9.2 BAT SURVEY REPORT

West Sussex County Council

A29 REALIGNMENT

Bat Survey Report

001
DECEMBER 2019

CONFIDENTIAL

West Sussex County Council

A29 REALIGNMENT

Bat Survey Report

TYPE OF DOCUMENT (VERSION) CONFIDENTIAL

PROJECT NO. 70055091-E03

OUR REF. NO. 001

DATE: DECEMBER 2019

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QUALITY CONTROL

Issue/revision	First issue	Revision 1	Revision 2	Revision 3
Remarks	Draft			
Date	December 2019			
Prepared by	Charlotte Hewitt			
Signature	 Hewitt, Charlotte (UKCMH003) 2019.12.20 12:45:31			
Checked by	Verity Dickie			
Signature	 Dickie, Verity 2019.12.20 13:05:29			
Authorised by	Owen Peat			
Signature	 Peat, Owen I am approving this document 2019.12.20 12:48:00			
Project number	70055091 – E03			
Report number	001			
File reference	\\uk.wspgroup.com\central data\Projects\700550xx\70055091 - WSCC - A29 Phase 1 Planning Application\03 WIP\10 Ecology\05 Reports\Bats			

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EXECUTIVE SUMMARY

West Sussex County Council is proposing the realignment of the A29 in Arun District, comprising the construction of a new single carriageway, as well as associated features including a 3m wide cycleway, footpath, 2.5m central island and four uncontrolled crossings. The 'Proposed Development' will be situated between the existing A29 at Fontwell Avenue and the B2233 Barnham Road, hereafter referred to as the 'Site'.

WSP was commissioned by West Sussex County Council to undertake bat surveys of the Site and a 20m buffer area (the 'Survey Area'), comprising bat activity surveys of the Survey Area using automated static detectors, and preliminary bat roost assessment (PBRA) surveys of buildings and trees within the Survey Area. Following the PBRA, further at-height surveys of trees and further dusk emergence/dawn re-entry surveys of buildings were also commissioned.

Following the PBRA of trees and subsequent at-height surveys, a bat roost was identified in tree T20, and a further 42 trees were found to have bat roosting potential. A bat roost was also recorded in tree T3 but damage to the tree during the survey period resulted in the exposure of the potential roosting feature, and T3 was subsequently assigned a negligible roosting potential. In addition, a soprano pipistrelle *Pipistrellus pygmaeus* and serotine *Eptesicus serotinus* roost was recorded in building B5 during the dusk emergence and dawn re-entry surveys. No other bat roosts were identified during the survey works.

The Survey Area has been found to provide commuting and foraging opportunities for an assemblage of at least eight bat species during the automated detector surveys, with activity dominated by common pipistrelle. Lower levels of activity were recorded for rarer species, including greater horseshoe bat *Rhinolophus ferrumequinum*, barbastelle *Barbastella barbastellus*, Nathusius' pipistrelle *Pipistrellus nathusii* and Leisler's bat *Nyctalus leisleri*. While activity levels were relatively constant between the survey locations, notably higher levels of activity were recorded for serotine at Location 1, near Barnham Road, and at Location 3 in September for *Myotis* bat species. The Survey Area is considered to be of conservation value at the District level overall for its assemblage of foraging and commuting bats, as informed by the Chartered Institute of Ecology and Environmental Management (CIEEM) and Ecobat evaluation methods.

Bats are protected under a range of national legislation and planning policy. Mitigation, compensation and enhancement measures will be required to ensure compliance with this legislation and policy. A summary of the likely key measures is provided below:

- Retention and avoidance of indirect impacts to building B5, or otherwise the application of a European Protected Species Licence to Natural England for the destruction of this roost.
- An updated at-height inspection of T20 in the bat active season prior to the commencement of works, to identify any change in use to this historic roost.
- Supervised soft felling of T3 (if required) as a precaution due to historic droppings recorded, despite the current exposure of the potential roosting features.
- Retention of trees with bat roosting potential, or otherwise soft-felling under ecological supervision and the provision of compensatory habitat in the form of bat boxes and habitat creation.
- The creation of suitable bat crossing points to be included within the design proposals.
- The provision of a lighting strategy which is sympathetic to bats.

1. INTRODUCTION

1.1. PROJECT BACKGROUND

1.1.1. West Sussex County Council (WSCC) is seeking to undertake the realignment of the A29 in Arun District, West Sussex, in two distinct phases. Phase 1 would see the construction of a new single carriageway to the south of Eastergate Lane, connecting the A29 Fontwell Avenue to the B2233 Barnham Road via a new junction. The new carriageway will also feature a 3m wide cycleway and footpath, a 2.5m central island, four uncontrolled crossings and potential noise barriers. The Phase 1 works described above are hereafter referred to as the 'Proposed Development'. The location of the Proposed Development, hereafter referred to as 'the Site', is shown on Figure 1.

1.1.2. It is understood that WSCC is aiming to submit a detailed planning application for the Proposed Development, supported by an Environmental Statement.

1.1.3. Phase 2 of the proposed A29 realignment, for land south of Barnham Road, is currently in the early stages of the design process and is likely to be subject to a separate planning application.

1.2. ECOLOGICAL BACKGROUND

1.2.1. A Preliminary Ecological Appraisal (PEA) of the Proposed Development was completed in September 2018 (WSP, 2018). Among other recommendations, the PEA proposed that a Preliminary Bat Roost Assessment (PBRA) should be undertaken due to the presence of suitable roosting habitat for bats, comprising buildings and mature trees on Site. Activity surveys were also recommended due to the presence of tree lines, the orchard, hedgerows and woodland edges with suitability for commuting and foraging bats.

1.3. BRIEF AND OBJECTIVES

1.3.1. WSCC commissioned WSP to complete bat surveys of the Site and a 20m buffer (hereafter referred to as the 'Survey Area' as shown on Figure 1), to account for the maximum extent of works. The brief was to:

- Conduct a ground-based PBRA of trees and structures within the Proposed Development footprint, to determine presence, potential presence or likely absence of roosting bats, in line with published guidance (Collins (ed.), 2016).
- Complete dusk emergence and/or dawn re-entry surveys for buildings identified with the potential to support roosting bats during the PBRA, in line with good practice guidance (Collins (ed.), 2016).
- Undertake at-height inspections of trees with potential roost features identified during the PBRA survey, through the use of a ladder or tree climbing where appropriate (or otherwise through ground level dusk emergence and/or dawn re-entry surveys), to confirm, upgrade or downgrade the bat roosting potential assigned during the PBRA;
- Conduct bat activity surveys using automated static bat detectors, to assess the usage of the Survey Area by commuting and foraging bats.
- Evaluate the Survey Area for bats and make recommendations as to how proposals should account for bats with respect to legislation, planning and biodiversity policy.

1.3.2. The results of these surveys, and subsequent recommendations, are included within this report.

2. METHODS

2.1. OVERVIEW

2.1.1. The Survey Area was first subject to a PBRA in April 2019, comprising an external ground level inspection of buildings and trees. Following these inspections each tree or building was assigned a level of potential to support roosting bats, based on the potential roosting features (PRFs) present and the surrounding habitat.

2.1.2. Buildings with roosting potential were then subject to further survey to determine the presence or likely absence of roosting bats. This further survey comprised dusk emergence and/or dawn re-entry surveys, with the level of survey effort determined by the roosting potential of the building, in line with best practice guidance (Collins (ed.), 2016).

2.1.3. Trees initially assigned a moderate or high level of bat roosting potential following the PBRA were subject to at-height inspections to inspect potential roosting features for evidence of roosting bats. The level of roosting potential for each tree surveyed was then confirmed or reassigned based on the results of the at-height inspections. Trees which could not be safely climbed or inspected from a ladder were instead subject to dusk emergence and/or dawn re-entry surveys.

2.1.4. Bat activity surveys were conducted at monthly intervals between April and October 2019, using automated static detectors deployed at four locations across the Survey Area.

2.2. PRELIMINARY BAT ROOST ASSESSMENT

2.2.1. All accessible buildings and trees present within the Survey Area were inspected to enable an assessment of their potential to support bat roosts, and to search for evidence indicating the current or historic use by roosting bats.

2.2.2. A visual inspection of the exterior of trees and buildings using binoculars and a high-powered torch was completed from ground level to search for features which may provide PRFs for bats. Where suitable PRFs were noted, their location and a brief description of their character was recorded. Additionally, each feature was visually inspected for evidence indicating use by roosting bats such as droppings, urine staining, and scratch marks / characteristic staining (from fur oils).

2.2.3. Buildings and trees were categorised in line with the descriptions in Table 2-1 overleaf. Based on the PRF present and the location of the buildings and trees, the potential for different types of bat roost was also considered. For the purpose of this PBRA, potential roost types were grouped as follows (from Collins (ed.), 2016):

- maternity (breeding roost);
- summer / transitional (to include transitional, satellite, night and day roosts); and
- hibernation.

2.2.4. The ground level inspection surveys were undertaken by a licenced bat surveyor (Licence number: 2019-39048-CLS-CLS) with over four years' experience in bat surveys.

Table 2-1 – Roost potential categorisation

Suitability Category	Description
Confirmed	Building or tree with features confirmed to be used by roosting bats either by historic records (verified appropriately), or evidence recorded during survey.
High	A building or tree with one or more potential roost sites that are obviously suitable for use by larger numbers of bats on a more regular basis and potentially for longer periods of time due to their size, shelter, protection, conditions and surrounding habitat.
Moderate	A building or tree with one or more potential roost sites that could be used by bats due to their size, shelter, protection, conditions and surrounding habitat but unlikely to support a roost of high conservation status (with respect to roost type only – assessment made irrespective of species conservation status which is established after presence is confirmed).
Low	A building with one or more potential roost sties that could be used by individual bats opportunistically. However, these potential roost sites do not provide enough space, shelter, protection, appropriate conditions and/or suitable habitat to be used on a regular basis by larger numbers of bats. A tree of sufficient size and age to contain potential roost features, but with none seen from the ground or features seen with only very limited roosting potential.
Negligible	A building or tree with no potential opportunities for roosting bats, or very few or minor features in an isolated/unsuitable location such that the presence of a roost is considered highly improbable e.g. isolated from suitable foraging and commuting habitats.

2.3. AT-HEIGHT INSPECTION OF TREES

2.3.1. A total of 35 trees identified with moderate or high potential to support roosting bats during the PBRA were subject to further at-height inspections, undertaken on two separate occasions within the active season for bats (May to August inclusive). Based on the results of these at-height inspections, the roosting potential of trees was either confirmed, upgraded or downgraded accordingly to provide the most accurate representation of suitability. Where the roosting potential of a tree was downgraded to low or negligible potential after the first survey visit, a second visit was not conducted.

2.3.2. Of the 35 trees, 31 were inspected at-height with the use of a ladder due to the low height of potential roost features previously identified. Potential roost features were inspected with the use of a high-powered torch and an endoscope, to thoroughly investigate any cavities present. Where suitable features were noted, their location and a brief description of their character was recorded. Each feature was closely inspected for evidence indicating use by roosting bats such as droppings, urine staining, and scratch marks / characteristic staining (from fur oils), or the presence of bats. These inspections were undertaken by a licenced bat surveyor due to the potential for encountering live bats (licence number: 2019-39048-CLS-CLS).

2.3.3. Rope climbing techniques conducted by a specialist ecological consultant were used to inspect the remaining four trees (T1, T2, T15 and T16), as PRFs on these trees could not be safely accessed with the use of a ladder. PRFs were closely inspected for bats or evidence of roosting bats with the use of high-powered torches and endoscopes as per the ladder at-height inspections.

2.4. BAT DUSK EMERGENCE / PRE-DAWN RETURN SURVEY

2.4.1. Buildings identified to have features with potential to support bat roosts were subject to further surveys to watch and listen for bats emerging from, or returning to roost. The level of survey effort employed was proportional to the level of potential for roosts to be present, the number and timing of survey visits is discussed in Section 2.7. Surveyor locations were utilised to fully cover the potential roosting features on all suitable buildings.

2.4.2. A dusk emergence and dawn re-entry survey was also completed for tree T44, which was assigned a moderate level of roosting potential but could not be inspected at-height due to safety concerns.

2.4.3. The dusk emergence surveys began 15 minutes before sunset and continued until 90 minutes after sunset. The dawn re-entry surveys began 90 minutes before sunrise and finished 15 minutes after sunrise.

2.4.4. The surveyors used Elekon BatLoggers and EchoMeter Touch bat detectors to listen to and record echolocation calls of bats observed. During the survey, surveyors mapped the flight-lines used by any bats observed and noted any features used by the bats to exit/enter the buildings. Incidental records of bat activity in the vicinity of the surveyor locations were also collected.

2.5. BAT ACTIVITY SURVEY

2.5.1. Bat activity data was gathered using static automated bat detectors installed at pre-determined locations within the Survey Area during each of the survey months (April to October inclusive).

2.5.2. A total of four Wildlife Acoustics SM2+ automated detectors were deployed for a minimum of five nights in each month, in accordance with best practice guidance (Collins (ed.), 2016). The automated detectors were set to commence recording at least 30 minutes before sunset and cease 30 minutes after sunrise for each night deployed. The locations of the automated detectors were selected to sample key habitats present within the Survey Area for commuting and foraging bats.

2.5.3. Calls registered by the static bat detectors were recorded for later analysis using specialist computer software, details are provided below.

2.6. DATA ANALYSIS

2.6.1. The recordings of bat echolocation calls collected during the dusk emergence/re-entry and bat activity surveys were analysed using specialist computer software, including BatExplorer (Elekon, Version no. 2.1.5.0) and Kaleidoscope (Wildlife Acoustics, Version no. 5.1.8). The analysis enables confirmation of species or species group based on call parameters, and the relative activity of different species of bats by counting the minimum number of bats recorded within discrete sound files. Once triggered by ultrasound, the detectors record sound files with a duration of 15 seconds, which may contain a number of individual bat calls (or passes), or discrete groups of ultrasound ‘pulses’. The assessment of relative bat activity between species is based on the relative abundance of recorded calls of each species within each survey period (i.e. each period of static monitoring per month, or each emergence/re-entry period) and across the combined study period.

2.6.2. It should be recognised that a series of separate sound files may represent a series of different bats commuting within the range of an automated detector, or a smaller number of bats repeatedly triggering the detector (e.g. bats making repeated foraging passes within the range of a detector).

2.6.3. Where possible, bat calls are identified to species level. However, species of the genus *Myotis* are grouped together in most cases as their calls are similar in structure and have overlapping call parameters, making species identification problematic (Russ, 2013). For *Pipistrellus* species the following criteria based on measurements of peak frequency are used to classify calls:

- Common pipistrelle *Pipistrellus pipistrellus* ≥ 42 and <49KHz.
- Soprano pipistrelle *Pipistrellus pygmaeus* ≥ 51KHz.
- Nathusius pipistrelle *Pipistrellus nathusii* <39KHz.
- Common/soprano pipistrelle ≥49 and <51KHz.
- Common/Nathusius pipistrelle ≥39 and <42KHz.

2.6.4. In addition, the following categories are used for calls which cannot be identified with confidence due to the overlap in call characteristics between species or species groups:

- *Myotis/Plecotus* sp.;
- *Nyctalus* sp. (either Leisler's bat *Nyctalus leisleri* or noctule *Nyctalus noctula*);
- Serotine *Eptesicus serotinus*/Leisler's; and
- Serotine/*Plecotus* sp.

2.7. DATES OF SURVEY AND PERSONNEL

Preliminary Bat Roost Assessment

2.7.1. The PBRA surveys were led by an experienced surveyor (Natural England survey licence number: 2019-39048-CLS-CLS). The lead surveyor has over four years' experience of ecological survey, including extensive bat survey experience and has held a Natural England bat survey licence since 2018.

2.7.2. The PBRA survey was conducted over two survey visits, including one on 4 April 2019 and the second on 15 April 2019.

At-Height Inspections of Trees

2.7.3. Ladder-based at-height inspection surveys of trees were conducted over two days on two separate occasions, by a licenced bat ecologist (licence number: 2019-39048-CLS-CLS). The rope-climbed inspection survey was conducted on only a single occasion by a licenced bat ecologist (licence number: 2015-16736-CLS-CLS), as the trees surveyed were either downgraded to low or negligible potential during the first visit (T1, T15 and T16) or otherwise considered to be a great enough distance from the Proposed Development so as to avoid direct or indirect effects (T2). The dates for these survey visits are provided in Table 2-2 below.

Table 2-2 – At-height inspection survey dates

Survey type	Trees Surveyed[1]	Survey Dates
At-height inspection (with ladders)	T3, T4, T6*, T8, T9, T10, T13*, T17, T18, T19, T20, T21, T22, T23, T24, T25, T26, T27*, T28, T30, T32, T33*, T34, T35, T36*, T37, T38, T39, T40, T41, T42*	**Visit 1:** 24 June 2019 and 26 June 2019 **Visit 2**: 8 August 2019 and 22 August 2019
At-height inspection (with rope climbing)	T1*, T2, T15*, T16*	**Visit 1:** 25 July 2019 **Visit 2:** N/A

Dusk Emergence and Dawn Re-entry Surveys

2.7.4. All dusk emergence and dawn re-entry surveys were led by at least one experienced bat surveyor with a minimum of four years' experience in undertaking bat surveys.

