

Cambridge Waste Water Treatment Plant Relocation Project
Anglian Water Services Limited

Appendix 8.7: Bat Technical Appendix

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1 Introduction

1.1 Overview

- 1.1.1 The bat surveys were carried out to inform the biodiversity assessment completed for the Proposed Development as reported in Chapter 8: Biodiversity (Application Document Reference 5.2.8). These species could be potential constraints to the Proposed Development or influence its design and implementation. An extended Phase 1 Habitat Survey (Appendix 8.10, App Doc Ref 5.4.8.10) identified and mapped the main habitats within 5km of the boundary of the Proposed Development as it was in 2020 – 2021.
- 1.1.2 Figures 8.40 to 8.70, which are associated with this document can be found the Book of Figures – Biodiversity (App Doc Ref 5.3.8).

1.2 Aims and objectives

- 1.2.1 This report provides the methodology used for the bat surveys and the potential constraints relating to bat species for this development.
- 1.2.2 This report also presents detailed results of the ecological baseline data relating to bats during surveys undertaken in 2021 and 2022 within 100m of the Scheme Order Limits.
- 1.2.3 It should be read in conjunction with Chapter 8: Biodiversity (App Doc Ref 5.2.8) of the Environmental Statement.

1.3 Project description

- 1.3.1 The proposed Development involves the construction of a new integrated waste water treatment plant (hereafter proposed WWTP) together with the associated waste water transfer infrastructure, comprising waste water transfer tunnel (underground tunnel), sewer rising main diversions and a treated effluent discharge outfall to the River Cam (the Outfall). The Proposed Development also includes a transfer pipeline corridor, the Waterbeach pipeline, from the Waterbeach Water Recycling Centre (WRC) to the existing Cambridge WWTP. The proposed WWTP will incorporate an integrated Sludge Treatment Centre (STC) which would treat sludge imported from other treatment plants in the Cambridge catchment.
- 1.3.2 Surrounding the development will be a landscaped area to soften the impact of the work on the surrounding environment and deliver on Anglian Water's vision of working with the existing landscape to enhance the natural environment and improve access to the greenbelt. The relocation project will allow Anglian Water to continue to provide critical waste water treatment and recycling services to residents in Cambridge and Greater Cambridge in a modern, low-carbon facility designed in collaboration with stakeholders and the community.

- 1.3.3 Construction of the proposed WWTP and the proposed landscape planting required by this project have the potential to disturb bats in nearby tree roosts and remove foraging habitat in the form of arable land, hedgerows, and scattered trees.
- 1.3.4 A detailed project description is included in Chapter 2: Project Description (App Doc Ref 5.2.2) of the Environmental Statement.
- 1.3.5 The Proposed Development is located north-east of Cambridge and is mostly comprised of arable land. The A14 and Low Fen Drove Way Country Wildlife Site (CWS) are dominant features of the landscape lying to the south and east respectively of the Proposed Development. The B1047 Horningsea Road borders the proposed WWTP site to the west. The River Cam is west of the WWTP site and is where discharges are treated effluent will occur.
- 1.3.6 The Scheme Order Limits covers an area of approximately 211ha. Surveys were undertaken within the Scheme Order Limits plus a 100m buffer.
- 1.3.7 Figure 1.1 below details the location of the Proposed Development and shows the Scheme Order Limits.

