2a	Site boundary adjacent to western side of railway line in south of Site. Microphone pointing	To determine use of the railway corridor as a route through the Site by bats. This location was used only for the October 2017 and April 2018 deployments. Thereafter it was decided that a location on Sandy Lane would be more useful (see 2b below), since this road and its associated hedgerows are likely to be of more value to bats, and will be bordered (and potentially affected) by development to the north and south under the PR8 development, whereas the railway corridor will be bordered by large areas of greenspace to the east.
2b	Northern side of hedgerow on Southern side of Sandy Lane, towards the centre of the site.	To determine the extent to which Sandy Lane is used by bats. This road and its associated hedgerows appear to provide useful east-west habitat connectivity across the centre of the Site. It could also provide a commuting route between any bat roosts in the two semi-detached houses the centre of the Site (building C on Figure 6c) and suitable foraging habitat to the east (e.g. the Oxford Canal) or west (e.g. gardens at Yarnton). Given that these buildings are outside the Site boundary due to separate ownership, and were not accessible for detailed surveys, the use of this static detector will also provide valuable information on the potential of this building to support significant bat roosts.
3	Close to southern boundary of site, adjacent to boundary ditch and hedgerow with mature trees.	To determine the extent to which this hedgerow is used by bats. It appears to provide useful east-west habitat connectivity in the south of the Site. This hedgerow would be bordered and potentially affected by development to the north under PR8.

5.45 The detectors were programmed to begin recording at half an hour before sunset and to stop half an hour after sunrise, allowing continuous monitoring to take place during the period when bats are active (i.e. sunset to sunrise). There were no detector failures during the survey.

Call identification

5.46 Bat audio data collected during transect and static surveys were analysed using Kaleidoscope Pro software to identify bat species and to assess activity levels at different times during the night period. Each bat call identified was manually checked by an ecologist experienced in sound analysis. Bat calls associated with emerging or re-entering bats (confirmed visually) during emergence/re-entry surveys were also subject to analysis.

5.47 Wherever possible the calls were identified to species level. However, due to the similarity of call characteristics which can prevent reliable species identification, species of the genus *Myotis* were grouped together and recorded as *Myotis* sp. Pipistrelle bat (*Pipistrellus* sp.) calls have been separated out into individual species where possible on the following basis:

- Common pipistrelle *Pipistrellus pipistrellus*: peak frequency ≥42 to <49 kHz
- Soprano pipistrelle *Pipistrellus pygmaeus*: peak frequency 51 kHz or above
- Nathusius' pipistrelle *Pipistrellus nathusii*: peak frequency <39 kHz

5.48 However, pipistrelle calls with intermediate characteristics cannot always be reliably separated. These calls were classified as follows, based on measurements of peak frequency:

- For calls with intermediate characteristics the following categories were used:
- "Pipistrelle 50 kHz" (calls within the ≥49 and <51 kHz range): These are indeterminate calls which could originate from either common or soprano pipistrelle bats.
- "Pipistrelle 40 kHz" (calls within the ≥39 and <42 kHz range): These are indeterminate calls which could originate from either common pipistrelle or Nathusius' pipistrelle bats.

5.49 Some of the calls produced by noctule bats *Nyctalus noctula* and Leisler's bats *Nyctalus leisleri* have overlapping characteristics, which can prevent reliable separation if the call recording quality is poor. Such calls were therefore identified simply as *Nyctalus* sp.

5.50 Similarly, some calls produced by brown long-eared bats *Plecotus auritus*, *Myotis* bats, and serotine bats *Eptesicus serotinus* can have overlapping characteristics, particularly when a call is poorly or partially recorded. Where such calls have been recorded they have been identified during the analysis as "indeterminate calls".

5.51 The data provided by automated bat detectors was entered into and analysed using a Microsoft Excel spreadsheet in order to determine the total number of bat passes recorded and also the pass rate (i.e. the average number of bat passes recorded per hour of night). It is difficult to assess actual bat numbers from the information collected by static bat detectors. Where multiple bat calls are recorded these could, for example, either have been produced by a single bat repeatedly flying back and forth past the detector or by multiple bats, each flying past on a single occasion. The data obtained therefore provides a relative measure of bat activity at different locations and at different times, rather than a measure of population size.

Table 5: Dates and conditions for reptile surveys.