2.7.5. Survey visits to buildings with multiple surveyor positions were conducted over a dusk emergence and dawn re-entry survey, to ensure all potential roosting features were observed on each visit.

2.7.6. Building B5 was initially assigned a moderate roosting potential during the PBRA survey, but was later confirmed as a bat roost during Visit 1 dusk emergence survey. Building B5 was therefore subject to three roost characterisation survey visits, in accordance with good practice guidance for confirmed roosts (Collins, (ed.), 2019).

2.7.7. Details of the survey timings and surveyor quantities for each building and tree are provided in Table 2-3 below.

Table 2-3 – Dusk emergence and dawn re-entry survey dates

Building/Tree Ref.	Bat Roosting Potential	No. Survey Visits Required	No. Surveyor Positions	Survey Details	
				Visit No.	Dates
B2	Low	1	4	Visit 1	08/07/19 (Dusk)
B5	Moderate	2	6	Visit 1	04/07/19 (Dusk) 05/07/19 (Dawn)
				Visit 2	12/08/19 (Dusk) 13/08/19 (Dawn)
				Visit 3	16/09/19 (Dusk) 17/09/19 (Dawn)

[1] Trees marked with an asterisk (*) indicate those for which roosting potential was downgraded to low or negligible during Visit 1 and were therefore not subject to a second survey during Visit 2.

Building/Tree Ref.	Bat Roosting Potential	No. Survey Visits Required	No. Surveyor Positions	Survey Details	
				Visit No.	Dates
B7	Moderate	2	4	Visit 1	19/07/19 (Dusk) 20/09/19 (Dawn)
				Visit 2	22/08/19 (Dusk) 23/08/19 (Dawn)
T44	Moderate	2	1	Visit 1	12/08/19 (Dusk)
				Visit 2	17/09/19 (Dawn)

Bat Activity Surveys

2.7.8. Four static detectors were deployed for the bat activity survey between April and October inclusive. Dates of the survey visits within each month are shown in Table 2-4 below.

Table 2-4 - Dates for Bat Activity Survey Visits

Month	Dates of Automated Survey	Total No. of Detector Nights per Month[2]
April	15/04/2019 – 19/04/2019	20
May	23/05/2019 – 27/05/2019	15
June	11/06/2019 – 15/06/2019	20
July	19/07/2019 – 23/07/2019	20
August	15/08/2019 – 19/08/2019	20
September	19/09/2019 – 23/09/2019	20
October	11/10/2019 – 15/10/2019	15

[2] Detector nights are calculated as the number of detectors successfully deployed multiplied by the number of survey nights the detectors were deployed for, with a maximum of 20 detector nights per month.

2.8. EVALUATION

2.8.1. The evaluation of the bat populations using the Survey Area has been based on CIEEM guidance (CIEEM, 2018). This guidance recommends that the evaluation is made with reference to a geographical frame of reference as follows:

- International and European;
- National (England);
- Regional (South-East England);
- District (West Sussex), vice county or other local authority-wide area;
- Local (Chichester); and
- Application Site (Survey Area).

2.8.2. In evaluating the relative importance of the Survey Area to different bat species, consideration is given to the relative frequency of each species (based on the bat activity survey results) in the context of their UK status and population estimates (Collins (ed.), 2016; Harris *et al*, 2008). The following categories for relative frequency (in terms of the results of this survey) have been used:

- Very frequent – recorded on all or most surveys with high numbers of calls/levels of activity.
- Frequent – recorded on all or most visits but with medium numbers of calls/levels of activity.
- Regular – recorded on most visits but with low numbers of calls/levels of activity.
- Infrequent – scattered records through the survey programme, generally low numbers of calls.
- Very infrequent – very few calls recorded on a low number of occasions.
- No confirmed activity – no confirmed bats of this species recorded in this Survey Area.

2.8.3. Consideration has also been given to which habitats/parts of the Survey Area are of highest value to bats based on the survey data. For example, this may include regular commuting flight lines or areas most frequently used by foraging bats.

Ecobat

2.8.4. The bat activity survey data, once analysed, was then input into 'Ecobat', an online analysis tool for objectively assessing bat activity levels. This tool sets the data within a percentile for the level of activity, based on the number of passes per species per night, allowing for variables such as location, weather, date and immediate surroundings.

2.8.5. Passes were defined as the presence of a species within a single 15 second sound file. Data analysis was aided by the use of the Ecobat website, which compares bat activity datasets relative to a wider database. Data were compared to other local data sets (i.e. within 100km of the Survey Area). Ecobat defines activity between low and high as follows:

- Low activity: 0-20th percentiles.
- Low to moderate activity: 21st-40th percentiles.
- Moderate activity: 41st-60th percentiles.
- Moderate to high activity: 61st-80th percentiles.
- High activity: 81st-100th percentiles.

2.8.6. Ecobat does not currently allow for the inclusion of unidentified *Pipistrellus* spp., *Nyctalus* spp. and Nyctaloid species as individual groups, and therefore these groups were excluded from the Ecobat analysis.

2.8.7. It is acknowledged that as a publicly accessible tool, there are no restrictions on who is able to upload data. Therefore, there is the potential that unverified bat calls (or calls not subject to thorough quality assurance) can be uploaded to the system and skew the analysis. Ecobat analysis, therefore, should not be considered as the definitive assessment of bat activity levels, but it is a useful tool in considering bat calls within a geographic context.

2.9. NOTES AND LIMITATIONS

2.9.1. Internal inspections were not undertaken of any buildings surveyed during the PBRA survey, due to a lack of information regarding asbestos for each building. However, a thorough ground level external inspection was completed for each building. As further survey to determine the presence or likely absence of bats in buildings with potential roosting suitability was undertaken, this is not considered to be a significant limitation.

2.9.2. A number of residential properties situated at both the A29 end and the Barnham Road end of the Proposed Development situated outside of the Site, but within the Survey Area, were unable to be surveyed due to a lack of access. These properties are not within the footprint of the Proposed Development, but there is the potential for construction activities within the Site to cause indirect disturbance effects should roosting bats be present within these buildings. Recommendations to address this limitation will be provided within the Environmental Statement.

2.9.3. The approach to bat activity surveys differs from that suggested in good practice guidance (Collins, (ed.), 2019). In particular, manual walked transect surveys are usually undertaken in tandem with automated detector surveys in order to give more detailed information on bat behaviour including foraging activity, flight lines and the spatial use of the Survey Area by bats. However, manual transect surveys only give data on a single night at a time, and are not able to cover the whole survey area throughout the night, thereby missing much activity. As such a scope based on using automated detectors at an elevated density and located at key crossing points was undertaken. This survey design and effort, in addition to the incidental activity recorded during the dusk emergence and dawn re-entry surveys (see Table 3-4), is considered to have provided sufficient information on the level and diversity of bats making use of the Survey Area.

2.9.4. As shown in Table 2-4, the number of detector nights for the bat activity surveys fell short of the targeted five nights per detector in three months throughout the survey period. In October, detector failure resulted in an absence of date at Location 2. The detector at Location 4 in May was stolen during the survey period. However, this is not considered to be a significant limitation to the survey as data was recorded for all locations in at least six months, including the maternity season (June to August inclusive) and at least one transitional period (April/May and September/October).

2.9.5. Activity surveys are unlikely to provide a complete measure of bat activity within the Site due to the tendency for *Plecotus* spp. to use low intensity calls which are rarely detected unless passing within 5m of the static detectors. Even then, *Plecotus* spp. do not always echolocate when foraging (Swift, 1998). As such, activity detected for *Plecotus* spp. at the Site is likely to be an underestimate of the total activity for these species.

3. RESULTS

3.1. PRELIMINARY BAT ROOST ASSESSMENT

External Building Inspections

3.1.1. A total of seven buildings were identified within the Survey Area during the PBRA, none of which featured evidence of roosting bats. Of these seven buildings, two were assessed as having a moderate bat roosting potential (B5 and B7), one with low potential (B2) and four were considered to have negligible potential to support roosting bats (B1, B3, B4 and B6). The locations of these buildings are shown on Figure 2, and the roosting potential of each building is detailed in Table 3-1 below. Photographs of buildings with bat roosting potential are provided in Appendix B.

Table 3-1 – Summary results of the PBRA of buildings within the Survey Area

Building No.	Description	Potential roosting feature or access/egress feature description	Potential for different bat roosts[3]			
			Trans	Mat	Hib	Overall
B1	A dilapidated wooden stable unit with missing panels and a sloping corrugated metal roof. B1 is open fronted on the eastern aspect, exposed to light and prevailing weather. Gaps are present between the barge board and wall on both the northern and southern aspects, but these are shallow and heavily cobwebbed, and so are unsuitable for roosting bats.	None	Neg	Neg	Neg	**Neg**
B2	A large agricultural barn in active use. Building is constructed of breeze-blocks with corrugated asbestos cladding. The roof is pitched with corrugated asbestos panels, and features plastic skylight panels. Several external potential roosting features and access/egress points into the building were observed.	- Damaged corrugated asbestos panel leading into a cavity on southern aspect. - Gaps between fascia and corrugated asbestos panels on western and eastern aspects. - Gaps between corrugated panels providing	Low	Neg	Neg	**Low**

[3] Trans = Transitional/summer roost (to include transitional, satellite, night and day roosts), Mat = maternity roost (breeding roost), Hib = hibernation roost.

Building No.	Description	Potential roosting feature or access/egress feature description	Potential for different bat roosts[3]			
			Trans	Mat	Hib	Overall
		egress on southern aspect. - Open access into building through missing corrugated panel on northern aspect.				
B3	A two-storey residential property constructed of brick. Roof is hipped and pitched with slate tiles, and skylights are present on northern aspect. B3 is approximately 10 years' old and in good condition with no PRFs observed.	None	Neg	Neg	Neg	**Neg**
B4	A stand-alone single-storey residential garage unit. Constructed of wooden panels and features a pitched roof with slate tiles. Building has been recently constructed and is in good condition with no PRFs observed.	None	Neg	Neg	Neg	**Neg**
B5	A barn unit used for storage of carpet samples. Barn is constructed from wood with corrugated metal panels, and a double pitched roof with corrugated metal panels. B5 is in a general state of disrepair with missing panels and rotting wood which provide potential roosting opportunities.	- Gaps between corrugated panels on south-western aspect - Gaps between wooden panels on north-eastern aspect - Lifted corrugated roof panels on north-eastern aspect - Dense ivy growth potentially obscuring features on south-eastern aspect.	Mod	Low	Neg	**Mod**
B6	A recently constructed carpet showroom in regular use. Building is of wooden construction and features a pitched, tiled roof. Building is in good condition with no PRFs observed.	None	Neg	Neg	Neg	**Neg**

Building No.	Description	Potential roosting feature or access/egress feature description	Potential for different bat roosts[3]			
			Trans	Mat	Hib	Overall
B7	A large warehouse building in current use as a storage facility. Building constructed from corrugated metal panels with a pitched, corrugated roof. B7 is generally is a good condition, but several gaps leading into the building are present which may provide access/egress points for bats to roost within the building.	- Gaps between corrugated sheeting and wall leading into building on north-western and south-eastern aspects. - Large gap leading into building above doorway on north-eastern aspect.	Mod	Low	Neg	**Mod**

Ground Level Tree Survey

3.1.2. A total of 44 trees with bat roosting potential were recorded within the Survey Area. This includes one tree confirmed as a bat roost (T3) due to the presence of bat droppings present within a large cavity. A further nine trees were assessed as having high potential to support a bat roost, 26 trees with moderate potential and eight trees with low potential. The remaining trees present within the Survey Area were found to have negligible potential to support roosting bats.

3.1.3. A summary of trees with bat roosting potential is provided in Table 3-2 below, with further details provided in Appendix A. The locations of these trees are shown on Figure 3, and photographs are provided in Appendix B.

Table 3-2 – Summary results of the PBRA of trees within the Survey Area.

Bat Roosting Potential	Tree No.
Confirmed roost	T3
High	T2, T17, T19, T20, T22, T25, T26, T34, T41
Moderate	T1, T4, T6, T8, T9, T10, T13, T15, T16, T18, T21, T23, T24, T27, T28, T30, T32, T33, T35, T36, T37, T38, T39, T40, T42, T44
Low	T5, T7, T11, T12, T14, T29, T31, T43

3.2. AT-HEIGHT INSPECTION OF TREES

3.2.1. All moderate and high potential trees identified during the PBRA survey were subject to an at-height inspection survey, with the exception of T44 which could not be safely surveyed at-height and was instead subject to emergence/re-entry surveys (see Section 3.4).

3.2.2. One tree, T20, was identified as a bat roost during the Visit 1 ladder inspection survey due to the presence of bat droppings within a cavity. The age and condition of the droppings suggests that the roost in T20 was in use within the previous year. No additional fresh droppings were recorded within T20 during Visit 2, and dense vegetation growth was partially blocking access to the PRF during Visit 2, which suggests that T20 is a historic roost that may be used on a seasonal basis.

3.2.3. T3 sustained branch damage between the PBRA survey and Visit 1 of the at-height inspections, exposing the feature where the droppings had previously been recorded. The PRF previously recorded is no longer considered to provide the same protection and shelter for bats. As a result, it is considered that T3 now has negligible potential to support roosting bats.

3.2.4. Two trees (T28 and T39) were upgraded to high potential following the at-height inspection surveys, whilst six (T2, T19, T22, T25, T26 and T34) were downgraded to moderate potential. A further eight trees were downgraded to low potential, and five are now considered to have negligible potential to support roosting bats. The summary results of the at-height inspection surveys are shown below in Table 3-3 and on Figure 4, with detailed results provided in Appendix A.

Table 3-3 – Summary results of the at-height inspection of trees within the Survey Area

Bat Roosting Potential	Tree No. [4]
Confirmed	T20*
High	T17, T28*, T39*
Moderate	T2*, T4, T8, T10, T18, T19*, T21, T22*, T23, T24, T25*, T26*, T30, T34*, T35, T37, T38, T40
Low	T1*, T6*, T9*, T13*, T27*, T32*, T36*, T42*
Negligible	T3*, T15*, T16*, T33*, T41*

[4] Trees marked with an asterisk (*) are those which have either been upgraded or downgraded in roosting potential from the results of the PBRA survey shown in Table 3-2.

3.3. BAT DUSK EMERGENCE / PRE-DAWN RETURN SURVEY

3.3.1. A single soprano pipistrelle and a single serotine bat were both recorded emerging from building B5 during the Visit 1 dusk survey on 4 July 2019. Both the soprano pipistrelle and serotine bat were observed emerging from a cavity between the wall and wooden weatherboarding, as shown on photographs in Appendix B. No other bats were observed emerging from or returning to roost at B5 on any of the subsequent survey visits. B5 is therefore considered to be a transitional/summer roost for a small number of bats.

3.3.2. No bats were recorded emerging from, or returning to roost within buildings B2 or B7, or tree T44, and therefore the likely absence of bat roosts from these buildings and tree is concluded. A summary of results is provided in Figure 5.

3.3.3. Common pipistrelle bats were observed incidentally emerging from the residential building adjacent to B7 during the Visit 2 dusk survey of this building. This residential property is located within the Survey Area but was not subject to a PBRA survey or further dusk and dawn survey due to a lack of access.

3.3.4. Calls from common pipistrelle, soprano pipistrelle, Nathusius' pipistrelle, noctule, serotine, *Myotis* sp. and unidentified *Pipistrellus* sp. were incidentally recorded within the vicinity of the surveyors during the dusk and dawn surveys of buildings and T44. A summary of incidental bat data across all surveys is provided below in Table 3-4, with full survey results provided in Appendix A.

Table 3-4 – Summary of incidental bat activity recorded during the dusk/dawn surveys

Building/ Tree ref.	Visit no.	Average no. bat calls detected	Sunset/ sunrise time	Time of first bat detected	Time of last bat detected	Notes
B2	Visit 1 Dusk	11	21:16	21:36	22:41	No bats observed emerging from any PRFs on building. Low level of incidental activity recorded throughout survey, but first bat detected within 20 minutes of sunset, which suggests that bats may be roosting near to the Survey Area.
B5	Visit 1 Dusk	3	21:18	22:24	22:46	Single soprano pipistrelle and single serotine bat observed emerging from B5 on Visit 1 dusk survey at 22:24. No other emergences or re-entry observed on any other survey visits, and generally low level of incidental activity recorded.
	Visit 1 Dawn	1	04:56	03:37	03:54	
	Visit 2 Dusk	1	20:30	21:09	21:56	
	Visit 2 Dawn	N/A	05:46	N/A	N/A	
	Visit 3 Dusk	5	19:15	19:48	20:25	
	Visit 3 Dawn	4	06:40	05:20	06:23	

Building/ Tree ref.	Visit no.	Average no. bat calls detected	Sunset/ sunrise time	Time of first bat detected	Time of last bat detected	Notes
B7	Visit 1 Dusk	27	21:07	21:25	22:36	No bats observed emerging from or returning to roost at B7, although bats were observed emerging from adjacent residential property (outside of Survey Area) on Visit 2 dusk survey. Incidental bat call activity was comparatively higher during dusk surveys due to foraging bats in the vicinity of the surveyor at Location 4.
	Visit 1 Dawn	2	05:10	03:52	04:40	
	Visit 2 Dusk	18	21:07	21:21	21:39	
	Visit 2 Dawn	3	06:00	05:20	05:33	
T44	Visit 1	61	20:30	20:35	22:00	No bats observed emerging from or returning to roost at T44. Moderate levels of incidental bat activity detected during dusk survey, including bats recorded within five minutes of sunset. This suggests that roosting bats may be in the vicinity of T44 but outside the Survey Area.
	Visit 2	9	06:40	05:15	06:07	

3.4. BAT ACTIVITY SURVEY

AUTOMATED DETECTOR SURVEY

3.4.1. A total of eight conclusive bat species were recorded within the Survey Area during the automated detector survey component of the activity survey. These species were as follows:

- Barbastelle *Barbastella barbastellus*;
- Greater horseshoe *Rhinolophus ferrumequinum*;
- Noctule;
- Leisler's bat;
- Serotine;
- Common pipistrelle;
- Soprano pipistrelle; and
- Nathusius' pipistrelle.

