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Begbroke PR8 Policy Area
Ecology Baseline Report

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1 Summary

- 1.1 BSG Ecology was commissioned by the Tripartite in October 2017. This was to undertake ecological surveys to provide baseline ecological information in support of potential development on land east of the A44 at Begbroke, Oxfordshire.
- 1.2 This 'Site', which is approximately 177 ha in extent, is shown in Figure 1. It includes all areas of the draft PR8 site that are owned by the Tripartite. It also includes the draft PR3b site, which is a single field in the south of the Site, adjacent to the railway line.
- 1.3 The Site forms the major part of a draft allocation under Cherwell Local Plan Draft Policy PR8 Land East of the A44¹, for a new urban neighbourhood comprising up to 1950 new homes, the expansion of Begbroke Science park, a secondary school, two primary schools, and associated infrastructure.
- 1.4 This report presents the results of an ecology desk study and a comprehensive set of ecology baseline surveys carried out at the Site in 2017 and 2018. The overall purpose of this work is to provide the ecology baseline information necessary to support an Ecological Impact Assessment of proposed development at the Site.
- 1.5 The scope of this work has been agreed with Cherwell District Council and includes: a desk study, Phase 1 habitat survey update, hedgerow survey, botanical survey, otter and water vole survey, freshwater invertebrate survey, white-clawed crayfish survey, preliminary bat roost appraisal of buildings and trees, bat roost inspection and emergence/re-entry survey, bat activity survey, dormouse survey, breeding bird characterisation survey, badger survey, reptile survey, and great crested newt survey.
- 1.6 Previous ecology-related work at the Site includes a 2015 Biodiversity Survey and Badger Survey, a 2016 statement of key constraints and opportunities, a 2017 soil survey and a 2018 hydrological study.
- 1.7 The main habitats present at the Site are arable land, poor semi-improved grassland, woodland, hedgerows, streams and ditches. Six ponds are present within the Site, as are numerous mature trees, and there are small areas of good semi-improved grassland, scrub, tall ruderal vegetation, amenity grassland, plantation woodland and hardstanding. Buildings are present at Begbroke Science Park in the centre-north of the Site, but outside of areas proposed for development under PR8, and at Parker's Farm within the north-east of the Site. Of these habitats, the woodland and hedgerows, and one of the ponds are Habitats of Principal Importance in England. Of the 53 hedgerows present at the Site, 37 hedgerows are species-rich and 30 are *Important* under the Hedgerow Regulations 1997.
- 1.8 The results of surveys indicate that the Site supports the following protected species: badger (including setts), roosting, foraging and commuting bats, ground and scrub/tree nesting birds, great crested newt, water vole, and reptiles (slow-worm, common lizard and grass snake). Common toad (which is a 'Species of Principal Importance' is also present. Based on surveys, dormouse and white-clawed crayfish are unlikely to be present. Freshwater invertebrate surveys indicate that the stream at the Site, the Rowel Brook, has moderate to good water quality.
- 1.9 A separate report by BSG Ecology, *Begbroke PR8 Policy Area: Potential Ecological Impacts and Opportunities*, provides advice on potential ecological impacts and opportunities of the PR8 development, based on the baseline information provided in the current report.

¹ In *Cherwell Local Plan 2011-2031 (Part 1): Partial Review – Oxford's Unmet Housing Need*. Pages 120–126). <https://www.cherwell.gov.uk/downloads/download/1228/pr73-cherwell-local-plan-2011-%E2%80%93-2031-part-1> [accessed 29/11/18].

2 Introduction

Background to commission

- 2.1 BSG Ecology was commissioned by the Tripartite in October 2017. This was to undertake and report ecological surveys to provide baseline ecological information in support of potential development on land east of the A44 at Begbroke, Oxfordshire.