Visit no.	Date	Surveyors	Temperature (°C)	Cloud (Otkas)	Weather Notes
Setup	14.03.2018	MN	N/A	N/A	N/A
1	13.10.2018	JP	10-11	8	Occasional sun Light wind
2	19.04.2018	PN + JB	11-19	0	Very light breeze, strong sun
3	25.04.2018	JB	10-13	5-7	Light wind, occasional sun, Rain at end of survey
4	01.05.2018	JB	10-13	0-4	Strong sun, light wind
5	08.05.2018	JB	16-19	0	Strong sun, light wind
6	14.05.2018	JB	15-18	0	Strong sun, light wind
7	25.05.2018	JB	14-17	8	Rain all morning prior to survey, light wind

Dormouse Survey

5.52 In order to determine whether dormouse *Muscardinus avellanarius* is present at the Site a dormouse survey was carried out in 2018. The survey targeted hedgerows at the Site that provide suitable habitat for this species and are likely to be affected by the Proposed Development. Hedgerows in areas proposed for greenspace under PR8 were not surveyed because adverse effects there are unlikely. Two hedgerows that run south of Begbroke Science Park (along the old access road) are heavily managed by trimming. They are heavily dominated by ivy and are species-poor. They are considered to provide poor habitat for dormouse and were therefore not surveyed.

5.53 The survey method and effort was based on industry standard guidance (Bright et al., 2006). A total of 170 dormouse survey nest tubes (of standard industry specification) were set out at approximately 20 m intervals in areas of suitable habitat on 28 March by John Baker MCIEEM, Senior Ecologist at BSG Ecology (Natural England dormouse survey licence; 2016-22591-CLS-CLS) and Joe Bishop, Ecologist at BSG Ecology. Locations of tubes are shown in Figure 7. Survey visits to examine the nest tubes to look for signs of dormouse (e.g. characteristic nests or hairs, or the animals themselves) were carried out approximately monthly between July 2018 and end-September 2018 by John Baker.

5.54 Survey tubes were checked for signs of dormouse on 1 June, 29 June, 31 July, 4 September, 1 October and 1 November 2018. Using the points-based system to assess survey effort of Bright et al. (2006), this survey achieved a score of 22 points. Taking into account the fact that 230 (rather than the minimum number of 50) nest tubes were deployed, the score was doubled, in line with

standard industry guidance (Natural England, 2015a). The score, of 44 points is therefore well above the minimum of 20 points recommended for determining absence of dormouse (Bright et al., 2006).

Water Vole Survey

5.55 In order to determine whether water vole is a present at the Site, surveys for this species were carried out over the period 2017–2018, based on standard industry guidance (Dean et al., 2016). The survey covered all suitable habitat for this species that is present at the Site, which comprises the Rowel Brook in the north of the Site and a tributary which flows into this from the east. Several ditches in the south-east of the Site were also surveyed (primarily because of historical records of the species from this location that were obtained in the desk study (see Results section), although these were considered to offer relatively poor habitat for water vole currently, due to the lack of water and/or riparian vegetation there.

5.56 A survey visit undertaken on 19 October 2017 by Peter Newbold MCIEEM, Principal Ecologist at BSG Ecology, and Elly Pattullo, Ecologist at BSG Ecology, covered all of the above areas. A survey visit on 24 April 2018 by Sarah Joscelyne, Ecologist at BSG Ecology, and Connor Butler, Ecologist at BSG Ecology, covered the eastern part of the Rowel Brook (and its tributary). A survey on 02 Oct by Tom Flynn MCIEEM, Ecologist at BSG Ecology and Peter Newbold MCIEEM, Principal Ecologist at BSG Ecology covered the remaining areas that were not surveyed in April 2018. All surveys were led by staff with experience in carrying out surveys for water vole.

5.57 On each survey visit, all accessible stretches of the stream or ditch within or on the boundary of the Site were surveyed. The survey involved systematically searching for evidence of water vole, including: latrines (communal areas of droppings), feeding stations, grazed lawns, burrows, runs and footprints. The habitats present were also assessed for their suitability to support the species (based on characteristics of the banks, channel depth and vegetation cover). Survey timing and effort took into account the recommendations of industry standard guidance (Dean et al., 2016).

5.58 Small parts (estimated at less than 5% of the total length) of the Rowel Brook were inaccessible during the survey due to the presence of dense scrub. Given that water vole was found to be present at the Rowel Brook during the survey, so long as it is assumed that it could be present anywhere along this watercourse within the Site (though some parts are more suitable than others), this limitation will not adversely affect the assessment of the ecological impacts of the proposed development.

5.59 Ditches forming the southern boundary of the Site east of the railway line are outside the Site boundary and were not surveyed.

Otter Survey

5.60 In order to determine whether otter is present at the Site, an otter survey was conducted by searching for signs of this species during the water vole survey detailed above. The survey covered the same sections of watercourse as the water vole survey (see Figure 8). The otter survey was based on the survey method of the Environment Agency (2010). This involved searching for evidence of otter and other riparian mammal species (such as American mink *Neovison vison*) along the stream and ditch banks and around any bridges. Such evidence can include spraints (droppings), footprints, runs (paths worn through vegetation adjacent to the water) slides (areas of steep bank showing signs of regular use by otters to access the water), and holts (burrows).