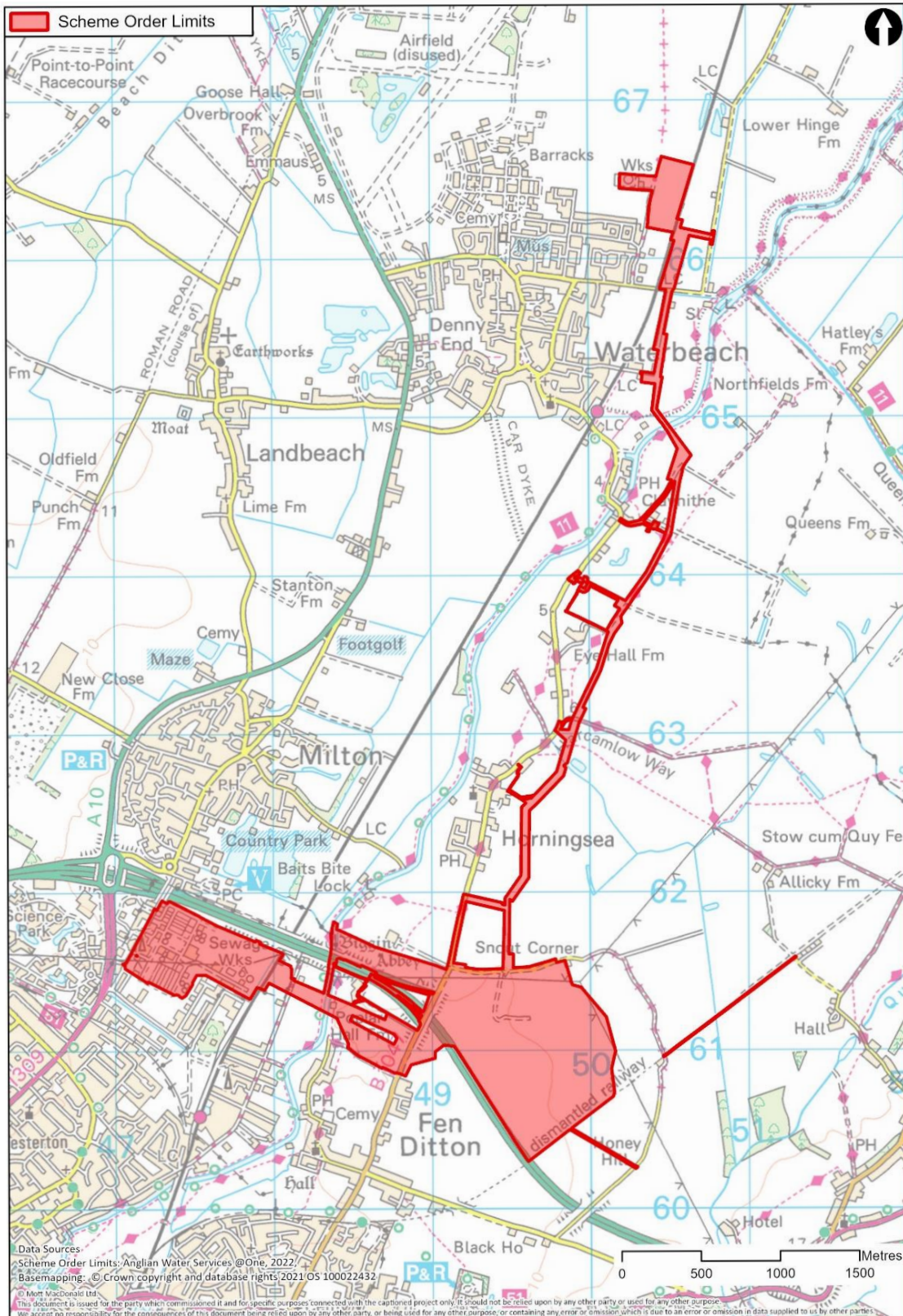


Figure 1.1: Scheme Order Limits

1.4 Legislation

- 1.4.1 All UK bat species are afforded full protection under the Conservation of Habitats and Species Regulations 2017 (as amended) and the Wildlife and Countryside Act (WCA) 1981 (as amended).
- 1.4.2 Under Regulation 41 of the Conservation of Habitats and Species Regulations it is illegal to:
- deliberately capture, injure, or kill any UK bat species;
 - deliberately disturb bats (in particular, disturbance which is likely to impair their ability to survive, to breed or reproduce, or to rear or nurture their young, to hibernate or migrate or to significantly affect the local distribution or abundance of the species to which they belong); and
 - damage or destroy a breeding site or resting place of any UK bat species.
- 1.4.3 Under Schedule 5 of the Wildlife and Countryside Act 1981 it is illegal to:
- deliberately capture, injure, or kill a bat;
 - intentionally or recklessly disturb a bat in its roost;
 - deliberately disturb a group of bats;
 - damage or destroy a bat roosting place (even if not occupied at the time);
 - possess or advertise/exchange a bat (dead or alive) or any part of a bat; and
 - intentionally or recklessly obstruct access to a bat roost.
- 1.4.4 The Countryside Rights of Way Act (CROW) 2000 further strengthens the Wildlife and Countryside Act (WCA) 1981, requiring the conservation of biodiversity in accordance with the Convention on Biological Diversity (CBD) 1992.
- 1.4.5 The Natural Environment Research Council (NERC) Act 2006 places obligation on public authorities to take the conservation of species and habitats of principal importance for conserving biodiversity into consideration. Section 41 of the Act contains a list of habitats and species of principal importance in England.
- 1.4.6 The following bat species are listed as Annex II species within the Conservation of Habitats and Species Regulations 2017:
- barbastelle (*Barbastella barbastellus*);
 - Bechstein's bat (*Myotis bechsteinii*);
 - greater horseshoe bat (*Rhinolophus ferrumequinum*); and
 - lesser horseshoe bat (*Rhinolophus hipposideros*).
- 1.4.7 The following species are listed as species of principal importance for the conservation of biodiversity in England, under Section 41 of the NERC Act, 2006:
- western barbastelle;

- Bechstein's bat;
- brown long-eared bat (*Plecotus auritus*);
- noctule (*Nyctalus noctula*); and
- soprano pipistrelle (*Pipistrellus pygmaeus*).

1.4.8 The Biodiversity Supplementary Planning Document (Greater Cambridge Shared Planning, 2022) stipulates that the guidance outlined in the draft Eversden and Wimpole Woods Special Area of Conservation (SAC) protocol should be adhered to in order to avoid impacts on the barbastelle bats present at this SAC. The Proposed Development lies outside of the 5km and 10km Impact Risk Zones (Greater Cambridge Shared Planning, 2022).

2 Methodology

2.1 Desk study

2.1.1 Data from within a 5km buffer of the Scheme Order Limits was used in the desk study. The desk study returned 817 records of bats of at least nine species (several records were assigned to genus or family only) within the buffer. No records were returned within the Scheme Order Limits. ArcPro GIS software was used to measure the proximity of the records to the Proposed Development. The Eversden and Wimpole Woods SAC is located 14.7km (to the nearest point) from the Proposed Development.

2.2 Field survey

2.2.1 Trees and structures within 100m of the Scheme Order Limits were surveyed for their suitability to support roosting bats. Ground level tree inspections were undertaken to assess which trees had potential to support roosting bats, using survey methods based on the Bat Conservation Trust (BCT) Good Practice Guidelines (Collins, 2016). These surveys involved two ecologists systematically assessing each of the trees present in any given land parcel with access that falls within the survey area. Where needed, notes and photographs were taken to aid in the assessment. Close-focusing binoculars and a light source such as a torch were also used, where necessary, to facilitate assessments. Potential Roost Features (PRF) could include rot holes, knot holes, tear-outs, flush cuts, hazard beams, wounds, splits, lifting bark or cankers and other cavities.

2.2.2 Surveyors sought to identify confirmed roosts through finding evidence of bat presence, or by examining PRF with evidence of use demonstrated by presence of:

- oil staining;
- bat droppings;
- feeding remains; and
- smoothing/polishing around the access entrance.

2.2.3 Once any PRF were identified, the information was assessed, and each tree was assigned a suitability value for potential for roosting bats. The way in which this suitability index was assigned is explained in Table 2-1.

Table 2-1: Categories of bat roost suitability for trees and structures

Roost suitability	Roosting features
Negligible	Negligible habitat features on site likely to be used by roosting bats.
Low	A structure or tree with one or more potential roost sites 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 surrounding habitat to be used on a regular basis or by larger numbers of bats (i.e., unlikely to be suitable for maternity or hibernation). 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.
Moderate	A structure 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 – the assessments in this table are made irrespective of species conservation status, which is established after presence is confirmed).
High	A structure 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.

Source: Bat Conservation Trust 2016

2.3 Tree inspections

- 2.3.1 Potential roost features may be used by bats at specific times of year or year-round, depending on their suitability and thermal stability. Using aerial tree inspection methods allows any given feature to be inspected thoroughly and therefore that feature can be assigned a more accurate roost type category. It is not always clear from ground observations whether a PRF has the internal capacity and attributes required to support, for example, hibernating bats, hence the need for aerial inspections.
- 2.3.2 To provide a high detail inspection of PRF, trees within the study area which were safe to climb and of moderate or high roost suitability were climbed using ropes or inspected from a ladder. All accessible PRF were then visually examined, and where needed endoscopes and torches were used to inspect cavities and features.
- 2.3.3 This greater detail was used to inform the extent and scope of dusk and dawn emergence/re-entry surveys. Referring to the information in Table 2-1 and using the information acquired from aerial tree assessments, trees were reclassified where necessary, for example, where a feature was observed as offering suitability from the ground, but on closer inspection at height did not offer such suitability. The updated bat roost suitability can be found in Table 3-3.

