 50m outside the site. Habitats identified within the survey are with potential to support bats include broad-leaved, mixed and conifer plantation woodland, standing and running water, hedgerows and trees (including veteran trees) (AECOM, 2016).

Phase 2 bat surveys 2016-2017

- 2.1.3. Following a preliminary roost appraisal undertaken in 2016 as part of the PEA, further preliminary roost appraisals in 2017 following updates to the Proposed Scheme and aerial inspections of 27 trees in April 2017 the following trees with bat roost potential (BRP) were identified (AECOM, 2017):
- One confirmed tree roost (in [REDACTED])
 - Nine trees with moderate BRP
 - Thirteen trees with low BRP
 - Four trees with negligible BRP
- 2.1.4. The A47 footbridge and A11 underpass were assessed as having negligible risk with regards to roosting bats owing to the lack of crevices or other suitable roost places.
- 2.1.5. Dusk emergence and dawn re-entry surveys undertaken in 2017 confirmed the roost in [REDACTED] identified in the aerial inspections and one further roost in [REDACTED], both of which were classified as day roosts of soprano pipistrelle *Pipistrellus*

pygmaeus, and concluded further pipistrelle roosts were likely present in residential areas near Cantley Lane and Cantley Lane South (AECOM, 20177).

2.1.6. Bat activity surveys were previously undertaken at the site between April 2017 and October 2017 based upon an assessment which concluded moderate habitat suitability for bats (AECOM, 2017). Seven species of bat were recorded on site; common pipistrelle *Pipistrellus pipistrellus*, soprano pipistrelle, Daubenton's, noctule *Nyctalus noctula*, brown long-eared, serotine *Eptesicus serotinus* and barbastelle *Barbastella barbastellus*. Four areas of relatively high bat activity were identified during the surveys; the woodland west of the Thickthorn services, along Cantley Lane north and south of the A47, a woodland edge/track and stream east of the A11 and the fishing lakes.

Phase 2 bat surveys 2018

2.1.7. In 2018 further dusk emergence/dawn re-entry roost surveys were undertaken on the two previously confirmed roosts () in accordance with recommendations following the 2016 and 2017 surveys (Highways England, 2018). Roosting behaviour was confirmed in and an oak *Quercus* sp. tree with the roosts characterised as occasional day roosts for single or small numbers of soprano pipistrelles. A third soprano pipistrelle day roost was incidentally identified during the surveys in a sycamore *Acer pseudoplatanus* tree .

2.2. Legislation

2.2.1. All bats in the UK are protected under UK and European law as set out below.

Wildlife and Countryside Act (WCA) 1981 (as amended)

2.2.2. All UK species of bat are protected under Schedule 5, Section 9.1 and 9.5(a)(b) of the WCA 1981 (as amended), making it an offence to:

- damage or destroy a bat roost (whether or not occupied by bats at the time)
- intentionally or recklessly obstruct access to a bat roost
- intentionally or recklessly disturb a bat in its roost, or deliberately disturb a group of bats
- deliberately kill, injure or take any bat

The Conservation of Habitats and Species Regulations (CHSR) 2017

2.2.3. Included in Annex II and IV of EC Directive 92/43/EEC on the Conservation of Natural Habitats and of the Wild Fauna and Flora (the Habitats Directive 1992) as obligated by the Bern Convention (1979) which implements the Conservation of Habitats and Species Regulations (CHSR) 2017 all bat species in the UK are

European Protected Species (EPS) afforded protection under Section 2 of the CHSR 2017 Regulation 42.

2.2.4. Under the CHSR, it is an offence if you:

- deliberately capture, injure or kill any wild animal of a EPS
- deliberately disturb wild animals of any such species
- deliberately take or destroy the eggs of such an animal
- damage or destroy a breeding site or resting place of such an animal

2.2.5. With specific reference to the offence of disturbance, Regulation 39(1) of the Conservation of Habitats and Species (Amendment) Regulations 2012 states that a person commits an offence if he:

“deliberately disturbs wild animals of any such species [i.e. a European Protected Species] in such a way as to be likely significantly to affect:

(i) the ability of any significant group of animals of that species to survive, breed, or rear or nurture their young; or

(ii) the local distribution or abundance of that species”.

2.2.6. Where development will result in damage to, or obstruct access to, any bat roost (whether occupied or not) or risks harming or significantly disturbing bats, a European Protected Species Licence (EPSL) is required from Natural England to allow the development to proceed.

Natural Environment and Rural Communities Act (NERC)

2.2.7. Bats are also afforded more general protection in England (and Wales) within the Natural Environment and Rural Communities Act (NERC) 2006. This imposes a duty on all public bodies, including local authorities and statutory bodies, in exercising their functions, *“to have due regard, so far as is consistent with the proper exercise of those functions, to the purpose of conserving biodiversity”* [Section 40 (1)]. It notes that *“conserving biodiversity includes restoring or enhancing a population or habitat”* [Section 40 (3)]. Consequently, attention should be given to dealing with the modification or development of an area if aspects of it are deemed important to bats, such as roosts, flight corridors and foraging areas.

2.2.8. Section 41 (S41) of this Act requires the Secretary of State to publish a list (in consultation with Natural England) of habitats and species which are of principal importance for the conservation of biodiversity in England. The S41 list is used to guide decision-makers such as public bodies including local and regional authorities, when carrying out their normal (e.g. planning) functions.

2.2.9. Seven species of bats (soprano pipistrelle, brown long-eared, greater horseshoe *Rhinolophus ferrumequinum*, lesser horseshoe *Rhinolophus hipposideros*, barbastelle, Bechstein's *Myotis bechsteinii* and noctule) are listed under Section 41 of the NERC Act 2006.

Norfolk Biodiversity Action Plan (BAP)

2.2.10. Local Biodiversity Action Plans (LBAP) identify habitat and species conservation priorities at a local level (typically at the County level) and are usually drawn up by a consortium of local government organisations and conservation charities. Soprano pipistrelle, brown long-eared bat, barbastelle and noctule are included in the Norfolk Biodiversity Action Plan Strategy.

2.3. Aims and objectives

2.3.1. The aim of the commissioned bat activity crossing points surveys is to:

- identify the main points of the current A47 and A11 at which bats cross the carriageways ('crossing points') by building on the previous activity surveys undertaken in 2017.
- Identify the species and if any rare bats (barbastelle) are using the A47 to cross over.
- Assess whether bats are crossing the road at safe heights or whether they are likely to collide with traffic.
- Assess whether bats repeatedly use the same points to cross the road.
- Assess the likely impacts upon commuting bats crossing the A47 carriageway as a result of the Proposed Scheme.
- Provide instructions for advised mitigation with regards to commuting (and foraging) bats to be incorporated into the Proposed Scheme design.

2.3.2. The aims of the commissioned preliminary ground level roost assessments and dusk emergence and dawn re-entry roost surveys are to:

- re-assess trees previously identified as having bat roost potential (BRP) that remain within the survey area (which is defined as the DCO boundary plus a 50m buffer) to determine the need for further survey and further survey effort required
- provide updated dusk emergence and dawn re-entry roost surveys of the previously identified roosts in [REDACTED] which shall, if roosting behaviour is observed;
 - identify the species and numbers of bats present
 - determine the type of roost (for example maternity roost, transitional roost, day roost, hibernation site)

- gain sufficient information to allow the potential impacts on bats of the Proposed Scheme to be assessed and for appropriate avoidance, mitigation and/or compensation measures to be designed.

2.3.3. This report will:

- summarise the findings of the crossing point surveys and assess the likely impacts upon commuting bats crossing the current A47 and A11 carriageways as a result of the Proposed Scheme.
- summarise the findings of the preliminary ground level roost assessments and dusk emergence/dawn re-entry roost surveys and assess the likely impacts of the Proposed Scheme upon roosting bats.
- detail future requirements with regards to further surveys and advised mitigation for commuting, foraging and roosting bats to be incorporated into the Proposed Scheme design.

3. Methodology

3.1.1. The field surveys were designed with reference to *Bat Surveys: Good Practice Guidelines 3rd Edition* (Collins, 2016). Additional guidance has been sought for the scheme-specific crossing point surveys (see Section 3.2.1 below).

3.2. Crossing point surveys

3.2.1. As bat activity crossing point surveys are a project-specific requirement which are likely to be necessary only on linear schemes of a certain scale, guidance in Collins (2016) is limited. As such guidance has been taken from 'Appendix G. Local effects of transport infrastructure & mitigation: best practice survey protocol and data analysis' of 'WC1060 Development of a Cost Effective Method for Monitoring the Effectiveness of Mitigation for Bats Crossing Linear Transport Infrastructure' (Berthinussen and Altringham, 2015) and 'Fumbling in the dark – effectiveness of bat mitigation measures on roads, Bat mitigation measures on roads – a guideline' (Elmeros et al., 2016).

3.2.2. The two surveyed locations were chosen for further investigation as potential bat crossing points from the presence of current linear features on-site perpendicular to the A47 and A11 (including hedgerows, tree lines, watercourses and roads or lanes) which could potentially provide a commuting route for the local bat populations. Cantley Stream flows west to east across a largely arable landscape and the stream is wooded for much of its length. It provides near-continuous habitat between the stream's confluence with the River Yare at Cringleford (approximately 1.5km downstream) and its source near Hethersett (approximately 3km upstream). The following sources of baseline information were also taken into consideration when choosing the survey locations:

- the results of the previous bat activity surveys undertaken in 2017
- the results of bat roost surveys previously undertaken in 2017 and 2018
- the Proposed Scheme design

3.2.3. Table 3.2-1 below details the locations of the surveyed crossing points chosen for further investigation and justifications for their selection. See Annex A: Crossing point locations for a drawing of the surveyed crossing points.