Site description

- 2.2 This 'Site', which is approximately 177 ha in extent, is shown in Figure 1. It includes all areas of the draft PR8 site that are owned by the Tripartite. It also includes the draft PR3b site, which is a single field in the south of the Site, adjacent to the rail line.
- 2.3 It is located south and east of the Village of Begbroke, and extends south to the village of Yarnton and east to the Village of Kidlington. It includes Begbroke Science Park in its northern part (though no new development is proposed there under PR8), and surrounds a former landfill site towards its centre. The A44 Woodstock road forms part of the western boundary, and the Oxford Canal forms part of the eastern boundary. The Site is crossed east-west by the minor road Sandy Lane, and north-south by the Oxford to Banbury railway line.
- 2.4 The Site is predominantly arable farmland with hedgerows and some grassland. The only buildings within the Site boundary are at Begbroke Science Park and two large modern barns and a smaller stone shed at Parker's Farm in the north-east corner of the Site.

Description of project

- 2.1 The Tripartite is promoting the Site for development.
- 2.2 The Site forms the major part of a draft allocation under Cherwell Local Plan Draft Policy PR8 Land East of the A44², for a new urban neighbourhood comprising up to 1950 new homes, the expansion of Begbroke Science Park, a secondary school, two primary schools, and other supporting uses.
- 2.3 The Draft Policy PR8 policies Map proposes that the majority of the centre and south of the Site will be allocated to residential use and schools), an arc around the north of Begbroke Science Park will be allocated to employment use (i.e. expansion of the Science Park), and the north and east of the Site will be allocated to a variety of greenspace uses.

Scope of this report

- 2.4 This report presents the results of a comprehensive set of baseline ecology survey work relating to the Site that was undertaken between October 2017 and October 2018, including desk study work and consultation (regarding the scope of this work) with statutory agencies, including Cherwell District Council, Natural England and the Environment Agency.
- 2.5 The overall purpose of the baseline surveys is to provide the ecology baseline information necessary to support an Ecological Impact Assessment of a proposed development at the Site.
- 2.6 The specific aims of the ecology baseline surveys work are as follows:
- To establish whether any designated wildlife sites are present within or close to the Site, and to provide a summary of their wildlife interest.

² In *Cherwell Local Plan 2011-2031 (Part 1): Partial Review – Oxford's Unmet Housing Need*. Pages 120–126). <https://www.cherwell.gov.uk/downloads/download/1228/pr73-cherwell-local-plan-2011-%E2%80%932031-part-1> [accessed 29/11/18].

- To map and describe the habitats present within the Site, and to collect botanical information to a level of detail sufficient to allow them to be evaluated against local and national criteria.
- To determine the potential of the Site to support any species that are legally protected or any species or species groups that are otherwise of conservation interest.
- To determine whether any such species or species groups are present at the Site and to provide information on their distribution within and their use of the Site.

2.7 A separate report *Begbroke PR8 Policy Area: Potential Ecological Impacts and Opportunities* (BSG Ecology, 2018) provides advice on potential ecological impacts and opportunities of the PR8 development, based on the baseline information provided in the current report and based on consultation with statutory agencies.

3 Previous ecology survey work

- 3.1 Previous relevant survey or desk study work containing baseline ecological information is summarised below.
- 3.2 Previous work focusing on ecological constraints and opportunities or on potential ecological impacts is not included here but is summarised in the accompanying report: *Begbroke PR8 Policy Area: Potential Ecological Impacts and Opportunities* (BSG Ecology, 2018).

2010 ecological assessment for Begbroke Science Park

- 3.3 An ecological survey and assessment was carried out in support of the planning application for a new access road from the A44 Woodstock Road to Begbroke Science Park (Applied Ecology Ltd., 2010). This assessment covered a narrow corridor of land in the north-west of the Site, west of the Science Park and was based on a habitat survey, a badger survey, and a ground-based assessment of buildings and trees to determine their potential to support roosting bats.
- 3.4 The assessment noted potential for great crested newt in ponds in the vicinity of the area surveyed, potential for bats to roost in two buildings, and the presence of a main badger sett and an outlier sett nearby. It specified appropriate ecology mitigation, including the installation of a badger tunnel under the new access road.