5.61 Particular attention was paid to prominent bankside or in-stream features such as tree trunks, branches, rocks, areas of bare ground, culverts and inflowing ditches or pipes, since these types of structures are often used as sprainting sites (otter spraints are used to indicate territories). Areas of mud were inspected for the presence of footprints.

5.62 Numerous potential spraining sites were examined during the survey (and no signs of otter were seen), and the Rowel Brook is unlikely to provide important foraging habitat for otter (given its small size and likely very limited fish population). Therefore the small proportion of the watercourse that

was inaccessible (as detailed under water vole survey above) will not adversely affect the assessment of the ecological impacts of the proposed development.

Breeding Bird Characterisation Survey

5.63 In order to provide information on the use of the Site by breeding birds, a breeding bird characterisation survey was carried out over the period April–June 2018. This involved monthly visits to the Site during which all habitats at the Site were walked over, with attention being paid especially to linear features and woodland areas. Adjacent to and within areas of woodland, frequent stops were made to listen and scan for singing and calling birds. Large open areas were covered either from the edges, through direct observation, or were crossed by the surveyors. Birds observed beyond the boundary of the Site were also noted in order to provide further contextual information. Bird locations were mapped and behaviour recorded using standard British Trust for Ornithology (BTO) codes and symbols on field maps during each survey. The maps obtained as a result of the three visits were then collated to produce a single territory map. Breeding was assumed for all species which displayed breeding behaviour (such as carrying nesting material or food) and for species displaying territorial behaviour in suitable habitat.

5.64 The survey visits were carried out on 5 April 2018, 04 May 2018 and 12 June 2018 by John Baker, Gareth Clay and Peter Newbold, all MCIEEM and Senior or Principal Ecologists at BSG Ecology, and experienced field ornithologists. During all visits, the weather conditions were suitable for breeding bird surveys (there was no rain, or winds exceeding 5 on the Beaufort Scale).

Great Crested Newt Survey

5.65 Great crested newt breeds in waterbodies and can be found within terrestrial habitat up to 500 m from (though typically within 250 m of) such aquatic habitat. All ponds within the Site and within 500 m of the Site were therefore identified using Ordnance Survey maps (see Figure 10).

5.66 The six ponds within the Site (Ponds P1 to P6 on Figure 10) were subject to Habitat Suitability Index (HSI) assessment for this species and to surveys to determine whether this species is likely to be present. The HSI assessment (and, where access permission was available, surveys) were extended to include ponds on adjacent land within 500 m of proposed development at the Site ('proposed development' excludes areas proposed as nature reserve, parkland or retained agricultural land). Seven ponds outside the Site were subject to HSI, of which three (P7, 8 and 9) were accessed (allowing further survey), three (P10, 11 and 12) were assessed using aerial photography and Ordnance survey mapping only, and one (P13) was not accessed directly but was viewed from within the Site.

5.67 Methods used at each of the ponds are listed in Table 6, and are described below in more detail.

Table 6: Summary of great crested newt surveys. Ponds within the PR8 Site are highlighted in grey.

Pond ID	Approximate distance from development (excluding greenspace)	Habitat Suitability Index Assessment (2016)	Environmental DNA Survey (2018)	Overnight Surveys	Terrestrial survey in vicinity
1	80 m	Yes	Yes	No	No
2	80 m	Yes	Yes	No	No
3	60 m	Yes	Yes	No	No
4	20 m	Yes	Yes	Yes	No
5	220 m	Yes	Yes	No	No
6	320 m	Yes	Yes	No	No
7	80 m	Yes	Yes	No	No
8	40 m	Yes	Yes	No	No
9	80 m	Yes	Yes	No	No
10	260 m	Yes	No access	No access	No

11	40 m	Yes	No access	No access	Yes
12	60 m	Yes	No access	No access	Yes
13	530 m	Yes	No access	No access	No

5.68 Two of the ponds outside the Site but within 500 m of proposed development (P11 and 12) were not subject to any on-site surveys due to a lack of access permission. The landowner was contacted twice in writing in April 2017 and did not respond. These ponds were identified from Ordnance Survey maps, and are situated directly adjacent to one another, approximately 40 m and 60 m south-east of the PR3b site and 120 m and 140 m south-east of the PR8 site respectively. From Ordnance Survey maps, these ponds appear to be former settlement ponds (or similar) at a disused sewage or water treatment works. Aerial photography indicates that they now support willow scrub / wet woodland rather than open water, and their potential to provide breeding habitat for GCN is therefore likely to be limited. However, because the use of these ponds by GCN cannot be ruled out, and this species could therefore use terrestrial areas of the Site in proximity to these ponds, a terrestrial survey for this species was carried out at the Site, in the area of suitable terrestrial habitat closest to these ponds (see *Terrestrial survey* below).