3.4.2. The following genera (not identifiable to species level) were also recorded:

- *Myotis* spp.; and
- *Plecotus* spp.

3.4.3. The bat data recorded during the automated detector monitoring periods each month are summarised in Table 3-5 overleaf.

Table 3-5 – Summary of bat species recorded during automated detector surveys

Month/ Location	Barbastelle	*Plecotus* sp	*Myotis* spp	Greater horsehoe	Noctule	Leisler's	Serotine	Nathusius Pipistrelle
April								
Location 1	-	1	1	-	1	6	15	3
Location 2	-	11	3	-	-	2	4	10
Location 3	3	14	22	-	5	9	24	12
Location 4	3	5	11	-	6	11	22	8
Total	**6**	**31**	**37**	**-**	**12**	**28**	**65**	**33**
May								
Location 1	-	-	4	-	6	-	12	-
Location 2	11	2	13	-	14	2	24	-
Location 3	-	7	20	-	2	7	20	-
Location 4	-	-	-	-	-	-	-	-
Total	**11**	**9**	**37**	**-**	**22**	**9**	**56**	**-**

Month/ Location	Barbastelle	*Plecotus* sp	*Myotis* spp	Greater horsehoe	Noctule	Leisler's	Serotine	Nathusius Pipistrelle
June								
Location 1	-	-	8	-	3	-	1	1
Location 2	15	1	15	-	32	1	-	-
Location 3	1	9	9	-	8	1	3	-
Location 4	-	15	2	-	2	2	7	-
Total	**16**	**25**	**34**	**-**	**45**	**4**	**11**	**1**
July								
Location 1	-	-	5	1	36	8	207	-
Location 2	1	3	5	-	6	2	15	-
Location 3	-	3	71	-	-	2	4	-
Location 4	4	1	2	-	13	1	10	2
Total	**5**	**7**	**83**	**1**	**55**	**13**	**236**	**2**

Month/ Location	Barbastelle	*Plecotus* sp	*Myotis* spp	Greater horsehoe	Noctule	Leisler's	Serotine	Nathusius Pipistrelle
August								
Location 1	-	-	5	-	3	-	2	-
Location 2	13	45	23	-	-	1	12	1
Location 3	-	7	179	-	1	7	6	-
Location 4	1	4	2	-	1	3	2	1
Total	**14**	**56**	**209**	**-**	**5**	**11**	**22**	**2**
September								
Location 1	-	2	24	-	1	1	1	1
Location 2	1	17	13	-	2	1	1	-
Location 3	1	4	730	-	-	1	1	-
Location 4	2	14	27	-	3	-	10	4
Total	**4**	**37**	**794**	**-**	**6**	**3**	**13**	**5**

Month/ Location	Barbastelle	*Plecotus* sp	*Myotis* spp	Greater horsehoe	Noctule	Leisler's	Serotine	Nathusius Pipistrelle
				October				
Location 1	1	-	16	-	2	-	4	1
Location 2	-	-	-	-	-	-	-	-
Location 3	-	30	247	-	1	8	4	-
Location 4	-	1	-	-	-	-	2	1
Total	**1**	**31**	**263**	**-**	**3**	**8**	**10**	**2**
Grand Total	**57**	**197**	**1467**	**1**	**148**	**79**	**419**	**45**
Percentage % (of total)	**0.52**	**1.79**	**13.33**	**0.01**	**1.35**	**0.72**	**3.81**	**0.4**

3.4.4. The most frequently recorded genera throughout the survey effort was *Pipistrellus* spp., accounting for 78.5% of all calls recorded. Common pipistrelle calls were the most abundant, comprising 82.9% of all *Pipistrellus* spp. calls, and accounting for 65.0% of the total calls recorded across all species. Both remaining *Pipistrellus* spp., soprano pipistrelle and Nathusius' pipistrelle, were also recorded but only comprise 12.9% and 0.41% respectively of the total calls recorded.

3.4.5. *Myotis* spp. were the next most commonly recorded genera across the Survey Area, accounting for 13.3% of calls, followed by serotine at 3.8%. The remaining calls detected are lower but include notable species, with 57 barbastelle passes and a single pass by a greater horseshoe bat at Location 1 in July.

3.4.6. The fewest overall passes recorded were detected in April, May and October, although missing detectors in May and October will have affected the totals for these months. The number of passes were broadly similar across the remaining months. September was the most active, averaging 117.9 passes per night, while the fewest passes overall (excluding May and October) were detected in April with an average of 50.1 passes per night.

3.4.7. Location 3 was the most active location, accounting for 44.4% of all calls throughout the survey period. The lowest activity was recorded at Location 2 (13.9%) and Location 4 (18.7%), although activity at these locations would have been affected by detector failure and theft in May and October.

3.4.8. Ecobat analysis enables a more sophisticated assessment of the results by fitting them into percentiles (low-high) based on species abundance in the region (100km radius). Table 3-6 shows the average Ecobat activity levels for each species, based on the average percentile score recorded within each month across the survey period.

Table 3-6 – Ecobat activity level (averaged across all locations) per month

Species or genera	Average Ecobat Activity Level (based on average percentile score)[5]						
	Apr	May	Jun	Jul	Aug	Sept	Oct
Barbastelle	Low	Low/Mod	Mod	Low	Mod	Low	Low
Serotine	Mod	Mod	Low	High	Low/Mod	Low/Mod	Low/Mod
Myotis spp.	Low/Mod	Low/Mod	Low/Mod	Mod/High	Mod/High	High	High
Leisler's bat	Low	Low/Mod	Low	Low/Mod	Low/Mod	Low	Low/Mod
Noctule	Low/Mod	Mod	Mod	Mod	Low/Mod	Low	Low
Nathusius' pipistrelle	Low/Mod	N/A	Low	Low/Mod	Low	Low	Low
Common pipistrelle	Mod/High	Mod/High	High	High	High	High	High

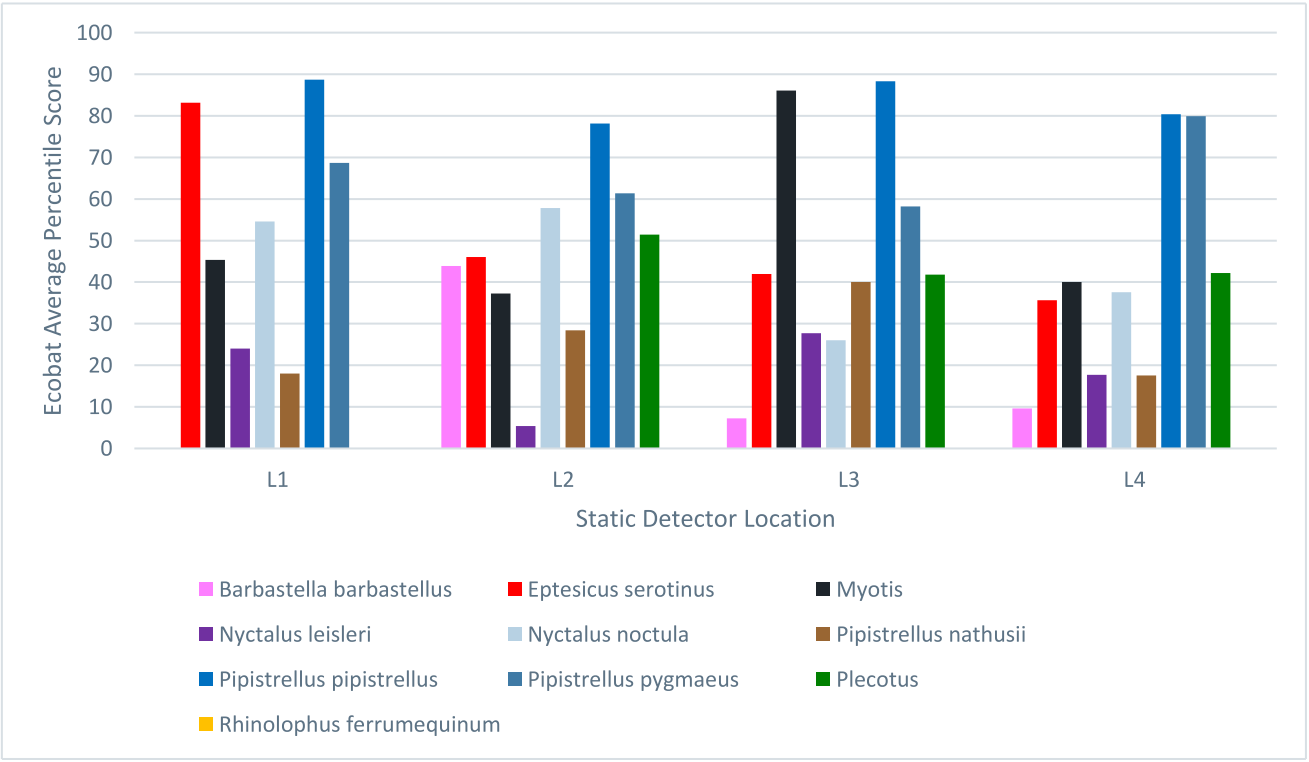
[5] Activity scores are not calculated for months where no activity was recorded for a species, as indicated by N/A.

Species or genera	Average Ecobat Activity Level (based on average percentile score)[5]						
	Apr	May	Jun	Jul	Aug	Sept	Oct
Soprano pipistrelle	Mod	Mod	High	Mod/High	Mod	Mod/High	Mod/High
Plecotus spp.	Low/Mod	Low	Mod/High	Low	Mod	Mod	Mod/High
Greater horseshoe bat	N/A	N/A	N/A	Low	N/A	N/A	N/A

3.4.9. High activity levels were recorded for serotine (July), *Myotis* spp. (September and October), soprano pipistrelle (June) and common pipistrelle (June to October inclusive). Also of note are the moderate activity levels recorded for barbastelle in June and August, for noctule bat between May and July, and for *Plecotus* spp. in August and September. All remaining species or genera recorded a maximum of low or low/moderate activity throughout the survey effort.

3.4.10. A breakdown of the activity levels by location is provided below in Chart 3-1, showing whether particular locations were of value for particular species or groups.

Chart 3-1 - Ecobat activity levels for species by location (average percentile score)



3.5. EVALUATION OF THE SITE FOR BATS

3.5.1. The results of the activity surveys suggest that the value of the Survey Area for bats is relatively non-uniform, with 44% of all calls recorded at Location 3 (with particular importance at this location

for *Myotis* spp. However, all locations recorded high or moderate/high Ecobat activity levels for at least one species or group, with Location 2 found to be of particular importance for barbastelle. All detectors were located in vegetated areas with connectivity to other vegetated corridors, away from anthropogenic influences, which provide suitable commuting opportunities for bats within the area. The species assemblage recorded is dominated by common pipistrelle, followed by *Myotis* spp. and soprano pipistrelle.

PIPISTRELLUS SPP.

3.5.2. The most abundant single species recorded throughout the activity surveys was common pipistrelle, accounting for 65% of all registrations, with soprano pipistrelle as the next most abundant *Pipistrellus* sp., with 12% of remaining calls. Nathusius' pipistrelle was recorded only rarely, with a total of 45 calls throughout the survey period. Ecobat analysis identified *Pipistrellus* spp. activity to vary between low and high. The highest average percentile score for common pipistrelle was recorded at Locations 3, relating to a high activity level, and high activity levels were recorded for this species in all months excluding April and May. Soprano pipistrelle only recorded a high activity level in Location 4, with June being the only month where a high activity score for this species was recorded. Activity levels for Nathusius' pipistrelle were consistently low or low/moderate across all survey months where the species was detected, although the species was recorded at all Locations. In addition, a single soprano pipistrelle was observed emerging from building B5 (located nearest to Location 4) in July 2019, confirming this building as a transitional/summer roost for this species.

3.5.3. Common and soprano pipistrelles are both common and widespread at a national level and local level, while Nathusius' pipistrelle is thought to be scarce but widespread in Sussex (Sussex Bat Group, 2019). Maternity and summer roosts are typically found in buildings, although small crevices in trees can also be used (Collins (ed.), 2016). The common pipistrelle is a generalist forager with a preference for deciduous woodland, whereas soprano and Nathusius' pipistrelle tend to be found near riparian habitats (Collins (ed.), 2016).

3.5.4. Overall, the Survey Area is considered to be of up to Local importance for P*ipistrellus* species based on the high levels of activity recorded for common pipistrelle throughout the survey effort and for soprano pipistrelle on occasion. The soprano pipistrelle roost identified is also a contributing factor to the local importance of the Survey Area, although transitional roosts of common species are typically considered to be of lower conservation value.

MYOTIS SPP.

3.5.5. *Myotis* spp. were recorded in all locations and in all months of the survey effort, accounting for 13% of all calls recorded, and was the next most abundant group after *Pipistrellus* spp. Ecobat activity levels for *Myotis* spp. increased progressively throughout the year, culminating in high activity levels recorded within September and October. Location 3 appears to be the most valuable to *Myotis* spp., with high activity levels recorded here compared to low/moderate and moderate levels at the remaining locations. The spike in calls recorded at Location 3 in September (730 calls, accounting for 51% of all *Myotis* spp. calls recorded) may be indicative of a swarming site near this location. Swarming sites are those used by a large number of males and females during late summer/autumn as part of the mating process (Collins (ed.), 2016).

3.5.6. The status of *Myotis* spp. in the UK varies depending on the species, with some such as Natterer's and Daubenton's bats *Myotis daubentonii* being comparatively common, whilst others such as Bechstein's *Myotis bechsteinii* are thought to be very rare (although little is known regarding their

populations and distribution, they are considered to be very rare within Sussex (Sussex Bat Group, 2019)). Due to the overlapping call parameters of bats in the *Myotis* genus, it is difficult to identify calls to species level based on call analysis alone.

3.5.7. *Myotis* spp. bats utilise a range of foraging habitats. Riparian habitats are important for Daubenton's, whiskered *Myotis mystacinus* and Brandt's *Myotis brandti* bats, and Bechstein's bat is typically associated with ancient woodlands (Collins (ed.), 2016), although these habitat features are not present within the Survey Area. Wooded areas particularly in the vicinity of Locations 3 and 4 are likely to provide suitable foraging opportunities for more generalist *Myotis* spp., and the Survey Area offers suitable commuting corridors to more suitable woodland foraging habitat to the north.

3.5.8. Based on the high activity levels recorded for *Myotis* spp. within the Survey Area, the possibility of a swarming site situated close to Location 3, and the uncertainty in the *Myotis* species recorded during the surveys, the Survey Area is considered to be of District value to *Myotis* spp.

SEROTINE

3.5.9. Following *Myotis* spp., Serotine was the next most abundant species, accounting for 3% of all calls recorded during the static detector survey. The majority of these serotine calls were registered at Location 1 in July, corresponding with a high level of activity (based on Ecobat Analysis). Moderate activity levels were also recorded for Serotine in April and May, despite the detector theft in May. Serotine was recorded in all months and at all Locations.

3.5.10. Serotines are uncommon but widespread within Sussex (Sussex Bat Group, 2019). This species is typically crevice dwelling with a preference for buildings, but can be found to roost in trees (Collins (ed.), 2016), and typically forage over a range of habitats including in and along woodlands, tall hedgerows, parkland and pasture (Russ, 2013). A single serotine was observed emerging from building B5 within the Survey Area during the dusk emergence and dawn re-entry surveys, confirming this building as a transitional/summer roost for serotine. The Core Sustenance Zone (CSZ), the area around a bat roost within which habitat quality and availability will have the greatest impact on a species, for serotine bat is 4km (Collins (ed.), 2016). Therefore the Site is also likely to be a important commuting and foraging resource for this serotine roost.

3.5.11. Given the presence of a transitional roost within the Survey Area and the high activity levels recorded during the activity surveys, the Survey Area is considered to be of Local value to Serotine.