2015 biodiversity survey

- 3.5 BSG Ecology carried out a biodiversity survey of the PR8 site in January 2015 (BSG Ecology 2015a, 2015b) comprising a desk study, extended Phase 1 habitat survey and a badger survey, and an assessment of the likely ecological impacts and mitigation options for development.
- 3.6 The updated desk study is reported in Section 6 of this report and is therefore not summarised here.
- 3.7 Habitats identified at the Site included arable land, semi-improved neutral grassland, species-poor semi-improved grassland, improved grassland, broad-leaved semi-natural woodland, plantation woodland, hedgerow, scrub, tall ruderal vegetation, swamp, running water (the Rowel Brook and an inflowing stream), ditches, ponds, mature and semi-mature trees, buildings and hard standing.
- 3.8 Evidence of badger *Meles meles* (including badger setts) was found in several location on and adjacent to the Site.
- 3.9 The Site was considered to have the potential to support the following protected or notable species: roosting, foraging and commuting bats, otter *Lutra lutra*, water vole *Arvicola amphibia*, dormouse *Muscardinus avellanarius*, breeding birds (including kingfisher *Alcedo atthis*, barn owl *Tyto alba* and farmland birds), reptiles and great crested newt *Triturus cristatus*. Surveys were recommended for these species. Surveys were also recommended to determine the nature conservation value of hedgerows and semi-improved grassland at the Site.

2018 ecology reports for Begbroke Science Park

- 3.10 BSG Ecology carried out biodiversity surveys over the period January to June 2018 in support of a planning application for building works at Begbroke Science Park. These included a desk study, Phase 1 habitat survey, reptile survey and great crested newt survey (BSG Ecology, 2018a and 2018b). The great crested newt survey recorded a maximum count of two animals in the formal ponds at Begbroke Science Park, and found no evidence of reptiles there. Since these surveys were carried out in concert with the surveys detailed within this report, these results are subsumed into Section 6.

4 Consultation

Cherwell District Council

4.1 Charlotte Watkins, Ecology officer at Cherwell District Council was consulted by email on 22 January 2018 by Tom Flynn of BSG Ecology, regarding the proposed scope of baseline ecology surveys for the Site. The 2015 Biodiversity Survey report (BSG Ecology, 2015) was also provided.

4.2 Charlotte responded on 5 February 2018, including the following:

“The scope of the surveys proposed looks generally fine at this stage. My main comments would be that there is no justification for not including invertebrate surveys and some of the habitat (from a desk top study) looks potentially important in this regard? and that the need for winter bird surveys should be based on the updated Phase 1.”

4.3 The term “no justification” is interpreted to mean that no justification was provided in the information submitted.

4.4 Tom Flynn responded on 12 February, providing the required justification, and explaining that terrestrial invertebrate surveys and winter bird surveys were not considered proportionate or necessary at the Site and providing the context and justification for this view. It was also noted that the Phase 1 habitat survey had not yet been updated, but walkover surveys of the Site (for the purposes of the badger survey) conducted in January and February 2018 had revealed no significant changes in land use at the Site.

4.5 There were no further comments from the Cherwell District Council Ecology Officer.

Natural England and Environment Agency

4.6 Consultation with these two government agencies was carried out with regard to potential ecological impacts of development at the Site. This is therefore discussed in the accompanying report *Begbroke PR8 Policy Area: Potential Ecological Impacts and Opportunities* (BSG Ecology, 2018).

5 Methods

Desk study

- 5.1 In order to obtain information on designated wildlife sites in the vicinity of the Site, together with historical records of protected species (or species that are otherwise of conservation interest) a data search was requested from the Thames Valley Environmental Records Centre (TVERC) on 06 December 2017. Data was received from TVERC on 20 December 2017 and included the following:
- Information on non-statutory wildlife sites within 2 km of any part of the Site centre.
 - Records of protected, notable³ and invasive species from within 2 km of any part of the Site.
- 5.2 A search for statutory designated wildlife sites was carried out on 05 December 2017 (and repeated on 12 October 2018) by searching the UK Government MAGIC⁴ website for the following:
- Information on International/European wildlife sites within 10 km of any part of the Site.
 - Information on statutory wildlife sites within 5 km of any part of the Site centre.
 - Information on ancient woodland within 3 km of any part of the Site centre.
- 5.3 Great crested newts can use terrestrial habitat up to 500 m from breeding ponds (English Nature, 2001) and therefore searches were carried out in January 2018 for ponds within 500 m of the Site using Ordnance Survey (OS) mapping available from the Multi-Agency Geographical Information for the Countryside (MAGIC) website.
- 5.4 Aerial imagery and OS mapping of the Site and surrounding area available at Bing⁵ and Google Maps⁶ were accessed over the period 2017 to 2018 to aid in the various ecology surveys that were carried out at this time.
- 5.5 The reports of previous surveys relating to the Site noted in Section 3 *Previous ecology survey work* were also reviewed as part of the ecology desk study.