5.69 Pond P10 is within 500 m of proposed development, but is located beyond 250 m from proposed development. Aerial photography indicates that this pond has suitable terrestrial habitat in its vicinity and it has poor connectivity to the Site because it lies beyond the A44 Woodstock Road which is a dual carriageway. For these reasons it is considered that any great crested newt populations associated with this pond is unlikely to utilise terrestrial habitat within areas of the Site proposed for development, and further surveys were therefore not carried out at this pond.

5.70 Pond 13 is located just outside the south-eastern boundary of the Site, close to parts of the Site that, under PR8, will be retained as agricultural land. Because of this retained agricultural land, and because much of the east of the Site is proposed as greenspace, P13 is 530 m from proposed development at the Site. It is considered that any great crested newt populations associated with this pond is unlikely to utilise terrestrial habitat within areas of the Site proposed for development, and further surveys were therefore not carried out at this pond.

5.71 The following paragraphs provide further detail on the four types of survey that were carried out for GCN.

Habitat Suitability Index Assessment

5.72 In order to provide a robust assessment of the potential for the presence of GCN at the Site, a Habitat Suitability Index (HSI) Assessment was undertaken for ponds within and close to the Site. This assessment was carried out by Dr Tom Flynn, MCIEEM, Senior Ecologist at BSG Ecology, on 16 and 17 April 2018. Tom Flynn has a Natural England great crested newt survey licence (number 2015-17735-CLS-CLS) and has carried out surveys for this species since 2005.

5.73 The HSI assessment covered all ponds within the Site, and all ponds within 250 m of the Site. For ponds P10, P11 and P12 (for which no access permission was obtained), the assessment was based on aerial photographs and Ordnance Survey mapping (with a precautionary approach taken for variables for which there was no information). Pond 13 was viewed from the Site but was not accessed directly.

5.74 HSI was developed for GCN by Oldham (2000). The revised method for determining HSI values, developed by ARG UK (2010) was used to implement the assessment. The method involves allocating scores to features associated with a pond such as size, quality of surrounding habitat and presence of fish. These scores are then combined to calculate the overall HSI for each pond as a number between 0 and 1, with 0 being the least suitable and 1 being the most suitable. The HSI score allows each pond to be placed in one of five pre-defined categories defining its suitability for GCN as follows: <0.5: poor; 0.5–0.59: below average; 0.6–0.69: average; 0.7 – 0.79: good; >0.80: excellent.

Environmental DNA survey

5.75 In order to determine presence or absence of GCN at the site, environmental DNA (eDNA) surveys were undertaken for ponds within and close to the Site. This assessment was carried out by Dr Tom Flynn, MCIEEM, Senior Ecologist at BSG Ecology and Ashley Sendell-Price, Ecologist at BSG Ecology, on 16 and 17 April 2018.

5.76 The eDNA survey covered all ponds within the Site, and all ponds within 250 m of proposed development at the Site, except for ponds P11 and P12, for which no access permission was obtained.

5.77 Water samples were collected as per the standard guidance (Biggs *et al.*, 2014) and sent by courier to ADAS Ltd for laboratory analysis for GCN DNA (order number 1040008-79534). ADAS also tested each sample for signs of inhibition or degradation (the presence of which could invalidate the analysis) and no such inhibition or degradation was found. Results were provided by ADAS on 24 April 2018.

5.78 There were no constraints or limitations on the effectiveness of the survey.

Overnight surveys

5.79 In order to provide data for the estimation of population size class, overnight surveys for great crested newt were carried out on one pond (Pond P4 in Figure 10). This pond was surveyed because the results of the eDNA survey indicate that this species is present there (but absent from all other ponds surveyed).

5.80 The overnight surveys were based on industry standard guidance (English Nature, 2001; Natural England, 2015b). This recommends that to estimate population size class, six appropriately-timed overnight survey visits should be undertaken. The overnight surveys should utilise a minimum of three methods: preferably torch survey (mid-March to mid-June), bottle-trapping (March to May) and egg search (April to June) and at least three of the overnight visits should be carried out between mid-April and mid-May.

5.81 Torch surveys involved searching for GCN after sunset using two Clulite 1 million candle power torches. All accessible parts of a pond's margins were slowly walked and searched.

