Peveril Securities

Bicester Arc.

Ecological Appraisal

June 2023

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1.0 INTRODUCTION

1.1 The following report has been prepared by FPCR Environment and Design Ltd. on behalf of Peverill Securities and considers the ecological implications of the Bicester Arc development and the dedicated 'eco park' on land off Lakeview Drive, Bicester (hereafter referred to as 'the Site'). The Site is centred approximately at Ordnance Survey Grid Reference: SP 579 215.

Site Context

1.2 The Site boundary is shown in **Figure 1** and is approximately 17 hectares (ha). It is located between a large Tesco superstore to the north and Bicester Garden Centre and sewage treatment plant to the south. To the west is the A41 and urban development and to the east is a railway line and beyond this arable farmland.

1.3 The Site was subject to an outline planning application in 2017 (Ref 17/02534/OUT) for the erection of a business park of up to 60,000 sq.m (GEA) of flexible Class B1(a) office / Class B1(b) research & development floorspace; associated vehicle parking, landscaping, highways, infrastructure and earthworks.

1.4 This was then subject to a s73 application (Ref 23/01080/F) to vary conditions 4 and 34 of the above consent.

1.5 This report is to provide an update the suite of ecology information that was produced for the above application.

Scope of Appraisal

1.6 This Ecological Appraisal describes the current ecological interest within and around the Site, which has been identified through standard desk- and field-based investigations. It then considers the potential ecological impacts and opportunities for ecological enhancement based on the landscape masterplan in the context of relevant legislation and planning policy as well as the comments received from Cherwell District Council on 29th September 2021. Finally, it identifies the necessary additional measures to avoid, mitigate or provide compensation for potential impacts, and the mechanisms for securing such measures.

2.0 METHODOLOGY

Desk Study

2.1 Consultation information was requested from the Thames Valley Environmental Records Centre (TVERC).

2.2 The Multi Agency Geographic Information for the Countryside (MAGIC) website was also consulted for statutory designated sites data[1].

2.3 The search area for biodiversity information was related to the significance of sites and species and potential zones of influence[2] (ZoI), as follows:

- 15km around the Site for sites of International Importance (e.g. Special Areas of Conservation [SACs], Special Protection Areas [SPAs], Ramsar sites);
- 2km around the Site for sites of National/ Regional importance (e.g. Sites of Special Scientific Interest [SSSIs] and National Nature Reserves [NNRs]); and
- 1km around the Site for non-statutory sites of County / local importance (eg Local Wildlife Sites [LWSs], statutory sites of county importance (Local Nature Reserves [LNRs]) and species records (e.g. protected, or Section 41 NERC species of principal importance[3] and notable species).

2.4 Further inspection, using colour 1:25,000 OS base maps (www.ordnancesurvey.co.uk) and aerial photographs from Google Earth (www.maps.google.co.uk), was also undertaken in order to provide additional context and identify any features of potential importance for nature conservation in the wider countryside.

Habitats/Flora

2.5 The Site was surveyed on 31st March 2021 using the standard Extended Phase 1 Habitat Survey methodology (JNCC, 2010[4]), as recommended by Natural England to identify specific habitats of ecological interest. Whilst the species lists should not be regarded as exhaustive, sufficient information was gained during the survey to enable robust assessment of habitat present.

2.6 During the Extended Phase 1 Surveys, hedgerows were surveyed individually using the Hedgerow Evaluation and Grading System (HEGS) to enable identification and evaluation of hedgerows of nature conservation importance within the Site. Hedgerows were graded on a scale of 1-4, within which grades 1 and 2 are generally considered to be of nature conservation priority as shown in **Table 1**.

Table 1: Conservation Value of Hedgerows

Grade	Value of Hedgerow
-1, 1, 1+	High to Very High
-2, 2, 2+	Moderately High to High
-3, 3, 3+	Moderate
-4, 4, 4+	Low

[1] www.magic.defra.gov.uk (accessed 06.09.21)
[2] Zone of Influence - the areas and resources that may be affected by the proposed development
[3] Natural Environment and Rural Communities Act 2006 species listed under Section 41 (formally UKBAP species)
[4] JNCC, 2010. *Handbook for Phase 1 habitat survey - a technique for environmental audit*

2.7 Hedgerows were also assessed against the Wildlife criteria provided in Part II of Schedule 1 of the Hedgerows Regulations 1997. Qualifying as an 'important' hedgerow requires the hedgerow assessed to be greater than 30 years of age and contain species listed in Schedule 5 (animals) and 8 (plants) of the Wildlife and Countryside Act 1981 (as amended), birds categorised as declining breeders (Category 3) within the 'Red Data Birds in Britain' (Batten 1990), or any species categorised as 'endangered', 'extinct', 'rare' or 'vulnerable' by any of the British Red Data Books.

2.8 Hedgerows are also considered important should they satisfy any of the following criteria:

- That the hedgerow is referred to in a record held by a biological records centre as containing protected plants (within 10 years) or birds and animals (within five years); or
- That the hedgerow contains one of the following criteria per average 30m section surveyed:
  - seven Schedule 3 species; or
  - six Schedule 3 species and three listed features (see below); or
  - six Schedule 3 species, including one of the following: black poplar, large-leaved lime, small-leaved lime or wild service-tree; or
  - five Schedule 3 species and four listed features; or
  - four Schedule 3 species, two listed features and lying adjacent to a bridleway or footpath;
- Listed features to include:
  - A bank or wall which supports the hedgerow along at least half of its length;
  - Gaps which together do not exceed 10% of the length of the hedgerow;
  - At least one standard tree per 50m of hedge;
  - At least three Schedule 2 woodland species within the hedgerow;
  - A ditch along at least one half of the length of the hedgerow;
  - Connections scoring 4 points or more (1 point per connection of the hedgerow with another, two points per connection of the hedgerow to a pond or broad-leaved woodland; and
  - A parallel hedge within 15 m of the hedgerow.

2.9 An update survey was conducted on 21 April 2023 to determine if there had been any material changes to the habitats within the Site in the intervening period.

Fauna

2.10 During the surveys, observations and signs of suitable habitat for any species protected under Part I of the Wildlife and Countryside Act 1981 (as amended), the Conservation of Habitats & Species Regulations 2017 (as amended) and the Protection of Badgers Act 1992 were noted. Consideration was also given to the existence and use of the Site by other notable fauna such as those listed on the Natural Environment and Rural Communities (NERC) Act, Section 41 (S41) as species which are of principal importance for the conservation of biodiversity in England. Consideration was also given to those species listed as Local Biodiversity Action Plan (LBAP) or Red Data Book (RDB) species.

Bats

Tree Assessments

2.11 The tree assessments were conducted from ground level, with the aid of a torch and binoculars and were undertaken on the 31st March 2021 by an experienced ecologist from FPCR. This was updated on 21st April 2023. During the survey Potential Roosting Features (PRF) for bats such as the following were sought (based on p16, British Standard 8596:2015[5]):

- Natural holes (e.g. knot holes) arising from naturally shed branches or branches previously pruned back to a branch collar.
- Man-made holes (e.g. cavities that have developed from flush cuts or cavities created by branches tearing out from parent stems).
- Woodpecker holes.
- Cracks/splits in stems or branches (horizontal and vertical)
- Partially detached or loose bark or bark plates.
- Cankers (caused by localised bark death) in which cavities have developed.
- Other hollows or cavities, including butt rots.
- Compression of forks with occluded bark, forming potential cavities.
- Crossing stems or branches with suitable roosting space between.
- Ivy stems with diameters in excess of 50mm with suitable roosting space behind (or where potential roosting space can be seen where a mat of thinner stems has left a gap between the mat and the trunk).
- Bat or bird boxes.
- Other suitable places of rest or shelter.

2.12 Certain factors such as orientation of the feature, its height from the ground, the direct surroundings and its location in respect to other features may reduce or enhance the potential.

2.13 Based on the presence of the above features, trees were classified into general bat roost potential groups. **Table 2** broadly classifies the potential categories as accurately as possible as well as discussing the relevance of the features. This table is based upon Table 4.1 and Chapter 6 in the survey guidance[6].

2.14 Although the British Standard 8596:2015 document groups trees with moderate and high potential, these have been separated below to allow more specific survey criteria to be applied.

[5] British Standards Institute 2015. *BSI 8596:2015 BSI Standards Publication Surveying for bats in trees and woodland - Guide*. BSI Standards Ltd.
[6] Collins, J. 2016. *Bat Conservation Trust Bat Surveys for Professional Ecologists - Good Practice Guidelines* (3rd edition).

Table 2: Classification and Survey Requirements for Bats in Trees

Classification of Tree	Description of Category and Associated Features (based on Potential Roosting Features listed above)	Likely Further Survey Work / Actions
Confirmed Roost	Evidence of roosting bats in the form of live / dead bats, droppings, urine staining, mammalian fur oil staining, etc.	A Natural England derogation licence application will be required if the tree or roost site is affected by the development or proposed arboricultural works. This will require a combination of aerial assessment by roped access bat workers (where possible, health and safety constraints allowing) **and** nocturnal survey during appropriate periods (e.g. nocturnal survey - May to August) to inform on the licence. Works to trees were undertaken under supervision in accordance with the approved good practice method statement provided within the licence. **However,** where confirmed roost site(s) are not affected by works, work under a precautionary good practice method statement may be possible.
High Potential	A tree with one or more Potential Roosting Features that are obviously suitable for larger numbers of bats on a more regular basis and potentially for longer periods of time due to their size, shelter protection, conditions (height above ground level, light levels, etc) and surrounding habitat. Examples include (but are not limited to); woodpecker holes, larger cavities, hollow trunks, hazard beams, etc.	Where the tree will likely be affected by development, a combination of aerial assessment by roped access bat workers (if appropriate) **and/or** nocturnal survey during appropriate period (May to August). Following additional assessments, a tree may be upgraded or downgraded based on findings. If roost site/s are confirmed and the tree or roost is to be affected by proposals a licence from Natural England will be required. After completion of survey work (and the presence of a bat roost is discounted), a precautionary working method statement may still be appropriate.
Moderate Potential	A tree with Potential Roosting Features which could support one or more potential roost sites due to their size, shelter protection, conditions (height above ground level, light levels, etc) and surrounding habitat but unlikely to support a roost of high conservation status (i.e. larger roost, irrespective of wider conservation status). Examples include (but are not limited to); woodpecker holes, rot cavities, branch socket cavities, etc.	Where the tree will likely be affected by development a combination of aerial assessment by roped access by bat workers **and/or** nocturnal survey during appropriate period (May to August). Following additional assessments, a tree may be upgraded or downgraded based on findings. After completion of survey work (and the presence of a bat roost is discounted), a precautionary working method statement may still be appropriate. If a roost site/s is confirmed a licence from Natural England will be required.
Low Potential	A tree of sufficient size and age to contain Potential Roosting Features but with none seen from ground or features seen only very limited potential. Examples include (but are not limited to); loose/lifted bark, shallow splits exposed to elements or upward facing holes.	No further survey required but a precautionary working method statement may be appropriate.
Negligible/ No potential	Negligible/no habitat features likely to be used by roosting bats	None.