Extended Phase 1 habitat survey

- 5.6 A Phase 1 habitat survey of the Site, based on standard industry guidance (JNCC, 2010), was carried out on 16 and 17 April and on 23 and 31 May by Dr Tom Flynn MCIEEM, Senior Ecologist at BSG Ecology. This survey updated a previous Phase 1 habitat survey of the Site carried out by the same surveyor on 8–12 January 2015 (and reported in BSG Ecology, 2015).
- 5.7 The extent of the Phase 1 habitat survey is indicated in Figure 2.
- 5.8 Habitats present at the Site were identified and mapped onto an Ordnance Survey base map, with any features of particular ecological interest target noted.
- 5.9 Lists of dominant plant species were collected for all habitats of potential conservation significance in a series of target notes to accompany the Phase 1 habitat plan.
- 5.10 It should be noted that species lists derived from the target notes are not necessarily an exhaustive inventory of all species occurring at a Site. They are intended to illustrate the character of habitats present, general species richness of a particular area, and draw attention to any species that may

³ “Notable” species in this context are those listed as notable in the TVERC database, indicating that they are included on any of various lists of species of conservation concern or priority at the local, regional or national level (e.g. the red data lists, Oxfordshire rare plants register, etc).

⁴ Multi-agency Geographical Information for the Countryside: www.magic.gov.uk.

⁵ www.bing.com/maps

⁶ www.google.uk/maps

be considered uncommon or unusual. The habitat surveys were conducted on days when the weather conditions were calm and dry and the weather did not constrain this work. The survey visits were carried out within the optimal time-of-year for Phase 1 habitat surveys (JNCC, 2010).

- 5.11 The Phase 1 habitat survey was 'extended' to give consideration to the potential of the habitats present at the Site to support protected species or species otherwise of conservation interest. This included a preliminary appraisal of the potential value of the Site for bats.

Hedgerow survey and assessment

- 5.12 In order to evaluate the conservation significance of hedgerows present at the Site, hedgerow surveys and assessment were carried out at the Site on 31 May 2018 by Kate Rooney GradCIEEM, Ecologist at BSG Ecology and on 02 and 03 October 2018 by Tom Flynn MCIEEM, Senior Ecologist at BSG Ecology. These surveyors have previous experience of hedgerow surveys. The surveys were undertaken a suitable time of year for hedgerow surveys (Defra, 2007).
- 5.13 All hedgerows present were mapped on to Ordnance Survey base maps of the Site (for hedgerow locations see Figure 3). The average numbers of woody and woodland species (as defined in the Hedgerow Regulations 1997) were recorded for each hedgerow. Hedgerows were placed into the categories 'species-rich' or 'species-poor' by the surveyor, based on whether the average number of woody species present in a 30 m length was five or more ('species rich') or fewer than five ('species poor') (see Defra, 2007). Hedgerows were also subject to the collection of further information, including the presence of: a bank or wall, less than 10% gaps, trees, woodland species, adjacent ditches, parallel hedgerow (within 15 m) and connections to other ecological features such as woodlands, ponds and other hedgerows.
- 5.14 Freely available aerial imagery from Bing Maps (www.bing.com/maps) was used to aid in the locating and mapping of hedgerows by indicating their lengths and the presence of significant gaps.
- 5.15 The above information was used to identify hedgerows at the Site meeting the criteria for determining 'Important' hedgerows under *Wildlife and Landscape* in Schedule 1 of the Hedgerow Regulations 1997.