2.3.4 All trees within the Scheme Order Limits were assessed for their roost suitability for bats. Only trees with moderate and high roost suitability were selected for further surveys, in line with Collins (2016).

2.4 Building inspections

2.4.1 All buildings within the survey area were assessed externally from the ground using close focusing binoculars and a light source to identify any PRF for both summer and hibernation roosts. PRF within structures and buildings include any cavities which are suitable for and large enough one or more bats. For a PRF to be viable, a bat must be able to access it. Access points for structures include lifted tiles, missing tiles, open eaves, open barn doors, lifted lead flashing and gaps in the brickwork or other materials. The area beneath any potential access points was also checked for bat droppings, urine splashes and fur oil staining.

2.4.2 Once PRF and access points were identified, each structure's or feature's suitability to support roosting bats was assessed. The way in which this suitability index is assigned is explained in Table 2-1 above.

2.4.3 During refinement of the survey effort no buildings were selected for surveys based upon the design at the time. This does not exclude any future building surveys, based upon design revisions and/or alterations. The refinement of the survey effort was undertaken by consulting a Principal Ecologist at Mott MacDonald Ltd to aid in the selection of trees and structures.

2.4.4 Where access was permitted, internal inspections were carried out on built structures which were identified as having a potential to support roosting bats. The interiors were inspected by suitably experienced and licensed bat ecologists. Surveyors searched for evidence of bats (i.e., droppings, urine stains, oil stains, scratching, insect remains).

2.5 Emergence and re-entry surveys

2.5.1 Dusk emergence and dawn re-entry surveys were undertaken on 20 trees in 2021 with moderate or high suitability to support roosting bats. The 20 trees surveyed in 2021 are listed below:

- B847_01
- O873_01
- G036-102
- Y039-101
- G040-08
- G040-05
- G040-04
- G040-03
- G040-02

- G036-02
- G040-01
- 18
- 20
- 42
- 43
- 45
- 47
- 48
- 49
- 50.

2.5.2 16 trees subject to emergence and re-entry surveys in 2022 are listed below (Waterbeach Pipeline):

- B106-T001
- B106-T006
- B106-T007
- G041-T004
- G041-T006
- O025-T001
- P041-T004
- P881-T018
- R107-T006
- R838-T001
- R838-T002
- R838-T003
- R838-T004
- Y041-T006
- Y838-T003
- Y838-T005.

2.5.3 The number of surveys undertaken for each tree/structure and when each survey was conducted was derived from the level of roost suitability, as shown in Table 2-2 below.

Table 2-2: Number and timings of surveys for each roost suitability

Roost type	Low roost suitability	Moderate roost suitability	High roost suitability
Structure	One survey between May to August.	Two separate surveys, one dusk and one dawn. One survey between May and August.	Three separate surveys including both dusk and dawn. Two of the surveys should be between May and August.
Tree	No further surveys are required.	Two separate surveys, one dusk and one dawn. One survey between May and August.	Three separate surveys including both dusk and dawn. Two of the surveys should be between May and August.

Source: Collins, 2016

2.5.4 Surveys were completed with a space of at least two weeks in between each survey. Surveys were only conducted in suitable weather conditions, as described below:

- temperature above 10°C;
- no rain or sporadic light rain; and
- low wind speeds.

2.5.5 Surveyors were positioned around the tree (where possible) to provide suitable coverage of all PRF present, and bat activity was recorded using a combination of visual observations and aural full spectrum bat detectors. Each surveyor used an Elekon Batlogger M+ or equivalent handheld device with built-in GPS and temperature recording capability. Bat activity, including emergence from potential roosting features, passes, direction of travel and behaviour were recorded, as were species and number. Limited light was used during all surveys to reduce the likelihood of the surveyors affecting bat behaviour.

2.5.6 Dusk emergence surveys started 15 minutes before sunset and ended between 1.5 and 2 hours after sunset. Dawn re-entry surveys started between 1.5 and 2 hours before sunrise and ended 15 minutes after sunrise. The variation in survey duration is due to the different lengths of the transect. Due to the specific nature of the areas surveyed it is not always possible to create transects of equal length. In addition, there is variation in walking pace between different surveyors. Transect surveys were carried out in optimal weather conditions.

2.6 Bat activity transect

2.6.1 In addition to the emergence and re-entry surveys, a set of transects (three) were used to assess bat activity across different habitats local to and within the footprint of the proposed WWTP. Transects were designed to identify species composition and general distribution of bats at the existing Cambridge WWTP as well as at the proposed WWTP site. Surveys focused on linear features with potential importance for commuting bats, in addition to habitats potentially used as foraging grounds. This

did not exclude non-linear and open areas of habitat from survey. The transect was designed to incorporate a range of habitats. Habitats in the transect include but were not limited to:

- amenity grassland;
- arable;
- built environment;
- ditches;
- ephemeral/short perennial;
- river;
- scrub;
- semi-improved grassland;
- species-poor hedge; and
- woodland.

2.6.2 The six transect routes are shown in the maps in the appendices.

2.6.3 When assessing potential foraging and commuting habitats, the guidelines (Tables 4.1 and 8.3) within the Bat Conservation Trust Good Practice Guidelines (Collins, 2016) were followed. The survey effort was determined by the habitat suitability given to the survey area. The habitat at the Proposed Development is of low quality for bats. In line with BCT guidelines one survey visit per season was conducted in Spring, Summer and Autumn 2021. In 2022, due to time constraints the transects for the Waterbeach pipeline were conducted in June, July and August.

2.6.4 The transect surveys aimed to indicate species and numbers of bats utilising habitats within and near the Proposed Development, and existing features within the landscape considered important for bat foraging, navigation and orientation that may be adversely affected by the Proposed Development.

2.6.5 In total, nine transect surveys were conducted along three routes between May and October 2021. Each transect began at sunset and continued for between one hour and five minutes after sunset to two hours and 45 minutes after sunset. Dawn transect surveys commenced approximately two hours before sunrise and ended at sunrise. The transect start point was alternated where possible between each survey, so that different sections of the survey area were visited at differing times pre/post sunset/sunrise. The surveyors walked at a steady pace, stopping at pre-defined points for five minutes at a time (Figures 8.45, 8.46 and 8.47, Book of Figures – Biodiversity (App Doc Ref 5.3.8)). Any bat calls heard on the detectors were identified to species level (where possible) and recorded, along with any associated visual records of flight direction and behavioral activity.