Transect Survey

2.15 Transect surveys were undertaken at dusk in May, July and September 2021, with the transect route predetermined prior to survey in order to comprehensively cover all areas of the site. These included point count stops to identify activity levels around the features of potential value to bats likely to be affected by proposals (i.e. hedgerows, tree lines and dense scrub). Each point count was c.5-minutes long, during which time all bat activity within range was recorded.

2.16 The transects commenced at sunset and continued until approximately two hours after sunset. Each was walked at a steady pace and when a bat passed by, the species, time and behaviour was recorded to help to form a general view of the bat activity on site and highlight any habitats features particularly associated with bat activity.

2.17 Surveyors used ultrasonic bat detectors (Wildlife Acoustics Inc. Echo Meter Touch® bat detectors in conjunction with Echo Meter Touch® app and Apple Inc. iPad®, during the transect surveys.

2.18 Post-survey, calls were analysed using Kaleidoscope Pro 4.5 (Wildlife Acoustics 2017), by taking measurements of the peak frequency, inter-pulse interval, call duration and end frequency. From this, the level of bat activity across the Site in relation to the abundance of individual species foraging and commuting was assessed.

2.19 The transects were undertaken when conditions were suitable (i.e. when the ambient air temperature exceeded 10ºC and there was little wind and no rain) see **Table 3**.

Table 3: Transect & Static Survey Conditions

Date	Sunset/ Sunrise	Temperature at start of survey °C	Rain (0-5)	Wind (0-5)	Cloud %
26.05.21	21:07	13	0	2	10
12.07.21	21:20	18	0	1	90
13.09.21	19:23	15	0	3	20

Automated Static Bat Detector Survey

2.20 A passive static recording broadband detector (Song Meter® SM4BAT+ bat detectors), with outputs saved to an internal storage device, was deployed to supplement the manual transect survey, in line with industry guidance.

2.21 Monitoring took place in May, July and September 2021 with the device staying in place for a minimum of 5 nights. The data from any additional nights were assessed for the presence of Annex II bat species only. The recorded data was analysed using Kaleidoscope Pro 4.5 and Bat Sound software to assess the species assemblage and relative level of bat activity on site. The recording units were deployed during periods of suitable weather conditions (little no rain/wind and temperatures above 10°C at sunset). The locations of the devices are shown in **Figure 3**.

Great Crested Newts

2.22 Two ponds are located adjacent to the Site boundaries: an ornamental pond in the north opposite McDonalds (P1) and one on the southern boundary in the grounds of the garden centre (P2). There are another two ponds within a 500m radius: a balancing pond to the west, across the A41 (P3) and waterbodies associated with the sewage treatment works to the south, across the brook (collectively referred to as P4). Only the ponds adjacent to the boundaries were permitted access for survey. Water body locations are shown in **Figure 2**.

Habitat Suitability Index

2.23 A habitat suitability index (HSI) assessment was undertaken on Ponds P1 and P2. This assessment[7] provides a measure of the likely suitability that a waterbody has for supporting great crested newts (GCN) *Triturus cristatus*. Whilst not a direct indication of whether or not a pond will support GCN generally, those with a higher score are more likely to support the species than those with a lower score and there is a positive correlation between HSI scores and ponds in which GCN are recorded. Ten separate attributes are assessed for each pond to calculate the suitability of the ponds to support GCN:

Geographic location	Presence of water-fowl
Pond area	Presence of fish
Pond drying	Number of linked ponds
Water quality	Terrestrial habitat
Shade	Macrophytic coverage

2.24 A score is assigned according to the most appropriate criteria level set within each attribute and a total score calculated of between 0 and 1. Pond suitability is then determined according to the scale set out in **Table 4** below. Using the index score the predicted presence of GCN being found within a pond can be made, based on the proportion of ponds typically occupied at that suitability level.

Table 4: HSI Score and Suitability for Supporting Great Crested Newts

HSI score	Pond Suitability
<0.5	Poor
0.5 - 0.59	Below average
0.6 – 0.69	Average
0.7 – 0.79	Good
>0.8	Excellent

2.25 An assessment of the suitability of terrestrial habitats to support GCN was also completed within the Site. Suitable terrestrial habitat includes shelter habitat such as scrub and rank vegetation and habitat that could provide suitable hibernation sites such as rubble piles or tussock grassland.

eDNA Surveys

2.26 Environmental DNA (eDNA) sampling was undertaken of P1 and P2 in the 2021 survey season to determine the presence/absence of GCN in accordance with the Technical Advice Note for field and laboratory sampling of GCN eDNA (WC1067)[8]. This methodology has been approved by Natural England for the determination of GCN presence/absence. Pond P1 was sampled again in the 2023 season.

2.27 Sampling was undertaken by appropriately licenced ecologists who collected a sample of water from each pond (during suitable weather conditions avoiding heavy rain). Sampling was undertaken using kits obtained from ADAS. The methodology comprised taking samples of agitated water from 20 locations around each pond and mixing thoroughly. 15ml of this water

[7] Oldham et al. 2000. *Herpetological Journal* 10(4); Evaluating the Suitability for the Great Crested Newt.
[8] Biggs J, Ewald N, Valentini A, Gaboriaud C, Griffiths RA, Foster J, Wilkinson J, Arnett A, Williams P and Dunn F 2014. Analytical and methodological development for improved surveillance of the Great Crested Newt. Appendix 5. *Technical advice note for field and laboratory sampling of great crested newt (Triturus cristatus) environmental DNA*. Freshwater Habitats Trust, Oxford.

was then placed into each of the six sterile sample tubes containing preservative, precipitates and a DNA sequence that was used for degradation control. All samples were stored in accordance with the protocols provided by the laboratory. The samples were then transported under suitable conditions for analysis. Following analysis, results provided by the laboratory could have one of three outcomes described in **Table 5** below. One kit is required for ponds up to 1ha then an additional kit is required for each additional hectare of pond area.

Table 5: Description of Possible Results of eDNA Analysis

Result	Description
Positive	A positive result means that eDNA from GCN was detected and they have been present within the water in the 20 days preceding sampling. An eDNA score would be provided indicating the number of positive replicates from a series of twelve.
Negative	DNA from GCN was not detected; in the case of negative samples the DNA extract is further tested for PCR inhibitors and degradation of the sample.
Inconclusive	Controls indicate degradation or inhibition of the sample, therefore the lack of detection of GCN DNA is not conclusive evidence for determining the absence of the species in the sample provided. Degradation can occur through poor storage of the samples or kits and inhibition can occur through unexpected chemicals in the sample.

Breeding Birds

2.28 A scoping Breeding Bird Survey (BBS) comprising a single visit was undertaken on 20th April 2021 by an experienced ornithologist from FPCR.

2.29 The survey methodology employed was broadly based on that of territory mapping as developed by the British Trust for Ornithology (BTO)9. All birds encountered (seen or heard) were recorded on a field survey plan using standard BTO species codes and symbols for bird activities and to denote activity, sex and age where appropriate. Birds were considered to be holding a territory and therefore likely to be utilizing the Site for breeding activities if they were displaying breeding behaviours, such as: singing, nest building, food carrying or territorial defence. If birds did not display such behaviours, e.g. they were only recorded flying over the Site, they were considered non-breeders. Breeding evidence used in this report follows EOAC guidelines 1979, as summarised in **Appendix A**.

2.30 The survey visit was undertaken between sunrise and 11.00 hrs. A route was mapped out prior to the survey being undertaken, with particular attention to linear features, such as hedgerows and watercourses. The survey was not undertaken in unfavourable conditions such as heavy rain or strong wind, which may negatively affect the results. The conditions throughout the survey visit are shown in **Table 6**.

Table 6: Conditions during the Breeding Bird Survey

Date	Cloud (%)	Rain	Wind	Visibility
20.04.21	10	None	Gentle breeze	Excellent

Badger

2.31 [redacted]

[9] Bibby, C.J., N.D. Burgess & D.A. Hill. 2000. *Bird Census Techniques*: 2nd Edition. London: Academic Press.

2.32 [redacted]

2.33 [redacted]

Reptiles

2.34 A reptile presence/absence survey was undertaken in 2021 across all areas of the Site identified as offering potential suitable habitat to reptiles.

2.35 The survey was undertaken based on current best practice guidelines as detailed within the Herpetofauna Workers Manual[11] and Froglife Advice Sheet[12]. Methods involved a search for basking reptiles on/under naturally occurring and strategically positioned artificial refugia placed in locations that offered the most suitable habitat for common reptiles. i.e. structurally diverse habitats, with variable vegetation heights, tangled or thorny areas, mosaics, bare patches or ecotones. Locations of the refugia are shown in **Figure 4**.

2.36 Surveys were undertaken in between May and September 2021 by suitability experienced ecologists. The prevailing weather conditions, including relative wind speed, cloud cover, ambient temperatures and any other notable weather, are provided in **Table 7**.

2.37 Guidelines recommend that surveys are undertaken during the following periods:

[10] Harris, S., Cresswell, P. and Jefferies, D. 1989. *Surveying Badgers*, Mammal Society.
[11] Gent, T. and Gibson, S. 2012. *Herpetofauna Workers' Manual*. Pelagic Publishing.
[12] Froglife 1999. Reptile Survey: An introduction to planning, conducting and interpreting surveys for snake and lizard conservation. *Froglife Advce Sheet 10.*

- At temperatures of between 9°C & 18°C;
- On sunny/cloudy days with little or no wind;
- Between 07:00 & 11:00 hrs ('AM survey') or between 16:00 & 19:00 hrs ('PM survey') (note: if temperature conditions are suitable the surveys can be undertaken outside of these periods).