Botanical survey

- 5.16 In order to obtain more detailed information on the conservation value of grassland at the Site, a botanical survey was undertaken on 31 May 2018 by Dr Tom Flynn MCIEEM, Senior Ecologists at BSG Ecology, who has experience of botanical survey and evaluation.
- 5.17 The area subject to detailed botanical survey (which includes four pasture fields at the east of the Site and an area of grass and scrub adjacent to the west of the rail line), is indicated in Figure 4.
- 5.18 Woodland at the Site was not subject to detailed botanical survey because its status as a valuable habitat, to be retained in the proposed development was clear from the results of the Phase 1 habitat survey. The areas of grassland at the Site required more detailed information for their conservation value to be determined.
- 5.19 The grassland survey involved the surveyor marking out five quadrats (each 2 m × 2 m in size, marked out using tape measures) in typical stands of vegetation in each of the four survey fields to the east of the railway line. For the small area of grassland just east of the railway line, two quadrats were taken in grassland and two in tall ruderal vegetation. The small size of these areas meant that further quadrats were considered unnecessary to characterise this vegetation. The area of scrub dominating the centre of this latter field was not subject to quadrat survey because the density of this scrub prevented access. A species list for this scrub was produced based on observations from the exterior, including estimation of relative abundance using the DAFOR⁷ scale.

⁷ DAFOR is a scale of relative abundance that is frequently used in habitat and botanical surveys, with the following categories: D: dominant; A: abundant; F: frequent; O: occasional; R: rare.

- 5.20 For each quadrat, the surveyor identified all vascular plant species present and estimated their percentage cover classes using the Domin scale (Rodwell *et al*, 1992). Where noted, bryophytes (mosses and liverworts) were also recorded, though a detailed search/survey for these species was not carried out.
- 5.21 Quadrat data were tabulated using Microsoft Excel and sorted into a floristic table (as used in Rodwell *et al*, 1992). Data analysis involved the following methods:
- The vegetation community identification keys in Rodwell *et al* (1992) were used to identify plant communities, based on the data in the floristic table.
 - The floristic tables were compared (by inspection) with those of Rodwell *et al* (1992).
- 5.22 A written summary of each of the grassland in each of the surveyed fields was also produced.
- 5.23 The conservation value of the grassland in the survey area was evaluated with reference to the following:
- BRIG (2011) *UK Biodiversity Action Plan Priority Habitat Descriptions*. JNCC. This was used to identify Habitats of Principal Importance in England (HPIs), designated under Section 41 of the NERC Act, 2006.
 - Stroh *et al* (2014) *A Vascular Plant Red List for England*. BSBI.
 - TVERC & BMERC (2009) *Criteria for the Selection of Local Wildlife Sites in Berkshire, Buckinghamshire and Oxfordshire*. TVERC.
 - Oxfordshire Flora Group (2015). *Oxfordshire Rare Plant Register*. ANHSO.

Badger Survey

- 5.24 In order to obtain information on the presence and use of the Site by badgers, and on the location of any badger setts, the Site was subject to a badger survey by Dr Tom Flynn and Helen Simmons on 23 January 2018 and by Dr Tom Flynn on the 23 February 2018. This was updated with incidental observation made during ecology surveys carried out across the Site by various ecologists employed by BSG Ecology between April and October 2018, including during the Phase 1 habitat survey of the Site. The badger survey covered all areas within the Site. Where evidence of badger in adjacent areas was seen from the Site, this was also recorded.
- 5.25 The badger survey involved searching for and mapping (using a hand-held GPS receiver) any field sign of badger, such as latrines, obvious pathways used by badger and locations of setts. Several categories of badger setts have been identified as described below (adapted from Neal and Cheeseman, 1996; Harris *et al.*, 1994):
- Main sett - Normally where cubs are raised and in continuous and regular use throughout the year. Typified by large spoil heaps and well-trodden paths. There can be many entrances to the sett (often with some of these disused), although a main sett can sometimes only have a single entrance.
 - Annexe setts - Intermediate-sized and may be used by breeding badgers. Normally close to a main sett and connected to it by obvious paths. They may not be in use all the time, even if the main sett is very active.
 - Subsidiary sett - Similar to annexe setts but are likely to be further away (at least 50 m from the main sett) and not as well connected to the main sett as annexe setts. May only be used intermittently.
 - Outlier setts - Small setts with one or two entrance holes which are used sporadically by badgers as a temporary refuge (Neal & Cheeseman, 1996). Spoil heaps are likely to be small and there may not be obvious paths connecting to other setts. Use may be sporadic. There may be several outlier setts within one badger social group's territory (Neal & Cheeseman, 1996).