***NYCTALUS* SPP.**

3.5.12. Noctule calls accounted for 1.35% of data during the automated detector survey, and was recorded in all locations and in all months throughout the survey period. Leisler's bat calls comprised 0.72% of all bat calls and was detected at all locations and in every month. Noctule activity across all locations reached a maximum of moderate between May and July, and at Locations 1 and 2, whereas Leisler's activity was either low or low/moderate within all months and at all locations.

3.5.13. Noctule and Leisler's bats exhibit similar habitat preferences and are found in a range of habitat types including deciduous woodland, parkland and pasture, and will also forage over waterbodies (Russ, 2012).

3.5.14. Noctule bats are considered to be relatively common and widespread nationally, but uncommon in Sussex (Sussex Bat Group, 2019). The species primarily roosts within tree cavities and are known to emerge from their roosts up to 26 minutes after sunset, returning at or very close to sunrise (Russ, 1999). The timing of the first recorded noctules on the static detectors were within 15 minutes

of sunset in May, June, July and September at Locations 1, 2, and 4. This indicates that noctule roosts may be present outside, but within the vicinity of the Survey Area.

3.5.15. Leisler's bats are considered to be uncommon and widespread nationally, and are rarely recorded in Sussex (Sussex Bat Group, 2019). Leisler's typically roost in buildings (although they can roost in trees), emerging from their roosts up to 20 minutes after sunset (Russ, 1999). The earliest call for Leisler's was detected 27 minutes after sunset at Location 3 in October, followed by 40 minutes at Location 2 in July and 50 minutes at Location 1 in April. No Leisler's roosts were recorded within the buildings surveyed in the Survey Area, although it is possible that a roost may be present in the vicinity of the Survey Area based on the timing of the first call recorded at Location 3 in October.

3.5.16. *Nyctalus* species were recorded at all locations in all months, suggesting that this species group uses features within the Survey Area as commuting corridors, and some individuals likely using the Survey Area as a foraging resource as part of a wider range. However, given the relative activity levels of the species and their UK and Sussex population status, it is considered that the Survey Area is of Application Site level importance for *Nyctalus* species.

PLECOTUS SPP.

3.5.17. Calls attributed to *Plecotus* spp. accounted for 1.79% of all calls recorded, with the highest number of calls detected in October which corresponds to a moderate/high activity based on Ecobat analysis. Moderate/high activity levels were also recorded in June, with moderate activity during August and September. Activity levels for *Plecotus* spp. were largely consistent across Locations 2, 3 and 4 during the survey effort, but was notably lower at Location 1 with only three calls in total recorded here. However, it is likely that bat activity for this species group has been under-recorded as described in Section 2.9.5.

3.5.18. Grey long-eared bat is considered to be rare in Sussex and mainly restricted to coastal areas (Sussex Bat Group, 2019). The CSZ for grey-long eared bat is 3km (Collins (ed.), 2016). As the Survey Area is located over 5km from the nearest coastline, *Plecotus* spp. recorded during the survey effort would be likely attributable to brown long-eared bats instead of grey long-eared bats.

3.5.19. Brown long-eared bats utilise a variety of habitats, including woodland and parkland, and tend to forage close to trees and foliage where they pick off prey from the surface of vegetation in a process known as 'gleaning' (Dietz *et al*., 2009). Suitable foraging habitat is present for brown long-eared bat within the wooded areas surrounding Locations 3 and 4, treelines in proximity to Location 2 and hedgerows near to Location 1. As such, this species may commute through the Survey Area and utilise these foraging resources.

3.5.20. Based on the moderate and moderate/high activity levels recorded, and to account for the potential of *Plecotus* spp. to go under-recorded, the Survey Area is assessed as of Local value for this species group.

BARBASTELLE

3.5.21. A total of 57 barbastelle calls were recorded between April and October during the automated detector surveys, with the most calls in June (16) and the fewest in October (1). Moderate levels of activity (based on Ecobat analysis) were recorded for barbastelle in June and August. Passes were recorded at all locations but only passes at Location 2 constituted moderate activity when data was averaged across all months. Barbastelle accounted for 0.5% of all bat calls registered throughout the survey.

3.5.22. The barbastelle is considered to be rare in Britain and very rare in Sussex (Sussex Bat Group, 2019), and only sparsely distributed throughout its range in Europe (Altringham, 2003). However, its characteristic short and directional echolocation call (Denzinger *et al*., 2001), and its fast and far-travelling flight (Dietz *et al.*, 2009) are likely to reduce detection levels. This species tends to forage in woodland where its summer roost sites are usually associated with splits, cracks or raised bark in trees (Dietz *et al*., 2009), particularly in undisturbed areas with thick cover (Collins (ed.), 2016).

3.5.23. This species tends to emerge from a roost between 25 and 60 minutes after sunset (Russ, 2012). The barbastelle has a strong aversion to well-lit areas; however, it emerges early to enable it to cover the large distances separating their roosting and foraging areas during the relatively short summer nights. In order to avoid possible predation by birds, barbastelles remain in dark, shaded woodland habitats, woodland rides and close to overgrown hedgerows flying close to the ground (1-2m) high). This strategy allows them to cover large distances before darkness has fully arrived (Greenaway, 2004).

3.5.24. The earliest barbastelle call was recorded at Location 2 in August, one hour and 10 minutes after sunset, with the majority of calls recorded later into the night. This indicates that a roost is not present within the Survey Area, but that the species commutes through and possibly forages within the Survey Area on an occasional basis, particularly along vegetated corridors near Location 2. Given the likely absence of roosts within the Survey Area, but the moderate levels of activity recorded for this species (based on Ecobat analysis) during June and August (and specifically at Location 2), it is considered that the Survey Area is of District level importance for barbastelle.

GREATER HORSESHOE

3.5.25. A single greater horseshoe pass was detected at Location 1 in July, corresponding with a low level of activity for this species based on Ecobat analysis. No other greater horseshoe calls were detected at any other location or in any other month.

3.5.26. At the local level, greater horseshoe bats are considered to be very rare (Sussex Bat Group, 2019), and are nationally rare with their range which is typically restricted to south-west England and south Wales. Preferred foraging habitats for this species include pasture, parkland, woodland and meadows, where it flies along well-defined corridors including woodland rides, hedgerows and treelines (Russ, 2013). Suitable habitat to support the foraging preferences of greater horseshoe bat is present within the Survey Area, but given the single pass recorded it is more likely that this species may use the Survey Area to commute to more suitable foraging or roosting habitat on a very occasional basis. The Survey Area is therefore considered to be of no higher than Application Site importance for greater horseshoe bats.

SUMMARY

3.5.27. The evaluation uses the CIEEM geographic frames of reference as set out in Section 2.8**,** informed by Ecobat analysis results. The relative frequency of each species based on the bat call data generated during the automated detector surveys is considered in the context of their UK status and population estimates (using the categories as set out in Section 2.8.1) and is shown in Table 3-7 overleaf.

Table 3-7 – Bat species geographical status summary (excluding *Myotis* spp.)

Species	UK Status[6]	County Status[7]	Est. UK Pop[8]	Relative Frequency in Survey Area	Likely Value of Survey Area to Populations of Bat Species
Common pipistrelle	Common	Abundant, widespread	3.04 million	Very Frequent	Local
Soprano pipistrelle	Common	Fairly common, widespread	4.67 million	Frequent	Local
Nathusius' pipistrelle	Rare, Widespread	Scarce, widespread	16,000*	Very Infrequent	Application Site
Serotine	Uncommon	Uncommon, widespread	136,000	Frequent	Local
Noctule	Common, widespread	Uncommon, widespread	565,000	Regular	Application Site
Leisler's	Uncommon, widespread	Rarely recorded	10,000*	Very Infrequent	Application Site
Brown long-eared	Common	Relatively abundant, widespread	934,000	Infrequent (Overall *Plecotus* Infrequent)	Local
Grey long-eared	Rare	Rare (south coast areas)	1000	No confirmed activity (Overall *Plectous* Infrequent)	Negligible
Barbastelle	Rare	Very rare, widespread	5,000*	Very Infrequent	District
Greater horseshoe	Rare	Very rare	12,900	Very Infrequent	Application Site

3.5.28. Overall the Survey Area is considered to be of value at no higher than District level for roosting, foraging and commuting bats. A soprano pipistrelle roost and serotine transitional roost (of lower conservation value than maternity or hibernation roosts) was identified in building B5, and a further two trees were confirmed as bat roosts of unknown species due to the presence of droppings. However, one of these trees (T3) is unlikely to still support a bat roost due to the damage sustained to the PRFs.

[6] UK Status is based on the National Bat Monitoring Programme (NBMP) Population Trends 2018 (BCT, 2019)
[7] County Status based on data held by the Sussex Bat Group (Sussex Bat Group, 2018).
[8] Estimated UK Population based on NBMP Population Trends 2018 (BCT, 2019). Estimates marked with an asterisk (*) are those based on Battersby (2005) or Harris *et al.* (2008), due to a lack of data used to inform the NBMP.

3.5.29. Notable species recorded within the assemblage during the activity surveys, including barbastelle and greater horseshoe bat, were recorded only very occasionally despite moderate barbastelle activity recorded in two of the survey months at Location 2. Other uncommon species including Nathusius' pipistrelle and Leisler's bat are likely to have been commuting through the Survey Area on occasion with only low or low/moderate average activity levels recorded. In contrast, common and widespread species (including common and soprano pipistrelle) appear to use the Survey Area regularly for foraging and commuting. Activity levels appear relatively consistent between detector locations, but Location 1 was of particular value to serotine and activity levels spiked for *Myotis* spp. at Location 3 in September, which may correspond to a swarming site nearby.

3.5.30. The value of the Survey Area for *Myotis* spp. is somewhat provisional due to the difficulty of separating these species by call alone. However, an assessment of the value has been made based on the activity levels recorded and habitats present within the Survey Area.

4. IMPLICATIONS FOR DEVELOPMENT

4.1. OVERVIEW

4.1.1. In the absence of mitigation, the Proposed Development has potential to affect bats, thorough direct effects upon confirmed bat roosts within building B5 and tree T20, and/or removal or degradation of habitat used by foraging and commuting bats on Site. In addition, indirect effects of noise and vibration during construction works may also negatively affect roosts present in the vicinity of the works. The legislation and planning policy relevant to bats and their roosts set out below is therefore relevant. Recommendations as to how the legislation and planning policy may be satisfied are set out in Section 5.

4.2. LEGAL COMPLIANCE

4.2.1. Bats and their roosts are afforded a high level of protection under the Conservation of Habitats and Species Regulations 2017 (the 'Habitat Regulations'), the legislation means that it is an offence to:

- *Deliberately capture, injure or kill a wild bat;*
- *Deliberately disturb wild bats; 'disturbance of animals includes in particular any disturbance which is likely:*
- *(a) to impair their ability —*
- *(i) to survive, to breed or reproduce, or to rear or nurture their young; or*
- *(ii) in the case of animals of a hibernating or migratory species, to hibernate or migrate; or*
- *(b) to affect significantly the local distribution or abundance of the species to which they belong.' and*
- *Damage or destroy a breeding site or resting place used by this species.*

4.2.2. Protection is also afforded under the Wildlife and Countryside Act 1981 (as amended) with respect to disturbance of animals when using places of shelter, and obstruction of access to places of shelter.

4.2.3. Due to the high level of protection afforded to bats and their habitat, mitigation for this species is governed by a strict licensing procedure administered by Natural England (normally, planning permission must be obtained before a licence can be sought). Licencing is subject to three tests, as defined under the Habitats Regulations 2017, as amended, these must also be applied by the planning authority before granting permission for activities affecting bats. For permission to be granted the following criteria must be satisfied:

- The proposal is necessary '*to preserve public health or public safety or other imperative reasons of overriding public interest including those of a social or economic nature and beneficial consequences of primary importance for the environment*';
- '*There is no satisfactory alternative*'; and
- The proposals '*will not be detrimental to the maintenance of the population of the species concerned at a favourable conservation status in their natural range*'.

4.2.4. Certain species of bats recorded during the emergence and automated detector surveys, including greater horseshoe bat, barbastelle, noctule, brown long-eared bat and soprano pipistrelle also listed as a Species of Principal Importance (SPI) for the Conservation of Biodiversity in England under Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006. Under Section 40 of the NERC Act (2006) public bodies (including local planning authorities) have a duty to have

regard for the conservation of SPI when carrying out their functions, including determining planning applications.

4.2.5. In addition, barbastelle is listed under Annexe II of the Habitats Directive, which places a requirement on member states to designate Special Areas of Conservation (SACs) for such species, in order to contribute to a European-wide network of protected sites. There are no SACs designated for barbastelle populations within 10km of the Site.

4.3. PLANNING POLICY COMPLIANCE

4.3.1. At the national level the National Planning Policy Framework (2019) forms the basis for planning system decisions with respect to conserving and enhancing the natural environment, including bats; the ODPM circular 06/2005 also provides supplementary guidance, including confirmation that '*the presence of a protected species is a material consideration when a planning authority is considering a development proposal'*.

4.3.2. The NPPF sets out, amongst other points, how at an overview level the *'planning system should contribute to and enhance the national and local environment by:*

- *…recognising the wider benefits from natural capital and ecosystem services; and*
- *minimising impacts on and providing net gains for biodiversity, including by establishing coherent ecological networks that are more resilient to current and future pressures…'*

4.3.3. A list of principles which local planning authorities should follow when determining planning applications is included in the NPPF, and includes the following:

- *'- if significant harm resulting from a development cannot be avoided…adequately mitigated, or, as a last resort, compensated for, then planning permission should be refused;*
- *- …opportunities to incorporate biodiversity in and around developments should be encouraged;*
- *- development resulting in the loss or deterioration of irreplaceable habitats (such as ancient woodland and ancient or veteran trees) should be refused planning permission unless there are wholly exceptional reasons and a suitable compensation strategy exists…'*

4.3.4. At a local level Policy ENV DM5 of the Adopted Arun Local Plan (2018), states that developments will minimise '*adverse impacts on existing habitats (whether designated or not*), and that '*Development schemes will be appropriately designed to facilitate the emergence of new habitats through the creation of links between habitat areas and open spaces'.* In addition, Policy ENV DM5 states that '*All developments shall have regard to Natural England's standing advice for protected species*'.

4.3.5. Without appropriate measures, it is considered that the Proposed Works will contravene national legislation and planning policy regarding bats through the loss of the soprano pipistrelle and serotine roost in building B5, the loss of a bat roost in tree T20. Additionally, vegetation clearance associated with the Proposed Works will result in the loss of foraging habitat and the severance of commuting habitats for bats. Outline avoidance, mitigation and compensation measures are recommended in Section 5 to enable the Proposed Works to be compliant with the above legislation and planning policy.

5. RECOMMENDATIONS

5.1. AVOIDANCE AND MITIGATION MEASURES

BAT ROOSTS

5.1.1. One soprano pipistrelle and serotine roost (comprising a single bat of each species) was identified within building B5. In line with the mitigation hierarchy described in the NPPF 2019, it is recommended that B5 is retained in the first instance, to avoid destruction of this roost.

5.1.2. If B5 can be retained, indirect effects likely to cause a disturbance to roosting bats should also be avoided. Indirect effects are considered to be those caused by the following:

- Construction or vegetation clearance activities which result in a noise or vibration disturbance, operating within an indicative distance of 20m of actual or potential roosting features.
- Temporary or permanent lighting which would illuminate roosting features which are otherwise dark overnight.

5.1.3. Should it not be possible to adhere to the avoidance and retention measures set out above, mitigation and the provision of alternative, compensatory roosting features will be required as set out below.

5.1.4. As set out in Section 4.2.3, the local planning authority must ensure they are satisfied that the three licencing tests are likely to be met. In order to satisfy the third test regarding the favourable conservation status of the species, a mitigation strategy should be prepared. The mitigation strategy should be based on recommendations in this report, showing that it will be feasible to progress the Proposed Development and maintain the favourable conservation status of roosting bats (including soprano pipistrelle and serotine). Once planning permission has been obtained, this strategy may then be refined and form the basis of a licence application to Natural England to permit the commencement of works affecting known bat roosts.

5.1.5. It is recommended that the mitigation strategy includes the following key components in accordance with current best practice guidance (Mitchell-Jones, 2004):

- Provision of alternative roosting opportunities, proportionate to the conservation status of the roosts identified. For the soprano pipistrelle and serotine roost identified in B5, this is likely to constitute installation of a suitable number and type of bat boxes on retained trees or buildings within 100m of the existing roost and a minimum of 20m outside of the Site boundary. Bat boxes should be installed a minimum of 3m above the ground, and on southerly or south-easterly aspects to ensure optimal roosting conditions.
- Methods for removal of existing roost structures, including supervised soft stripping of actual and potential roosting features on B5. Removal of existing roosts should occur in September/October or April/May, so as to avoid sensitive hibernation or maternity periods
- A mechanism for future maintenance and monitoring of replacement roosts.