2.6.6 During 2022, three transects were used to assess the activity along the Waterbeach Pipeline. These transects are referred to as north, middle and south, relative to their

position along the pipeline route. Each of these transect routes was subject to three survey visits. Due to time constraints these visits took place in June, July and August.

2.7 Static detectors

- 2.7.1 During May, July, August and September, four static detector locations (one static location per transect for the two smaller transects and two for the large transect) were deployed for a minimum of five nights, often longer (up to nine nights). The static detectors deployed were Elekon Batlogger A+ and were set up as per the manufacturer's guidelines. The number of detectors deployed was informed by the BCT Good Practice Guidelines (Collins, 2016). In the field, they were placed along a linear feature or edge habitat and secured to a tree or fence post with an appropriately secure lock. The microphones were placed approximately 1.5m from the ground and oriented in such a way that they pointed towards the likely flight path of any bats using that habitat. Microphones were situated so that they did not become obscured by vegetation. The microphone was the standard Elekon Batlogger microphone. Memory cards were at least 32GB.
- 2.7.2 The recordings made during the automated surveys were analysed using Wildlife Acoustics Kaleidoscope Pro software, version 5.9.1g and Elekon Bat Explorer, version 2.1.9.1. All data has gone through an internal quality control process whereby at least 10% of all bat registrations and 100% of registrations identified as less commonly recorded species within the dataset (i.e., long eared bats (*Plecotus* species), serotine (*Eptesicus serotinus*), barbastelle) were double-checked by an experienced bat ecologist.

2.8 Ecobat

- 2.8.1 Ecobat (The Mammal Society, 2017) was used as a tool to quantify bat activity levels with reference to local and national datasets. Data collected within the study area was provided along with methodology information, in order for a report to be generated. The report compared the results of the surveys with data from within 200km.
- 2.8.2 The Ecobat proforma was downloaded and the data were entered in the required format. Where applicable, optional information was added. This optional information included the height of the detector's microphone, proximity to a linear feature, type of feature (<25m option included), and whether the detector was located within 25m of an anthropogenic feature. The proforma was then submitted for a report to be generated. Records were set to be compared to a reference dataset that included records from any time of year, records from within 200km of the survey location and records using any detector type. Data were specified as 'do not publish'.

2.9 Survey limitations and assumptions

- 2.9.1 Biological records obtained from third parties and presented in the desk study do not represent a full and complete species list for the area. They are mostly given by individuals on an ad hoc basis, often meaning there are areas of deficiency in the

- data, for example, where access is restricted and/or where survey specialisms are required.
- 2.9.2 Aspects of the Proposed Development, for example, the incoming sewer tunnel may have impacts on trees that have potential to support roosting bats. Design features such as the location of the incoming sewer tunnel were not available when the shortlist of trees for emergence/re-entry surveys was created. As a result, some trees may require future surveys.
- 2.9.3 Some trees are unsafe to climb due to the features present. These include, but are not limited to, ivy cover, hazard beams, split limbs, bark inclusion, rot and unsafe ground conditions. Where trees requiring further survey were identified as being unsafe to climb, and other means of access such as use of a Mobile Elevated Working Platform was not possible, they were subject to appropriate emergence/re-entry surveys in line with the BCT Good Practice Guidelines (Collins, 2016)
- 2.9.4 Access was not permitted to Biggin Abbey structures. As such, no assessments or surveys of these structures were carried out. Given that the work taking place at the closest point to Biggin Abbey is a cut and cover pipeline, the denied access is not considered to be a major limitation.
- 2.9.5 Due to the length of two of the transects, one at the existing Cambridge WWTP and one around PRoW 85/6 and adjacent land parcels (Figures 8.45, 8.46 and 8.47, Book of Figures – Biodiversity (App Doc Ref 5.3.8)), activity transects fell short of the recommended duration in the Bat Conservation Trust Good Practice Guidelines (Collins, 2016).
- 2.9.6 During May 2021 and August 2021 the River Cam static detector (location TL 48410 61610), despite being deployed for at least five nights, only collected three nights' worth of data from each month. Likewise, during August and September at the Proposed Development static detector location (TL 49846, 61223) only four nights of data were collected from each month. This was due to high instances of bat calls or other noise, filling the memory cards or running the batteries low, leading to power failure.
- 2.9.7 Between the end of the ground level appraisals and the start of the emergence/re-entry surveys, tree 22 was felled. Tree 22 was initially appraised as having a moderate suitability to support bats. As a result, the surveys planned for this tree could no longer take place. Tree 22 was inspected at ground level post-felling. It was found to have negligible suitability. No further action was required.
- 2.9.8 The results taken from bat detector recordings are biased towards bats that use louder echolocation calls. Therefore, quiet species such as brown long-eared bats may be under-recorded due to the limited recording range of the equipment. This is an unavoidable limitation for all surveys using bat detectors, the implications of which have been considered when analysing the results.
- 2.9.9 During bat call analysis there were several limitations. There is often a considerable overlap in the call parameters of the species within the *Myotis* genus. This means that members of this genus can sometimes only be identified as far as *Myotis* spp.

This is also the case for some of the calls from *Pipistrellus* and *Nyctalus* species. The overlap in call parameters of *Pipistrellus* species will often lead to difficulty distinguishing common pipistrelle calls from those of Nathusius' pipistrelle, as well as soprano from common pipistrelle in some instances. Also, during call analysis, bats from acoustically similar groups (i.e., Serotine and *Nyctalus*) were sometimes only identified as Nyctaloid. Likewise, where calls could not be identified to species level within the *Nyctalus* genus, the call was left as *Nyctalus*.

- 2.9.10 Calls recorded on any type of detector are not directly indicative of a number of bats. This is especially the case when static automatic detectors are utilised. A handheld detector has the advantage of the surveyor's observations, which can be used to provide an indication of the number of individual bats. Bat passes or bat calls may represent one or a small number of individuals that are continually and frequently passing/calling within detection range of the static detector.
- 2.9.11 Bat droppings used to confirm the presence of roosting bats in two of the trees on the Waterbeach pipeline were not used for DNA to determine species. The bat box on tree B106-T007 rendered the droppings inaccessible. The single bat dropping found in tree R838-T004 was crushed to determine whether it was from a bat or other mammal. No more droppings were found during searches of this roost.
- 2.9.12 During two attempts to survey P041-T004, there was livestock in the field which rendered the survey unsafe. A request to the landowner to move the livestock was made but was not successful.