5.26 For all badger sett entrance holes that were found, an indication of the level of activity was also recorded according to Harris et al. (1989), as follows:

- Active - active sett entrances contain no debris or vegetation, are obviously regularly used and often show signs of having been recently excavated.
- Partially used - partially used entrances are those not in regular use, and which may have debris (leaf litter, twigs, moss, etc.) around the entrance. However, they could potentially be used regularly in the future with minimal clearance necessary.
- Disused - disused sett entrances show signs of not having been used for a considerable period of time and would not be used again without extensive clearance by a badger.

Bat Survey

Assessment of Buildings

5.27 A preliminary ground level roost assessment was carried out on 23 January 2018 by Dr Tom Flynn MCIEEM, Senior Ecologist at BSG Ecology and Helen Simmons, ACIEEM (who holds Natural England bat licences (numbers 2015-10061-CLS-CLS and 2015-10063-CLS-CLS). This survey was carried out to determine the potential of buildings that could be affected by the proposed development to support roosting bats. The survey was based on industry standard guidance (Chapters 4 and 6 of Collins, 2016). Buildings were allocated to the following categories of suitability for bats, based on the above guidance: Negligible, Low, Moderate or High. Notes of building structure and any potential bat roost features that were visible were also made during the survey.

Emergence/re-entry survey of Buildings

5.28 Emergence/re-entry surveys were carried out at the stone shed at Parker's Farm (building A3 on Figure 6c), which is the only building with potential to support roosting bats within the Site, in order to determine whether it is being used by roosting bats. In line with the guidance in Chapter 7 of Collins (2016) and the moderate bat potential assigned to this building, the survey involved one dusk emergence survey (on 09 August 2018) and one dawn re-entry survey (on 28 September 2018).

5.29 Emergence/re-entry surveys were also carried out at the Begbroke Hill Farmhouse building complex at Begbroke Science Park (buildings 2a to 2e on Figure 6d), which was assessed as having high potential to support roosting bats. This building is outside of the area proposed for new development under PR8, and no direct effects on this building from PR8 are therefore anticipated. However, given the potential for this building to support a roost of high conservation significance, and the fact that the Science Park (and hence this building) will be surrounded by new development under PR8, it was considered appropriate to obtain more information on the any use of the building by bats. Internal surveys were not considered safe due to the lack of asbestos survey information for the building, and for this reason emergence/re-entry surveys were carried out instead. In line with the guidance in Chapter 7 of Collins (2016) and the high bat potential assigned to this building, the survey involved two dusk emergence surveys (on 01 and 22 August 2018 at the main farmhouse and on 31 July and 23 August 2018 on a building to the south-west of this) and one dawn re-entry survey (on 5 September 2018 on the main farmhouse and on 6 September 2018 for the building to the south-west of this). Buildings at Begbroke Science Park with negligible or low suitability to support roosting bats were not subject to emergence/re-entry surveys.

5.30 The emergence and re-entry surveys were carried out in accordance with industry standard guidance (Chapter 7, Collins, 2016). Numbers and positions of surveyors for each survey visit were determined by Helen Simmons ACIEEM, Ecologist at BSG Ecology, who holds Natural England bat licences (numbers 2015-10061-CLS-CLS and 2015-10063-CLS-CLS). Numbers of surveyors viewing each building on each survey visit and dates of survey visits are provided in Table 1. Where buildings were adjacent and within a surveyor's field of view, multiple buildings were

surveyed by one surveyor. Buildings at the Site that were assessed as having negligible value for roosting bats were not subject to these, or any further, surveys.

Table 1: Dates of emergence surveys and numbers of surveyors employed.

Location	Building Number	Number of Surveyors	Bat Potential	Survey Visit		
				1	2	3
Stone Barn at Parkers Farm	A3	2	Moderate	09/08/18 Dusk	28/09/18 Dawn	N/A
Begbroke Hill Farmhouse and adjacent buildings	B2c & B2e	4	High	01/08/18 Dusk	22/08/18 Dusk	05/09/18 Dawn
Building south – west of Begbroke Hill Farmhouse	B2d	2	High	31/07/18 Dusk	23/08/18 Dusk	06/09/18 Dawn

- 5.31 The numbers of emergence/re-entry survey visits met the number required under the standard guidance (Chapter 7 of Collins, 2016).