5.1.6. T20 is considered to support a historic bat roost (due to the presence of old droppings), which has not been in use in the last year due to the lack of fresh evidence and dense vegetation growth around the PRF recorded during the Visit 2 at-height inspection survey. However, as the PRF is still intact there is the potential for T20 to be used by roosting bats again in the future. As such, it is recommended that T20 is subject to an updated at-height inspection during the bat active season

(May to September inclusive) prior to the commencement of works, to identify if the use of the historic roost has changed.

5.1.7. The roost identified in tree T3 during the PBRA survey is no longer considered to be active due to a branch snap which has exposed the PRF. However, given that this tree has previously been recorded as a bat roost, supervised soft felling under ecological supervision is recommended for T3 if it is not possible to retain this tree, as set out in Section 5.1.8.

5.1.8. A number of trees were identified during the PBRA and subsequent at-height inspection surveys in which no bat roost was recorded but which nevertheless have the potential to support a bat roost. This includes all trees except those assigned a negligible roosting potential (T15, T16, T33 and T41). Where it is not possible to retain trees with bat roosting potential, it is recommended that PRFs on trees to be lost are replaced on a minimum of a two for one basis. Additionally, precautionary measures including ecological supervision during felling may be required. T3, which has historically supported a bat roost, should also be felled under ecological supervision, as a precaution.

FORAGING AND COMMUTING HABITAT

5.1.9. The habitat associated with Location 1 (see Figure 6) is considered particularly important for serotine, while moderate activity was recorded for barbastelle at Location 2, and Location 3 supported high activity for *Myotis* spp. Habitat at all locations is considered important for common pipistrelle. Based on the current road alignment shown in Figure 1, habitats at all locations surveyed are likely to be lost and/or severed. As such, mitigation measures will be required. The following mitigation measures, which may be refined following the production of final detailed designs, are recommended:

- The provision of bat underpasses to provide a safe crossing point beneath the traffic flow, sited at the location of severed vegetation lines. Such an underpass would be of particular importance along the vegetated footpath where static detector Location 2 was installed, given the moderate levels of barbastelle activity recorded along this flight line. Bat underpasses should be left unlit, and vegetated where possible to encourage use by commuting bats.
- Where necessary, the creation of bat 'hop-overs' to enable safe bat crossing points across the road. Such hop-overs should feature dense vegetation at a suitable height above the road (on raised verges where appropriate) so as to minimise the mortality risk to bats from passing traffic, and be unlit as a 'dark gap' so as to further encourage the use of the crossing point.
- Alternatively, the provision of an appropriate planting strategy to direct commuting bats away from the new road and towards more suitable habitat. In particular, the planting should encourage bats to take alternative routes around the road, instead of crossing the road directly.
- The provision of alternative foraging habitat set away from the road and accessible along retained flight-lines. Planting within the foraging habitat should include species which are known to attract night-flying insects, including those described in Bat Conservation Trust guidance (BCT, 2012).

5.1.10. Lighting both during the construction phase and operational phase of the Proposed Development could also have a negative effect upon bat activity on Site. The mitigation measures described above should be considered in conjunction with a lighting strategy for the Site which seeks to:

- Use the minimum number and levels of necessary to illuminate the road, this may equate to reducing light intensity, and/or using the minimum number or light sources or minimum column height.

- Use hoods, louvres or other luminaire design features to avoid light spill onto retained and newly created areas of vegetation likely to be used by foraging and commuting bats.
- Use narrow spectrum light sources where possible to lower the range of species affected by lighting, specifically avoiding shorter wave length blue light, using instead warm/neutral colour temperature <2,700 kelvin lighting (ILP, 2018).
- Use light sources that emit minimal ultra-violet light to avoid attracting night-flying invertebrate species which in turn may attract bats to the light.

5.1.11. Where possible, consideration should also be given to varying the lighting levels in particularly ecologically valuable areas. For example, it may be possible to reduce lighting levels or perhaps even switch installations off after certain times e.g. between 00:00 and sunrise in the vicinity of tree lines of proposed landscaping. This use of “adaptive lighting” can tailor the installation to suit human health and safety as well as wildlife needs (BCT, 2014).

6. CONCLUSIONS

6.1.1. Bat surveys completed to inform the Proposed Development have shown that the Survey Area supports a confirmed soprano pipistrelle and serotine roost in building B5, as well as a roost of unidentified species in T20. A roost previously identified in T3 is no longer considered suitable to support a bat roost due to damage sustained to the PRF. In addition, results from the activity surveys indicate that the Survey Area is used by at least eight species of bat including barbastelle and greater horseshoe bat. Total bat activity was highest at Location 3 within the Survey Area, with Location 2 considered to be important for barbastelle. Overall, bat activity across the Site was dominated by common pipistrelle.

6.1.2. Overall the Survey Area has been assigned District level value for roosting, foraging and commuting bats. The Proposed Works will likely result in the loss of suitable foraging and commuting habitat, and may result in the loss of bat roosts in B5 and T20. Provided that the recommendations for avoidance and mitigation are adhered to, the Proposed Development should be compliant with legislation and planning policy regarding bats.

7. REFERENCES

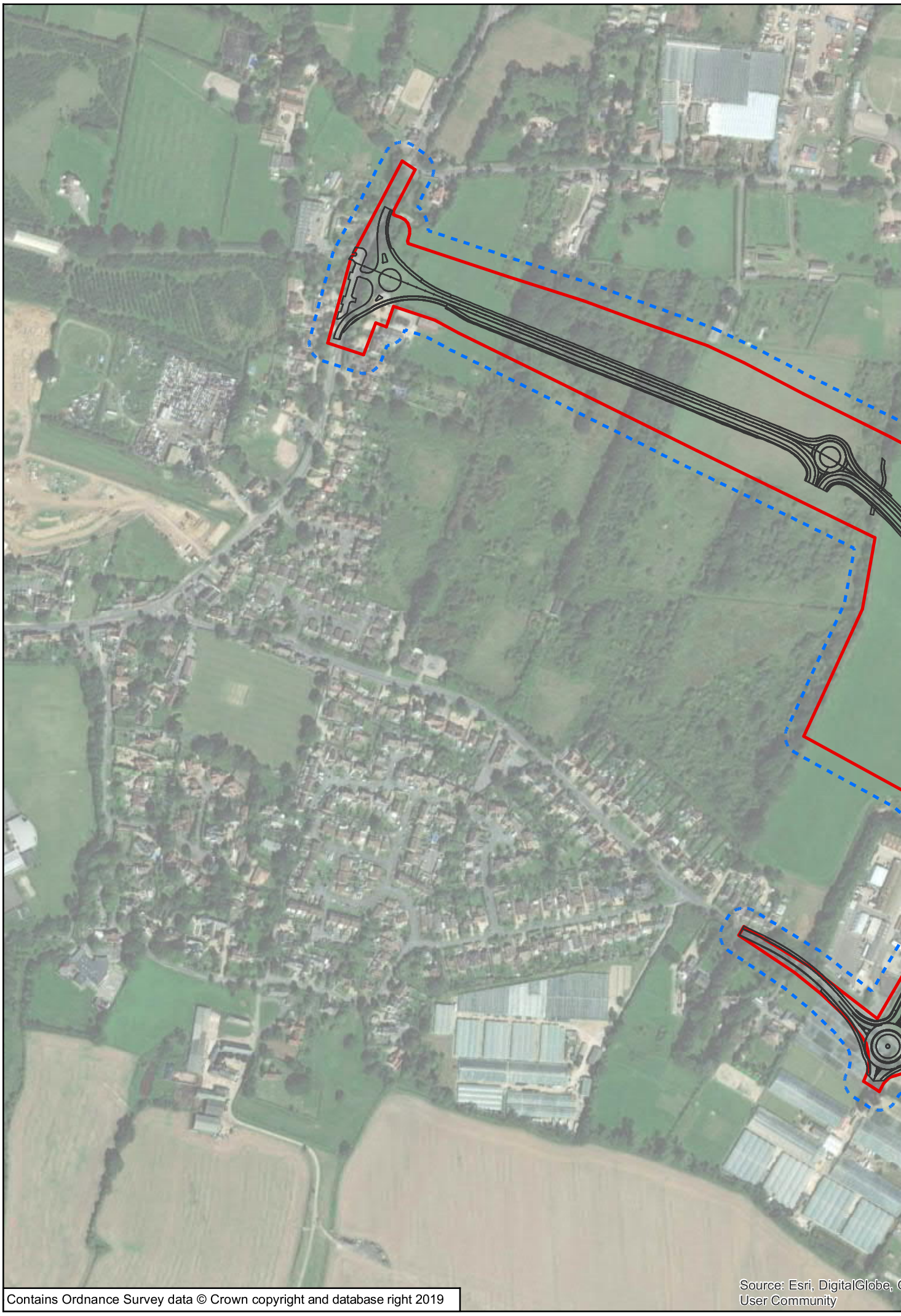
7.1. PROJECT REFERENCES

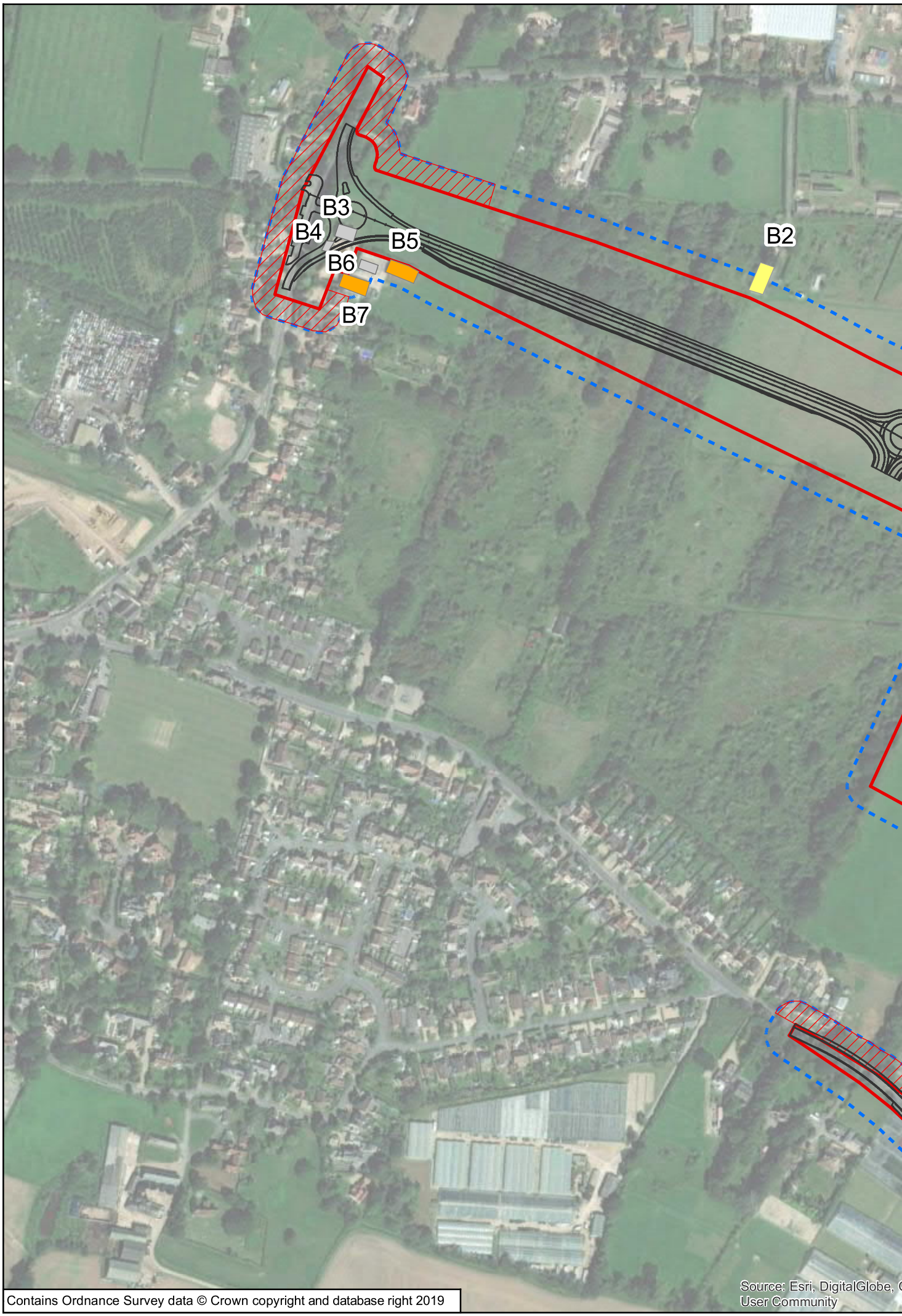
- WSP (2018) A29 Realignment: Preliminary Ecological Appraisal. Report reference: 70031782-ECO1.