Table 3.2-1: surveyed crossing point locations and justifications for their selection for survey

Crossing point	Approximate grid reference and location description	Justification for survey as a crossing point
1	TG 17929 04861 The Cantley Stream A11 underpass south-west of the A47 Thickthorn Junction.	Cantley Stream, as a linear feature with foraging potential, and offers a potential commuting route for bats. The stream offers a route connecting the woodland areas (which are foraging resources)

Crossing point	Approximate grid reference and location description	Justification for survey as a crossing point
	<p>It has a single track vehicle access and the stream is narrow and canalised under it. Trees and woodland surround both sides of the underpass. Hedgerows running along the A11 over the underpass are approximately 3m high. The underpass is approximately 3m high and is unlit.</p>	<p>south and east of the A11 to those woodland areas north and west of the A11.</p> <p>During activity surveys undertaken in 2017 bats have been recorded near this location multiple times and on one occasion in June 2017 a bat was recorded using the underpass and in September 2017 bats were recorded commuting along Cantley Stream east of the underpass towards the underpass (AECOM, 2017). In addition, on multiple occasions during the 2017 activity surveys bats were recorded commuting along the perimeter of the woodland to the east of the underpass which is parallel to Cantley Stream and also leads to the underpass (AECOM, 2017).</p>
2	<p>TG 18750 05104 The Cantley Lane footbridge over the A47 south of the A47 Thickthorn Junction</p>	<p>Cantley Lane cycle and footpath east of the A47 provided a good commuting route in the activity surveys and is lined with aged trees which offer good foraging potential. This linear feature is connected with Cantley Lane to the west of the A47 via a footbridge over the A47. As such a potential commuting corridor exists between the residential areas, hedgerows and treelines to the east and the woodland parcels to the west of the A47.</p>

- 3.2.4. During the surveys undertaken in 2020, one surveyor was positioned at either side of the A47/A11 at the potential crossing point. They were equipped with a full spectrum bat detector (Anabat Walkabout) or EM Touch and Anabat Scout detectors to aid detection of bats and made notes of the times and locations of bat calls and any bat activity that had been seen or heard (commuting, foraging or social calls).
- 3.2.5. Particular attention was paid to bats crossing the A47/A11, with flight height and direction recorded. The locations of the origins of the bat calls were plotted on a map (Annex A). Bat calls were recorded in full spectrum format using a Anabat Walkabout detector or an EM Touch and Anabat Scout detector for later analysis using Anabat Insight and AnalookW analysis software.
- 3.2.6. Instances of bats crossing the A47 that were visually observed (hereafter referred to as 'confirmed crosses') were recorded in addition to bat calls which were heard and recorded on the detector but not seen. The recordings and the field notes from survey one (see Section 3.2.10 below) were used to help identify any unseen bats which may have used the potential crossing point to cross the

A47 and A11 by comparing the notes of surveyors at each side of the carriageway. Where bat calls of the same species were recorded within the same minute, or consecutive minutes, at either side of the crossing point, and no bats of that same species were visually observed within that minute to suggest that call came from a bat not crossing, the bat pass has been identified as a 'potential cross'.

- 3.2.7. This identification of potential crosses has not been attempted for big bat sp. (noctule, serotine or Leisler's - NSL) as these species have very loud calls which can be detected at distances which exceed the width of the carriageway and, as such potential crosses could not be confirmed with any certainty for these species. The omission of these species from the analysis of crossings data is not considered a constraint because these species tend to fly at heights well in excess of vehicle passage height and they are also less reliant on landscape elements for commuting and foraging (Berthinussen and Altringham, 2015).
- 3.2.8. A Pulsar Helion XP28 thermal imaging scope was used during the second dusk surveys at each crossing point on 4 August 2020 at crossing point one and 6 August 2020 at crossing point two in order to have a visual observation of the bats in darker conditions and confirm whether or not the bats recorded on the detector were crossing the A47/A11 carriageways.

Survey timings and weather conditions

- 3.2.9. The optimal survey season for undertaking bat activity surveys is between June to August, inclusive (Berthinussen and Altringham, 2015). The months of May and September are considered sub-optimal for survey, though acceptable with suitable weather conditions upon the professional judgement of the licensed ecologist (Berthinussen and Altringham, 2015).
- 3.2.10. Survey effort was determined by professional judgement based on guidelines in Berthinussen and Altringham (2015) and upon research undertaken on barbastelle bats in the area for the Norwich Western Link Road (NWLR). Two surveys, one dusk and dawn survey and one either dusk or dawn survey, were undertaken at each potential crossing point with different survey times and lengths to target different species. 'Survey one' comprised a 1.5-hour dusk survey starting 15 minutes before sunset and ending one hour and 15 minutes after sunset, and a 1-hour dawn survey starting one hour before sunrise. These surveys targeted earlier emerging species (such as pipistrelle species) which may sometimes emerge before sunset. 'Survey two' comprised either a dusk survey (crossing point one) starting at sunset and ending approximately 2.5 hours after sunset or a dawn survey (crossing point two) starting approximately 2.5 hours before sunrise and ending at sunrise.

- 3.2.11. These surveys targeted later emerging species (such as the rarer barbastelle bat). The research undertaken for the NWLR revealed that barbastelle bats in the area spend time foraging near the roost location after emerging and don't commute further afield until later in the evening.
- 3.2.12. Berthinussen and Altringham (2015) recommend surveying at temperatures of 7°C and above at the start of the survey in dry conditions with wind speeds lower than 20km/h. All surveys were undertaken within the recommended weather conditions (see Table 4.1-1 below).
- 3.2.13. Crossing point surveys were undertaken by Diane Wood MCIEEM (Principal Consultant Ecologist, Sweco) who holds a level 2 Natural England bat class licence (registration number 2015-13155-CLS-CLS) and Beth Mell GradCIEEM (Consultant Ecologist, Sweco) assisted by Lydia Waite (Ecology Field Assistant, Sweco) and Lewis Gospel (Ecology Field Assistant, Sweco), and by Ben Jervis BSc (Hons) MSc MCIEEM (Director/Principal Ecologist, Bench Ecology) and Christine Hipperson-Jervis BSc (Hons) MCIEEM (Ecologist, Bench Ecology).

3.3. Preliminary ground level roost assessments

- 3.3.1. Update daytime preliminary ground level roost assessments were undertaken on trees previously assessed for bat roost potential (BRP (AECOM, 2017)) on 22 and 29 July 2020. The update preliminary ground level roost assessments include an inspection to identify any features suitable for roosting bats (potential roost features (PRFs) including, but not limited to, woodpecker holes, rot holes, hazard beams, other vertical or horizontal cracks and splits, partially detached flakey bark, knot holes, man-made holes, cankers and bat or bird boxes (Collins, 2016). Where features were of height to allow close inspection signs of bat presence, including audible squeaking, bat droppings, odour and staining, were searched for. Trees were then assigned a category of BRP in accordance with those guidelines in Collins (2016) and in Table 3.3-1 below.

Table 3.3-1: categories of bat roost potential (BRP) in trees (taken from Collins (2016))

Tree Category	Description
High	Trees with multiple highly suitable features capable of supporting larger roosts.
Moderate	Trees with definite bat potential, supporting fewer suitable features or with potential for use by single bats.
Low	Trees with no obvious potential, although the tree is of a size and age that elevated surveys may result in cracks or crevices being found; or the tree supports some features which may have limited potential to support bats.
Negligible	Trees with no potential to support bats. Trees with negligible bat roost potential are not mapped or considered further within this report.

- 3.3.2. Surveys were undertaken by Diane Wood MCIEEM (Principal Consultant Ecologist, Sweco) who holds a level 2 Natural England bat class licence

(registration number 2015-13155-CLS-CLS) and Beth Mell GradCIEEM (Consultant Ecologist, Sweco) and assisted by Lydia Waite (Ecology Field Assistant, Sweco).

3.4. Dusk emergence and dawn re-entry roost surveys

- 3.4.1. Dusk emergence and dawn re-entry surveys are used to determine the presence or likely absence of bat roosts in trees when the preliminary ground level roost assessment cannot reasonably rule out the presence of roosting bats. They are also used to identify the type of roost where a known roost is present.
- 3.4.2. Dusk emergence and dawn re-entry surveys can be undertaken between May and September when bats are most active, with optimum bat activity being between June and August.
- 3.4.3. Dusk emergence and dawn re-entry survey effort is dictated by the category of BRP assigned to a tree during the preliminary ground level roost assessment (see Table 3.2-1).
- 3.4.4. Table 3.4-1 (taken from Collins, 2016) summarises the survey effort required for structures to give confidence in a negative result. This guidance is also recommended for trees however confidence in negative results is lower for tree roost surveys (Collins, 2016).

Table 3.4-1: recommended minimum survey effort for dusk emergence and dawn re-entry surveys (taken from Collins, 2016)

Low roost suitability	Moderate roost suitability	High roost suitability
One survey visit. One dusk emergence or dawn re-entry survey (structures). No further surveys required (trees).	Two separate survey visits. One dusk emergence and a separate dawn re-entry survey.	Three separate survey visits. At least one dusk emergence and a separate dawn re-entry survey. The third visit could be either dusk or dawn.