5.82 Bottle trapping was carried out where water depth and bank side access allowed. Bottle traps (constructed from 2 L plastic drinks bottles) were set in suitable parts of a pond at dusk and left in place overnight. Bottle traps were checked for amphibians the following morning within 12 hours of setting, and any animals caught were released at the point of capture. Because the pond is lined with concrete, it was not possible to support traps on bamboo canes inserted into the pond base. Traps were therefore modified by adding weights to the funnel end, allowing them to float vertically below the surface, supported by an air bubble at the top. Traps were tethered to the bank to avoid loss.

5.83 Egg searches were conducted in order to determine whether GCN were breeding. This involved searching marginal and aquatic vegetation for the distinctive leaf folding pattern and egg size and colour produced by GCN. Results from egg searches are only useful for indicating presence/likely absence, and not population size. The presence of GCN eggs also provides clear evidence of attempted breeding at a pond.

5.84 Overnight surveys were carried out on the dates and under the weather conditions indicated in Table 7, and by the surveyors listed in Table 8. The surveys were led by Dr Tom Flynn MCIEEM, Senior Ecologist at BSG Ecology who holds a Natural England GCN survey licence (number 2015-17735-CLS-CLS), and has carried out surveys for this species since 2005. A surveyor holding a Natural England survey licence for GCN was present on each survey visit.

Table 7: Survey conditions during overnight surveys for great crested newt.

Visit	Date	Surveyors (see Table 8)	Temperature (after torch survey)	Wind Speed (Beaufort)	Rain (during survey)	Turbidity score (/5)	Vegetation score (/5)
1	26.04.2018	TF + MS	6	2	none	0	1
2	02.05.2018	TF + JP	7	2	none	0	2
3	10.05.2018	TF + JB	6	2	none	2	2
4	17.05.2018	TF + RM	6	2	none	2	2
5	23.05.2018	TF + KR	12	3	none	2	2
6	30.05.2018	TF + RM	14	1	none	2	2

Table 8: Surveyors participating in overnight surveys for great crested newt.

Surveyor	Initials	Job title and employer (at time of survey)	CIEEM Status	Natural England Great Crested Newt Licence number
Dr Tom Flynn	TF	Senior Ecologist, BSG Ecology	MCIEEM	2015-17735-CLS
Rachel Mcdonald	RM	Ecologist, BSG Ecology		
Jamie Peacock	JP	Ecologist, BSG Ecology		2016-20471-CLS-CLS
Kate Rooney	KR	Ecologist, BSG Ecology	GradCIEEM	2015-17459-CLS-CLS
Melanie Sanders	MS	Ecologist, BSG Ecology		
Joe Bishop	JB	Ecologist, BSG Ecology		

5.85 The above guidance recommends that to determine population size class, the peak count obtained from six survey visits should be used, with at least three of these visits carried out between mid-April and mid-May. GCN populations (which can include multiple ponds, depending upon the distance and habitats between them) can then be classed as 'small' for maximum counts of up to 10 adults, 'medium' for maximum counts between 11 and 100, and 'large' for maximum counts exceeding 100 adults.

5.86 Weather conditions during the survey visits (including temperature) were suitable for the surveys (see summary data in Table 7 above). Turbidity and vegetation cover were within acceptable limits for torchlight surveys on all six survey visits (the ranges were 0–2 and 2–2 respectively). There were no constraints or limitations on the effectiveness of the survey.

Terrestrial survey

5.87 Because surveys were not carried out at the off-site ponds P11 and P12, and these are within 250 m of proposed residential or other, potentially high impact, development at the Site, it was considered appropriate to carry out a terrestrial survey for GCNs. The purpose of this survey was to determine whether GCNs are present in suitable terrestrial habitats within parts of the Site close to ponds P11 and P12.

5.88 The closest terrestrial habitat suitable for GCN within the Site is a triangular shaped area of scrub and rough grassland that forms the PR3b Site. This area is between 40 and 150 m from Ponds 11 and 12. In order to survey this area for terrestrial GCN, a total of 20 artificial refuges consisting of carpet tiles measuring 50 cm by 50 cm were placed out around the perimeter of the area (the centre is inaccessible due to the presence of dense scrub). These tiles were in addition to 20 artificial reptile shelters placed in this area for the reptile survey (see *Reptile Survey* below), which also provided suitable sheltering sites for GCN. The 40 artificial refuges where checked by surveyors on six occasions during daytime between 13 April 2018 and 04 June 2018, and on a further four occasion between 10 September 2018 and 01 October 2018. Survey visits were carried out by the following staff who hold Natural England GCN survey licences: Mark Norriss, Ecologist at BSG Ecology (Natural England GCN licence number 2016-22023-CLS-CLS), Tom Flynn, John

Baker MCIEEM, Senior Ecologist at BSG Ecology (Natural England GCN licence number 2016-22258-CLS-CLS) and Peter Newbold MCIEEM, Principal Ecologist at BSG Ecology (Natural England GCN licence number 2015-18530-CLS-CLS). Joe Bishop, Ecologist at BSG Ecology assisted with some of the survey visits.