Due to a malfunction with the handheld bat logger, July data for the middle transect on the Waterbeach pipeline element was missing the GPS data. As such, the species recorded during this survey cannot be mapped spatially. Due to partial satellite connectivity during the survey in July, spatial data for the south transect is limited; again this resulted in these data not being mapped spatially.

3 Survey results

3.1 Desk study

- 3.1.1 The desk study returned 817 records of bats of at least nine species (several records were identified to genus or family only) within a search buffer of 5km. No records were returned within the Scheme Order Limits, however, there were four roosts for brown long-eared bat (*Plecotus auritus*) within 120m from the Scheme Order Limits, and one for an unspecified pipistrelle (*Pipistrellus spp.*) species within 100m.
- 3.1.2 Other roost records were returned for Natterer's bat (*Myotis nattereri*) within 200m; for noctule (*Nyctalus noctula*) within 1,800m; serotine (*Eptesicus serotinus*) within 200m; soprano pipistrelle (*Pipistrellus pygmaeus*) within 800m; and common pipistrelle (*Pipistrellus pipistrellus*) within 3,300m.
- 3.1.3 Other species recorded within the search buffer were as follows:
- Daubenton's bat (*Myotis daubentonii*);
 - Nathusius' pipistrelle (*Pipistrellus nathusii*);
 - parti-coloured bat (*Vespertilio murinus*); and
 - western barbastelle.
- 3.1.4 Two records of parti-coloured bat (not considered a UK native species) were reported near to Cambridge Airport and it is understood these were both taken into care.
- 3.1.5 The nearest record for western barbastelle was for 1.5km away from the Scheme Order Limits, although, as no information on roosting is provided, it is considered that this, along with the two other records, are field records.
- 3.1.6 There is a wide range of species using the area surrounding the Scheme Order Limits. These species are likely to be using the area for foraging, commuting, breeding and roosting.
- 3.1.7 Eversden and Wimpole Woods SAC is located approximately 16.7km south-west from the center of the Proposed Development. This SAC is designated for barbastelle bats. There are maternity roosts present in this woodland and the Proposed Development is within the foraging range of this species.

3.2 Field survey results

- 3.2.1 The surveys undertaken during the 2021 and 2022 survey season found at least nine different bat species. The bat species recorded within the study area included:
- common pipistrelle;
 - soprano pipistrelle;
 - Nathusius' pipistrelle;
 - noctule;

- Leisler’s;
- serotine;
- brown long-eared;
- western barbastelle; and
- *Myotis* species.

3.2.2 Figure 8.49, Book of Figures – Biodiversity (App Doc Ref 5.3.8) shows the location of the western barbastelle and *Myotis* calls. These are provided due to their status as Annex II species (or possible status in relation to *Myotis*).

3.3 Ground level roost appraisals

3.3.1 During the initial ground-level surveys for PRF, 86 trees were identified as having moderate or high suitability to support bat roosts (Table 3-1 below).

Table 3-1: The 86 trees identified during the 2021 survey season as having at least moderate potential to support roosting bats

Tree identification code	Ground level roost appraisal initial assessment
	High
	Moderate
	Moderate
	Moderate
	High
	Moderate
	Moderate
	High
	Moderate
	Moderate
	Moderate
	High
	High
	Moderate
	Moderate
	Moderate
	Moderate
	High
	Moderate
	High
	High (confirmed)
	Moderate
	Moderate

Tree identification code	Ground level roost appraisal initial assessment
	Moderate
	Moderate
	Moderate
	High
	Moderate
	Moderate
	Moderate
	Moderate
	High
	High
	Moderate
	Moderate
	High
	Moderate
	Moderate
	Moderate
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	High
	Moderate
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	Moderate
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	High
	Moderate
	Moderate
	Moderate
	Moderate

Tree identification code	Ground level roost appraisal initial assessment
	High
	Moderate
	High
	Moderate
	Moderate
	Moderate
	Moderate
	High
	Moderate
	Moderate
	High
	High
	High
	High
	High
	High
	High
	Moderate
	Moderate
	Moderate (confirmed)
	Moderate
	Moderate
	High

Source: Mott MacDonald Ltd Surveys 2021

3.3.2 Of these 86 trees, 20 trees from the 2021 survey season were selected for the emergence and re-entry surveys based on the design information available at the time and suitability for roosting bats. This does not exclude the remaining trees from future surveys.

3.3.3 The Waterbeach pipeline was subject to surveys in 2022. Along its proposed route, 16 trees were subject to emergence and re-entry surveys. These are shown in Table 3-2 below.

Table 3-2: The 16 trees subject to emergence and re-entry surveys during 2022 (Waterbeach Pipeline)

Tree identification code	Roost potential
	Moderate
	Low

Tree identification code	Roost potential
[REDACTED]	High
[REDACTED]	High
[REDACTED]	High
[REDACTED]	Moderate
[REDACTED]	Moderate
[REDACTED]	High
[REDACTED]	High
[REDACTED]	High
[REDACTED]	High
[REDACTED]	High
[REDACTED]	High
[REDACTED]	High
[REDACTED]	Moderate
[REDACTED]	Moderate

Source: Mott MacDonald Ltd Surveys 2022

3.4 Aerial survey (tree climbing)

3.4.1 Nineteen trees were subject to further surveys, of which four were climbed with either a rope or had their potential roost features accessed from ladder. The remaining trees, those unsafe to climb, were subject to emergence and re-entry surveys. This information was then used to refine the classification and inform emergence and re-entry survey effort (Table 3-3).

Table 3-3: The four trees that were suitable for climbing and their updated potential.