- 3.4.5. Notes were made on the times of bat calls and any bat activity seen or heard (commuting, foraging, roosting or social calls). Where roosting behaviour is observed the number and species of bats observed roosting are recorded, in addition to the location, and where possible feature, that the bat(s) emerged from or re-entered. Bat calls were simultaneously monitored and recorded using Titley Scientific Anabat Walkabout, batscanner or batlogger detectors. Recorded data were used to verify the survey notes with regards to species calls identified in the field and for analysis, using Anabat Insight and Analook or BatExplorer software, of those calls which were either not identified in the field or not recorded by the surveyor but recorded automatically. Analysed recorded data can then be manipulated to provide numbers of bat passes per species and thus

provide information on the level of bat activity at the location. A bat call has been defined as a discrete sequence of digital calls up to 15 seconds long.

3.4.6. Any roosts identified are characterised based upon the recorded survey observations (see Section 3.3.4) in accordance with the following roost types (Collins, 2016):

- Transitional or occasional Roost: Used by a few individuals or occasionally small groups for generally short periods of time on waking from hibernation or in the period prior to hibernation.
- Maternity Roost: Where female bats give birth and raise their young to independence.
- Satellite Roost: An alternative roost found in close proximity to the main nursery colony used by a few individual breeding females to small groups of breeding females throughout the breeding season.
- Mating: Sites Where mating takes place from late summer and can continue through the winter.
- Hibernation Roost: Where bats may be found individually or together during winter. They have a constant cool temperature and high humidity.
- Night Roost: A place where bats rest or shelter in the night but are rarely found in the day. May be used by a single individual on occasion or it could be used regularly by the whole colony.
- Day Roost: A place where individual bats, or small groups of males, rest or shelter in the day but are rarely found by night in the summer.
- Feeding Roost: A place where individual bats or a few individuals rest or feed during the night but are rarely present by day.
- Swarming sites: Where large numbers of males and females gather during late summer to autumn. Appear to be important mating sites.

3.4.7. Dusk emergence and dawn re-entry surveys were undertaken by Diane Wood MCIEEM (Principal Consultant Ecologist, Sweco) who holds a level 2 Natural England bat class licence (registration number 2015-13155-CLS-CLS), Beth Mell GradCIEEM (Consultant Ecologist, Sweco), Sophie Barrell MEdol (Hons) GradCIEEM, John Johnson BSc (Hons), Beck Harrington-Harding BSc (Hons) MCIEEM and Jordan Hurst MRes BSc (Hons), assisted by Lydia Waite (Ecology Field Assistant, Sweco) and Lewis Gospel (Ecology Field Assistant, Sweco).

3.5. Endoscope survey

3.5.1. All accessible features on [REDACTED] were internally inspected using a 4m ladder and a RIDGID CA-350 endoscope. The features were inspected for evidence of bat use including droppings in, around and below the feature, odour,

audible squeaks and staining below the feature. The endoscope survey was undertaken on 17 November 2020.

- 3.5.2. The endoscope survey was undertaken by Martin Brammah PhD MA (Cantab) BA (Hons) CEcol MCIEEM MRSB who holds a bat level two class licence (licence number: 2015-14077-CLS-CLS) and Sam Wilson BSc (Hons) ACIEEM.

3.6. Limitations

- 3.6.1. The comprehensiveness of any ecological assessment will be limited by the season in which surveys are undertaken. To determine presence or likely absence of a protected species and their status (for example, the number of individuals present) usually requires multiple visits at suitable times of the year. The survey conditions and timings were suitable for surveying bats and therefore are not considered to be a limitation to the effectiveness of the surveys.
- 3.6.2. The results of these surveys are intended for informing the design of the Proposed Scheme and the likely impacts and required mitigation (as set out within the ES). CIEEM guidelines (CIEEM, 2019) indicate that ecological survey results remain valid for up to 18 months (i.e. until March 2022) however bat use of roosts can and will change over time and for the purpose of Natural England licence applications a new review of the ecological conditions should be collected in the closest survey season to the start of works.
- 3.6.3. Due to delays in surveys commencing and land access being arranged for the surveys due to COVID-19 restrictions, it was not possible to undertake dusk emergence or dawn re-entry roost surveys of all trees which require further survey following the preliminary ground level roost assessments. As such dusk emergence or dawn re-entry roost surveys were concentrated upon those three roosts previously identified (see Section 2.1.7) which would be lost or modified due to the Proposed Scheme in order to allow for an application for a draft European Protected Species (EPS) mitigation licence. Dusk emergence or dawn re-entry roost surveys of the remaining trees which have, following preliminary ground level roost assessment, moderate or high BRP have been recommended to be undertaken in 2021 (see Section 5.3.7).
- 3.6.4. Due to the delays in arranging land access due to COVID-19 restrictions it was not possible to access [REDACTED] to undertake the preliminary ground level roost assessment. It has been recommended that this is undertaken in 2021.(see Section 5.3.7).
- 3.6.5. The dusk emergence or dawn re-entry roost survey of [REDACTED] undertaken on 2 September 2020 was aborted early at 20:21, 41 minutes after sunset and after only 51 minutes of survey (see Table 4.3-1), due to heavy rain. As bats generally

do not fly in heavy rain it is considered possible that should any later-emerging species (such as *Myotis* sp. or brown long-eared) have been roosting in the tree, roosting behaviour would not have been observed due to the heavy rain and the termination of the survey only 41 minutes after sunset.

- 3.6.6. Trees with previously confirmed roosts are treated as having high roost suitability (or BRP) and as such it is required that three surveys are undertaken on such trees. Due to COVID-19 and its associated restrictions it was not possible to undertake all three dusk emergence or dawn re-entry roost surveys of [REDACTED] and [REDACTED] within the season recommended by good practice guidelines: For a tree with high roost suitability May to September with a minimum of two surveys between May and August (Collins, 2016).
- 3.6.7. As such a survey was undertaken in November 2020 (see Table 4.3.1), however as the bat active season is generally considered to stretch from April – October inclusive (Collins, 2016), this is considered a significant limitation on the third and final dawn re-entry roost survey undertaken on [REDACTED]. An endoscope survey was undertaken on [REDACTED] in November 2020 in order to compensate for the late season of the final roost survey.
- 3.6.8. Some bat calls were identified to species level and some were grouped (NSL; *Myotis*). This is because of large overlaps and similarities in the call parameters. This is not considered a limitation in terms of the crossing point survey assessment. The NSL species are all known to fly high and are unlikely to be involved in road traffic accidents. In previous research, roads are unlikely to have a negative impact upon these species (Berthinussen and Altringham, 2015). *Myotis* species calls are difficult to distinguish to species level and grouping them together does not alter the mitigation at crossing points. The *Myotis* species grouped for this report are *Myotis Daubentonii*, *Myotis Brandtii*, *Myotis mystacinus* and *Myotis nattereri*. Rarer *Myotis* species Bechstein's bat *Myotis bechsteinii* and *Myotis Alcaethoe* are not known to be present in this part of Norfolk.

4. Survey results

4.1. Crossing point surveys

4.1.1. Table 4.1-1 below details the confirmed (visually observed) and potential (not visually observed, identified following data analysis) instances of bats crossing the A11 (crossing point one) or A47 (crossing point two) carriageways.

Crossing point one

- 4.1.2. The majority of bat passes recorded at crossing point one during the two dusk and one dawn survey undertaken were of common species of bat including common and soprano pipistrelle, noctule and unidentified big bats (NSL (noctule, Leisler's or serotine)). Other species detected include serotine (one pass on 4 August 2020) and Myotis sp. with a small number of Myotis sp. calls detected during the dusk survey undertaken on 22 July 2020 representing at least two bat passes.
- 4.1.3. One of these Myotis sp. passes is considered to potentially have crossed the A11 as, following data analysis, calls were identified at 22:12 on the south side of the underpass and 22:11 and 22:12 on the north side. One single pass of the rarer barbastelle was recorded on the northern side of crossing point one during the dusk survey on 22 July 2020, however as the bat was not seen and it was not detected on the southern side of the underpass it cannot be determined whether this species crossed the A11 or not.
- 4.1.4. As such, the following species have been recorded crossing the A11 at crossing point one utilising the underpass; common and soprano pipistrelle and Myotis sp. Bat species recorded crossing the A11 at crossing point one flying over the A11 include common and soprano pipistrelle, Myotis sp., noctule and unidentified by bat (NSL) species. The majority of bats crossing the A11 carriageway do so using the underpass as opposed to commuting over the A11 itself.
- 4.1.5. In addition to those bats simply commuting through the A11 underpass, during the dusk survey undertaken on 22 July 2020, common pipistrelles were recorded foraging underneath and around the underpass. It is considered that the underpass itself may provide good foraging habitat for bats as Cantley Stream passes through the underpass and is an aquatic habitat will attract invertebrates which, due to the ceiling of the underpass, will get trapped in the space and provide a foraging resource for bats.

Crossing point two

- 4.1.6. Common species of bat only, including common and soprano pipistrelle, noctule and unidentified big bat species (NSL), were recorded at crossing point two during the one dusk and two dawn surveys undertaken there. Common and soprano pipistrelle are the only species which have been identified using crossing point two, in addition to multiple unidentified bats which have used the crossing point.
- 4.1.7. The majority of bats recorded crossing the A47 during the first survey undertaken on 22 July 2020 did so slightly to the north of the footbridge and the general direction of the majority of bat crosses has been bats flying towards the south-west from the north-east. Based upon the results from the surveys on 22 July and 6 August 2020, most bats crossing the A47 at this location cross either at roughly the same height as the footbridge or higher, with only three instances of bats recorded crossing below the height of the footbridge.
- 4.1.8. During the dusk survey undertaken at crossing point two on 22 July 2020 the surveyor on the east side of the footbridge observed a common pipistrelle flying into the centre of the road which was then lost from view. Analysis of the recorded data has revealed a common pipistrelle call detected within the same minute on the east side of the footbridge, confirming the surveyors visual record of a bat, however no bat calls were detected on the west side of the footbridge within this minute or the following minute. In addition, the surveyor on the west side of the footbridge did not manually record any bats visually observed at this time and as such this cross is recorded in Table 4.1-1 below as a potential cross only.