5.89 The use of artificial refuges without the use of the dug-in drift fencing that is specified in industry standard guidance for terrestrial GCN survey (English Nature, 2001) was considered a proportionate level of survey effort, given the limited potential for ponds 11 and 12 to be breeding ponds and (form aerial photographs) the abundance of suitable terrestrial habitat in their vicinity outside the Site.

5.90 Weather conditions during the survey (i.e. in April, May and September 2018) were suitable. The weather in April was bright and showery. May had above average temperatures but rainfall was close to normal across central and southern England. September had unsettled weather for most of the month[8].

Reptile Survey

5.91 From the results of the Phase 1 habitat survey, suitable reptile habitat was identified at the Site. This is predominantly on the margins of fields adjacent to hedgerows or scrub, or in rough grassland. In order to determine whether reptiles are present (and if so, which species), a presence/absence survey for reptiles following the industry standard guidance of Froglife (1999) was carried out in 2018.

5.92 A total of 100 artificial refuges (each comprising a piece of roofing felt 100 x 50 cm (i.e. 0.5 m^2) were placed within the suitable habitats at the Site on 15 March 2018 (see Figure 8 for locations). Because of the nature of the Site (predominantly arable fields) it is difficult to accurately map the area of potentially suitable reptile habitat and hence to calculate refuge density that was required and deployed in suitable habitat. However, based on the recommendations of Froglife (1999), which refer to a refuge density of 5–10 refuges per hectare, the 100 refuges used were sufficient to cover 10–20 ha of suitable habitat (i.e. 5–11 % of the 177 ha Site). Based on the Phase 1 habitat survey (see Figure 2), this is considered to be significantly more that the area of suitable reptile habitat at the Site.

5.93 The artificial refuges were checked for reptiles on seven occasions between 13 April and 25 May 2018. Survey visits were carried out on the dates and under the weather conditions indicated in Table 9. The timing and weather conditions were suitable for reptile surveys (Froglife, 1999; Natural England, 2015c). The surveyors were as listed for terrestrial GCN survey above. All have previous experience and/or formal training in reptile survey

Table 9: Dates and weather conditions of reptile survey visits.

Visit no.	Date	Surveyors*	Temperature (°C)	Cloud (Otkas)	Weather Notes
Setup	14.03.2018	MN	N/A	N/A	N/A
1	13.04.2018	JP	10-11	8	Occasional sun Light wind
2	19.04.2018	PN + JB	11-19	0	Very light breeze, strong sun
3	25.04.2018	JB	10-13	5-7	Light wind, occasional sun, Rain at end of survey
4	01.05.2018	JB	10-13	0-4	Strong sun, light wind
5	08.05.2018	JB	16-19	0	Strong sun, light wind
6	14.05.2018	JB	15-18	0	Strong sun, light wind
7	25.05.2018	JB	14-17	8	Rain all morning prior to survey, light wind

[8] Source: https://www.metoffice.gov.uk/climate/uk/summaries/2018 [accessed 29/11/2018].

* Surveyors: MN: Mark Norriss, Ecologist at BSG Ecology; JP: Joe Pollard, Ecologist at BSG Ecology; JB: John Baker, Senior Ecologist at BSG Ecology.

Invertebrate Surveys

Crayfish survey

5.94 A manual and night torchlight survey for white clawed crayfish *Austropotamobius pallipes* was undertaken on 04 October 2017. The survey was carried out by Julie Bywater of Bywater Ecology who has extensive experience of crayfish surveys and holds a white-clawed crayfish Natural England survey licence, assisted by Sarah Joscelyne, Ecologist at BSG Ecology.

5.95 The night survey was preceded by a daytime inspection to target suitable areas for night survey and a manual survey involving searching for crayfish by stone turning and hand netting. The torchlight survey involved searching the Rowel Brook within the Site by torchlight (using two Clulite 1 million candle power torches).

Targeted stream aquatic macroinvertebrate survey

5.1 Aquatic macroinvertebrates were collected at a total of five sampling points on 04 October 2017 and 24 April 2018 along Rowel Brook. Sample 1 was taken from a tributary to the east of the Rowell Brook. Samples 2-5 were taken from Rowel Brook itself, which flows from west to east. Sampling locations are shown in Figure 8 and Photographs A2-1 to A2-6 in Appendix 2.