Tree identification code	Updated roost potential
18	Moderate
20	High
G040-08	High
Y039-101	Moderate

Source: Mott MacDonald Ltd Surveys 2021

3.5 Emergence and re-entry surveys

- 3.5.1 Two trees were confirmed as roosts during the survey season of 2021, tree [REDACTED] tree [REDACTED] (Table 3-4). Both roosts are day roosts, each only being host to one *Pipistrellus* species at the time of confirmation. One of these trees can be found within 100m of the proposed WWTP site (tree [REDACTED]). The other confirmed roost is located at [REDACTED], close to the [REDACTED] ([REDACTED]). No tree of low, moderate, or high potential will be lost under the footprint of the proposed WWTP site.
- 3.5.2 During the 2022 survey season, which focused on the Waterbeach Pipeline, five trees were identified as having roosts. Two of these five roosts were only identified through droppings and therefore the species cannot be definitively identified. The droppings were not collected for DNA for two reasons. Firstly, the droppings present in the bat box on tree [REDACTED] 7 were only visually accessible. Secondly, there was only one dropping found in tree [REDACTED] which was crushed to determine whether it was from a bat. Searching for more droppings was not successful, the roost had a thick layer of debris at the bottom. The remaining three trees are roosts for *Pipistrellus* species. Tree [REDACTED] is a soprano pipistrelle and common pipistrelle roost. Tree [REDACTED] is a soprano pipistrelle roost. Tree [REDACTED] a *Pipistrellus* species roost; this was only confirmed visually and not with audio evidence. Flight characteristics were used to infer the species.
- 3.5.3 A development licence (Appendix 8.20: Natural England Ghost Licence Method Statement – Bats (App Doc Ref 5.4.8.20)) from Natural England is likely to be required for the roost in tree [REDACTED] as it seems unlikely that disturbance to this roost can be avoided.
- 3.5.4 The bats using the tree [REDACTED] roost were not identified to species level but were noted at the time of survey to be a *Pipistrellus* species, calling at 50khz.
- 3.5.5 The two confirmed roosts are likely to be summer/day roosts. The trees offer suitability for crevice dwelling species such as pipistrelles.

Table 3-4: The two confirmed tree roosts from the 2021 survey season.

Tree ID	Date	Species	Number roosting	Dusk/dawn	Type of roost
[REDACTED]	06.07.21	<i>Pipistrellus</i> spp.	1	Dusk	Day roost
[REDACTED]	24.08.21	<i>P. pygmaeus</i>	1	Dusk	Day roost

Source: Mott MacDonald Ltd Surveys 2021

Table 3-5: The five confirmed tree roosts from the 2022 survey season (Waterbeach Pipeline)

Tree ID	Date	Species	Number roosting	Dusk/dawn	Type of roost
	26.05.22	<i>P. pygmaeus</i>	1	Dawn	Day roost
	15.06.22	<i>P. pipistrellus</i>	1	Dusk	Day roost
	14.06.22	Likely <i>Pipistrellus</i> spp.	Unknown	N/A	Day roost
	13.06.22	<i>P. pygmaeus</i>	1	Dusk	Day roost
	13.05.22	Likely <i>Pipistrellus</i> spp.	Unknown	N/A	Bat box
	04.07.22	<i>Pipistrellus</i> spp.	1	Dusk	Day roost

Source: Mott MacDonald Ltd Surveys 2022

*These trees were confirmed during scoping surveys

**Audio data were not recorded for this emergence. It was confirmed visually only. Flight characteristics and later recordings were used to infer the emerging species.

3.6 Bat activity transects

- 3.6.1 Activity transects identified areas of bat activity along the routes (see appendices).
- 3.6.2 The activity survey conducted at the existing WWTP (transect 1) showed a broadly uniform level of activity along the northern and the eastern boundaries. Few calls were recorded along the western or southern boundaries (Figure 8.46 and Figure 8.52, Book of Figures – Biodiversity (App Doc Ref 5.3.8)).
- 3.6.3 Along transect 1, the northern boundary of the existing Cambridge WWTP (along the A14) showed elevated activity levels compared to the rest of the route. This activity was predominantly by soprano pipistrelle bats (Figures 8.49, 8.50, 8.51 and 8.52, Book of Figures – Biodiversity (App Doc Ref 5.3.8)). The transect shows that the existing Cambridge WWTP is being used as foraging habitat for bats, mainly *Pipistrellus* species, and *Nyctalus* species which are likely roosting nearby and.
- 3.6.4 The transect at the proposed WWTP (transect 2) has the majority of the activity concentrated along Low Fen Drove Way and the County Wildlife Site (CWS) (Figure 8.46, Book of Figures – Biodiversity (App Doc Ref 5.3.8)).
- 3.6.5 Transect 2 covers a wide area of the Proposed Development. The Low Fen Drove Way CWS and Low Fen Drove Way are both used by foraging and commuting bats, mostly barbastelle, common pipistrelle, soprano pipistrelle, *Myotis* spp. and noctules (Figure 8.56, Book of Figures – Biodiversity (App Doc Ref 5.3.8)). Figure 8.46, Book of Figures – Biodiversity (App Doc Ref 5.3.8) shows consistent levels of activity along the Low Fen Drove Way CWS. Activity at the western end of Low Fen Drove Way is considered low. This is evident from visual inspections of the transect figures

(Figures 8.49 to 8.60, Book of Figures – Biodiversity (App Doc Ref 5.3.8)). The structure of the Low Fen Drove Way CWS (the disused railway section) provides ideal foraging and commuting habitat for bats as does the track that runs through the CWS. This is evident when reviewing Figures 8.53, 8.54, 8.55 and 8.56, Book of Figures – Biodiversity (App Doc Ref 5.3.8). The majority of the barbastelle calls along this transect are located on the disused railway (north-east – south-west). Two of the barbastelle calls are positioned along the gravel track (north-west – south-east). This suggests that the majority of the activity is associated with the disused railway line and that barbastelle bats are using it to commute.

- 3.6.6 The PRow (85/6) and land parcel G040 transect (transect 3) showed some level of activity along the majority of the route. A cluster of activity was located at the A14 bridge over the River Cam (Figure 8.47, Book of Figures – Biodiversity (App Doc Ref 5.3.8)). Transect 3 is the transect located centrally with respect to the Scheme Order Limits. This transect covers the habitat surrounding the River Cam. The species using this area are barbastelle, Daubenton's, noctule, common and soprano pipistrelles. Transect 3 also captures the confirmed roost in tree ■■■
- 3.6.7 When viewing Figure 8.60, Book of Figures – Biodiversity (App Doc Ref 5.3.8), it is clear that the bridge over the River Cam has a lot of activity compared to other sections of the transect route. The River Cam is likely to be used as a foraging and commuting route by the species present on this transect, with perhaps the exception of noctule, which typically fly at above 10m. The species present on this transect are barbastelle, Daubenton's, noctule, common and soprano pipistrelle. Barbastelles are likely to be commuting given that only one recording was made along this transect route, although this does not rule out foraging.
- 3.6.8 Daubenton's are often associated with water and often roost near water. They are likely to be roosting nearby. They will also be foraging and commuting using the River Cam as surrounding adjacent habitat. *Pipistrellus* species are foraging and roosting along this transect route; their calls make up the majority of the recordings.
- 3.6.9 The data show that the existing hedgerows at the center of the rotunda design are not heavily used by foraging or commuting bats. The species recorded within the Proposed Development rotunda footprint are noctule, brown long-eared (one instance recorded), common and soprano pipistrelle. They are likely to be using this area for commuting and foraging only.
- 3.6.10 The Waterbeach pipeline was subject to three transects. Each transect received three survey visits. These transects are referred to as north, middle and south.
- 3.6.11 The north transect shows activity, both by foraging and by commuting bats. This transect showed activity from the following species: common, Nathusius' and soprano pipistrelle, as well as brown long-eared and noctule. The majority of the activity is in the central portion of the transect along Burgess's Drove, which is likely a commuting route for bat species. Figures 8.61, 8.62, 8.63 and 8.64, Book of Figures – Biodiversity (App Doc Ref 5.3.8), show the activity mapping from this transect. When viewing Figures 8.61, 8.62, 8.63 and 8.64, Book of Figures – Biodiversity (App