Other activity recorded

- 4.1.9. During the crossing point survey undertaken at crossing point two at dusk on 22 July 2020 one common pipistrelle and one soprano pipistrelle were recorded flying among and above the woodland to the south-west of the crossing point location and footbridge. Both bats were travelling south. A common pipistrelle, also flying south, was also recorded in the woodland to the south-west of the crossing point during the dawn survey undertaken on 23 July 2020.
- 4.1.10. During the dusk survey of crossing point one undertaken on 22 July 2020 the surveyor to the south (or south-east) of the crossing point recorded a common pipistrelle commuting alongside the A11 corridor travelling west. On the 23 July 2020 another observation of a common pipistrelle travelling alongside the A11 flying west was recorded. These passes have not been recorded in Table 4.1-1 as the bats were not seen to cross the A11 carriageway to the west (or north-west) side.

- 4.1.11. Common pipistrelle foraging activity was recorded around the south-eastern entrance and the north-western entrance to the A11 underpass and in the vegetation to the north of the underpass at crossing point one during the dusk survey on 22 June 2020. Noctule foraging activity was also recorded to the north-east of the underpass at crossing point one.
- 4.1.12. During the dusk survey on 22 July 2020 at crossing point one a bat, identified in the field as a brown long-eared, was visually recorded flying east to west along the A11 for approximately 4m. Data analysis identified no brown long-eared calls at the time of the record. Brown long-eared bats have very quiet calls and detectors often do not record them.

Table 4.1-1: confirmed and potential bats crossing the A11 and A47 carriageways as recorded during the surveys

Crossing Point (XP) Ref	Survey date and type	Sunset/sunrise time and survey time	Surveyors	Weather conditions at the start and the end of survey(Temp in °C, % cloud, wind in Beaufort)	Bat species and number crossing	Crossing location and direction	Total and summaries of crosses
1	22 July 2020 Dusk	Sunset 20:41 20:45 – 22:17	Diane Wood Lewis Gospel	Temp: 18 - 17 Cloud: 20 - 20 Wind: 1 - 1 Precipitation: none	Common pipistrelle x7	Below the underpass flying from south to north	Common pipistrelle: 9 Pipistrelle sp.*: 1 Through the underpass: 10 Over the A11: 0 South-east to north-west: 8 North-west to south-east: 2
					Common pipistrelle x2	Below the underpass flying from north to south	
					Pipistrelle sp.* x1	Below the underpass flying from south to north	
					<u>Potential</u> Common pipistrelle x4 Soprano pipistrelle x3 Myotis sp. x1	N/A	

1	23 July 2020 Dawn	Sunrise: 5:01 4:07 – 5:00	Diane Wood Lewis Gospel	Temp: 13 - 13 Cloud: 40 - 15 Wind: 1 - 0 Precipitation: none	Big bat (NSL) sp. x1	Over the A11 from south to north approximately 15m high	Common pipistrelle: 1 Big bat (NSL) sp.: 1 Below the underpass: 0 Over the A11: 2 South to north: 1 North to south: 1
					Common pipistrelle x1	Over the A11 flying north to south approximately 12m above ground	
					Potential Common pipistrelle x1	N/A	
1	4 August 2020 Dusk Thermal imaging scope	Sunset 20:41 20:41 – 23:09	Ben Jervis Christine Hipperson-Jervis	Temp: 19.6 – 19.5 Cloud: Wind: 3 – 3 Precipitation: none	Common pipistrelle x2	Below the underpass flying east to west	Common pipistrelle: 14 Soprano pipistrelle: 4 Myotis sp.: 2 Noctule: 1 Through the underpass: 16 Over the A11: 5 East to west: 7 West to east: 9
					Common pipistrelle x8	Below the underpass flying west to east	
					Common pipistrelle x2	Below the underpass direction unknown	
					Common pipistrelle x2	Over the A11 at height of ,5m	
					Soprano pipistrelle x3	Below the underpass flying east to west	
					Soprano pipistrelle x1	Over A11 flying east to west at height of ,5m	
					Noctule x1	Over A11 flying south	
					Myotis sp. x1	Below the underpass flying west to east	

					Myotis sp. x1	Over A11 flying east to west	
2	22 July 2020 Dusk	Sunset: 21:02 20:45 – 22:17	Beth Mell Lydia Waite	Temp: 18 – 17 Cloud: 30 – 80 Wind: 1 – 1 Precipitation: none	Common pipistrelle x3	Alongside the footbridge, 2-3m north of the footbridge, east to west	Common pipistrelle (confirmed): 4 Unidentified bat: 3 North of the footbridge: 7 South of the footbridge: 1 (potential) North-east to south-west: 8 South-west to north-east: 0 At the height of the footbridge: 3 Below the footbridge: 2 Above the footbridge: 7
					Common pipistrelle x1	Crossed swooping from height of footbridge to approximately 10 – 15m high in the centre of the road, 8m north of the footbridge, east to west	
					Potential Common pipistrelle x8 Soprano pipistrelle x1	One common pipistrelle just below the footbridge, 1m to the south of the footbridge, east to west into the centre of the road (then lost from sight) N/A	
					Unidentified bat x3	At approximately 18m height, north of the footbridge, east to west	
2	23 July 2020	Sunrise: 5:00 4:02 – 5:00	Beth Mell Lydia Waite	Temp: 14 - 14 Cloud: 15 - 15	Unidentified bat x1	At approximately 10m height, north of the footbridge, west to east	Unidentified bat

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	Dawn			Wind: 0 - 1 Precipitation: none	Potential Common pipistrelle x1	N/A	North of the footbridge West to east
2	6 August 2020 Dawn Thermal imaging scope	Sunrise 5:23 2:45 – 5:23	Ben Jervis Christine Hipperson- Jervis	Temp: 19.4 – 18.2 Cloud: Wind: 0 – 1 Precipitation: none	Common pipistrelle x2	Above the footbridge flying north to south	Common pipistrelle: 3 Soprano pipistrelle: 3
					Common pipistrelle x1	Below the footbridge at safe height .5m flying south to north	Above the footbridge: 5 Below the footbridge at safe height >5m: 1
					Soprano pipistrelle x3	Above the footbridge flying north to south	North-east to south-west: 5 South-west to north-east: 1

*common or soprano pipistrelle only. Not considered possibly Nathusius'

4.2. Preliminary ground level roost assessments

- 4.2.1. The results of the 2020 update preliminary ground level roost assessments, in addition to the results from the previous assessments and aerial inspections undertaken in 2017, are detailed in Table 4.2-1 below. See Annex B: Bat roost potential (BRP) and dusk emergence/dawn re-entry roost survey locations for locations of the trees with BRP.
- 4.2.2. [REDACTED] was not accessible (see Section 3.6.4) and therefore not subject to an update assessment. [REDACTED] and the new tree in which a roost was incidentally observed in 2018 (hereafter and in Table 4.2-1 below referred to as [REDACTED] were not subject to update assessments as these trees are already confirmed roosts and were subject to update dusk emergence/dawn re-entry roost surveys (see Section 2.3.2).
- 4.2.3. It was not possible to locate TN95 during the update preliminary ground level roost assessments. Trees along the field margin on which TN95 was located were inspected and one mature oak was identified which was in approximately the correct location however upon close observation did not have the PRFs identified in the previous 2017 assessment (a dead north-facing branch with possible cavity). It is considered possible that the PRF, the dead north-facing branch, identified during the 2017 assessments has since fallen down and left no PRFs in its place, or else that the tree may have been felled. Therefore, TN95 is considered to be either no longer present, or changed in structure with no PRFs.
- 4.2.4. TN9 ((2017) consisting of five individual trees within a block of woodland) was not identifiable due to insufficient location data.

Table 4.2-1: results of the 2020 update preliminary ground level assessments

Tree	Species	Grid reference	Previous (2017) aerial inspection results	Further noted PRFs in 2020	2020 update BRP category
TN1	Ash	TG 19079 04758	Low	N/A	Not assessed
TN4	Oak	TG 17899 05316	Low	None	Low
TN5	Oak	TG 17835 05478	Negligible/low	None	Low
TN6	Oak	TG 19018 05297	Low	None	Low
NT2a (previously TN7 2017)	Maple sp.	TG 17907 05505	Low	Cavity on west-facing limb. Small cavity on south-west aspect of dead limb. Approximately 1m diameter at breast height (DBH)	Moderate