2.38 In addition, guidelines also recommend:

- Using regularly spaced felt as artificial refugia, with a black upper side;
- Approaching refugia from a downwind direction, casting no shadow and making sure not to disturb basking animals when checking;
- That lifting and replacing tins, to check for the presence of reptiles, underneath, is undertaken with care to avoid potential harm to any animals underneath;
- That the location and number of tins are mapped to aid survey and avoid the possibility of leaving tins in situ upon completion of the survey.

Table 7: Data and Weather Conditions during Reptile Survey

Survey	Date	Start Time	Temp.	Weather	Rain
1	24.05.21	10:00	10°C	Bright, 50% cloud cover, light breeze	No
2	28.05.21	10:45	15ºC	Bright, 80% cloud cover, no wind	No
3	04.06.21	09:30	13ºC	Bright 90% cloud cover, no wind	No
4	23.06.21	10:45	17ºC	Sunny <10% cloud cover, light breeze	No
5	28.06.21	11:30	15ºC	Bright, 100% cloud, slight breeze,	No
6	01.09.21	11:30	16ºC	Sunny, bright, 90-100% cloud, moderate breeze	No
7	16.09.21	10:45	17°C	Sunny, 40% cloud, very light breeze	No

Population Assessment

2.39 Where reptile populations are identified, the populations are assessed in accordance with the population level criteria as stated in the Key Reptile Site Register (HGBI, 1998)[13]. This system classifies populations of individual reptile species into three population categories assessing the importance of the population (**Table 8**). These categories are based on the total number of adult animals observed during individual survey occasions.

Table 8: Key Reptile Site Survey Assessment Categories (HGBI, 1998)*

Species	Low Population (No. of Individuals)	Good Population (No. of Individuals)	Exceptional Population (No. of Individuals)
Adder	<5	5 – 10	>10
Common lizard	<5	5 – 20	>20
Grass snake	<5	5 – 10	>10
Slow worm	<5	5 – 20	>20

*Figures in the table refer to the maximum number of adults seen by observation and / or under tins (placed at a density of up to 10 per hectare, by one person in one day)

Riparian Species

2.40 Langford Brook and the drain running through the eastern part of the Site were surveyed for their suitability to support otter *Lutra lutra* and water vole *Arvicola amphibius*.

[13] Herpetofauna Groups of Britain and Ireland. 1998. Evaluating local mitigation/translocation programmes: maintaining best practice and lawful standards.

2.41 Suitable Habitat for water voles[14] includes:

- Water more than 50cm deep and relatively stable;
- Muddy bottom;
- Static or slow flowing water;
- Earth banks of >45° (for burrowing);
- Dense vegetation cover on the banks of a good mix of grasses and herbs for summer food and cover and some berry bearing bushes, tubers and trees for autumn and winter food;
- Emergent, in-channel vegetation; and
- 1-2m wide.

2.42 Otter have been known to exploit a wide range of aquatic habitats, and no specific variables have been found to be preferred by otter. Suitable otter habitat is therefore a somewhat loose term[15] but specifically overhanging tree roost and other areas that could be used as holts or couches (resting sites) were searched for.

[14] Dean, M., Strachan, R., Gow, D. and Andrews, R. 2016, *Water Vole Mitigation Handbook*. Mammal Society Mitigation Guidance Series. Eds Fiona Matthews and Paul Channin. Mammal Society, London.
[15] Chanin, P. 2003. *Ecology of the European Otter*. Conserving Natura 2000 Rivers Ecology Series No. 10. English Nature, Peterborough.

3.0 RESULTS

Desk Study

Statutory Designated Sites

3.1 The Site itself is not covered by any statutory designations and there are no international designations within 10km; however, four national statutory sites occur within 5km of the Site. The sites and further details are given in **Table 9**.

Table 9: Statutory Sites of nature conservation importance within the Site's Potential Zone of Influence

Site name	Approx. distance & direction from Site	Interest feature(s)
Wendlebury Meads and Mansmoor Closes SSSI	3.7km S	A series of traditionally-managed unimproved neutral meadows supporting a complex variety of plant communities that have developed in response to varying management, drainage and soils. Amongst the few surviving examples of calcareous clay pasture communities which were widespread throughout southern England at the turn of the century, but now rare.
Arcott Bridge Meadows SSSI	3.6km SE	Exhibit medieval ridge-and-furrow features indicating that parts, at least, have remained unploughed for many centuries. Managed as hay meadow and pasture and accordingly support a wide range of plant species which are largely confined to such old, unimproved, neutral grassland.
Ardley cutting and Quary SSSI	3.7km NW	The grassland contains a variety of species associated with limestone grassland including quaking grass *Briza media*, basil thyme *Acinos arvensis*, clustered bellflower *Campanula glomerata*, dropwort *Filipendula vulgaris* and sainfoin *Onobrychis viciifolia.* The flora of the woodland includes lords and ladies *Arum maculatum*, wood anemone *Anemone nemorosa* and green hellebore *Helleborus viridis* The invertebrate fauna is particularly rich along the railway cutting, with large populations of calcareous grassland butterflies like small blue *Cupido minimus*, brown argus *Aricia agestis*, dark green fritillary *Argynnis aglaja,* green hairstreak *Callophrys rubi* and Duke of Burgundy *Hamearis lucina,* all of which are uncommon in Oxfordshire.
Bure Park LNR	1.9km N	Habitats include grass meadow, young broad-leaved woodland, hedges and scrub. A small river (the Bure) runs through the site, feeding a small pond which is home to great crested newts. A balancing pond at one end of the Reserve is fed by run-off from the area.

Non-statutory Designated Sites

3.2 Non-statutory designations in Oxfordshire include Local Wildlife Sites (LWSs) which are considered of ecological value at a County level. Other non-statutory designations which may be pertinent in the locality include Cherwell District Wildlife Sites (and proposed CDWSs), which are valuable at a District level. The proposed sites have not yet been valued against the criteria for designation but for the purposes of this assessment should be treated as such.

3.3 The Site itself is not covered by any non-statutory designations, though there are two non-statutory sites within 2km. **Table 10** provides a summary of each.

Table 10: Non-statutory sites of nature conservation importance within 2km of the Site

Site name	Approx. distance & direction from Site	Interest feature(s)
Bicester Wetland Reserve LWS	300m S	Mostly wet grassland. Includes a small area of reedbed, open water (including shallow water for waders and deeper areas for other species), wet ditches, banks with tall herb and a dry grassland field to the east. The margins around the open water have swamp vegetation and areas of wet grassland. Important for over-wintering wildfowl including teal, pintail, pochard, wigeon, gadwall, snipe and water rail. It is also very important for birds which require wet grassland such as jack snipe, little ringed plover and green plover.
Promised Land Farm Meadows pCDWS	300m S	The sward is grass-dominated, with some meadow barley and yellow oat grass. A few unusual species, characteristic of ancient hay meadows have been recorded including great burnet, hay rattle, meadow knapweed (the rayed form) and pepper saxifrage. There is a spring-fed pond with marginal hard rush, celery leaved buttercup and pink water speedwell.

Protected Species

3.4 Relevant records provided by TVERC are summarised in **Table 11** below and are discussed in the relevant species section.

Table 11: Protected and Notable Species Records within 2km of the Site

Scientific Name	Common Name	Approx. distance from Site	Date	Status
Birds				
Many species recorded from Bicester Wetland Reserve at 280m S including Bearded Tit, Bittern, Black-headed Gull, Black-tailed Godwit, Black Tern, Bullfinch, Common Gull, Common Sandpiper, Common Tern, Crane, Cuckoo, Curlew, Dunlin, Dunnock, Fieldfare, Gadwall, Glossy Ibis, Grasshopper Warbler, Green Sandpiper, Greenshank, Grey Wagtail, Greylag Goose, Herring Gull, Hobby, House Martin, House Sparrow, Kestrel, Kingfisher, Lapwing, Lesser Black-backed Gull, Lesser Redpoll, Lesser Spotted Woodpecker, Linnet, Little Egret, Little Ringed Plover, Mallard, Marsh Harrier, Marsh Tit, Meadow Pipit, Mistle Thrush, Mute Swan, Oystercatcher, Peregrine, Red-necked Phalarope, Red Kite, Redshank, Redwing, Reed Bunting, Ringed Plover, Ruddy Shelduck, Ruff, Shelduck, Shoveler, Skylark, Snipe, Song Thrush, Starling, Stock Dove, Swift, Teal, Tree Sparrow, Turtle Dove, Wigeon, Willow Warbler, Wood Sandpiper, Woodcock, Yellow Wagtail, Yellowhammer				
Reptiles and amphibians				
Triturus cristatus	Great crested newt	Many records from areas east of the Site, the other side of the brook around Graven Hill and the MOD site from 2011-2017		EPS
Lissotron vularis	Smooth newt	1km NE	2013	WCA S5
Rana temporaria	Frog	1km NE	2017	WCA S5
Mammals				
Erinaceous europaeus	Hedgehog	Many records throughout the town from 2014-2019		NERC s.41

Scientific Name	Common Name	Approx. distance from Site	Date	Status
Mustela putorius	Polecat	200m SW	2012	NERC s.41
Bats				
Pipistrellus pipistrellus	Common pipistrelle	700m W	2013	EPS
Plecotus auritus	Brown long eared bat	900m NE 700m N	2012 2010	EPS
Plants				
Wild clary *Salvia verbenaca,* Ragged robin *Silene flos-cuculi,* Hoary plantain *Plantago media*		500m N	2018	
Small flowered buttercup *Ranunculus parviflorus*, Grey club rush *Schoenoplectus tabernaemontani*		300m S	2017	
Invertebrates				
A number of notable beetle, moth, fly and butterfly species recorded at Gavray Drive Meadows at c.1.4km NE. Including black, brown and white letter hairstreak butterflies.				