Doc Ref 5.3.8), it is apparent that Bannold road is also likely to be a commuting route.

- 3.6.12 Activity from the middle transect is from brown long-eared, common pipistrelle, *Myotis* species, noctule, *Nyctalus* species and soprano pipistrelle bats. The habitats, particularly the hedgerows and tree lines, are used for foraging and commuting. The activity survey results can be viewed in Figures 8.65, 8.66 and 8.67, Book of Figures – Biodiversity (App Doc Ref 5.3.8). The activity presented in the combined map for the middle transect (Figure 8.67, Book of Figures – Biodiversity (App Doc Ref 5.3.8)) is not fully representative of the activity as not all of the data could be mapped spatially.
- 3.6.13 Finally, the south transect on the Waterbeach pipeline aspect of the Proposed Development has activity from the following species: barbastelle, common pipistrelle, noctule, serotine and soprano pipistrelle. The barbastelle activity is only a single recording and as such is likely due to commuting through the landscape. The activity presented in the combined map for the south transect (Figure 8.70, Book of Figures – Biodiversity (App Doc Ref 5.3.8)) is not fully representative of the activity as not all of the data could be mapped spatially.
- 3.6.14 The tables below provide a summary of the weather conditions recorded during each of the transect surveys undertaken in 2021 and 2022. Wind is given as a value out of 12, using the Beaufort scale, and cloud cover is given as a value out of 8, using the Oktas scale. Precipitation is a binary system, yes (1) or no (0).

Table 3-6: Weather conditions for transect surveys on the Cambridge WWTP route (transect 1)

Survey visit	Date	Temperature	Weather	Wind	Cloud cover	Rain	Duration
1	18.05.21	14°C	Dry and cloudy, light rain at 23:00	2	7	1	1h 43min (20:53 – 22:10)
2	22.07.21	23°C	Mild, dry	1	3	0	2h 47min (21:05 – 23:52)
3	29.09.21	12°C	Cool, dry, clear sky and light wind	2	0	0	1h 10min (20:00 – 21:10)

Source: Mott MacDonald Ltd Surveys 2021

Table 3-7: Weather conditions for transect surveys on the proposed WWTP route (transect 2)

Survey visit	Date	Temperature	Weather	Wind	Cloud cover	Rain	Duration
1	17.05.21	13°C	Dry and cloudy after rain	2	6	0	2h 5min (20:51 – 22:56)
2	29.07.21	20°C	Mild, dry	1	3	0	2h 4min (20:54 – 22:58)
3	04.10.21	14°C	Dry after earlier rain shower with light to moderate wind	2	6	0	2h 43min (18:30 – 22:13)

Source: Mott MacDonald Ltd Surveys 2021

Table 3-8: Weather conditions for transect surveys on PRow (85/6), G040 and R037 (transect 3)

Survey visit	Date	Temperature	Weather	Wind	Cloud cover	Rain	Duration
1	18.05.21	12°C	Dry and cloudy.	3	8	0	2h 29min (20:53 – 22:10)
2	22.07.21	21°C	Mild, dry	1	3	0	2h 47min (21:05 – 23:52)
3	29.09.21	12°C	Cool, dry, clear sky and light wind	2	0	0	1h 4min (18:41 – 19:45)

Source: Mott MacDonald Ltd Surveys 2021

3.6.15 Below are the remaining tables containing the information on the transects conducted on the Proposed Development.

Table 3-9: Weather conditions for transect 2 (north transect) on the Waterbeach Pipeline

Survey visit	Date	Temperature	Weather	Wind	Cloud cover	Rain	Duration
1	28.06.22	20°C	Calm and cool, cloud on horizon	1	3	0	1h 33min (21:26 – 22:59)
2	29.07.22	10°C	-	0	1	0	1h 45min (03:39 – 05:24)
3	03.08.22	20°C	Cooler, breeze, humidity low to moderate	1	6	0	0h 49min (03:57 – 04:46)

Source: Mott MacDonald Ltd Surveys 2022

Table 3-10: Weather conditions for transect 2 (south transect) on the Waterbeach Pipeline.

Survey visit	Date	Temperature	Weather	Wind	Cloud cover	Rain	Duration
1	27.06.22	15°C	Breezy, sunny	2	1	0	2h 05min (21:25 – 23:30)
2	28.07.22	18°C	-	3	3	0	1h 45min (20:40 – 22:25)
3	02.08.22	22°C	-	1	5	0	1h 10min (03:35 – 04:45)

Source: Mott MacDonald Ltd Surveys 2022

Table 3-11: Weather conditions for transect 3 (middle transect) on the Waterbeach Pipeline

Survey visit	Date	Temperature	Weather	Wind	Cloud cover	Rain	Duration
1	15.06.22	20°C	Warm with slight breeze	2	1	0	2h 03min (21:00 – 23:03)
2	28.07.22	13°C	-	0	4	0	1h 45min (03:36 – 05:21)

3	02.08.22	29°C	Very warm and humid	1	7	0	1h 17min (20:34 – 22:19)
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Source: Mott MacDonald Ltd Surveys 2022

3.6.16 Table 3-12 below shows summary statistics for transect 3 (middle transect), which did not have a GPS connection for the survey.

Table 3-12: Species recorded and number of recordings for middle transect on Waterbeach Pipeline aspect of Proposed Development

Species	Number of recordings during the transect
Brown long-eared	1
Common pipistrelle	66
Nathusius' pipistrelle	1
Soprano pipistrelle	6

Source: Mott MacDonald Ltd Surveys 2022

Table 3-13: Species recorded and number of recordings for south transect on Waterbeach Pipeline aspect of Proposed Development.