Assessment of Trees

- 5.32 In order to assess trees with the potential to be affected by the proposed development for their potential to support roosting bats, a preliminary ground level roost assessment was carried out on 2 and 3 October 2018 by Dr Tom Flynn. The survey was based on industry standard guidance (Chapters 4 and 6 of Collins, 2016).
- 5.33 All trees present within or on the boundary of areas of the draft Policy PR8 plan (see Appendix 1) proposed for built development were surveyed. Trees were allocated to the following categories of potential suitability for bats, based on Table 4.1 in Collins (2016): Negligible, Low, Moderate, or High as per the above guidance. Locations of trees with Low, Moderate and High suitability were mapped using a handheld GPS receiver. Trees with Negligible suitability for roosting bats were not mapped. This survey was also extended to the draft policy PR3b area.
- 5.34 Trees within parts of the PR8 area not proposed for built development (e.g. the proposed Local Nature Reserve, Nature Area, Parkland, and Retained Agricultural Land) were not subject to survey because trees in these areas are not likely to be affected by the proposed development.

Inspection of Trees

- 5.35 Trees at the Site assessed as having moderate or high suitability to support bats (in the bat potential assessment), or for which roosting potential could not be confidently determined from the ground, were subject to ground level or climbed roost inspections (as appropriate). Ground level inspections with an endoscope were carried out on 19 October 2018 by Helen Simmons ACIEEM (who holds Natural England bat licences (numbers 2015-10061-CLS-CLS and 2015-10063-CLS-CLS), covering trees T5, T6 and T10. A climbing inspection was carried out by Karl Lofthouse, an independent licensed bat worker and trained tree climber, and an assistant, on 26 October 2018, covering tree T9. Tree T3 was considered to have moderate bat potential, but was considered unsafe to climb, due to fungal rot being present.

Transect Surveys

- 5.36 In order to provide information on the level of bat activity at the Site, walked dusk transect surveys based on standard industry guidance (Chapter 8 in Collins, 2016) were carried out in October 2017 and approximately monthly over the period April-September 2017. Survey dates are shown in Table 2.

Table 2: Dates and weather conditions of monthly bat activity transect surveys.

Visit	Date	Surveyors	Temperature (start–end °C)	Wind (start–end, Beaufort)	Cloud (start–end, Oktas)	Rain
1	10.10.17	Sarah Joscelyne , Ashley Sendell-Price, Tom Flynn, Elly Pattullo	17-14	3-1	3-6	None
2	26.04.18	Thomas Flynn, Melanie Sanders, David Kent, Mia Milsom	11-6	2-1	4-2	None
3	23.05.18	Thomas Flynn, Mark Norriss, Sarah Joscelyne, Joe Bishop	16-13	4-2	8-7	None
4	26.06.18	Thomas Flynn, Sarah Joscelyne, Joe Bishop, Kate Rooney	20-17	1-1	0-0	None
5	17.07.18	Sarah Joscelyne, Elly Pattullo, Thomas Flynn, Kate Rooney	18-15	3-2	6-5	None
6	15.08.18	Joe Bishop, Ashley Sendell-Price, Sarah Joscelyne, Elly Pattullo	20-17	4-3	8-6	None
7	10.09.18	Mark Norriss, Elly Pattullo, Sarah Joscelyne, Ashley Sendell-Price	18-19	4-1	8-6	None