Field Survey

Habitats

3.5 The habitat distribution within the Site is shown on **Figure 2**.

Improved Grassland/ Temporary Grass Ley

3.6 A majority of the Site was covered by improved grassland[16] dominated by perennial ryegrass *Lolium perenne* and Yorkshire fog *Holcus lanatus* with very few other species. The past land use history of the Site indicates however that this grassland is temporary and has been sown in a rotation between cropping cycles.

Dense Continuous Scrub

3.7 The Site was bound to the northeast by dense continuous scrub. This habitat also extended along a drain located through the east of the Site. Scrub species included willow *Salix species*, hawthorn *Crataegus monogyna*, elder *Sambucus nigra*, common ash *Fraxinus excelsior*, blackthorn *Prunus spinosa* and field maple *Acer campastre*. The boundary scrub was edged by tall ruderal species such as green alkanet *Pentaglottis sempervirens*, common nettle *Urtica dioica*, cleavers *Galium aparine,* broad-leaved dock *Rumex obtusifolium*. cow parsley *Anthriscus sylvestris* and lesser burdock *Arctium minus*.

Mature Trees

3.8 There were several mature trees within the hedgerows and there is also a small area of mature trees cover that encroach onto the grass ley. Species include willow *Salix* sp. and common ash.

[16] JNCC. 1990. Handbook for Phase 1 habitat survey – a technique for environmental audit. Peterborough: JNCC

Tall ruderal

3.9 Tall ruderal vegetation had partially encroached onto the edges of the eastern field parcel. Species included broadleaved dock, nettle, white dead nettle *Lamium album*, spear thistle *Cirsium vulgare*, lesser burdock and a few grasses such as cocks foot *Dactylis glomerata* and false oat grass *Arrhenatherum elatius*.

Urban Bioswale

3.10 A bioswale along the side of Lakeview Drive was damp at the time of survey and dominated by reeds *Phragmites australis*.

Standing Water

3.11 A ditch runs through the eastern part of the Site. This was almost entirely shaded by scrub vegetation. The banks were steep and at the time of survey there was little standing water; most of the ditch was damp with some areas containing 1-5cm of water. There was little aquatic vegetation; being only present in the few unshaded area and consisting of water crowfoot *Ranunculus fluitans*, water-plantain *Alisma plantago-aquatica*, water-starwort *Callitriche stagnalis* and brooklime *Veronica beccabunga*. Bulrush *Typha latifolia* was present and rosebay willow herb *Chamaenerion angustifolium* and bramble was encroaching in drier areas.

Flowing Water

3.12 A small brook bordered the Site to the southeast and at the time of survey contained 20-30cm of fast flowing water over a varied substrate of gravel and mud. Aquatic and emergent vegetation was sparse due to the overshading by trees and scrub.

Hedgerows

3.13 There are four hedgerows bounding the Site on the western and southern boundaries. As shown in **Table 12** all except H4 scored highly under the HEGs assessment and would likely be considered important under the Hedgerow Regulations.

3.14 Hedgerow 1 is a mix of newly planted saplings to the eastern end and semi mature and mature hedge/trees at the western end.

3.15 Hedgerow H2 is more like a line of trees but is still managed as a hedgerow and thus is included as one.

3.16 Hedgerows H3 and H4 are relatively unmanaged hedgerows with few or no standards.

Table 12: HEGS and Hedgerow Regulations Table

Hedge	Woody Canopy Species	Mature trees /100m	% gaps	End Conns	Assoc. features	HEGS	REGS
H1	*U, Sn, Ca, Ag, Fe, Qr, Cm, Ps, Ac*	3	None	1	ditch	2+	Y
H2	*Ac, Sn, Ca, Ag, Fe, Qr, Ms,*	4	None	2	ditch	2+	Y
H3	*Cm, Sn, Ms, Ps, Fe, S*	1	<10%	2	ditch	-2	Y
H4	*Cm, Sn, Ps*	0	<10%	2	ditch	3	N

Species key: *Cm - Crataegus monogyna* (hawthorn), *Fe - Fraxinus excelsior* (Ash), *Ps - Prunus spinosa* (Blackthorn), *Qr - Quercus robur* (oak) *S – Salix sp. (*willow sp.*)*, *Sn - Sambucus nigra* (elder), *Ca - Corylus avellana* (hazel), *U - Ulmus* sp. (elm sp.), *Ap - Acer pseudoplatanus* (sycamore), *Ac - Acer campastre* (field maple), *Ms - Malus sylvestris* (crab apple).

Hardstanding

3.17 There was a small area of bare ground and hardstanding in the west of the Site that appears to be used for access onto the grass area from the A41.

Fauna

Bats

Roosting – Tree Assessment

3.18 There are several trees within the Site boundaries with features suitable for roosting bats such as thick ivy and some spits. These are all to be retained within the scheme and are shown in T1 to T3 on **Figure 2**.

3.19 There are four trees that encroach into the Site from the southern boundary and require removal, however all are considered to have negligible potential to support roosting bats. A detailed tree assessment is therefore not considered necessary.

Foraging - Habitat Assessment

3.20 Only records of common pipistrelle *Pipistrellus pipistrellus* and brown long eared bat *Plecotus auritus* were returned during the desk study. A majority of the Site was considered to have low suitability to support foraging and commuting bats because it is well it by the A41 and adjacent supermarket, also temporary grass leys are an intensively managed habitat that is unlikely to support large numbers of invertebrates. Bat foraging and commuting activity is likely to be confined to the drain along the eastern section and the boundary vegetation.

Transect Surveys

3.21 The spring transect survey was undertaken at dusk on 26 May 2021 and recorded occasional foraging and commuting passes by common and soprano pipistrelle *P. pygmaeus*, with only two passes by noctule *Nyctalus noctula*. There were very low levels of bat activity recorded. Results are shown on **Figure 5**.

3.22 The summer transect survey was undertaken at dusk on 12th July 2021 and recorded occasional foraging by common pipistrelle and soprano pipistrelle only. Activity levels were very low with only four passes recorded. Results are shown on **Figure 6**.

3.23 The autumn transect was undertaken on 13th September 2021 and recorded a higher level of activity than previously, and additionally recorded a *Myotis* species that wasn't recorded in previous months. Bat activity was again predominantly identified as common and soprano pipistrelle. Results are shown on **Figure 7**.

3.24 The transect surveys did not show any particular area of the Site as being favoured by bats.

Automated Static Bat Detectors

3.25 The location of the static detector is shown in **Figure 3**.

3.26 The spring static detectors remained in situ from 21st to 25th May and recorded low levels of bat activity with an average of 4.6 registrations per hour. Activity was predominantly from common pipistrelle (82%). *Myotis* sp, soprano pipistrelle and noctule were the next most frequently recorded species at 7.5, 6.5 and 3% of activity respectively. Brown long eared bat were recorded infrequently.

3.27 Peaks in activity were recorded approximately two hours after sunset, and almost no activity was recorded after 1am. Activity was not closely following sunset or preceding sunrise therefore was not indicative of the presence of a nearby roost site.

3.28 The summer static detector remained in-situ from 22nd to 26th of July and recorded a higher level of bat activity with an average of 18.9 registrations per hour. Activity was predominantly common pipistrelle (90.5%), with less frequently encountered noctule (5%), soprano pipistrelle (2.5%), brown long-eared bat (<1%) and *Myotis* (<1%). Peaks in activity were recorded approximately two hours after sunset and again at 2-3am, over two hours before sunrise. The timing of these peaks do not indicate the presence of a nearby roost.

3.29 The autumn detector remined in situ from 13th to 17th September and recorded an average of 22.3 registrations per hour. Activity was again predominantly from common pipistrelle (62%) but soprano pipistrelle activity was higher than during the previous surveys (23.5%). Noctule, *Myotis* sp. and brown long-eared bat activity accounted for 9%, 3% and 1%, respectively.

3.30 The static bat detector results are summarised in **Appendix B**. The above data indicate a small assemblage of common and widespread light tolerant bat species uses the Site for commuting and foraging purposes.

Great Crested Newt and Other Amphibians

3.31 The grass ley and boundary scrub, trees and hedgerows were considered to provide suitable terrestrial habitat for GCN. Pond P1 was considered to have poor suitability to support breeding GCN, and pond P2 was considered to have moderate suitability.

3.32 Detailed HSI scores for the two ponds are shown in **Appendix C**.

3.33 Both P1 and P2 returned negative eDNA results for GCN (both in 2021 and 2023 for P2), as shown in **Appendix D**. Other ponds within 500m are separated from the Site by Langford Brook which is considered to be a barrier to GCN dispersal. In addition, a development to the south of the Site (ref:19/01740/HYBRID) on the same side of Langford Brook as the Site, has three ponds within its boundary. All of these ponds had negative eDNA results in 2019. GCN are therefore not considered likely to be present within the Site and are not considered further in this appraisal.

3.34 Common and widespread amphibians such as common frog *Rana temporaria* and toad *Bufo bufo* could potentially breed in P2 and thus use the Site in their terrestrial phase. The mostly likely habitat to be used are the boundary vegetation.

Breeding Birds

3.35 A total of 28 bird species were recorded within the Site during the breeding bird survey completed in 2021. Of these, nine were considered notable species as they appear on one or more of the following:

- Schedule 1 of Wildlife and Countryside Act (WCA) 1981 (as amended)
- Species listed as Species of Priority Importance (SPI) under Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006; and
- Birds of Conservation Concern (BoCC) Red or Amber lists.

3.36 Of the 28 species, none were confirmed as breeding. Six species were considered probable breeders, including the notable skylark *Alauda arvensis* and dunnock *Prunella modularis*. The remaining four probable breeding species were all BoCC Green-listed species (low conservation

concern). The remaining 22 species recorded were considered possible breeders (15) or non-breeders (7).

3.37 **Table 13** provides a summary of the notable bird species and their breeding status within the Site. **Figure 8** shows their general recorded locations. A full list of results is provided in **Appendix A**.