Species	Number of recordings during the transect
Serotine	1
Myotis spp.	38
Nyctalus spp.	1
Pipistrellus spp.	54
Soprano pipistrelle	115

Source: Mott MacDonald Ltd Surveys 2022

3.7 Static detectors

- 3.7.1 The locations of the static detectors can be viewed in Figure 8.43, Book of Figures – Biodiversity (App Doc Ref 5.3.8).
- 3.7.2 Species/species groups were assessed in the following combinations: big bats (*Nyctalus* spp. and *Eptesicus* spp.), *Myotis* (all *Myotis* spp.), barbastelle (*Barbastella barbastellus*), long-eared bats (*Plecotus* spp.) and pipistrelles (*Pipistrellus* spp.).
- 3.7.3 Static detectors have allowed the relative activity levels between each of the species groups defined in section 3.7.2 to be assessed. Ecobat bat activity analysis was conducted using their analysis tool. Relative activity at the Proposed Development is compared to records from within a 200km radius of the static detector locations. Figure 8.42, Book of Figures – Biodiversity (App Doc Ref 5.3.8), shows the bat activity at the Proposed Development as a percentile of the data available from the 200km radius around the static detector locations. Activity is low, in the bottom 20% when compared to the reference dataset from Ecobat, for *B. barbastellus* and *E. serotinus* at sites 4/4 and 3/4, respectively. *Myotis* spp. activity is in the bottom 20% of relative

activity level across all sites and all dates, suggesting that there is very little *Myotis spp.* activity at the Proposed Development. This low level of activity can be used to infer that there is a low number of *Myotis spp.* present.

- 3.7.4 For Nyctaloid and *Nyctalus* species the nightly activity is high in the percentiles (or simply, higher than average) when compared with the reference dataset from Ecobat, with the majority of these data being over 60%. However, Nyctaloid species are commonly identified down to species level. Where this has been possible, such as with *N. noctule* it is evident that the activity is low when compared to data from within a 200km radius of the static detector locations. This is also evident with the limited data collected from *N. leisleri* at the existing Cambridge WWTP.
- 3.7.5 In a similar fashion to Nyctaloid records identified to *Pipistrellus* are displaying as in the top 20% at all sites where this level of identification occurred. However, once the records are identified to species level, all three *Pipistrellus spp.* are in the bottom 20% across all four detector locations.
- 3.7.6 The following tables show the number of bat passes recorded at each static detector location. A bat pass is defined as a single recording. The tables below show relative activity levels between the species groups outlined above.

Table 3-14: Bat passes recorded by a static detector placed at the existing Cambridge WWTP (TL 47941 61508)

Species/species group	May	July	September
Barbastelle	0	8	3
Big bats	199	1,181	104
Long-eared	2	7	15
Myotis	2	6	12
Pipistrelle	746	857	3,751

Source: Mott MacDonald Ltd Surveys 2021

Table 3-15: Bat passes recorded by a static detector placed within the proposed WWTP site (TL 49847 61223)

Species/species group	May	July	September
Barbastelle	9	0	4
Big bats	9	21	8
Long-eared	0	1	10
Myotis	5	1	52
Pipistrelle	96	113	2,293

Source: Mott MacDonald Ltd Surveys 2021

Table 3-16: Bat passes recorded by a static detector placed near the midpoint of the Low Fen Drove Way CWS (TL 50013 60625)

Species/species group	May	July	September
Barbastelle	13	11	17
Big bats	34	32	33
Long-eared	3	3	4
Myotis	4	13	12
Pipistrelle	2,628	2,708	1,444

Source: Mott MacDonald Ltd Surveys 2021

Table 3-17: Bat passes recorded by a static detector placed near the A14 bridge over the River Cam (TL 48410 61613)

Species/species group	May	July	September
Barbastelle	1	0	21
Big bats	137	4	166
Long-eared	18	0	13
Myotis	33	0	18
Pipistrelle	3,634	24	1,819

Source: Mott MacDonald Ltd Surveys 2021

4 Conclusions

- 4.1.1 Five different survey types were utilised to assess where and how bats are using the habitats at the Proposed Development. Each survey type provides information that allows the presence, likely presence, activity and type of activity to be assessed.
- 4.1.2 Ground level roost assessments, emergence/re-entry, activity and static detector surveys have confirmed that at least nine of the 18 resident UK bat species are present at the Proposed Development site and the existing Cambridge WWTP. The full species list can be found in section 3.2. The majority of the activity is from the *Pipistrellus* genus.
- 4.1.3 Ecobat has provided percentile data drawing upon a database containing records from a 200km radius around the detector locations. A national database of static detector records (Ecobat) was used to compare the data recorded at the Proposed Development and determine the percentiles. Overall activity is low when comparing data from the static detectors deployed at the four locations across the Proposed Development with the Ecobat database. With the exception of higher level (genus and above) identification, activity is in the bottom 20% compared to the reference data set.
- 4.1.4 During 2021 surveys two of the surveyed trees have been confirmed as roosts: one for soprano pipistrelle, one for an unspecified *Pipistrellus* species. These roosts are likely to be day roosts. Neither of these roosts will be lost to the project. The roost located in tree [REDACTED] (TL 50021 60796) may be subject to disturbance during construction.
- 4.1.5 Activity surveys conducted in 2021 show that the main development, i.e., the rotunda footprint, does not have high volumes of bat foraging/commuting activity. They show that Low Fen Drove Way CWS is an important commuting and foraging route for several species of bat.
- 4.1.6 Barbastelle were recorded along the Low Fen Drove Way Grasslands and Hedges County Wildlife Site, particularly along the disused railway section. They are likely to be using this habitat feature as a means to commute and forage. No roosting barbastelle bats were recorded within the survey area.
- 4.1.7 During 2022 surveys for the Waterbeach Pipeline aspect of the Proposed Development five of the trees surveyed were confirmed as roosts. Two of these trees were confirmed during the initial roost suitability assessments. The remaining three were confirmed by emergence and re-entry surveys. None of these five roosts will be lost to the Proposed Development.
- 4.1.8 Activity surveys conducted in 2022 for the Waterbeach Pipeline aspect of the Proposed Development show that there are at least eight species using the habitats around the Waterbeach Pipeline aspect of the Proposed Development. They are using this habitat to forage, commute and roost.

5 References

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