Tree	Species	Grid reference	Previous (2017) aerial inspection results	Further noted PRFs in 2020	2020 update BRP category
	Oak	TG 17991 05538	Not assessed	Four cavities on the southern aspect. Dead limbs present. Approximately 1.3m DBH	High
	Oak	TG 18016 05428	Not assessed	Fissure present under bark. Approximately 1.2m DBH.	Low
	Oak	TG 18002 05397	Not assessed	Cavities present. A south-facing dead limb. Dead bark. Approximately 0.9m DBH	Moderate
	Oak	TG 17984 05395	Not assessed	Dead limb cavities facing north. Approximately 1m DBH.	
	Oak	TG 17988 05410	Not assessed	Dead east-facing limb, south-facing cavity approximately 3m high. Approximately 0.9m DBH.	
	Oak	TG 18064 05301	Not assessed	Slit in west-facing branch. Approximately 1.5m DBH.	Moderate
	Oak	TG 17876 05428	Not assessed	South-facing dead limb. Approximately 0.8m DBH.	Low
	Oak	TG 17940 05444	Low	Dead broken limbs present. Approximately 1m DBH.	Low
	Oak	TG 17790 05520	Moderate	None	Not assessed
	Oak	TG 17803 05518	Negligible	None	Not assessed
	Oak	TG 17816 05536	Moderate	None	Not assessed
	Oak	TG 17839 05545	Negligible	None	Not assessed
	Oak	TG 17827 05504	Low	None	Not assessed
	Oak	TG 18951 05282	Low	None	Incidentally observed potential roost (2020)
	Oak	TG 18876 05382	Negligible	None	Negligible

Tree	Species	Grid reference	Previous (2017) aerial inspection results	Further noted PRFs in 2020	2020 update BRP category
	Oak	TG 18654 05349	Moderate	East-facing cavity at approximately 8m high on northernmost trunk. Cavity on north-facing branch at approximately 2.5m high – cavity approximately 20cm deep. Another cavity directly above on this north-facing branch at approximately 3m high.	High
	Oak	TG 18649 05103	Low	Cavities low down on the main stem facing west and south-west. Peeling bark. Approximately 1.5m DBH.	Moderate
	Oak x2	TG 18207 04850 TG 18242 04847	Moderate	None	Moderate
	Oak	TG 17846 04732	Moderate	None	Moderate
	Oak	TG 17973 05136	Moderate	Numerous cavities, some peeling bark and deadwood	High
	Oak	TG 18490 05201	Low	None	Low
	Oak	TG 18427 05260	Low	None	Low
	Oak	TG 18277 05177	Moderate	Tree not found. No trees with previously identified PRF found.	Suspected no longer present or changed in structure with no PRFs
	Oak	TG 18310 05152	Low	None	Moderate

4.2.5. It was not possible to identify those trees along Cantley Lane south-east of the A47 Thickthorn Junction which were previously assessed in 2017 (TN7, TN9 and TN11). There are a large number of mature oaks adjacent to the lane at this location. As the surveys were undertaken in July 2020, dense foliage on the trees on occasion obscured limbs and limited the surveyors view and may have prevented the identification of features identified in the aerial inspections undertaken in April 2017. In addition, tree felling or pruning works appeared to

have occurred along Cantley Lane South which may have increased the difficulty in tree identification. Therefore, a new assessment of the BRP of trees along Cantley Lane south-east of the A47 Thickthorn Junction was undertaken, the results of which are detailed in Table 4.2-2 below. Trees TN6 and TN10 due to their locations and descriptions from previous survey, and TN8 due to previous dusk emergence/dawn re-entry roost surveys, were identifiable and as such have been included in Table 4.2-1 above.

Table 4.2-2: BRP assessment results of trees down Cantley Lane south-east of the A47 Thickthorn Junction

Tree	Species	Approximate grid reference	Noted PRFs	BRP category
	Oak	TG 18756 05150	No obvious PRFs, however tree is of an age (semi-mature) where PRFs may be present which may have been obscured in the upper branches by foliage.	Low
	Oak	TG 18785 05162	No obvious PRFs, however tree is of an age (semi-mature) where PRFs may be present which may be obscured by thin covering of ivy on trunk.	Low
	Oak	TG 18855 05218	Cavity on west aspect of one of the two main stems approximately 6-7m high. Main trunk rotted out to leave a large cavity on the north facing aspect from ground level to approximately 2.5m up – very open. North-facing cavity approximately 10m high on stub of dead branch which is potentially sealed from weather – may potentially form a cavity approximately 30cm deep.	High
	Oak	TG 18877 05232	Woodpecker hole on the south-facing aspect of one of the main stems approximately 7 – 8m high.	Moderate
	Maple sp.	TG 18855 05200	Moderate ivy cover on main trunks	Low
	Oak	TG 18875 05213	Large vertical split on south-facing aspect of main stem from ground level to approximately 10m high. The majority of the split would be susceptible to bad weather, however there are some crevices inside which may provide shelter.	Moderate
	Oak	TG 18893 05223	Peeling bark on the north-east aspect of main stem at 2m and 3m high. A south-facing cavity is present from approximately 1m high to 10m high – cavity is quite open at the top, however there are small cavities inside and the cavity is more sealed towards the bottom.	Moderate

Tree	Species	Approximate grid reference	Noted PRFs	BRP category
			Potentially previous TN11 – moderate BRP.	
	Oak	TG 18922 05241	Small amount of lifted bark on north-aspect of main stem in two locations approximately 1m high.	Low
	Oak	TG 18959 05267	No visible features however tree is of an age where features may be present which may be obscured by foliage	Low
	Unknown	TG 18976 05277	Tall stump rotted in the middle on the south-facing aspect – open to the elements. Light ivy cover on the south-aspect.	Low
	Oak	TG 18996 05296	Dense ivy foliage obscures the tree, however the ivy stems are not thick enough to provide shelter themselves. Potentially previous TN7.2 – low BRP	Low
	Oak	TG 19000 05299	Hollowed out main stem on north aspect from ground level to approximately 2.5m high. Very open to the elements and has no inner, small cavities,	Low

4.3. Dusk emergence/ and awn re-entry roost surveys

4.3.1. Table 4.3-1 below details the results of the update dusk emergence and dawn re-entry roost surveys undertaken on those trees with roosts previously confirmed in 2017 and or 2018 (). Roosts are ‘confirmed’ from those instances in which a surveyor has observed a bat emerge from or re-enter a tree with some degree of certainty. Potential roost observations can result from observations of bats which appear to have emerged from the direction of a tree however there is a possibility the bat may have been flying through, or merely by, the tree. Potential roost observations may be due to lower light levels and poor visibility.

4.3.2. In summary, the following roosts were identified:

- confirmed common pipistrelle day roost in
- potential noctule day roost in

- confirmed soprano pipistrelle day roost in [REDACTED]
- confirmed common pipistrelle day roost in [REDACTED]
- potential noctule day roost in [REDACTED]
- potential common pipistrelle day roost in [REDACTED]
- potential noctule day roost in [REDACTED]

4.3.3. Common and soprano pipistrelles have been known to roost in the same tree and as the surveyor did not see the exact feature on [REDACTED] the bats emerged from it is probable that there is a roost of common pipistrelle and a roost of soprano pipistrelles in separate locations on the tree. This is also the case for [REDACTED], which was found to have a confirmed soprano pipistrelle roost in 2017 and a confirmed common pipistrelle roost in 2020.

4.3.4. During the dusk emergence roost survey undertaken on [REDACTED] on 23 July 2020 the surveyor located to the south-west of [REDACTED] recorded two common pipistrelles emerging from [REDACTED] two common pipistrelles potentially emerging from [REDACTED] and on one occasion a common pipistrelle entering [REDACTED]. In addition, on one occasion the surveyor had recorded two noctules emerging from either [REDACTED] or [REDACTED] was found to have no PRFs during the BRP assessment (see Table 4.2-2) undertaken following the survey of [REDACTED] is considered most likely that these recorded common pipistrelles did not in fact emerge from or re-enter [REDACTED] but were merely flying through the tree between limbs and foliage or perching for a rest. This same flying through behaviour had been recorded by the surveyor to the north of [REDACTED] during the same survey undertaken on 23 July 2020 who recorded pipistrelle bats flying round and within [REDACTED]. The two noctules which were recorded as bats emerging from [REDACTED] have been recorded as potential emergences from [REDACTED] in Table 4.3-1 below.

Table 4.3-1: results of the dusk emergence/dawn re-entry roost surveys of TN8, TN77 and NT1 in 2020

Tree	Survey date and type	Sunset/sunrise time and survey time	Surveyors	Weather conditions at the start and the end of survey(Temp in °C, % cloud, wind in Beaufort)	Roost?	Species identified	Survey notes
█	23/7/2020 Dusk emergence	Sunset 21:01 20:46 – 22:31	Beth Mell Lydia Waite	Temp: 19 – 17 Cloud: 100 – 95 Wind: 0 – 0 Precipitation: none	Yes; █ CP x1 emerged from █ NO x1 emerged from the tree line at the approximate location of █ This is considered a potential emergence from █, although it is also possible it emerged from one of the adjacent trees. █ SP x1 emerged from █ CP x1 emerged from █ NO x2 potentially emerged from █ or were recorded flying through █ (see Section 4.3.2) █ NO x1 potentially emerged from high up in █ CP x1 potentially emerged from █	CP, SP, NO, BB (NSL)	A relatively high level of pipistrelle (mainly common but also some soprano) commuting and foraging activity was recorded throughout the survey. At times as many as 3-4 pipistrelle bats were observed at once. Noctule activity was also relatively high and it is considered likely that this species was also foraging close by. The first bat was a common pipistrelle recorded at 21:11 and the last bat was a common pipistrelle at 22:30. The surveyor to the north of █ noted that, at 21:20 at a time of high pipistrelle activity when 3 – 4 bats were visible, bats were flying around █ and were lost to view several times. The surveyor also noted that common pipistrelles at this time were spending time flying between limbs and directly near the woodpecker hole on the north-east aspect of █ Unidentified bats were also recorded foraging beneath the street lights further down Cantley Lane closer to the A47.
█	19/8/2020 Dawn re-entry	Sunrise 5:47 4:17 – 5:47	Sophie Barrell John Johnson	Temp: 16 - 18 Cloud: Wind: 0 – 0 Precipitation: none	No	CP	Constant foraging and commuting behaviour. The first call was recorded at 4:30 and the last call at 5:21. At 5:16 – 5:18 a surveyor noted that three common pipistrelles were potentially swarming around █