Table 13: Notable Bird Species Recorded at the Bicester Arc site during the Breeding Bird Survey and their recent status in Oxfordshire

Species	Legal/ Conservation Status	Number Recorded	Breeding status	Recent Status in Oxfordshire
Greylag goose *Anser anser*	Amber list WCA Sch.1 (Pt. 2)	2 flyovers	Non-breeder	Common feral bird, occasionally breeds
Mallard *Anas platyrhynchos*	Amber list	1 flyover	Non-breeder	Very common resident
Red kite *Milvus milvus*	Green list WCA Sch. 1	2 flyovers	Non-breeder	Established resident
Skylark *Alauda arvensis*	Red list NERC S.41	7	Probable	Common resident and passage migrant
Willow warbler *Phylloscopus trochilus*	Amber list	1	Possible	Most common breeding warbler in Oxfordshire. Recent evidence of decline.
Starling *Sturnus vulgaris*	Red list NERC SPI	2	Possible	Widespread winter visitor. Much reduced breeding distribution
Song thrush *Turdus philomelos*	Red list NERC S.41	3	Possible	Common resident, perhaps declining in suburban areas. Autumn immigration augments wintering population
Dunnock *Prunella modularis*	Amber list NERC S.41	8	Probable	Common and widespread resident
Meadow pipit *Anthus pratensis*	Amber list	2	Possible	Usually abundant passage migrant and common winter visitor. Patchily distributed scarce breeder

3.38 The hedgerows, scrub and scattered trees provided breeding and foraging opportunities for common and widespread generalist species, with notable species including song thrush *Turdus philomelos*, dunnock, starling *Sturnus vulgaris* and willow warbler *Phylloscopus trochilus*. Dunnock was considered a probable breeder due to the observation of a pair in suitable breeding habitat, whilst song thrush, starling and willow warbler were considered only possible breeders due to the lack of breeding evidence recorded. Other species of low conservation concern utilising these habitats included green woodpecker *Picus viridis*, blackbird *Turdus merula*, robin *Erithacus rubecula*, wren *Troglodytes troglodytes*, woodpigeon *Columba parambus* and the range of common and widespread warbler, finch, tit and corvid species recorded.

3.39 The internal parts of the grassland fields provided relatively limited breeding opportunities for birds. An exception was skylark, which was recorded in small numbers (seven individuals) and considered a probable breeder on Site. Meadow pipit *Anthus pratensis* was also recorded within the internal parts of the fields and was categorised as a possible breeder, however it is likely the two individuals recorded were passage migrants. Other species of low conservation concern which utilised the fields for foraging included carrion crow *Corvus corone* and magpie *Pica pica*.

3.40 Several bird species were only recorded flying over the Site, including the notable greylag goose *Anser anser*, mallard *Anas platyrhynchos* and red kite *Milvus milvus*.

Site Value

3.41 The Site was assessed against published criteria for LWS selection in the Local Wildlife Sites Selection Criteria Berkshire, Buckinghamshire and Oxfordshire Version 7[17] to confirm whether it achieved any of the thresholds for county value on the basis of the bird assemblages recorded. The Site does not meet any of the relevant criteria and therefore does not qualify for selection as an LWS based on its breeding bird assemblage.

3.42 The habitats within the Site supported an assemblage of common and widespread bird species in small to moderate numbers typical of the habitats present and the size of the Site. Therefore, the Site was considered to be of no more than Local level importance for its overall breeding bird assemblage.

3.43 Individually dunnock, song thrush and skylark were considered of Local importance based on the small to moderate numbers of each recorded within the Site. The other breeding bird species recorded were considered as being of only Site importance since they were either recorded in smaller numbers, noted in unsuitable breeding habitats and/or are considered common and widespread breeding species nationally and/or locally.

Badger

3.44 No badger records were returned within 1km and no direct evidence of badger was recorded on the Site during the survey, however several mammal trails across the Site were noted.

Reptiles

3.45 The Site provided some suitable habitat for reptile species, especially around the edges of the boundary scrub, hedges and trees and along the ditch in the east. Records of common lizard *Zootoca vivipara* and grass snake *Natrix helvetica* records were returned during the desk study but from over 1km from the Site.

3.46 No reptiles were recorded during any of the surveys. Reptile species are not considered likely to be present.

Riparian Species

3.47 Langford Brook does provide some, albeit limited habitat for otter and water vole.

3.48 No records of water vole were returned during the desk study and the stretch of Langford Brook adjacent to the Site is especially limited for this species due to the lack of in-channel and bank side vegetation, providing limited suitable food or cover. Water vole are considered very unlikely to be present within the Site.

3.49 There are no suitable breeding or resting places for otter on the adjacent stretch of Langford Brook. It is considered likely that Langford Brook forms a small part of a much wider otter foraging territory and could therefore be used occasionally by foraging or commuting individuals.

Other Notable Mammals

3.50 Records of hedgehog *Erinaceous europaeus* and polecat *Mustela putorius* were returned during the desk study and harvest mouse *Micromys minutus* has been recorded over 1km from the Site.

[17] Thames Valley Environmental Records Centre and Buckinghamshire & Milton Keynes Environmental Records Centre (2018). Local Wildlife Sites Selection Criteria Berkshire, Buckinghamshire and Oxfordshire, Version 7 [Online]. Available at http://www.tverc.org/cms/sites/tverc/files/LWS%20Selection%20Criteria_v7%20Aug18.pdf [Accessed 01.11.21]

3.51 The Site is considered very unlikely to support harvest mouse with suitable habitat being limited to the small section of tall ruderal vegetation which is in itself sub optimal. This species is therefore not considered likely to be present.

3.52 The boundary vegetation provides some suitable vegetation for hedgehog and polecat. Rabbits are also present and are a prey species of polecat. The presence of small numbers of hedgehog and polecat in the boundary vegetation is assumed.

Invertebrates

3.53 A number of notable beetle, moth, fly and butterfly species have been recorded at Gavray Drive Meadows c.1.4km northeast of the Site. These include black hairstreak *Satyrium pruni*, brown hairstreak *Thecla betulae* and white-letter hairstreak *Satyrium w-album* butterflies. Black and brown hairstreak larvae require blackthorn scrub, and white-letter hairstreak larvae require elm species. The boundary scrub and hedgerows do support habitat suitable for the larvae of each of these butterfly species, however nectar sources for the adult butterflies are fairly limited. The presence of small numbers of each of these species cannot be discounted and is therefore assumed for the purpose of this assessment.

3.54 The presence of temporary grass ley (preceded by arable crops) as the predominant habitat means that insecticides have likely been applied to the Site in recent years and so a notable diversity of invertebrates is considered unlikely.

4.0 DISCUSSION & RECOMMENDATIONS

Statutory Designated Sites

4.1 The Site supported no statutory designations for nature conservation interest, but three SSSIs and one LNR lie within the potential ZoI as shown on **Figure 1**.

4.2 The site lies within the outer limits of the SSSI Impact Risk Zones[18] of Wendlebury Meads and Mansmoor Closes, Arcott Bridge Meadows and Ardley Cutting and Quarry Residential SSSIs. Development is not however listed as a development type that Natural England identify as a potential risk to the conservation status of any of these sites.

4.3 Given the intervening distance and absence of public footpath connectivity from the Site to the SSSIs, no material increase in recreational pressure as a result of the development is considered likely. Furthermore, there is no hydrological connectivity between the site and Arncott Bridge Meadows and Ardley Cutting and Quarry.

4.4 Wendlebury Meads and Mansmoor Closes SSSI also lies adjacent to Langford Brook downstream of the Site. To minimise the risk to downstream habitats including the SSSI construction operations and site management protocols to prevent pollution and soil run-off resulting in siltation and/or changes in water quality. Although the Environment Agency (EA)'s Pollution Prevention Guidelines (PPGs) have been withdrawn, they still remain the best source of guidance in relation to avoidance of pollution. Reference will be paid to PPG01-06, PPG21 and PPG22 (available on the National archives).

4.5 The Construction Industry Research and Information Association (CIRIA) guidance will also be followed, in particular:

- CIRIA C471 – Environmental Good Practice on Site (4th Edition) 2015;
- CIRIA C532D – Control of water pollution from construction sites. Guidance for consultants and contractors (2001); and
- CIRIA SP156 – Control of Water Pollution from Construction Sites (2012).

4.6 These measures should be detailed within an Ecological Construction Method Statement (ECMS) prepared for the development. Subject to these measures being fulfilled, no significant impacts upon water quality of Langford Brook or adjacent habitats are anticipated to arise as a result of the development.

4.7 Furthermore, the proposed creation of wetland habitats within the 'eco park' to the east of the Site will complement existing semi-aquatic habitats, providing a wider network of wetland habitats in the immediate area.

4.8 No significant impacts on local SSSIs are therefore anticipated as a result of the proposed development.

4.9 Bure Park LNR is situated within the urban extent of Bicester. There are no terrestrial or hydrological links between the Site and the habitats within the park, which is managed for recreation with an established network of footpaths[19]. The small increase in residential dwellings

[18] The Impact Risk Zones (IRZs) are a GIS tool developed by Natural England to make a rapid initial assessment of the potential risks to SSSIs posed by development proposals. They define zones around each SSSI which reflect the particular sensitivities of the features for which it is notified and indicate the types of development proposal which could potentially have adverse impacts
[19] https://redkitedays.co.uk/bure-park-nature-reserve/

at the Site will not result in a significant increase in residential impacts on the LNR above that which is it already designed to accommodate.

Non-statutory Designated Sites

4.10 The Site does not support any non-statutory designations though there are two within 2km of the Site: Bicester Wetland Reserve LWS and Promised Land Farm Meadows potential CDWS.

4.11 Bicester Wetland Reserve LWS lies 300m south of the Site on the opposite side of Langford Brook. It is separated from the Site by the sewage treatment works and Bicester Garden Centre however, it is however hydrologically linked to the Site by Langford Brook. This non-statutory site will be protected from indirect impacts arising during construction by the precautionary working methods outlined above.

4.12 Promised Land Farm Meadows potential CDWS lies within the site boundary of part of a consented development (ref:19/01740/HYBRID). A majority of the Site will be lost as a result of this development and thus it is not considered further in this appraisal.

4.13 No significant impacts on local non-statutory sites are therefore anticipated as a result of the proposed development.

Habitats

4.14 The degree to which habitats receive consideration within the planning system relies on a number of mechanisms, including:

- Inclusion within a specific policy, for example veteran trees, ancient woodland and linear habitats within the National Planning Policy Framework (NPPF);
- A non-statutory site designation;
- Habitats considered as habitats of principal importance for the conservation of biodiversity as listed within Section 41 (S41) of the NERC Act 2006; or
- Habitats identified as being a Priority Habitat within the local Biodiversity Action Plan (LBAP).