- 5.37 The main aim of the transect surveys was to aid the characterisation of the bat assemblage, and patterns of bat activity and to determine the location of any areas with higher levels of bat activity, such as potential foraging areas and/or commuting routes. Accordingly, the selected transect route was designed to sample areas of the Site which support habitat suitable for use by bats (based on the guidance in Chapter 4 of Collins, 2016). Survey effort was based on the assessment of the Site having moderate value for bats (based on the results of the previous Phase 1 habitat survey (BSG Ecology, 2015) and on the guidance in Table 4.1 of Collins (2016).
- 5.38 Two transect routes were mapped out with each transect survey involving two surveyors walking predetermined routes through the Site (see Figure 6a) whilst recording bats. Bat activity was recorded using Anabat express or Anabat SD1 hand-held electronic bat detectors. These models of detector automatically record all bat passes, allowing species identification to be confirmed by analysis of call characteristics. Where bats were seen, surveyors recorded the observed behaviour and numbers of bats onto a field survey form. Field notes included a record of the time of each bat encounter, thus allowing results to be cross-referenced with the calls recorded using the bat detectors.
- 5.39 The two transects cover the majority of the field boundaries at the Site. Transect 1 passes around the fields surrounding Begbroke Science Park, past Begbroke Hill Farmhouse within the Science Park, around agricultural buildings at Parker's Farm, runs adjacent to and crosses Sandy Lane and runs along much of the perimeter of the old landfill site which is located in the centre of the Site (though outside the Site boundary due to separate ownership). This transect does not pass through two fields in the north of the Site which are proposed as a Local Wildlife Site in the draft PR8 plan, because impacts from the proposed development in this location are unlikely.
- 5.40 Transect 2 follows field boundaries in the east of the Site (which are dominated by hedgerows with trees), this includes a section adjacent to the Oxford Canal at the east of the Site, a section of Yarnton Lane byway (which is unsuitable for motor vehicles and bordered on both sides by deep

diches and hedgerows with abundant mature trees), and a section along the southern boundary of the Site which is adjacent to a hedgerow dominated by mature trees located adjacent to the south of the boundary.

- 5.41 Transect surveys were carried out in suitable weather conditions. Weather conditions are shown in Table 2. Transects commenced at or before sunset and finished 2 to 2.5 hours after sunset. The timing of the surveys covered the bat emergence period and the period of most intense foraging activity when invertebrate prey is most abundant (Altringham, 2003). The direction and start point of each transect route was altered for each survey to ensure that different parts of the Site were surveyed at different times of the night.
- 5.42 Surveyors participating in activity survey transects are listed in Table 3. Each transect was led by a surveyor with experience in undertaking bat activity transects.

Table 3: Surveyors participating in transect surveys.

Surveyor	Job title	CIEEM status
Thomas Flynn	Senior Ecologist, BSG Ecology	MCIEEM
Mark Norris	Ecologist, BSG Ecology	GradCIEEM
Sarah Joscelyne	Ecologist, BSG Ecology	
Kate Rooney	Ecologist, BSG Ecology	GradCIEEM
Ashley Sendell-Price	Ecologist, BSG Ecology	
Elly Pattullo	Ecologist, BSG Ecology	
Mia Milsom	Ecologist, BSG Ecology	
David Kent	Ecologist, self-employed	ACIEEM
Joe Bishop	Ecologist, BSG Ecology	

Automated Surveys

- 5.43 Automated detector surveys were conducted at the Site, based on standard industry guidance (Chapter 8 of Collins, 2016). These surveys employed Wildlife Acoustics Song Meter 4 (SM4) bat detectors. These are full spectrum detectors that trigger automatically to record bat echolocation calls, and can be deployed and left to remotely record bat activity for a period of several nights. Detector locations are shown in Figure 6a.
- 5.44 These detectors were deployed for at least five nights at three pre-defined locations within the Site in October 2017 and monthly over the period April–September 2018. One of these locations (2a) was changed (to 2b) after the first two months of survey. The rationale for choosing the locations (shown in Figure 6a), and changing Location 2 is provided in Table 4. The survey periods were: 4–10 October 2017, 24–30 April, 23–31 May, 26 June–2 July, 17–23 July, 16–21 August and 19–25 September 2018.

Table 4: Static bat detectors locations.

Location	Location and Features	Reason for inclusion in survey
1	Southern edge of shelterbelt of trees along southern boundary of Begbroke Science Park.	To determine the extent of bat activity associated with the trees around Begbroke Science Park and with the old entrance road to the Science Park (and its associated trees and hedgerows). This location is also the part of the Site that is closest to Begbroke Hill Farmhouse which was considered likely to (and subsequently was found to) support roosting bats, and there is potential for the shelterbelt of trees here to be affected by the Proposed Development.