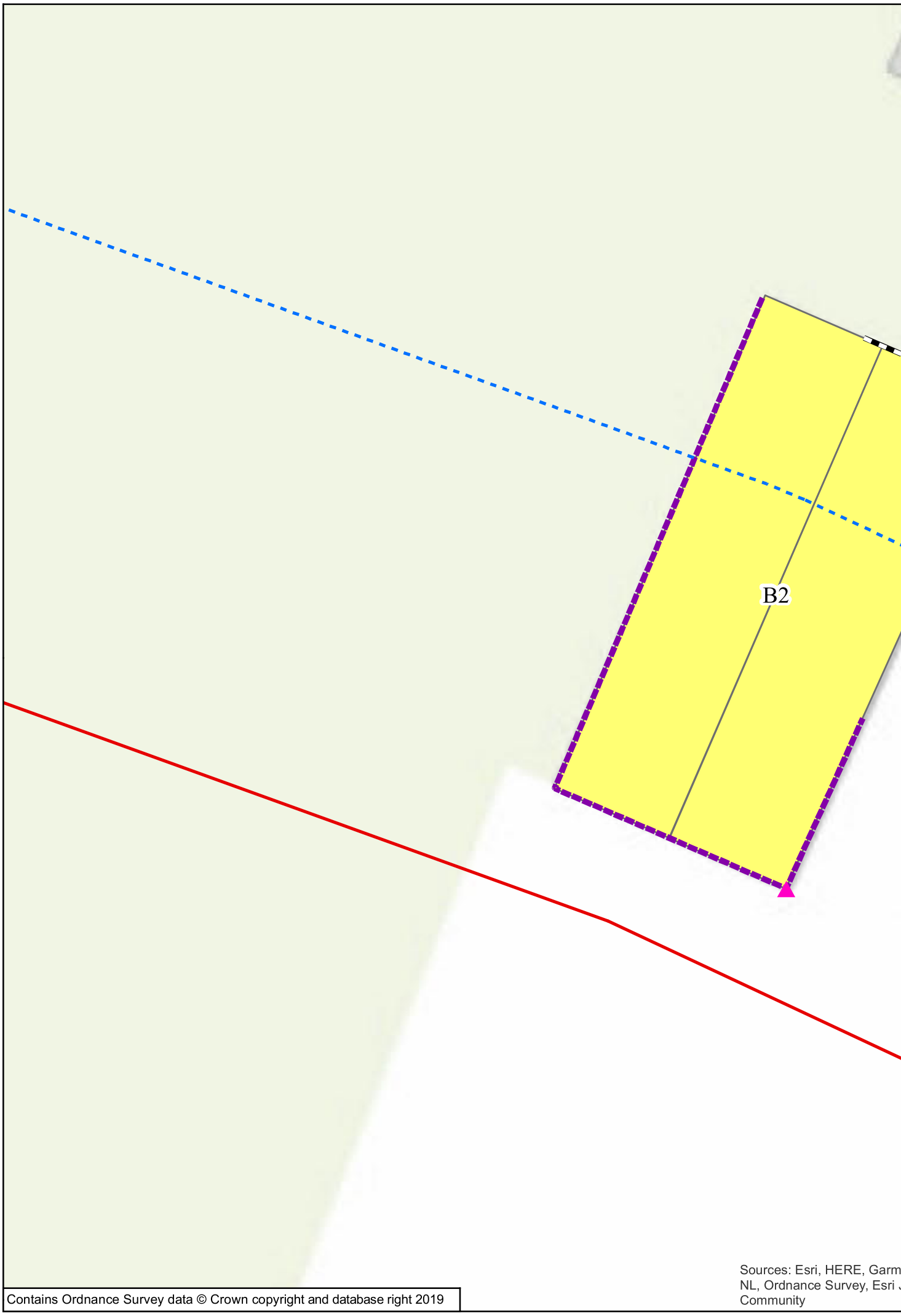
7.2. TECHNICAL REFERENCES

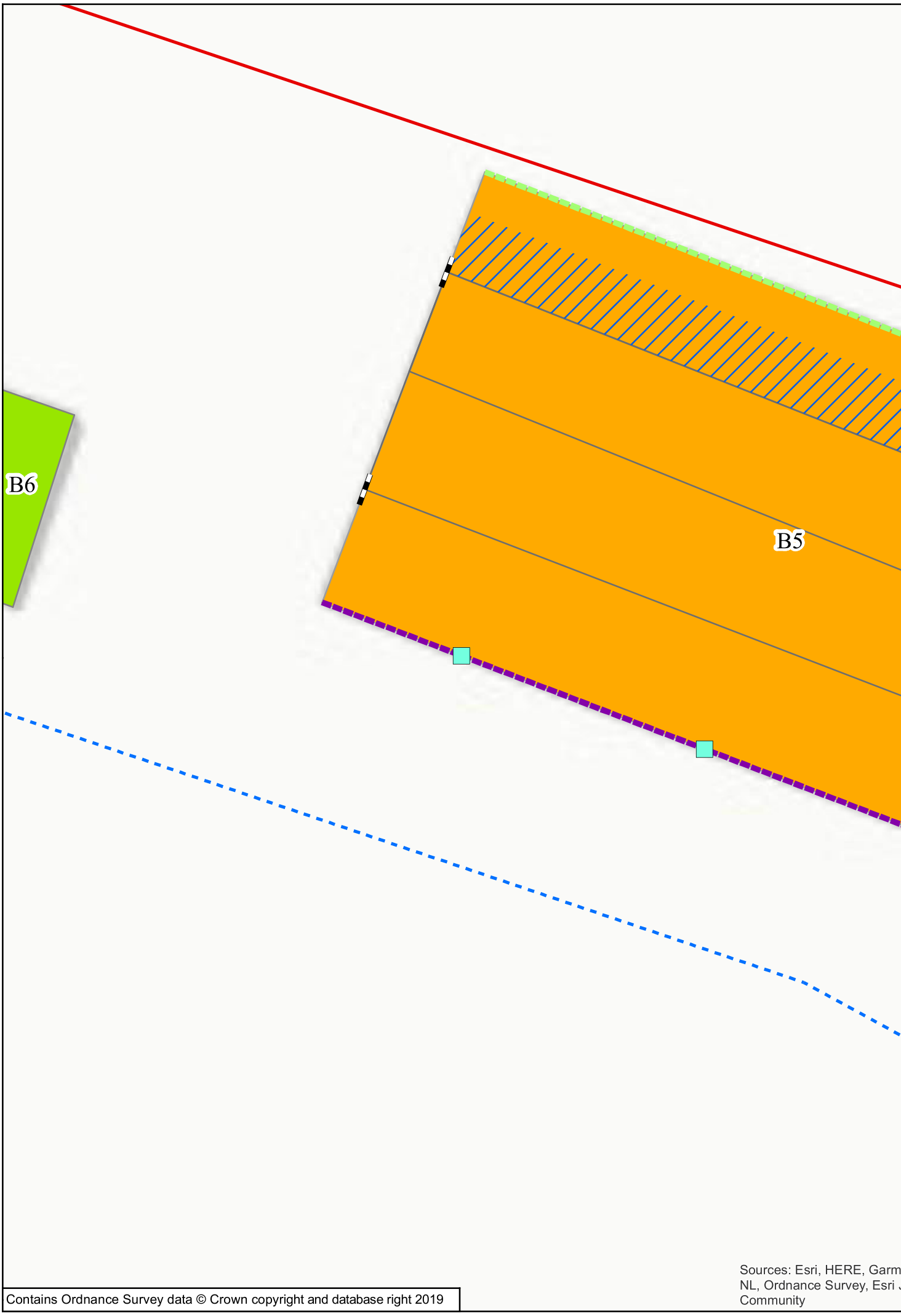
- Arun District Council (2018) Adoption Arun Local Plan 2011-2031.
- Altringham, J. D. (2003) British Bats. Collins.
- Bat Conservation Trust (2012a) Encouraging Bat – A Guide for Bat-friendly Gardening and Living.
- BCT (2014) Artificial Lighting and Wildlife – Interim Guidance: Recommendations to help minimise the impact of artificial lighting
- BCT (2019) The National Bat Monitoring Programme. Annual Report 2018. Bat Conservation Trust, London.
- Battersby, J. (2005) UK Mammals: Species Status and Population Trends. First Report by the Tracking Mammals Partnership. JNCC/Tracking Mammals Partnership, Peterborough.
- Collins, J. (ed.) (2016) Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edition). The Bat Conservation Trust, London.
- Denzinger, A., Schuab, A., Siemers, B. M. & Schnitzler, H. U. (2001) Echolocation by the barbastelle bat, Barbastella barbastellus. Journal of Comparative Physiology 187(7):521-8.
- Dietz, C., von Helverson, O & Nill, D. (2009) Bats of Britain Europe and Northern Africa. A&C Black.
- Harris, S. & Yalden, D. 2008. Mammals of the British Isles: Handbook, 4th edition. The Mammal Society. 328-331
- Her Majesty's Stationary Office (HMSO) (1981). Wildlife and Countryside Act (as amended by the Countryside and Rights of Way Act 2000)
- HMSO (2005) Biodiversity and Geological Conservation – Statutory Obligations and Their Impact Within the Planning System. Office of the Deputy Prime Minister (ODPM) Circular 06/2005 HMSO, Norwich.
- HMSO (2006) Natural Environment and Rural Communities Act.
- HMSO (2010). The Conservation of Habitats and Species Regulations 2017 (the Habitat Regulations)
- Institute of Lighting Professionals (ILP) (2018) Bats and Artificial Lighting in the UK. Guidance Note 08/18. Bat Conservation Trust, London.
- Ministry for Housing, Communities and Local Government (2019), National Planning Policy Framework.
- Mitchell- Jones, A.J (2004) Bat Mitigation Guidelines. English Nature.
- Russ, J (1999) The Bats of Britain and Ireland: Echolocation Calls, Sound Analysis and Species Identification. Alana Ecology Ltd.
- Russ, J (2013) British Bat Calls a Guide to Species Identification. Pelagic Publishing.
- Sussex Bat Group (2019) Bats in Sussex. Available at: http://www.sussexbatgroup.org.uk/batsinsussex
- Swift, S.M. (1998) Long-eared bats. T & A.D. Poyser Ltd, London.