4.15 The only habitats to fall under any of the above are the boundary hedgerows and trees. These more established habitats are considered to be of greater value to wildlife and will be largely retained and enhanced within future layouts for applications which impact these boundaries.

4.16 To avoid damage/disturbance of these retained features during construction it is recommended that an Ecological Protection Zone (EPZ) around the retained trees and vegetation along the watercourse should be established during the construction phase. EPZs can often be achieved through co-ordination with tree protection measures required as good arboricultural practice including BS5837 Trees in Relation to Construction – Recommendations: 2012 for trees and hedgerows, where all retained trees are protected from damage and soil compaction during works by maintaining protected Root Protection Areas (RPAs). This zone is demarcated with temporary protective fencing determined in accordance with BS 5837 (2012) and signage. It is recommended that details of such measures and their implementation are delivered through an ECMS prepared for the Site.

4.17 The dominant temporary grassland habitat was of limited botanical value being temporary, under intensive management and comprised of common and widespread plant species. The removal of this habitat is not considered likely to significantly impact local wildlife populations and its loss

does not represent a constraint to development. There is significant scope for enhancement within the 'eco park', which will serve to provide the mitigation and enhancements required to serve the entire development. The following being incorporated into the landscape design for this area:

- Retention of a majority of the existing boundary hedgerows and scrub;
- Creation a pond designed, planted and managed for wildlife to compliment the habitat within the Bicester Wetland Reserve LWS;
- Creation of neutral species rich grassland;
- Enhancement of some of the temporary grass ley to become a permanent grassland;
- Planting of additional scattered native scrub throughout the ecopark, including fruit and seed-bearing species to compliment that which is already present along the ditch and the Site boundaries;
- Creation of a quiet zone for wildlife around the ponds and neutral grassland towards the rear of the 'eco park'. This will have less footpaths (and only mown rather than sealed) and signage and interpretation boards to ensure it is kept separate from the main amenity area at the front; and
- Planting of trees throughout the development to add structural and species diversity to the Site.

4.18 Design for the habitat creation in this area and the biodiversity net gain it provides for the entire development, is provided in the Bicester Arc 'Eco Park' Biodiversity Net Gain Technical Note[20].

4.19 Specifications for new planting in the 'eco park' and other habitat creation as well as the measures to maintain existing habitats, to ensure successful establishment of new habitats, and to maintain the value of all ecological features in the long-term should be detailed within a Landscape Ecology Management Plan (LEMP) secured by planning condition.

Protected/Notable Species

4.20 Certain species receive legal protection in the United Kingdom and are commonly known as 'Protected Species'. In reality, the level of protection for different species varies considerably, from protection solely against 'killing and injury' to full protection of the species and their places of refuge. Where pertinent, details of legal protection afforded to species/species-groups are provided below.

4.21 In addition to protected species, there are other species/species-groups that do not receive legal protection, but which are notable owing to their conservation status as Priority Species or other status. Details of any actual or potential notable species within the Site are identified below.

4.22 Baseline investigations have identified protected species implications for the Site relating to breeding birds, foraging and commuting bats, reptiles, badgers and hedgehogs which are discussed in turn below.

[20] FPCR 2023, Bicester Arc 'Eco Park' Biodiversity Net Gain Technical Note. Produced for Peverill Securities.

Bats

4.23 All bats and their roosts are afforded full legal protection under the Conservation of Habitats and Species Regulations 2017 (as amended) and the Wildlife & Countryside Act 1981 (as amended). The purpose of the legislation is to maintain and restore protected species to a situation where their populations are favourable.

4.24 Under Regulation 41 of the Conservation of Habitats and Species Regulations 2017 (as amended) it is illegal to deliberately capture, injure or kill; deliberately disturb (including intentionally or recklessly) all UK bat species. This includes disturbance which impairs their ability to: breed and rear young; migrate; and hibernate; or affects their local distribution and abundance.

Foraging and Commuting

4.25 Bat activity across the Site was generally low level and comprised a small assemblage of common and widespread bat species. The majority of habitat to be lost consists of temporary grass ley which is considered to be of limited value to bats and its loss is not considered likely to significantly impact use of the site by bats.

4.26 The majority of more suitable habitat, mature hedgerows and trees, are to be retained and protected within the layout.

4.27 In addition, the habitat enhancements and creation within the 'eco park' will serve to enhance the site for foraging and commuting bats by increasing the habitat diversity present, thus encouraging invertebrate prey species. The retained hedgerows along the southern boundary also provide an east-west dark corridor for bats along the southern boundary to the 'eco park'. Future development phases that adjoin the southern boundary will ensure these retained hedgerows remain dark.

4.28 A sympathetic lighting scheme is recommended with the following design measures:

- The direct lighting of existing trees, scrub, hedgerows and any habitat on the 'eco park' should be avoided;
- Road and flood lighting should avoid using mercury or metal halide lamps, and where possible utilise warmer colour lights with peak wavelengths >550nm (~3000°K);
- Lighting should be directional and light spillage should be avoided;
- Lighting columns should in general be as short as possible, although in some locations taller columns would allow reduced horizontal spill;
- Lighting levels should be as low as guidelines permit and only used where required for public safety.

4.29 Subject to these measures being applied, it is not anticipated that the proposed development will have a significant adverse impact on foraging or commuting bats.

Badger

4.30 No evidence of badger activity was recorded during site surveys, however several mammal trails were recorded across the Site.

4.31 Badgers are likely to utilise on-site habitats for foraging. Therefore, construction best practice measures to be detailed within an ECMS will be followed and include:

- avoiding the use of noisy plant and machinery in the two hours before sunset within 30 metres of the brook;
- directing any security lighting away from the brook and retained boundary vegetation;
- covering any trenches at the end of each working day, or including a means of escape for badgers (and other mammals); and
- capping of temporarily exposed pipe systems out of work hours.

4.32 In addition, the use of native fruit and seed-bearing trees within new planting will enhance foraging opportunities on the Site for badger and the sensitive lighting scheme designed for bats will ensure minimal impact on badger.

4.33 Subject to these recommendations, the proposed scheme is likely to have a neutral to positive impact on any badger within the area.

Reptiles and Amphibians

4.34 In England and Wales all reptile species are listed on Schedule 5 of the Wildlife and Countryside Act 1981 (as amended). This affords them protection against killing and injuring. Common toad are listed as a Priority Species for conservation.

4.35 Reptiles are not considered likely to be currently present on the Site. Common and widespread amphibians could potentially breed within P2 and thus be on the Site in their terrestrial phase. The measures incorporated into the detailed landscaping scheme for the 'eco park' will enhance the Site for reptiles and amphibians and thus encourage any in the vicinity to utilise the Site and expand their range within Bicester.

4.36 Installation of hibernacula around the pond will provide shelter and hibernation potential where there is currently none.

Birds

4.37 All wild birds, their nests and eggs are protected under Section 1 of the Wildlife and Countryside Act 1981 (as amended). This makes it an offence to:

I. Intentionally kill, injure or take any wild bird;

II. Take, damage or destroy the nest of any wild bird while it is in use or being built;

III. Take, damage or destroy the egg of any wild bird; or

IV. To have in one's possession, or control, any wild bird (dead or alive) or egg or any part of a wild bird or egg.

4.38 In addition, further protection is afforded to those wild bird species listed on Schedule 1, prohibiting any intentional or reckless disturbance to these species while it is nest building, or at a nest containing eggs or young, or to recklessly disturb the dependent young of such a bird.

4.39 The habitat measures described for the 'eco park' will retain and enhance existing habitat and create further habitat for the generalist species recorded within the Site including the locally important song thrush and dunnock. The planting of native fruit and seed-bearing species will enhance foraging opportunities for a wide range of species.

4.40 The loss of the grassland fields will lead to a loss of the locally important skylark as a probable breeder on Site since this species favours large open fields for breeding. The creation of species rich grassland within the 'eco park' will continue to provide some foraging and breeding resources for this species as well as other such as meadow pipit. This grassland will be managed appropriately (i.e. no cut between early April and the end of May and subsequent cuts at least seven weeks apart to enable success for later nests) to ensure it remains potential habitat for skylark. The species rich grassland to the east of the scrub/ditch dividing line will be located in a quieter area of the 'eco park' to allow reduce disturbance to ground nesting birds. Overall, considering the abundance of similar suitable grassland habitats in the wider landscape to the south of the Site it is considered that the development proposals will lead to a minor (non-significant) impact on the grassland species recorded including skylark.

4.41 To avoid disturbance to breeding birds, areas for ground clearance works and vegetation removal will be checked prior to removal or works by an experienced ecologist. If active nests are found, vegetation will be left untouched and suitably buffered from works until all birds have fledged. Specific advice will be provided prior to undertaking the clearance. This would be a statutory requirement due to the protection of all nesting birds and their nests under WCA. A suitably qualified ecologist would supervise this. These measures will ensure the impact of disturbance during construction to any nesting birds is reduced to negligible.

4.42 The proposed creation of the ponds within the 'eco park' will provide an ecological enhancement by providing suitable habitat for a range of wetland birds not yet recorded within the Site. Planting the ponds with an appropriate native marginal vegetation mix that includes common reed for example will provide suitable nesting opportunities for species including reed bunting *Emberiza schoeniculus* and sedge warbler *Acrocephalus schoenobaenus*. Non-native wetland plants should be avoided.

4.43 Additional enhancements that could be integrated with the on-going management of the Site include the erection of a mixture of nest box types on retained trees. The following provides details of suitable nest box types to be erected at suitable locations:

- A mixture of small hole (25 to 32mm diameter) boxes placed on suitable trees will provide nesting opportunities for species such as blue tit *Cyanistes caeruleus* and great tit *Parus major.* These boxes generally have a high uptake rate;
- Small open fronted nest boxes placed on suitable trees especially those which support a climber such as ivy which provides a degree of concealment. These boxes typically attract species such as robin and blackbird; and
- Larger wood nest boxes with large holes (45-50 mm diameter) placed on suitable trees will provide nesting for starling. These boxes will also provide suitable nesting for great spotted woodpecker *Dendrocopos major* when placed on large mature trees.