5.2 Macroinvertebrates were collected using standard three-minute kick sample methodology (BS EN 27828:1994) using a 1 mm mesh hand net. Three minutes of net sampling was carried out with the time divided equally between all of the mesohabitats present. Stony or sandy substrates were lightly kick-sampled to disturb and capture macroinvertebrate inhabiting the stream bed. Care was taken to avoid deep accumulations of soft sediment since this makes later sorting extremely difficult. Similarly, the netting of large volumes of plant material was avoided. One minute of hand searching (of rocks, logs, leaf packs and other submerged debris) was then carried out for invertebrates (e.g. limpets, caddis larvae, pond skaters, riffle and whirligig beetles) that might otherwise have been missed during the net sampling.

5.1 Coarse debris was checked for clinging invertebrates before being removed from the net. Samples were preserved immediately in 70% industrial methylated spirit for subsequent laboratory analysis.

5.2 At each sampling point, habitat details such as channel characteristics, adjacent land use and macrophyte cover and composition were recorded on a standard form. In addition, water chemistry was measured using a multi-parameter meter. Recordings of conductivity, pH, total dissolved solids and dissolved oxygen were taken.

Macroinvertebrate identification

5.3 In the laboratory, aquatic macroinvertebrates were separated from material collected incidentally as a by-catch of the kick-sampling process. All macroinvertebrate individuals present in the sample were identified to family-level under a stereoscopic microscope (x70) using the most the most up-to-date identification keys available.

5.4 Macroinvertebrate samples were identified by Dr Jessica Kent of BSG Ecology. The brook and its tributary were at a normal flow level during both surveys.

Weather conditions

5.5 The weather on 04 October 2017 was overcast and cool (maximum temperature 14°C), with a moderate breeze.

5.6 On 24 April 2018 the weather was overcast and cool (maximum temperature 14°C), with a moderate breeze and occasional rain.

Data analysis – WHPT

5.7 A calculation was made of the Whalley, Hawkes, Paisley and Trigg (WHPT) metric from the macroinvertebrate family list. WHPT supersedes the Biological Monitoring Working Party (BMWP) index (WFD UKTAG, 2014).

5.8 Macroinvertebrate families which are more susceptible to pollution, including Philopotamidae (caddis fly), Siphlonuridae (mayfly) and Taeniopterygidae (stonefly) score highly. Conversely, pollution-tolerant groups (such as Oligochaeta (worms) and Chironomidae (non-biting midge larvae)) score the least points. Accordingly, high-scoring watercourses have highest water quality, whilst polluted watercourses score the lowest. WHPT scores are weighted by the abundance of individual families.

5.9 The WHPT metric can be expressed as the Number of Taxa (NTAXA), which is the total number of scoring taxa, and the Average Score Per Taxon (ASPT), which is obtained by dividing the WHPT score by the number of scoring taxa. The higher the ASPT, the cleaner the watercourse is; in general, ASPT scores over 5 are indicative of good biological quality, and scores below 4 are indicative of poor biological quality.

Baseline Survey Limitations

5.10 All relevant survey limitations have been noted within the above text.

6 Results and Interpretation

6.1 A summary of relevant legislation and planning policy is provided in Appendix 3.

Statutory Designated sites

6.2 There are no statutory wildlife sites within the Site. Statutory wildlife sites within the desk study search area are indicated in Figure 1 and listed in Table 10.

Table 10: Statutory designated wildlife sites within 5 km of the Site centre.

Site Name	Designation	Overview	Area (ha)	Approximate distance and
Rushy Meadow	SSSI[1]	Damp meadow.	8.7	10 m NE
Oxford Meadows	SAC[2]	Floodplain grassland, including grazed pasture and hay meadows.	267.4	1.8 km S
Cassington Meadows	SSSI	Hay meadows and fen.	7.0	2.8 km SW
Pixey and Yarnton Meads	SSSI	Floodplain hay meadows.	85.6	1.8 km S
Wolvercote Meadows	SSSI	Floodplain hay meadows.	9.2	2.4 km S
Blenheim Park	SSSI	Oak-dominated pasture woodland and lakes.	225.2	2.5 km NW
Portmeadow with Wolvercote Common and Green	SSSI	Grazed floodplain grassland.	166.7	2.5 km S
Shipton on Cherwell and Whitehill Farm Quarries	SSSI	Notified for its geological interest: white limestone containing abundant and important fossils.	27.7	2.7 km N
Wytham Ditches and Flushes	SSSI	Ditches supporting species-rich eutrophic aquatic and fen flora.	5.7	2.7 km SW
Hook Meadows and the trap Grounds	SSSI	A series of poorly-drained unimproved neutral meadows.	11.3	3.6 km S
Wytham Woods	SSSI	A complex of ancient woodland, wood pasture, common land and old limestone grassland.	426.5	3.6 km SW
Woodeaton Quarry	SSSI	Notified for its geological interest: a Bathonian section and white limestone formation.	6.4	4.0 km E
Shipton-on-Cherwell and Whitehill Farm Quarries SSSI	SSSI	Notified for its geological interest: a section from near the base of the White Limestone up to the Lower Cornbrash (with important fossil reptiles) at Shipton Quarry; and the highly fossiliferous Shipton Member of the White Limestone at Whitehill Quarry.	4	4.4 km N
Woodeaton Wood	SSSI	Woodland forming an intact relic of the ancient Shotover Forest.	14.1	4.8 km E
New Marston Meadows	SSSI	A series of agriculturally unimproved neutral meadows on the flood plain of the River Cherwell.	44.4	4.9 km SE
Long Hanborough Gravel Pit	SSSI	Notified for its geological interest: This site provides exposures in the gravel of the Pleistocene Hanborough Terrace of the Evenlode Valley.	4.3	5.0 km W