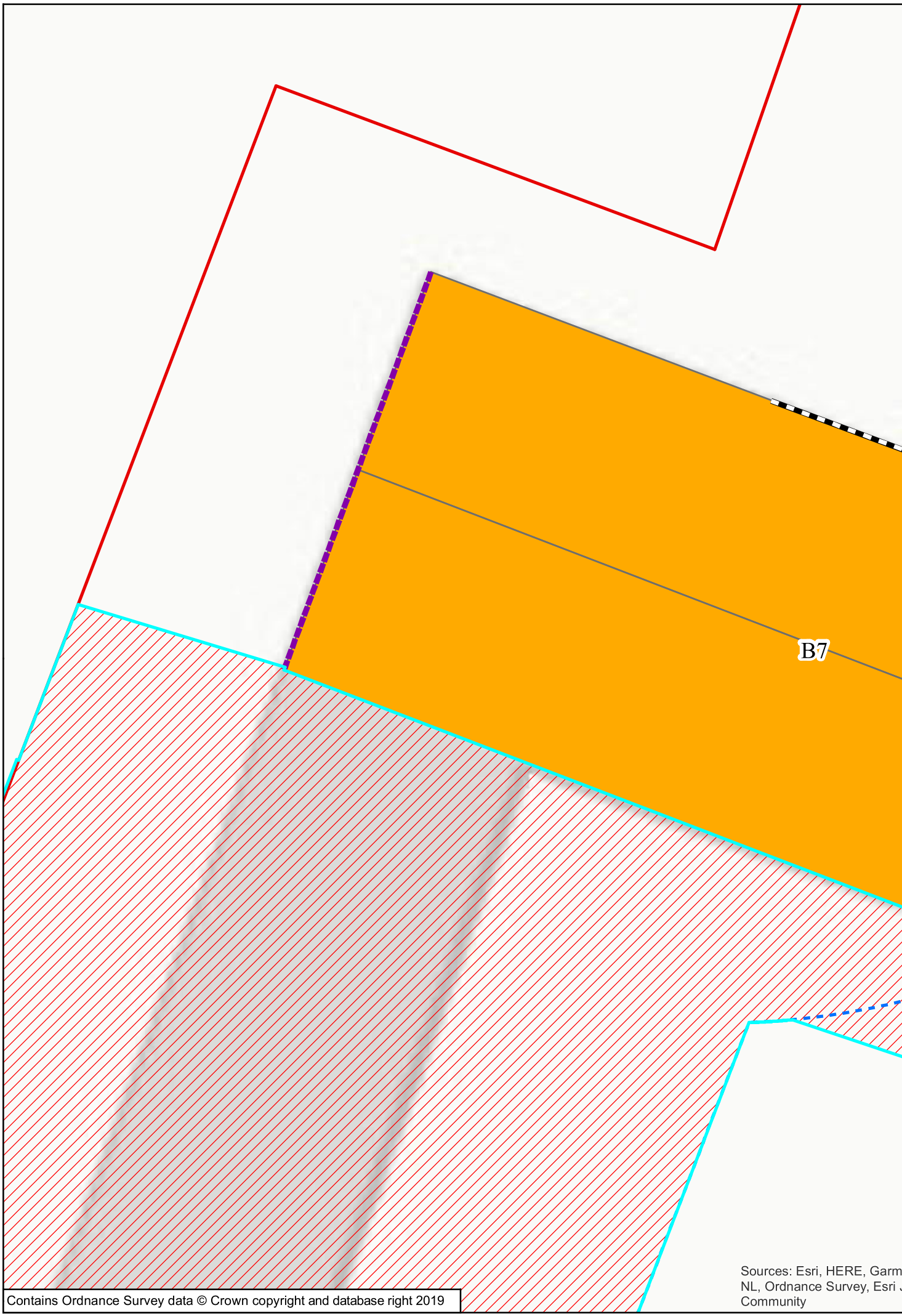
8. FIGURES

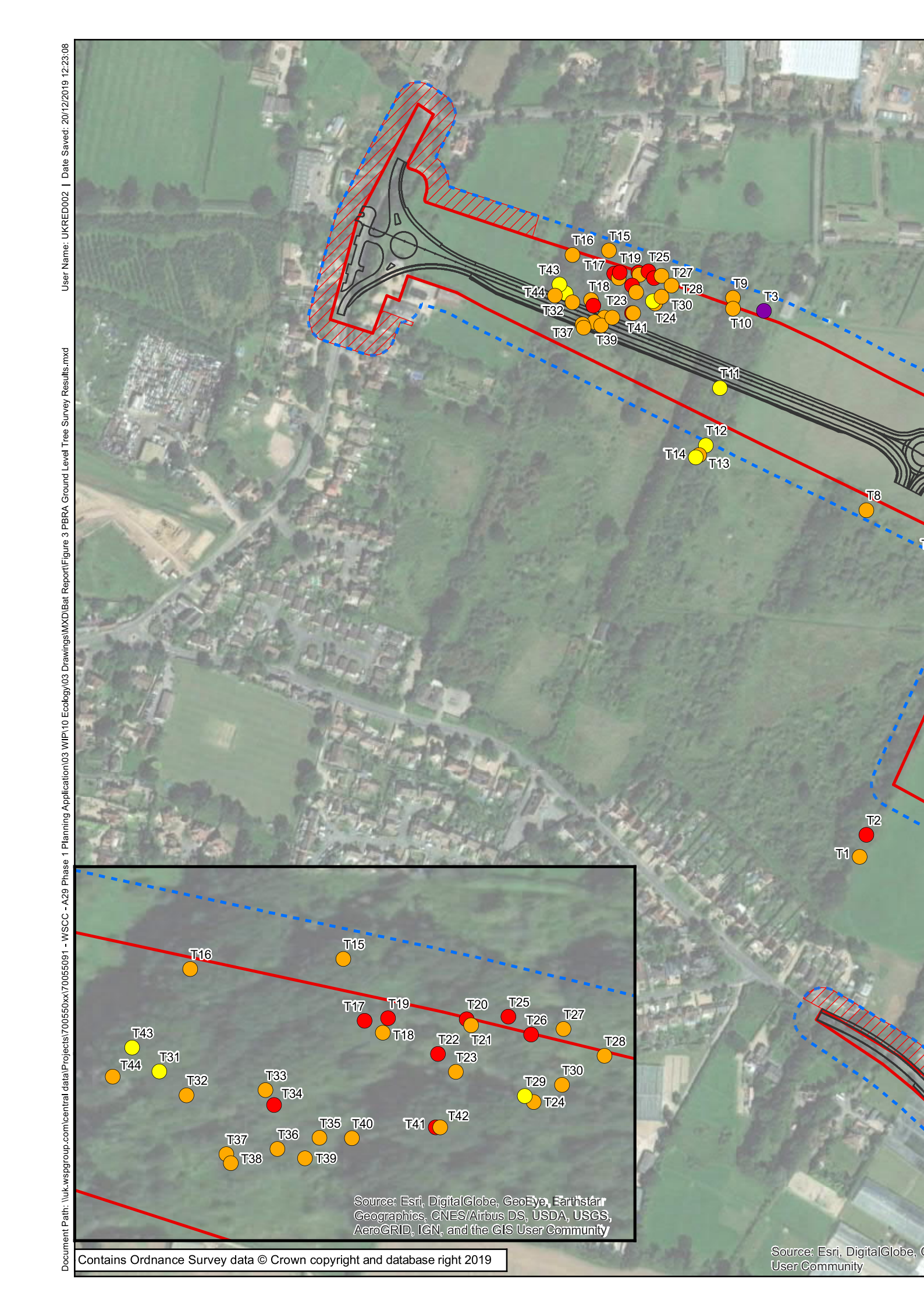


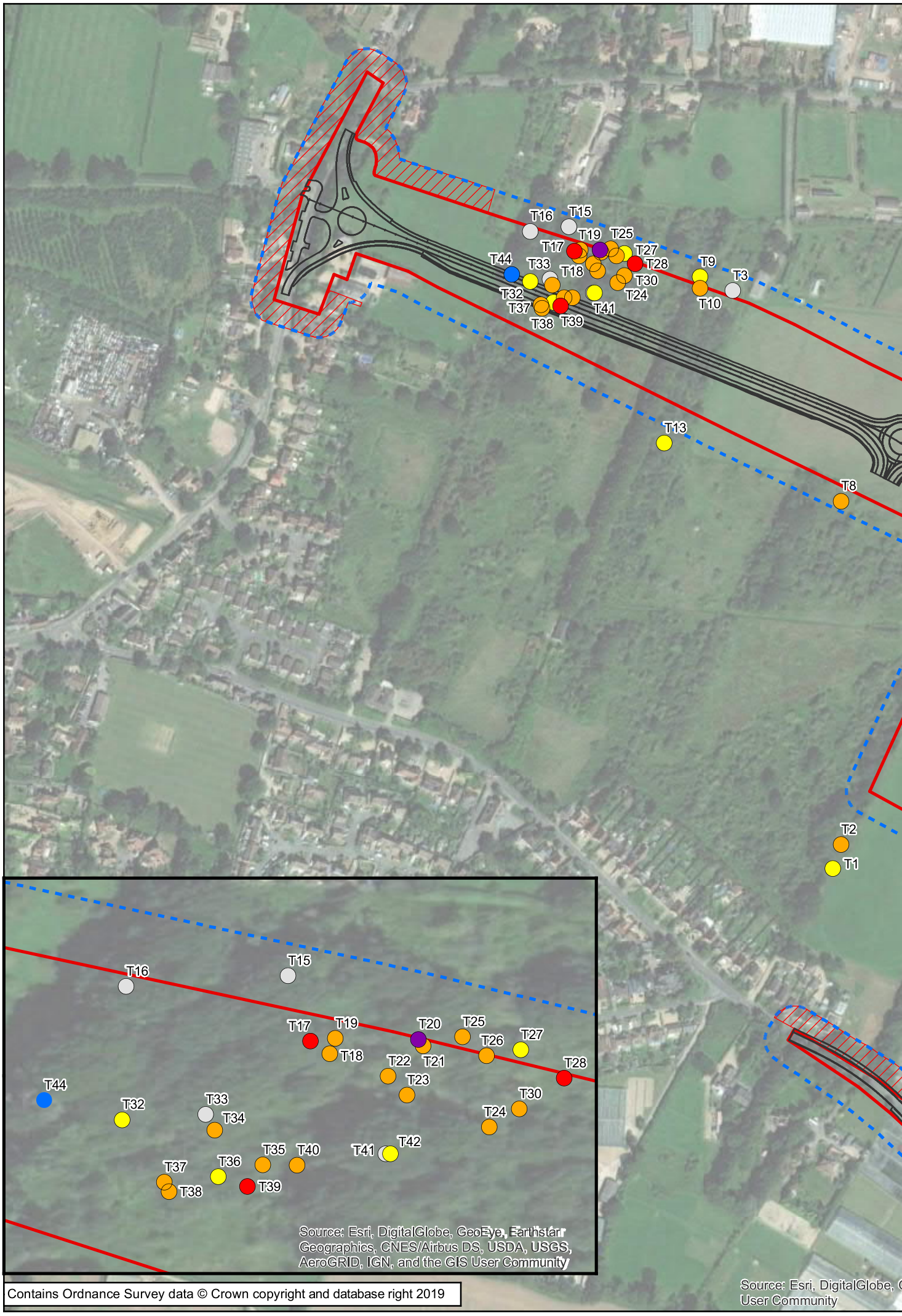


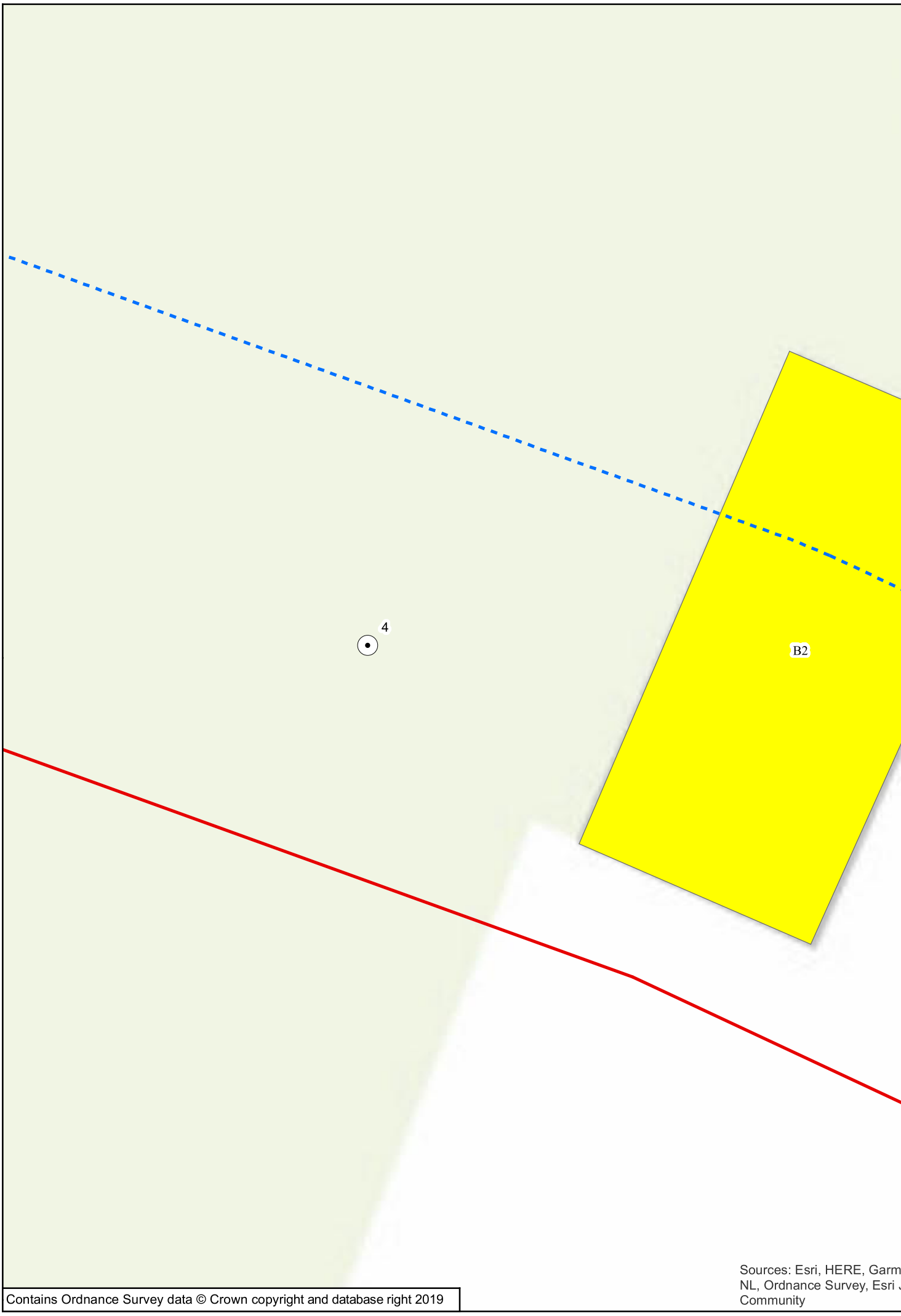


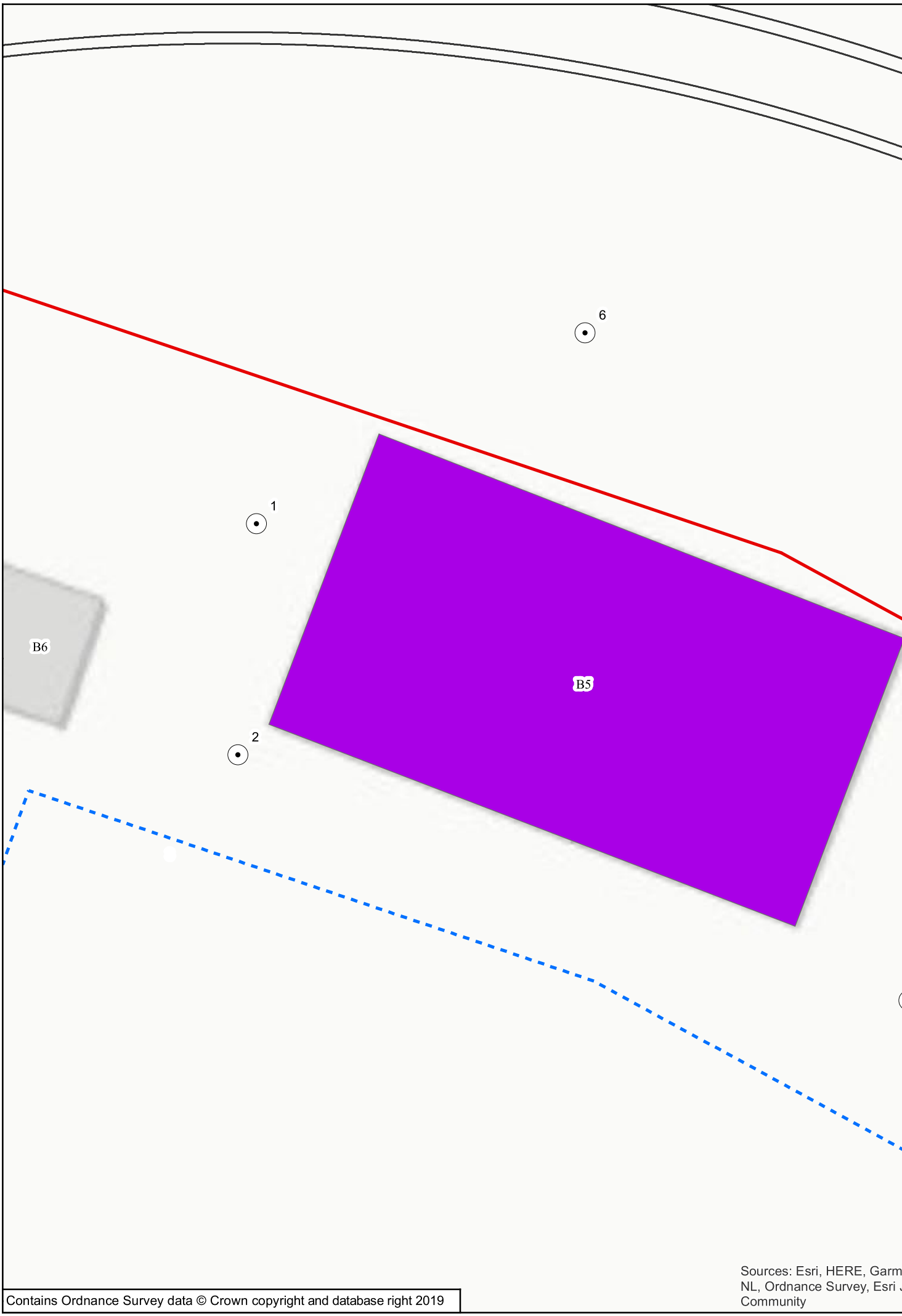


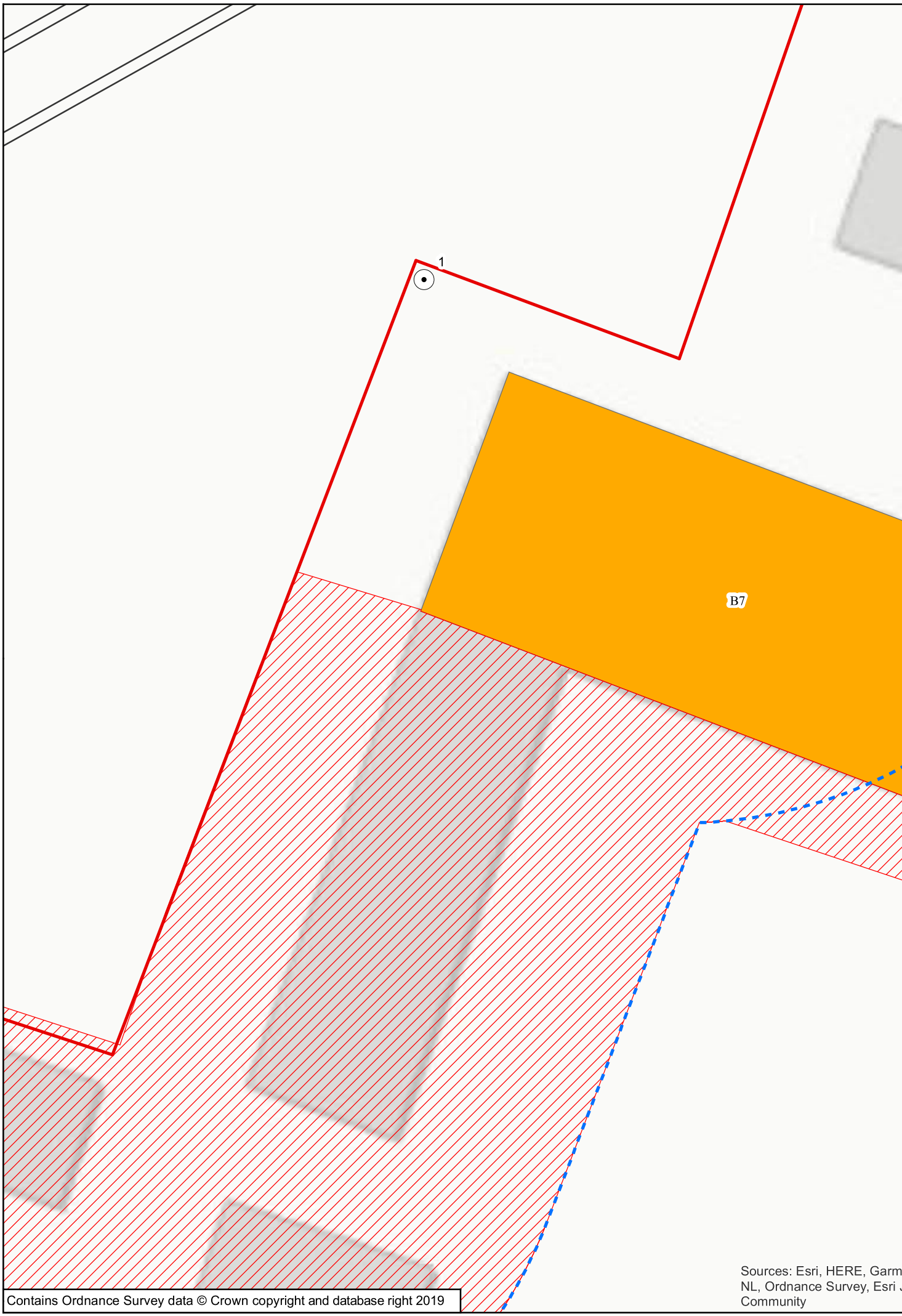


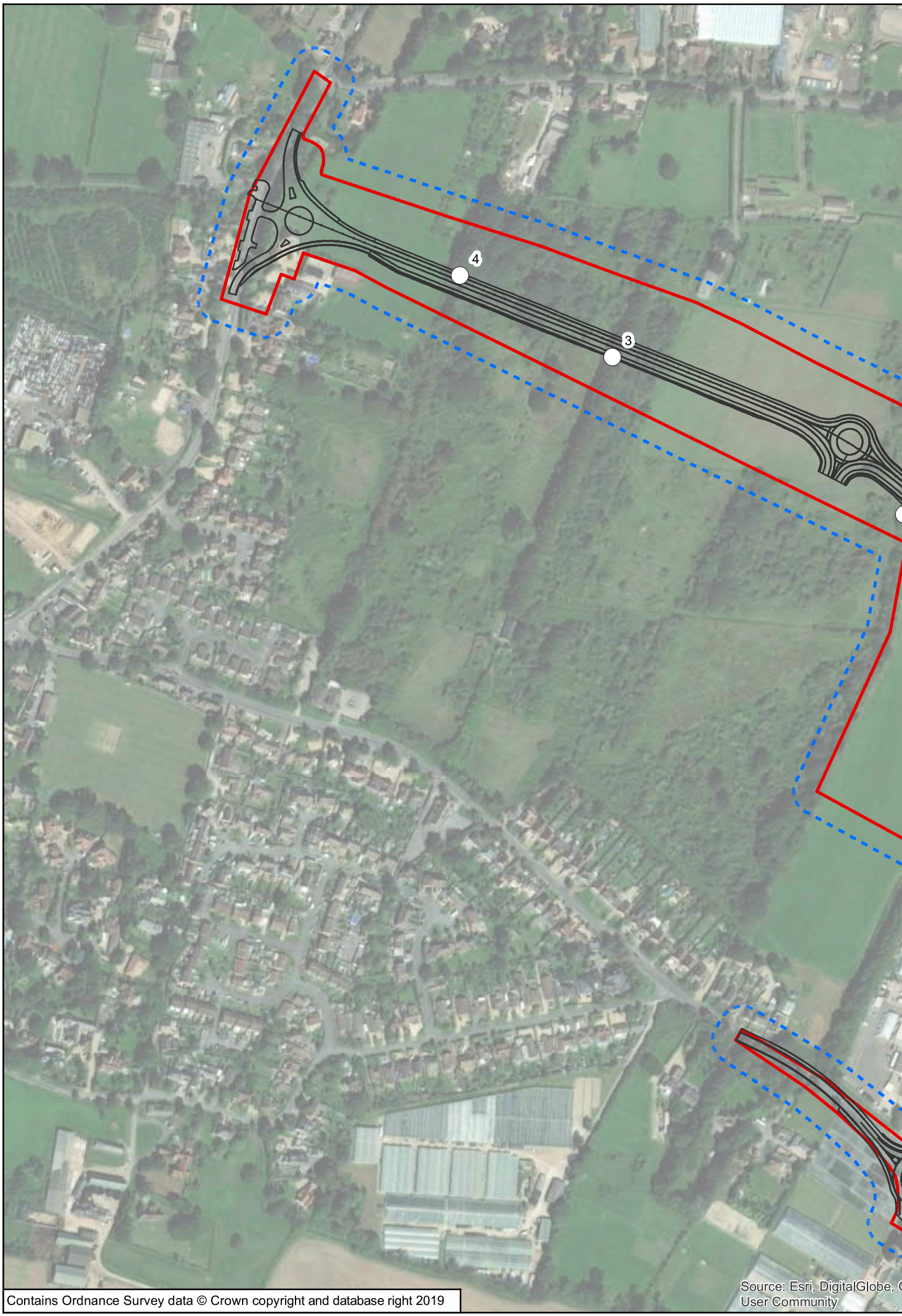












Appendix A

RAW DATA

Table A-1 – Full results from the PBRA, ladder inspections and climbed inspection surveys of tree

Tree	Species	Approx. height	PBRA Description	Roost types [9]	Overall suitability	Ladder survey Visit 1	Roost types[3]	Ove suit
T1	*Quercus robur*	10	Rot hole on small dead limb leading into cavity on western aspect.	T	Moderate	N/A	N/A	N
T2	*Fraxinus excelsior*	12	Multi-stem mature ash with multiple woodpecker holes and callus rolls on western aspect at varying heights. Tree climbing recommended.	T, M, H	High	N/A	N/A	N
T3	*Malus* sp.	4	Isolated apple tree with dead wood, splits and cracks. Large stem cavity with approx. 10 bat droppings observed in leaf litter, potentially more at base of cavity.	T, M	Confirmed	Bat droppings collected from within a branch cavity. Droppings of varying age. Three PRFs in total, all comprising very large trunk cavities on separate stems. Cavity at base of tree very exposed. Recent tree damage (split/broken branch) has likely resulted in the tree becoming unsuitable for bats, as features when droppings were found is now fairly exposed as open at top.	N/A	Neg

[9] T = Transitional (summer/satellite) roosts, M = Maternity roosts, H = Hibernation roosts.