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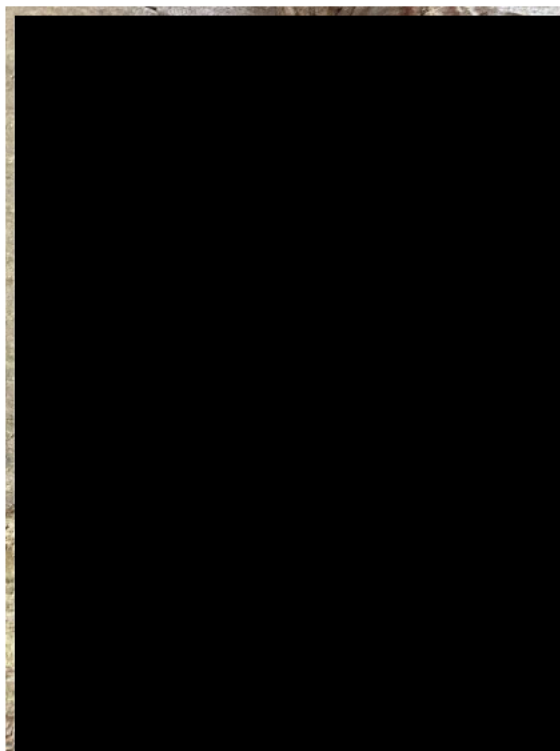
█	2/9/2020 Dusk emergence	Sunset 19:40 19:30 – 20:21	Ben Jervis Christine Hipperson-Jervis	Temp: 17-15 Cloud: Wind: 1-1 Precipitation: none	No	CP	Common pipistrelle bat(s) were observed foraging around █ one and two minutes after sunset. Surveyor recorded three to four common pipistrelles foraging around █ at one time. A potential emergence from the trees to the west of █ was recorded.
█ █	23/7/2020 Dusk emergence	Sunset 21:00 20:40 – 22:20	Diane Wood Lewis Gospel	Temp: 19 – 17 Cloud: 100 – 100 Wind: 0 – 0/1 Rain: spitting at the start of the survey	No	CP, BB (NSL)	The first bat was a common pipistrelle recorded at 21:28 and the last bat was also a common pipistrelle recorded at 22:20. In addition to these two calls there were two recorded calls of big bat sp. (NSL). No visual observations of bats were recorded.
█ █	5/8/2020 Dusk emergence	Sunset 20:41 20:26 – 22:14	Beck Harrington-Harding Jordan Hurst	Temp: 21 - 20 Cloud: Wind: 1 – 3 Precipitation: none	No	CP, SP, NO, BLE, BA	The first bat was a soprano pipistrelle recorded at 20:48. The last bat was a common pipistrelle recorded at 22:06. Sporadic common and soprano pipistrelle calls were recorded throughout the survey.
█ █	17/11/2020 Dawn re-entry	Sunrise 7:22 5:52 – 7:22	MLM surveyors x2	Temp: 11 – 11 Cloud: Wind: 3 – 3 Precipitation: None	No	None	No bats seen or heard.

Species key: CP – common pipistrelle, SP – soprano pipistrelle, NO – noctule, BB (NSL) – big bat species (noctule, serotine or leisler), BLE – brown long-eared, BA – barbastelle

4.4. Endoscope surveys

- 4.4.1. No evidence of bats was identified within any of the features accessed by ladder on [REDACTED]
- 4.4.2. A large amount of organic material was present at the base of the feature on [REDACTED] which may have included bat droppings from roosting bats throughout the summer. However, due to the state of the material, bat droppings cannot be readily identified and as no DNA analysis of the material was undertaken bat guano was not confirmed to be present. The feature was very damp and full of woodlice *Oniscidea* sp. and it is considered possible that much or all of the organic matter present in the feature may be attributable to decaying wood and/or frass from woodlouse feeding.

Figure 1: NT1 during the endoscope survey on 17 November 2020, showing the organic matter in the feature



4.5. Incidental findings

- 4.5.1. During the preliminary ground level roost assessments undertaken in July 2020 surveyors identified a managed arable field margin in a field immediately south of the A11 underpass at [REDACTED]. A search on MAGIC maps (MAGIC, 2020) has revealed that this area of land is within an Entry Level and Higher Level Stewardship Agreement. It is considered that this 'arable field margin' may classify as the priority habitat under Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006 of the same name.

4.5.1.4.5.2. During the barn owl survey undertaken in September 2020 (Appendix 8.6, Breeding Bird, Hobby and Barn Owl Survey Report (APP-XXX)), piles of peacock butterfly (*Aglais io*) wings were present on the floor of a metal shack suggesting that the building has been used as a brown long-eared bat (*Plecotus auritus*) feeding roost.

5. Conclusions, impact assessment and future requirements

5.1. Crossing points – conclusion and impact assessment

Crossing point one

5.1.1. The following species have been confirmed using the A11 underpass as a commuting route to cross beneath the A11. The number in brackets refers to the total number of confirmed crosses (using the underpass) across all surveys:

- Common pipistrelle (21)
- Soprano pipistrelle (3)
- Myotis sp. (1)
- Pipistrelle sp. (1)

5.1.2. The following species have been confirmed crossing the A11 (over the road) at crossing point one. The number in brackets refers to the total number of confirmed crosses (using the underpass) across all surveys:

- Common pipistrelle (3)
- Soprano pipistrelle (1)
- Myotis sp. (1)
- Noctule (1)
- Big bat sp. (NSL) (1)

5.1.3. The majority of identified crosses have been of common pipistrelle bats, with soprano pipistrelle the second-most common bat to cross the A11 (either using the underpass or over the road) at crossing point one. Significantly more bats have been recorded crossing the A11 using the underpass as opposed to crossing the road and live traffic. In addition, bats have been recorded foraging within and around underpass itself (see Section 4.1.4) which, with Cantley Stream running through, would attract invertebrates which would become 'trapped' beneath the underpass.

5.1.4. The most confirmed crosses recorded in one survey (either 'survey one' consisting of a dusk and dawn totalling 2.5 hours, or 'survey two' comprising either a 2.5 hour dusk or dawn) were recorded during survey two when 21 confirmed instances of bats crossing the A11 were recorded (see Table 4.1-1), of which 16 bats crossed using the underpass. This is likely due to the use of the thermal imaging scope in survey two which allows more bats to be visually observed.

- 5.1.5. Crossing point one has been confirmed as a popular commuting route for bats, specifically common pipistrelle, and also a foraging resource for some bats. As many as 21 instances of bats crossing the A11 at crossing point one have been recorded in one 2.5-hour survey and bats have been confirmed crossing both above and below the A11.
- 5.1.6. The Proposed Scheme includes the lengthening of the existing A11 underpass to include the proposed single lane slip road which would take the length from four lanes to five lanes. The height of the underpass will remain the same.
- 5.1.7. The bats found to fly beneath the current underpass; pipistrelles and Myotis species; are known to fly beneath six lane underpasses on motorways (Berthinussen and Altringham, 2015) and the underpass is not to be lit which can deter light averse Myotis bats. The few bats recorded flying over the road at this point were noted as flying high above traffic height, but three bats were recorded flying at an unsafe height of less than 5m. Noctules and NSL bats are known to fly high above traffic collision heights. High vegetation is to be retained at the south and trees are to be planted at the north.

Crossing point two

- 5.1.8. The following species have been confirmed crossing the A47 at crossing point two. The numbers in brackets refer to the numbers of crosses across both surveys:
- Common pipistrelle (7)
 - Unidentified bat (4)
 - Soprano pipistrelle (3)
- 5.1.9. All bats crossed at a safe height of 5m or above, the footbridge and the traffic.
- 5.1.10. During the dusk survey undertaken on 22 July 2020 all bats confirmed crossing the A47 (seven in total) did so slightly north of the footbridge; one bat was seen to potentially cross the A47 just south of the footbridge. The most confirmed crosses in one survey (either 'survey one' consisting of a dusk and dawn totalling 2.5 hours, or 'survey two' comprising either a 2.5 hour dusk or dawn) were recorded during survey one when eight confirmed crosses were recorded, seven of which occurred in the 1.5-hour dusk survey alone.
- 5.1.11. The Proposed Scheme includes the widening of carriageway at crossing point two via the addition of the slip-road for the A11-A47 link road and the construction of a new public footpath to include an all user bridge across the A47, approximately 50m south of the location of the current footbridge. High vegetation at the southern side of the crossing point location is to be retained.

On the north side, where the proposed slip road is to be built, heavy standard trees are to be planted and a high fence on the north of the A47, between the A47 Eastbound and the A47 on-slip from Thickthorn interchange is to be erected to maintain height above the proposed on slip road and encourage bats to continue to fly above traffic collision heights.