[1] Site of Special Scientific Interest
[2] Special Area of Conservation

6.3 Of these, one statutory wildlife site is within 1 km of the Site: Rushy Meadows Site of Special Scientific Interest (SSSI). This site lies close to the north-east of the Site, separated by track, public footpath and double hedgerow. The citation for this site[9] notes that Rushy Meadows SSSI consists of a series of unimproved alluvial grasslands alongside the Oxford Canal, and that the low-intensity, traditional management of this site has produced rich meadow and fen communities containing several uncommon plant species such as pepper saxifrage *Silaum silaus*, devil's bit scabious *Succisa pratensis*, heath grass *Danthonia decumbens*, marsh valerian *Valeriana dioica*, betony *Stachys officinalis*, early marsh orchid *Dactylorhiza incarnata*, distant sedge *Carex distans* and water avens *Geum rivale*. It also notes that meadow habitats of this type are now both rare and under threat in Britain, particularly, in this district due to the pressures of agricultural improvement and urban development.

6.4 The next closest statutory wildlife site is Oxford Meadows Special Area of Conservation (SAC), ca. 1.8 km to the south of the site, beyond the A44 Woodstock Road, a railway line and the A40 road. This site supports unimproved lowland hay meadow and pasture, and is designated for the EU Annex I habitat Lowland hay meadows (*Alopecurus pratensis, Sanguisorba officinalis*) and the EU Annex II plant species creeping marshwort *Apium repens*. The SAC is made up of all or part of four SSSIs (specifically, Cassington Meadows SSSI, Pixey and Yarnton Meads SSSI, Wolvercote Meadows SSSI, and the majority of Portmeadow with Wolvercote Common and Green SSSI).

6.5 The Site is within the SSSI Impact Risk Zones for Rushy Meadow SSSI and Oxford Meadows SAC.

Ancient Woodland

6.6 The Site contains no sites listed on Natural England's Ancient Woodland Inventory (which includes ancient replanted woodland sites). There are six such sites within 3 km of the Site, listed in Table 11.

Table 11: Ancient Woodland within 5 km of the Site centre.

Site Name	Approximate distance and direction
Begbroke Wood	0.66 km W
Bladon Heath	0.90 km W
Worton Heath	1.1 km W
Burleigh Wood	2.4 km W
Busby's Spinny	2.9 km N
Wytham Wood (including various sub-compartments)	3.6 km SW

Non-statutory designated sites

6.7 Non-statutory designated sites within 2 km of the Site are listed in Table 12. The Site contains one non-statutory designated site: Lower Cherwell Valley Conservation Target Area (CTA), part of which occupies an arable field and a pasture field in the north-east of the Site (within areas of proposed greenspace). This CTA also extends along the Oxford Canal adjacent to the eastern boundary of the Site. There are six Local Wildlife Sites (LWS) within 2 km of the Site, one Potential Local Wildlife Site (PLWS), one Conservation Target Area (CTA) and one Woodland Trust Reserve. Of these, the Woodland Trust reserve at Stratfield Brake is the nearest to the Site, being located 80 m east beyond the Oxford Canal.

Table 12: Non-statutory wildlife sites within 2 km of the Site.

Designation	Site Name and ID	Description	Approx. Distance & Direction from Site
CTA	Lower Cherwell Valley	The Cherwell Valley from Lower Heyford to Kidlington and south of Kidlington along the Oxford Canal. Dominated by lowland meadows	Overlaps with north-eastern part of Site.

[9] https://designatedsites.naturalengland.org.uk/PDFsForWeb/Citation/1001685.pdf