Tree	Species	Approx. height	PBRA Description	Roost types [9]	Overall suitability	Ladder survey Visit 1	Roost types[3]	Ove suit
T4	*Malus* sp.	5	Dying tree with dense ivy growth and broken stems at ground level. Callus roll on north aspect leads into main stem with some cobwebs. Cavities on southern aspect too exposed.	T, M, H	Moderate	1 PRF, comprising two access points (cavities), extending 0.5m upwards and 0.25m downwards	T, M	Mod
T5	*Malus* sp.	5	Mature tree choked with dense ivy stems which may provide suitable PRFs, or obscure PRFs. Precautionary potential assigned	T	Low	N/A	N/A	N
T6	*Malus* sp.	5	Mature tree choked with dense ivy stems which may provide suitable PRFs. Split on lower limb on southern aspect which leads into potential cavity. Inspection recommended.	T, M, H	Moderate	Upon inspection, the split was found to be blocked, and therefore very shallow and exposed, as such it is considered to have negligible potential to support bats. The dense ivy remains.	T	L
T7	*Malus* sp.	5	Mature tree with significant cover of dense ivy stems which may provide suitable PRFs. Precautionary potential assigned.	T	Low	N/A	N/A	N
T8	*Malus* sp.	4.5	Mature tree with dead wood and in poor condition. Multiple cavities leading into hollow stem, some of which are exposed.	T, M	Moderate	Single PRF, comprising one long trunk cavity approx. 1.5m long, with two access points at either end. Feature considered to be sheltered.	T, M	Mod

Tree	Species	Approx. height	PBRA Description	Roost types [9]	Overall suitability	Ladder survey Visit 1	Roost types[3]	Ove suit
T9	*Prunus avium*	5.5	Thin cherry tree leaning onto adjacent tree. Small open cavity into main stem on northern aspect approximately 2m high.	T, M	Moderate	Cavity inspected. Extends approximately 20cm upwards.	T, M	Mod
T10	*Populus sp.*	9	Mature poplar with twin leaders. Woodpecker hole provides access into hollow stem at approx. 2m high on southern aspect.	T, M, H	Moderate	Open cavity extends around 0.5m upwards before narrowing. It extends downwards 0.3m. Bark within cavity is smooth.	T, M, H	Mod
T11	*Malus* sp.	4	Mature tree with dense ivy growth and stems throughout. May provide suitable roosting habitat, precautionary potential assigned.	T	Low	N/A	N/A	N
T12	*Malus* sp.	4	Mature tree with significant lean and dense ivy coverage potentially obscuring features. Precautionary potential assigned.	T	Low	N/A	N/A	N
T13	*Malus* sp.	5	Small apple tree with limited ivy growth. One cavity leads up into hollow stem approximately 2m high on western aspect. Further inspection recommended.	T, M	Moderate	Cobwebs present over cavity entrance. Cavity extends upwards approx. 0.5m, but daylight can be seen at the top, so somewhat exposed. Ivy provides a cluttered environment around the entrance.	T, M	L
T14	*Malus* sp.	3	Small tree with dense ivy stems which may act as PRFs	T	Low	N/A	N/A	N

Tree	Species	Approx. height	PBRA Description	Roost types [9]	Overall suitability	Ladder survey Visit 1	Roost types[3]	Ove suit
T15	*Quercus robur*	8	Mature oak with split, potentially leading into stem downwards from the union, approx. 5m high on northern aspect. Feature partially exposed. Further inspection recommended.	T, M	Moderate	N/A	N/A	
T16	*Quercus robur*	9	Large, mature multi-stem oak and splits and cracks in deadwood on limbs on southern aspect. Northern aspect could not be surveyed due to access limitations.	T, M	Moderate	N/A	N/A	
T17	*Malus* sp.	5	Mature fruit tree with multiple rot holes leading into cavities and a split at base of main stem which leads up into cavity.	T, M, H	High	Basal cavity leads up into stem, also accessed via woodpecker hole. Two PRFs in total.	T, M	H
T18	*Malus* sp.	4	Mature fruit tree with multiple cavities across tree into hollow stem. Cavities at base are open-ended and exposed, but cavities on higher stems may provide more suitable PRFs	T, M, H	Moderate	Three PRFs all comprising hollow stem / branch. No evidence of bats. Features heavily cobwebbed and somewhat exposed in places.	T, M	Mod
T19	*Malus* sp.	3	Mature tree with multiple woodpecker/rot holes on main stem, all of which appear to lead into sheltered hollow main stem cavities.	T, M, H	High	No evidence of bats, four PRFs in total, heavily cobwebbed and most quite shallow. Maximum extent into stem is 15cm.	T, M	Mod

Tree	Species	Approx. height	PBRA Description	Roost types [9]	Overall suitability	Ladder survey Visit 1	Roost types[3]	Ove suit
T20	*Malus* sp.	4	Mature tree with bracket fungi. Cavities present on deadwood limbs and in main stem which appear to lead into hollow cavities.	T, M, H	High	Bat droppings collected from within cobwebs outside a feature approximately 0.5m from the ground. Four PRFs in total. One excluded as too exposed / light for bats.	T, M, H	Con
T21	*Malus* sp.	3	Mature fruit tree with multiple cavities throughout. Cavities at base levels are open-ended and exposed, higher cavities may provide more sheltered/suitable PRFs.	T, M, H	Moderate	No evidence of bats, some features fairly exposed, but potential for bats remains. Three PRFs in total	T, M, H	Mod
T22	*Malus* sp.	5	Mature fruit tree with multiple large rot holes and woodpecker holes between 0m and 2m on all aspects. Some are exposed and lead downwards into hollow stem, others are more sheltered.	T, M, H	High	Three PRFs in total. Two hollow stems present, 1 with evidence of bird nest (2 eggs) Rot hole present leading into a fairly shallow cavity.	T, M	Mod
T23	*Malus* sp.	5	Mature tree with large trunk cavity on east-facing limb. One large cavity is open and exposed, smaller cavity leads up into stem.	T, M, H	Moderate	Two PRFs. Hollow cavity leading in both directions, extending 30cm up. Broken branch leading into cavity.	T, M	Mod

Tree	Species	Approx. height	PBRA Description	Roost types [9]	Overall suitability	Ladder survey Visit 1	Roost types[3]	Ove suit
T24	*Malus* sp.	4	Mature tree with some dense ivy stems. Two cavities leading down into stems on west aspect, approx. 1.5-2m high.	Transitional, Maternity	Moderate	Two PRFs - one cavity leading downwards 0.5m, second extends 0.3m downwards. Evidence of nesting birds.	Transitionary	Mod
T25	*Malus* sp.	4	Mature tree with dead/cracked limbs on floor. Multiple woodpecker/rot holes leading into stem on all aspects, though those at base are exposed and open.	T, M, H	High	Four PRFs comprising hollow stems or rot / woodpecker holes.	T, M	Mod
T26	*Malus* sp.	4.5	Mature tree with multiple rot holes/splits/cavities on all aspects, most of which appear to lead into hollow stem.	T, M, H	High	Two PRFs. Callous roll leading into cavity, evidence of birds nest. Hollow tree stem.	T, M, H	Mod
T27	*Malus* sp.	5	Mature tree with dense ivy coverage which may be obscuring PRFs. Some cavities leading into stem on north aspect approx. 2m high.	T, M, H	Moderate	Two PRFs inspected. Very narrow and damp. Ivy cover remains	T	L
T28	*Malus* sp.	3.5	Small tree with base cavity leading up into main stem.	T, M	Moderate	One PRF with three entrances comprising one large cavity in main stem.	T, M	H
T29	*Malus* sp.	4	Mature tree with dense ivy stems potentially obscuring PRFs. Precautionary potential assigned.	T	Low	N/A	N/A	N
T30	*Malus* sp.	3	Mature tree with basal and higher cavities at approx. 2m on all aspects. Most appear to lead into hollow stem, some are exposed.	T, M	Moderate	Two PRFs. Woodpecker hole with bird nesting material. Hollow stem extending 0.5m down. Ivy cover.	T, M	Mod

Tree	Species	Approx. height	PBRA Description	Roost types [9]	Overall suitability	Ladder survey Visit 1	Roost types[3]	Ove suit
T31	*Quercus robur*	9	Mature oak with slight hazard beam/split on north and south aspects of a lower limb. Depth of split unknown.	T	Low	N/A	N/A	N
T32	*Malus* sp.	5	Mature tree with large basal cavity and rot holes on lower limbs.	T, M	Moderate	Two woodpecker holes - too shallow and damp. Split branch providing access into branch cavity.	T	Mod
T33	*Malus* sp.	5	Mature tree with woodpecker holes on southern aspect of a secondary stem, approximately 2m high.	T, M	Moderate	Cavity does not extend	N/A	Neg
T34	*Malus* sp.	4	Mature tree with multiple woodpecker/rot holes on all three stems.	T, M, H	High	Four PRFs. Three woodpecker holes leading into large cavities. Branch drop put leading into cavity	T, M, H	H
T35	*Malus* sp.	4	Mature tree with cavity at base leading up into stem.	T, M, H	Moderate	Cavity extends approx. 1m up the stem.	T, M, H	Mod
T36	*Malus* sp.	4	Cavity at base leading up into stem on southern aspect	T, M	Moderate	Cavity extends 0.5m. Very damp in places	T	L
T37	*Malus* sp.	4	Cavity on main stem from approximately 2.5m high on western aspect	T, M, H	Moderate	Large cavity, cobwebs present. Extends in both directions.	T, M	Mod
T38	*Malus* sp.	4	Woodpecker holes, rot holes and lifted bark on western aspect	T, M	Moderate	Lifted bark. Three woodpecker holes leading into one cavity which is exposed to elements and contains birds nest.	T	Mod

Tree	Species	Approx. height	PBRA Description	Roost types [9]	Overall suitability	Ladder survey Visit 1	Roost types[3]	Ove suit
T39	*Malus* sp.	5	Basal cavity, woodpecker hole and split on dead stem, all on southern/south-eastern aspect	T, M	Moderate	Two PRFs. Split extends both ways. Hole leading into large cavity	T, M, H	H
T40	*Malus* sp.	3	Basal cavity leading into hollow stem on both stems.	T, M	Moderate	Two cavities on either stem. West cavity extends to small round tunnel, 0.5m depth.	T, M	Mod
T41	*Malus* sp.	4	Multiple rot holes/woodpecker holes/cavities along length of short, dead stems.	T, M H	High	Rot holes inspected and found not to lead anywhere. On the eastern limb, the cavity extends upwards, but very damp and so likely to be unsuitable for bats.	N/A	Neg
T42	*Prunus avium*	4	Small cavities on upright stem with split (majority of remaining stems run along ground).	T, M	Moderate	Low features which join to form one cavity.	T	L
T43	*Quercus robur*	15	Mature oak of appropriate size to support PRFs, although none observed. Precautionary potential assigned.	T	Low	N/A	N/A	N
T44	Unknown	12	Dead tree with multiple woodpecker holes.	T	Moderate	Tree could not be insp		

Table A-2 – Full results from the dusk emergence and dawn re-entry surveys of buildings B2, B5 a

Building/Tree No.	Survey	Date	Sunset/ Sunrise Times	Start/End	Time
B2	Dusk	08.07.19	21:16	Start	21:01
				End	22:46
				Species Recorded Incidentally	
B5	Dusk	04.07.19	21.18	Start	21:03
				End	22:48
				Species Recorded Incidentally	
	Dawn	05.07.19	04:56	Start	03:26
				End	05:11
				Species Recorded Incidentally	
	Dusk	12.08.19	20:30	Start	20:15
				End	22:00
				Species Recorded Incidentally	
	Dawn	13.08.19	05:46	Start	04:16
				End	06:01
				Species Recorded Incidentally	
	Dusk	16.09.19	19:15	Start	19:00
				End	20:45
				Species Recorded Incidentally	
	Dawn	17.09.19	06:40	Start	05:10
				End	06:55

[10] Wind speed as measured by the Beaufort scale, with a value between 1 and 12.

[11] Cloud cover as measured in Oktas, with a value between 0 (complete absence of clouds) and 8 (full cloud cover with no break

Building/Tree No.	Survey	Date	Sunset/ Sunrise Times	Start/End	Time
				Species Recorded Incidentally	
B7	Dusk	18.07.19	21:07	Start	20:52
				End	22:37
				Species Recorded Incidentally	
	Dawn	19.07.19	05:10	Start	03:40
				End	05:25
				Species Recorded Incidentally	
	Dusk	22.08.19	20:10	Start	19:55
				End	21:40
				Species Recorded Incidentally	
	Dawn	23.08.19	06:00	Start	04:30
				End	06:15
				Species Recorded Incidentally	
T44	Dusk	12.08.19	20:30	Start	20:15
				End	22:00
				Species Recorded Incidentally	
	Dawn	17.09.19	06:40	Start	05:10
				End	06:55
				Species Recorded Incidentally	

Appendix B

PHOTOGRAPHS

Table B-1 – Photographs of buildings with low (B2), moderate (B7) and confirmed (B5) bat roosting potential

	
Photo 1. Southern aspect of building B2	**Photo 2.** Eastern aspect of building B2
	
Photo 3. Western aspect of building B5	**Photo 4.** Eastern aspect of building B5

Photo 5. Southern aspect of building B5

Photo 6. Roost emergence location on eastern aspect of B5.

Photo 7. Northern aspect of building B7.

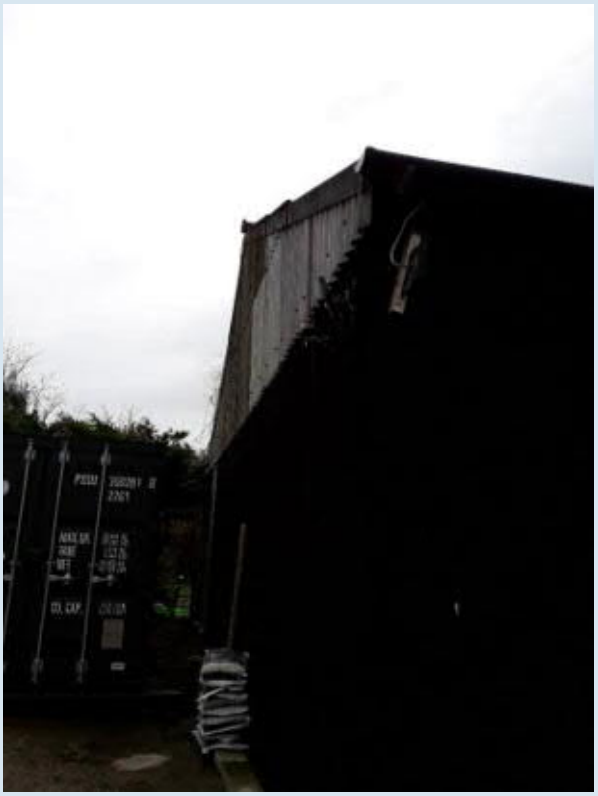


Photo 8. Eastern aspect of building B7.

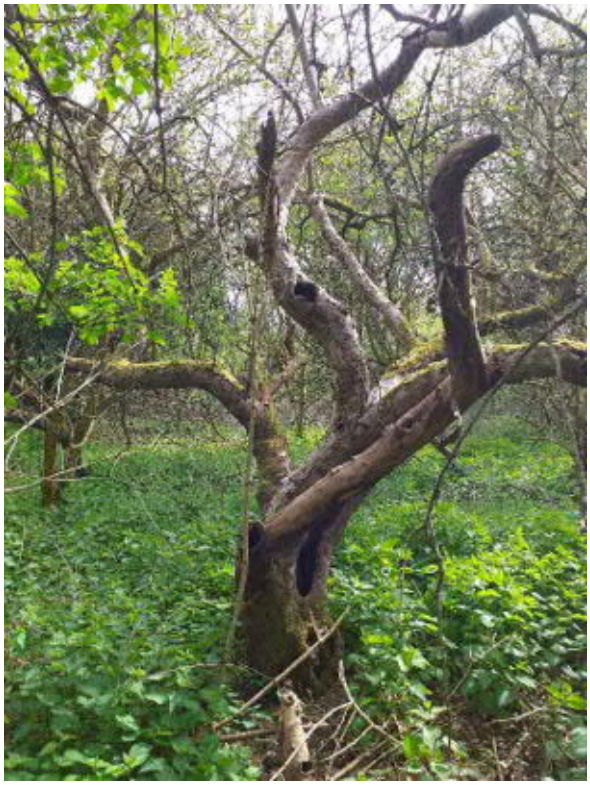
Table B-2 – Photographs of trees with moderate, high or confirmed roosting potential following the at-height inspection surveys

Tree No.	Final Overall Roosting Suitability	Photograph
T2	Moderate	
T3	Confirmed Roost	

Tree No.	Final Overall Roosting Suitability	Photograph
T4	Moderate	
T8	Moderate	

Tree No.	Final Overall Roosting Suitability	Photograph
T10	Moderate	
T17	High	

Tree No.	Final Overall Roosting Suitability	Photograph
T18	Moderate	
T19	Moderate	

Tree No.	Final Overall Roosting Suitability	Photograph
T20	Confirmed Roost	
T21	Moderate	

Tree No.	Final Overall Roosting Suitability	Photograph
T22	Moderate	
T23	Moderate	

Tree No.	Final Overall Roosting Suitability	Photograph
T24	Moderate	
T25	Moderate	

Tree No.	Final Overall Roosting Suitability	Photograph
T26	Moderate	
T28	High	

Tree No.	Final Overall Roosting Suitability	Photograph
T30	Moderate	
T34	Moderate	

Tree No.	Final Overall Roosting Suitability	Photograph
T35	Moderate	
T37	Moderate	

Tree No.	Final Overall Roosting Suitability	Photograph
T38	Moderate	
T39	High	

Tree No.	Final Overall Roosting Suitability	Photograph
T40	Moderate	

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