5.2. Bat roosts – impact assessment

- 5.2.1. Table 5.2-1 below details the assessment of direct impacts upon trees with confirmed and potential roosts and BRP. Although [REDACTED] have negligible BRP they have been included in the impact assessment in Table 5.2-1 as the recommended update preliminary ground level roost assessment surveys (see Section 5.3.6) may conclude these trees now have BRP.
- 5.2.2. In summary two trees with confirmed bat roosts will be lost ([REDACTED]). One further tree with confirmed bat roost(s) in, [REDACTED], and one tree with potential bat roost(s) in, [REDACTED], shall potentially be indirectly impacted by the Proposed Scheme as they are located approximately [REDACTED] and [REDACTED] respectively from the DCO scoping boundary. [REDACTED] which also has confirmed bat roost(s) in, is a more significant distance from the DCO scoping boundary, [REDACTED] (see Table 5.2-1 below), and as such it is considered unlikely that indirect impacts from additional noise, light or vibrations would have an adverse impact upon the roost(s) in [REDACTED]
- 5.2.3. In addition to [REDACTED] six further trees with BRP are directly within (or in the case of [REDACTED] adjacent to and between) the footprint of the works and will certainly be lost;
- [REDACTED]
 - [REDACTED]
 - [REDACTED]
 - [REDACTED]
 - [REDACTED]
 - [REDACTED]
- 5.2.4. A number of other trees with BRP are adjacent to the footprint of the works or within the footprint of associated works areas such as site compounds or potential pre-cast yards and may therefore may potentially be lost.

Table 5.2-1: assessment of direct impact upon confirmed roosts and trees with BRP

Tree	BRP category	Roost?	Approximate distance from the DCO scoping boundary	Direct impacts?
[REDACTED]	Confirmed roost	Confirmed common pipistrelle day roost and potential noctule day roost (2020) Confirmed roost (considered likely soprano pipistrelle (2018)) Confirmed soprano pipistrelle roost (2017)	█	No
	Confirmed roost	Confirmed soprano pipistrelle roost (2017)	Within the DCO scoping boundary	Yes, will be lost
	Confirmed roost	Confirmed soprano pipistrelle day roost (2018)	Within the DCO scoping boundary	Yes, will be lost
	Confirmed roost	Confirmed soprano and common pipistrelle day roost(s) and potential noctule day roost (2020)	█	No
	Potential roost	Potential common pipistrelle and noctule day roosts (2020)	█	No
	Low	No	█	No
	Low	No	Within the DCO boundary	No, to remain with special construction measures
	Low	No	Within the DCO boundary	No, to remain with special construction measures
	Low	No	█	No
	Moderate	No	Within the DCO boundary	Yes, will be lost
	High	No	Within the DCO boundary	No, to remain with special construction measures
	Low	No	Within the DCO boundary	No, to remain with special construction measures
	Moderate	No		

Tree	BRP category	Roost?	Approximate distance from the DCO scoping boundary	Direct impacts?
[REDACTED]			Within the DCO boundary	No, to remain with special construction measures
	Moderate	No	92m	No, to be retained and protected
	Low	No	Within the DCO boundary	No, to remain with special construction measures
	Low	No	Within the DCO boundary	No, to remain with special construction measures
	Moderate (2017)	No	Within the DCO boundary	Likely to be retained
	Negligible (2017)	No	Within the DCO boundary	Likely to be retained
	Moderate (2017)	No	Within the DCO boundary	Likely to be retained
	Negligible (2017)	No	Within the DCO boundary	Likely to be retained
	Low (2017)	No	Within the DCO boundary	Likely to be retained
	Negligible	No	121m	No
	High	No	█	No, to be retained and protected
	Moderate	No	Within the DCO boundary	No, to remain with special construction measures
	Moderate	No	Within the DCO boundary	Yes, will be lost
	Moderate	No	On/partially within the DCO boundary	No, to be retained and protected
	High	No	Within the DCO boundary	Yes, will be lost – adjacent to/between the footprint of the works
	Low	No	Within the DCO boundary	No, to be retained and protected
	Low	No	Within the DCO boundary	Yes, will be lost
	Moderate	No	Within the DCO boundary	No, to be retained and protected
	Low	No	Within the DCO boundary	Yes, will be lost
	Low	No	Within the DCO boundary	Yes, will be lost

Tree	BRP category	Roost?	Approximate distance from the DCO scoping boundary	Direct impacts?
	High	No	On/partially within the DCO boundary	No
	Moderate	No	20m	No
	Low	No	Within the DCO boundary	Likely to be retained
	Moderate	No	Adjacent to the DCO boundary	No
	Moderate	No	Adjacent to the DCO boundary	No
	Low	No	Adjacent to the DCO boundary	No
	Low	No	55m	No
	Low	No	75m	No
	Low	No	105m	No
	Low	No	112m	No

5.3. Future survey requirements

- 5.3.1. During October 2020, the final preliminary design was released which resulted in changes to the Proposed Scheme DCO boundary. This included the removal of an area of DCO boundary adjacent to Intwood Lane to the south of the A47 Thickthorn Junction. In addition, the Proposed Scheme DCO boundary was extended west along the A11 and the B1172 carriageways besides other small changes to the DCO scoping boundary. As a result, the following trees subject to update preliminary ground level assessment surveys in July 2020 (except [REDACTED] which had no update survey (see Section 3.5.4)) are now outside of the survey area and **require no further survey:** [REDACTED]
- 5.3.2. As these trees are a significant distance (50m or more) from the DCO boundary no adverse direct (loss, damage) or indirect (disturbance due to additional noise, light and/or vibration)) impacts upon any roosts which may be present in them is anticipated as a result of the Proposed Scheme.
- 5.3.3. As the third survey of [REDACTED] in September 2020 was aborted early due to heavy rain and was as such not in accordance with the minimum survey length of 1.5-hour (Collins, 2016) it is recommended that [REDACTED] is subject to one further dusk emergence or dawn re-entry survey prior to works commencing to complete a full suite of three surveys. Whilst [REDACTED] were subject to third and final

survey in November 2020, which is outside of the recommended survey season outlined in Collins (2016), as the features on these trees were also subject to endoscope survey they are considered to have had sufficient survey effort and require no further survey (until March 2022 (see Section 3.6.2) should works not commence before then).

- 5.3.4. [REDACTED] which has a confirmed roost(s) following incidental observations of roosting behaviour during a survey undertaken on [REDACTED] in 2020 (see Table 4.3-1), will require two further dusk emergence/dawn re-entry roost surveys, at least one of which must be a dawn re-entry survey, to complete a full suite of three surveys (Collins, 2016) in order to accurately characterise the roost(s). [REDACTED] which is considered a potential roost(s) following incidental potential emergences observed during the same survey on [REDACTED] in 2020 will also require two further dusk emergence/dawn re-entry surveys (at least one which should be a dawn re-entry survey).
- 5.3.5. The following trees with moderate or high BRP following the 2020 update preliminary ground level roost assessments require further survey: [REDACTED]
[REDACTED]
[REDACTED] These trees shall be subject to either an aerial assessment by a qualified tree climber and subsequent dusk emergence or dawn re-entry surveys based upon the aerial assessment (for moderate or high BRP) or, where a tree is not considered safe to climb, dusk emergence or dawn re-entry surveys based upon the 2020 preliminary ground level roost assessment.
- 5.3.6. Those trees with moderate BRP (either following aerial assessment if subject to one or following 2020 update preliminary ground level assessment if considered unsafe to climb) should be subject to one dusk emergence roost survey and one dawn re-entry roost survey, whilst those with high BRP (following either aerial assessment or update 2020 preliminary ground level assessment) should be subject to three dusk emergence/dawn re-entry surveys with at least one of each survey type.
- 5.3.7. [REDACTED] ((2017) consisting of five separate trees within a block of woodland) should be subject to update preliminary ground level roost assessments and, dependent upon the results, subsequent dusk emergence/dawn re-entry surveys.
- 5.3.8. To summarise, the following surveys will be undertaken in 2021:
- **Two further dusk emergence or dawn re-entry roost surveys of the confirmed roost(s) [REDACTED] and the potential roost(s) in [REDACTED]** (to include a minimum of one dawn re-entry survey) in order to complete a full suite of recommended surveys (three surveys (Collins, 2016)) and allow for an accurate characterisation of the roost.

- **One further dusk emergence or dawn re-entry roost survey of the confirmed roost in [REDACTED]** to replace the aborted survey on 2 September 2020 and complete a full suite of recommended surveys (three surveys (Collins, 2016)) to allow for an accurate characterisation of the roost.
- **Aerial assessments of trees** which are safe to climb and are considered to have moderate or high BRP following the 2020 update preliminary ground level roost assessment (to include the trees which were previously climbed in 2017 unless significant structure change has deemed it unsafe to climb, the following trees which are considered safe to climb: [REDACTED] and any other trees assessed by a competent, qualified climber as safe to climb).
- **Dusk emergence or dawn re-entry roost surveys of trees** with moderate (two surveys) or high (three surveys) BRP following the aerial assessments or, where no aerial assessment was undertaken, following the 2020 update preliminary ground level assessment.
- **Update preliminary ground level roost assessments of TN9** and, dependent upon the results, subsequent **appropriate dusk emergence/dawn re-entry surveys**.

5.4. Mitigation requirements

Crossing points

- 5.4.1. There is no guidance in Berthinussen and Altringham (2015) on what triggers should be used to determine mitigation. The author Dr Anna Berthinussen was contacted in July 2020 on the issue and written correspondence confirming that they *“don’t specify a trigger for providing mitigation. We didn’t want to be too prescriptive as the need for mitigation will really be site and species-specific”* was received back.
- 5.4.2. Consultation with Natural England also occurred during June to August 2020 on barbastelle bat mitigation and in essence their response was for us to use our professional judgement and “be most appropriate based on the available evidence”.
- 5.4.3. Currently, there are no types of mitigation (green bridges, underpasses or bat hops) that have been proven to work as there has only been a small amount of monitoring surveys undertaken at them (Berthinussen and Altringham, 2015).
- 5.4.4. Site specific considerations at crossing point two include the addition of a 3m high environmental barrier between the existing A47 and the proposed new slip road in order to maintain the current higher bat flight path over the slip road and encourage bats to fly above traffic. This will also be achieved east of the proposed new slip road by a re-installed bund, in conjunction with the retention of the existing trees along Cantley Lane east of the DCO boundary, which will encourage bats to cross the proposed new slip road higher.