4.44 The inclusion within the built environment of species-specific nest boxes for house sparrow *Passer domesticus* and swift *Apus apus* will encourage these urban species which have both undergone significant local and national declines to breed on Site.

Otter

4.45 Otter are fully protected under Schedule 5 of the Wildlife and Countryside Act 1981 and are priority conservation species. They are also a European Protected Species which affords them the same level of protection as is given to bats.

4.46 There is some potential for otter to use Langford Brook as part of a much wider foraging territory. Otter could be disturbed whilst using this habitat during construction. The good practice measures described with regards to badgers will also avoid impacts on foraging otter.

4.47 Given the provision of a significant green buffer between the development footprint and the brook (the 'eco park'), and the water quality protection measures to be detailed in an ECMS, construction of the proposed development is not considered likely to have any impacts on otter potentially using the brook.

4.48 The habitat creation measures described will enhance the habitat adjacent to the brook and the sensitive lighting scheme will ensure that there is no disturbance from lighting during the operational phase of the development.

4.49 Subject to the fulfilment of these recommendations, the proposed development will have no impact on foraging otter.

Hedgehog and polecat

4.50 Whilst hedgehog and polecat are not currently a protected species, their populations have declined significantly in recent years, and they are considered a priority for conservation.

4.51 The main potential habitats for these species on the Site are the boundary hedgerows and scrub which is to be largely retained.

4.52 As hedgehogs hibernate within piles of dead vegetation and debris, removal of such material across the site should be conducted outside of November to February inclusive. It is also recommended that during the construction phase materials should not be stored near areas of retained habitat or otherwise should be hand searched prior to removal. The best practice measures to be followed throughout construction for badger and otter (and detailed within an ECMS) will also ensure no harm to hedgehogs occurs.

4.53 The habitat creation measures discussed will ensure connectivity is maintained across the Site for hedgehog as well as create addition foraging areas. No significant impacts upon hedgehogs are anticipated to arise as a result of the development.

Invertebrates

4.54 The boundary scrub and hedgerows do support habitat suitable for the larvae black, brown and white-letter hairstreak butterfly species, however nectar sources for the adult butterflies are fairly limited. The larval habitats are to be retained and protected during construction. Furthermore, the habitat creation measures described within paragraph 4.17 will enhance the site for these species by providing additional blackthorn and elm scrub habitat for the larvae and the species rich grassland and pond edge planting will provide an enhanced nectar source for the adults. The proposed development is considered likely to have a positive impact on these species.

5.0 CONCLUSIONS

5.1. The desk- and field-based baseline investigations have demonstrated that the habitats present within and around the Site do not pose an 'in principle' constraint to the Bicester Arc development.

5.2. The retention of ecologically valuable habitats within the site design and the designation of the eastern part of the site as an 'eco park' supporting wetland, scrub and species rich grassland habitats means that the site is capable of achieving an enhancement for biodiversity in addition to providing additional habitat for a range of protected and notable species.

5.3. On this basis, by virtue of the relatively limited constraint posed by the limited habitats and protected species interest within the site and the scale and scope of the 'eco park', the scheme is capable of compliance with relevant planning policy for the conservation of the natural environment at all levels.

Key

- Land in Client Ownership
- 1km Search Area

Designated sites

- Potential Local Wildlife Site (pLWS)
- Local Wildlife Site (LWS)

Amphibians

- Great Crested Newt
- Palmate Newt
- Smooth Newt

Bats

- Brown Long Eared Bat
- Common Pipistrelle
- Pipistrelle Bat Species

Birds

- Black-headed Gull
- Bullfinch
- Common Sandpiper
- Gadwall
- Green Sandpiper
- Grey Wagtail
- House Sparrow
- Kestrel
- Kingfisher
- Lapwing
- Little Egret
- Mistle Thrush
- Mute Swan
- Pintail
- Red Kite
- Reed Bunting
- Shelduck
- Shoveler
- Snipe
- Starling
- Swift
- Teal
- Tree Sparrow
- Wigeon
- Willow Warbler

Invertebrates

- Brown Hairstreak
- Large Heath

Mammals

- Eurasian Badger
- Polecat
- West European Hedgehog

Plants

- Dwarf Spurge
- Hoary Plantain
- Ragged-Robin
- Wild Clary

Promised Land Farm Meadows

Bicester Wetland Reserve

0 250 500 m

client
Sladen Estates

project
Bicester Arc,
Bicester

drawing title
CONSULTATION PLAN

scale @ A3
1:9,750

drawn
FMH / BRJ

issue date
28/4/2023

drawing / figure number
Figure 1

rev
10048-E-01

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Key

- Land in Client Ownership
- Bare ground
- Built Environment: Buildings/hardstanding
- Improved grassland
- Introduced shrub
- Other tall herb and fern - ruderal
- Scrub - dense/continuous
- Standing water
- Standing water
- Running water
- Intact hedge - species-poor
- Hedge with trees - species-poor
- Dry ditch
- Scrub - scattered
- Tree with bat potential
- Broadleaved tree

0 50 100 m

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client
Sladen Estates

project
Bicester Arc,
Bicester

drawing title
PHASE ONE HABITAT PLAN

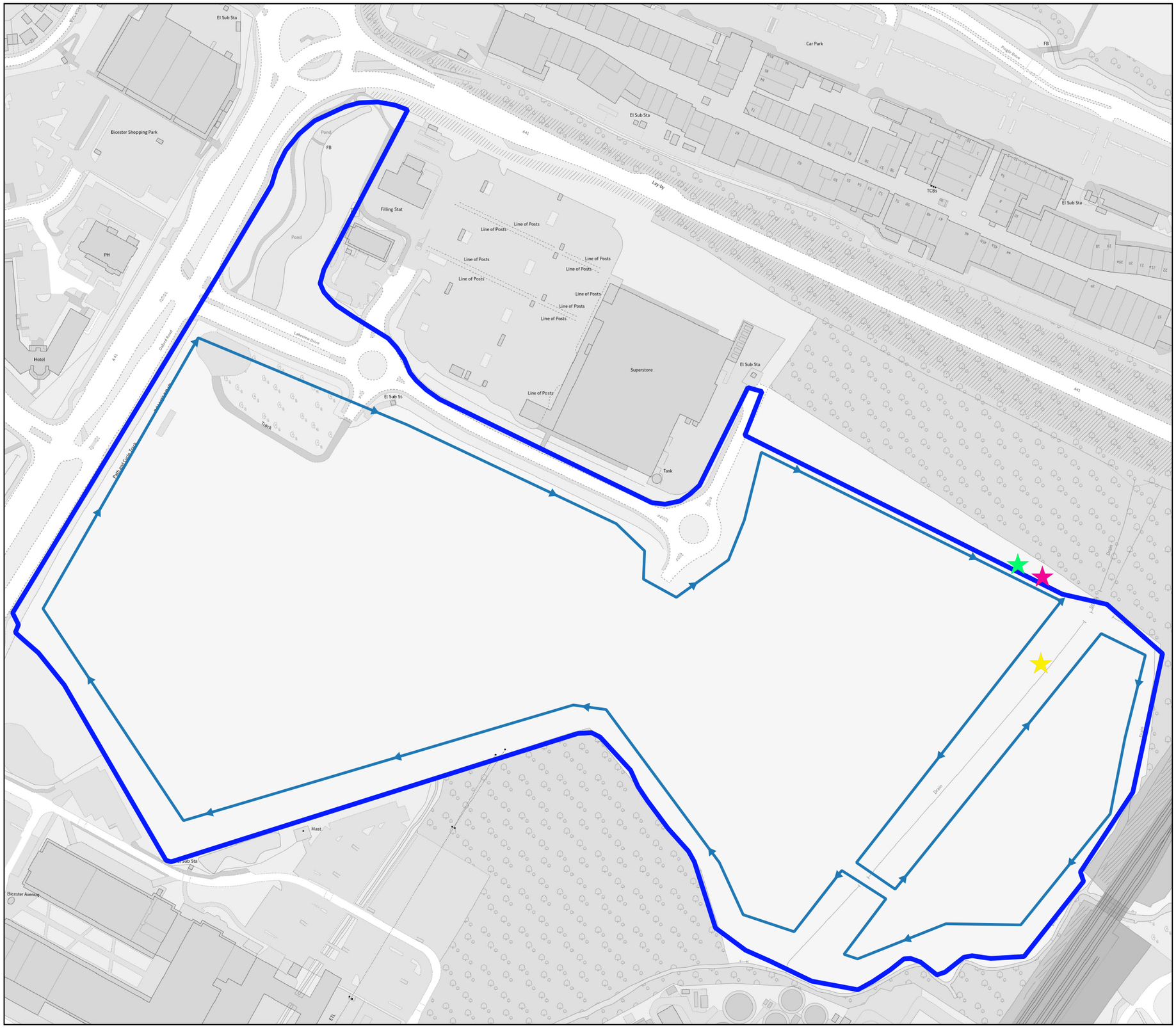
scale
1:2,550

drawn
FMH/VF

issue date
13/6/2023

drawing / figure number
Figure 2a

rev
10048-E-02



Key

- Land in Client Ownership
- Transect Route

Static Bat Detector Locations

- Autumn
- Spring
- Summer

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client
Sladen Estates

project
Bicester Arc,
Bicester

drawing title
BAT TRANSECT ROUTE & STATIC DETECTOR LOCATION PLAN

scale @ A3
1:2,550

drawn
FMH / VF

issue date
28/4/2023

drawing / figure number
Figure 3

rev
10048 - E - 03

Key

- Land in Client Ownership
- Reptile mats

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0 50 100 m

client
Sladen Estates

project
Bicester Arc,
Bicester

drawing title
REPTILE MAT LOCATION PLAN

scale
1:2,750

drawn
FMH / VF

issue date
28/4/2023

drawing / figure number
Figure 4

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10048 - E - 04

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Key

- Land in Client Ownership
- Start point
- Finish point
- Point Count Locations
- Transect Route
- Flight Arrow
- Common Pipistrelle
- Soprano Pipistrelle
- Noctule