- 5.4.5. At crossing point one, the lengthening of the underpass is not to such an extent that bats would not still use it to fly beneath.

Bat roosts and trees with BRP

- 5.4.6. Two confirmed bat tree roosts ([REDACTED]) will be lost due to the works (see Table 5.2-1) and as such it will be necessary to obtain an EPS mitigation licence from Natural England to allow works to proceed. The licence application will include a method statement detailing how works are to proceed with regards to bats including the detailing of sensitive felling techniques under supervision of a suitably qualified ecologist (SQE). Additional surveys may be required to inform any licence application to ensure that data are from the most recent survey period.
- 5.4.7. Trees with BRP in which no roosts have been identified (including trees with low BRP which have not been subject to survey) which shall be directly impacted by the works (for example pruned or felled (see Table 5.2-1)) shall be subject to sensitive felling techniques supervised by a SQE following an inspection of cavities and features by the SQE a maximum of 24 hours prior to felling (or 48 hours prior in winter).

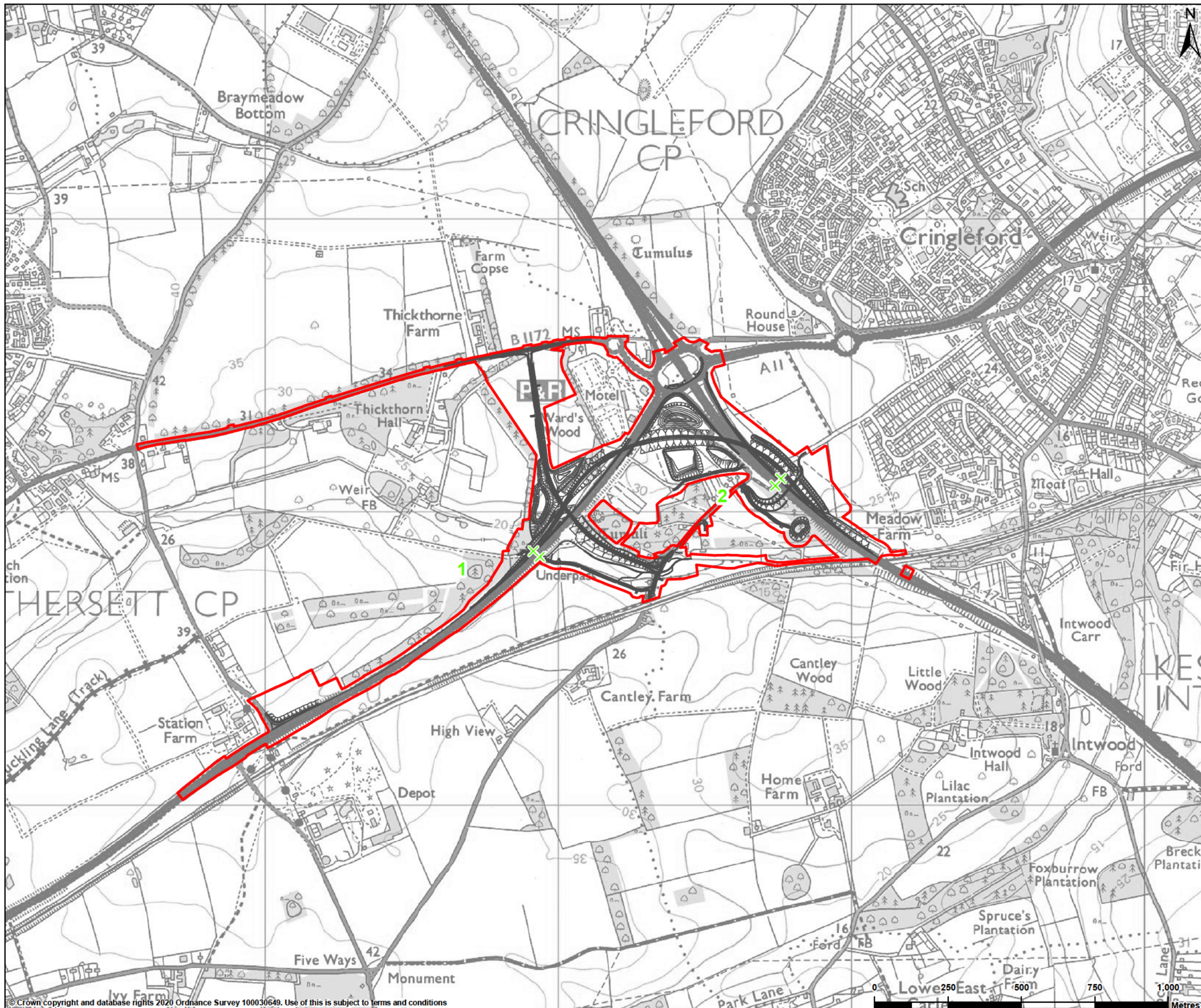
General mitigation

- 5.4.8. The following mitigation measures should be adhered to as good practice:
- Any trees removed to facilitate works should be replaced like-for-like with native species (preferably fast-growing) to retain any areas potentially used for foraging or, in the case of tree lines, commuting routes
 - Any sections of hedgerows removed should be reinstated with native species to maintain potential commuting corridors
 - Night lighting and working should be kept to a minimum. If it necessary to light the site at night, lights should be hooded to avoid spill over of light and direct light to the ground, in addition to directing light away from any natural habitat features such as the Cantley Stream, woodland, tree lines or hedgerows
- 5.4.9. Works are proposed along the north and north-east field boundary where the arable field margin (which may potentially be classed as the S41 habitat) was recorded (see Section 4.5.1). Areas of this habitat lost should be reinstated like for like along the new field margin post construction.

6. References

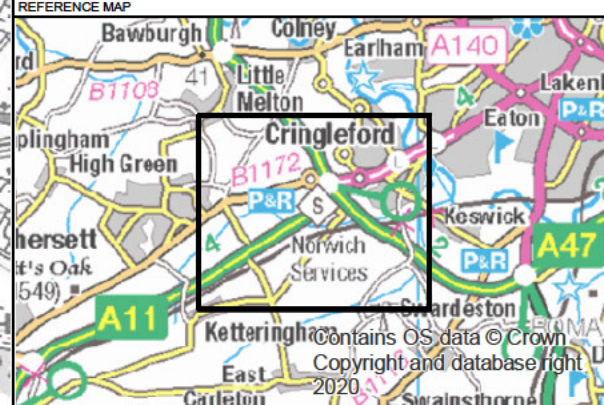
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[REDACTED]
[REDACTED]
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[REDACTED]
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Annex A. Bat crossing point survey locations



LEGEND

- Proposed scheme design - Nov 2020
- DCO boundary - Nov 2020
- ✕ Bat Crossing Location



REV	DATE	REVISION NOTE	LEGEND UPDATE	JB	FB	BA

DESIGNER

CONTRACTOR

CLIENT

PROJECT TITLE
A47/A11 THICKTHORN JUNCTION

PROJECT STAGE
PCF STAGE 3

DRAWING TITLE
BAT CROSSING POINT SURVEY LOCATIONS

SUITABILITY
FOR INFORMATION

SHEET SIZE	SCALE	STATUS
A3	1:12,500	S3

DRAWING NUMBER
HE551492-GTY-EBD-000-DR-LB-30007

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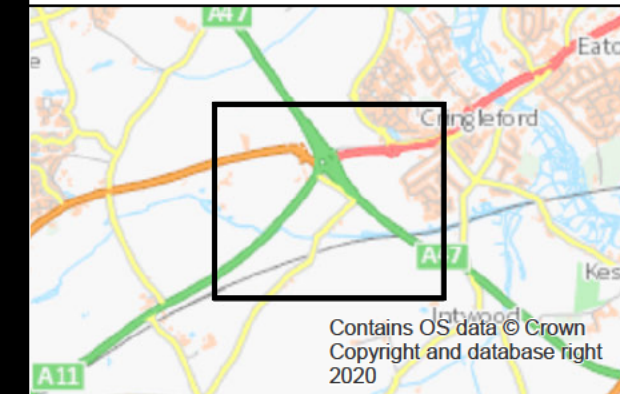
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Annex B. Bat roost potential (BRP) and dusk emergence and dawn re-entry roost survey location

LEGEND

- DCO boundary - Nov 2020
- 2020 Bat Roost Potential (BRP)
 - Confirmed roost
 - Potential roost
 - High
 - Moderate
 - Low
 - Negligible
 - Not assessed
- 2016/17 Bat Roost Potential (BRP)
 - Moderate
 - Low
 - Negligible

REFERENCE MAP



P02	20/11/2020	LEGEND UPDATE	JB	FB	BA
REV	DATE	REVISION NOTE	ORG	CHKD	APP'D

DESIGNER

SWECO

CONTRACTOR

CLIENT

PROJECT TITLE

A47/A11 THICKTHORN JUNCTION

PROJECT STAGE

PCF STAGE 3

DRAWING TITLE

ANNEX B
BAT ROOST POTENTIAL (BRP) AND DUSK EMERGENCE/
DAWN RE-ENTRY ROOST SURVEY LOCATIONS

SUITABILITY

FOR INFORMATION

SHEET SIZE	SCALE	STATUS
A3	1:6,000	S3

DRAWING NUMBER

HE551492-GTY-EBD-000-DR-LR-30008