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0 50 100 m

client
Sladen Estates

project
Bicester Arc,
Bicester

drawing title
SPRING BAT TRANSECT PLAN

scale @ A3
1:2,550

drawn
FMH / VF

issue date
28/4/2023

drawing / figure number
Figure 5

rev
10048 - E - 05

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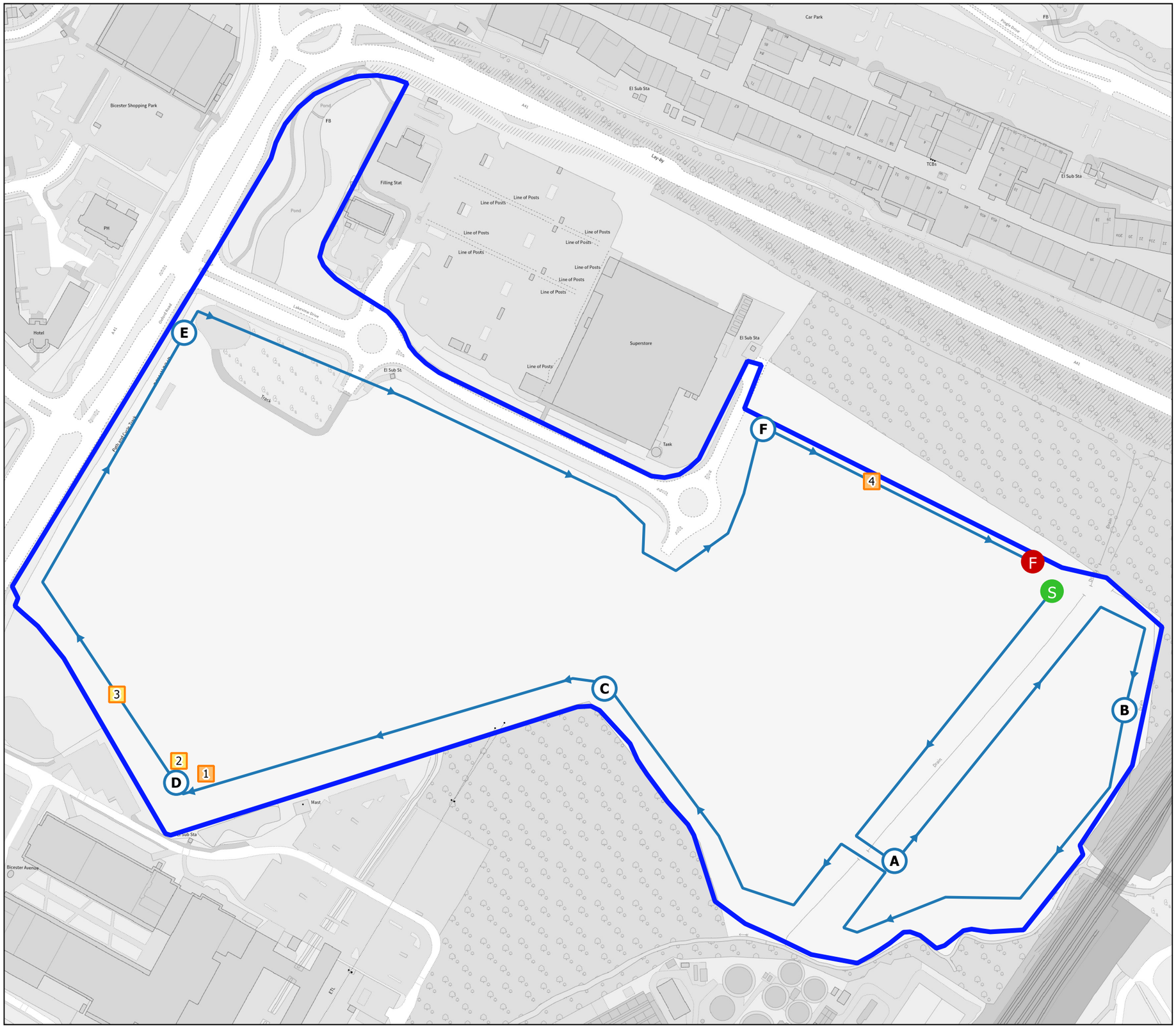

Key

- Land in Client Ownership
- Start point
- Finish point
- Point Count Locations
- Transect Route
- Common Pipistrelle
- Soprano Pipistrelle

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0 50 100 m

client
Sladen Estates

project
Bicester Arc,
Bicester

drawing title
SUMMER BAT TRANSECT PLAN

scale @ A3
1:2,550

drawn
FMH / VF

issue date
28/4/2023

drawing / figure number
Figure 6

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10048 - E - 06

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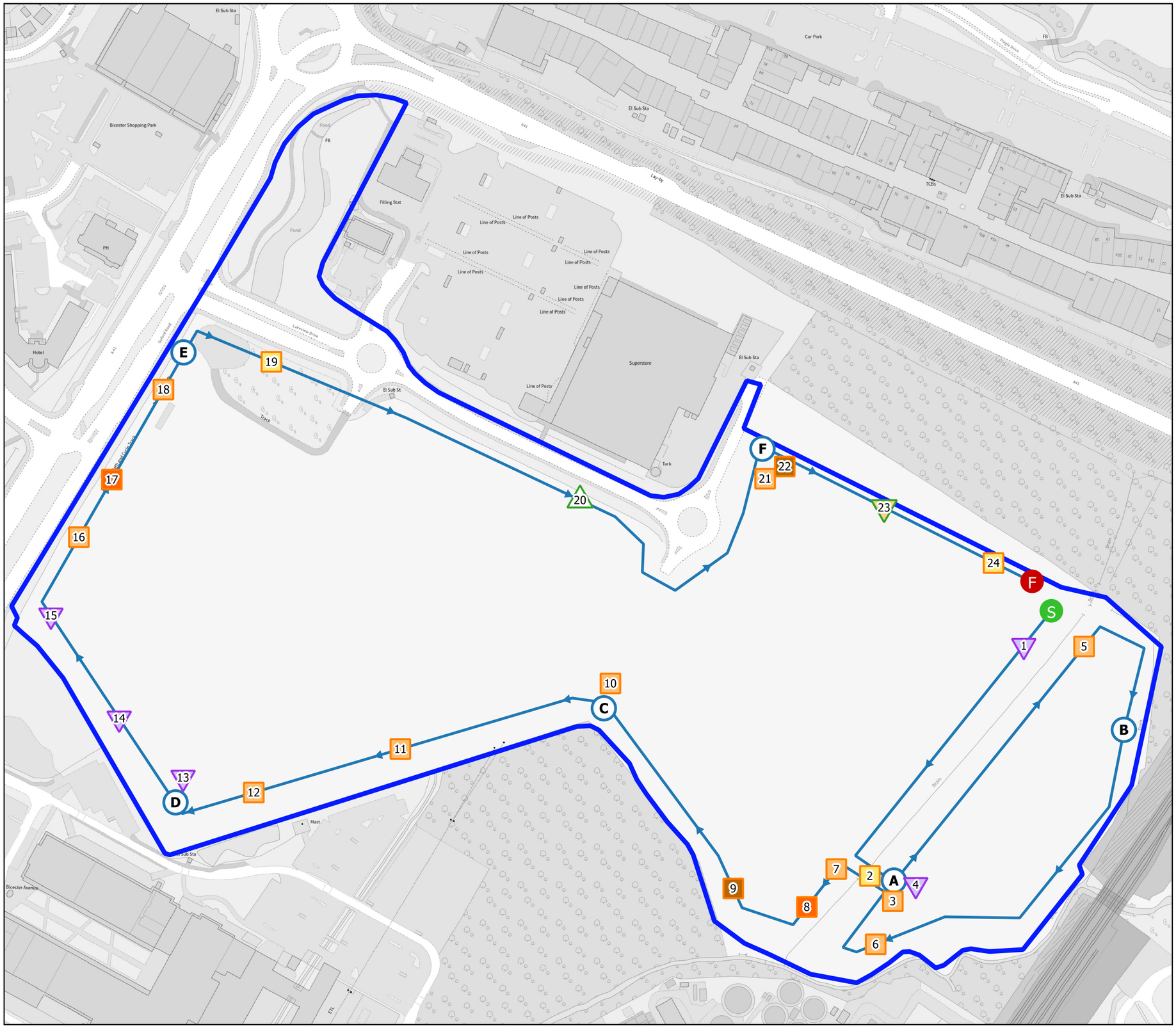

Key

- Land in Client Ownership
- Start point
- Finish point
- Point Count Locations
- Transect Route
- Common Pipistrelle
- Common Pipistrelle & Pipistrelle species
- Common Pipistrelle & Myotis species
- Soprano Pipistrelle
- Common & Soprano Pipistrelle
- Myotis Species
- Noctule

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0 50 100 m

client
Sladen Estates

project
Bicester Arc,
Bicester

drawing title
AUTUMN BAT TRANSECT PLAN

scale @ A3
1:2,550

drawn
FMH / VF

issue date
28/4/2023

drawing / figure number
Figure 7

rev
10048 - E - 07

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Key

Land in Client Ownership

Fly over only

BoCC Red-Listed Species

S Skylark

ST Song Thrush

SG Starling

BoCC Amber Listed Species

D Dunnock

GJ Greylag Goose

MA Mallard

MP Meadow Pipit

WW Willow Warbler

BoCC Green List Species

KT Red Kite

Additional Protections

NERC Species of Principle Importance

Schedule 1 Species

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0 50 100 m

client
Sladen Estates

project
Bicester Arc,
Bicester

drawing title
SCOPING BREEDING BIRD SURVEY RESULTS - LOCATIONS OF NOTABLE SPECIES

scale@A3 1:2,750 | drawn IJ / MJF | issue date 28/4/2023

drawing / figure number **Figure 8** | rev -

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Appendix A: Scoping Breeding Bird Survey Results & EOAC Criteria for Categorisation of Breeding Status

Species: British Common Name	Species: Latin name	Survey 1	Conservation Status & Protection	Breeding status[1]
Greylag goose	*Anser anser*	2 flyovers	Amber list WCA Sch.1 (Pt. 2)	Non-breeder F
Mallard	*Anas platyrhynchos*	1 flyover	Amber list	Non-breeder F
Red kite	*Milvus milvus*	2 flyovers	Green list WCA Sch.1	Non-breeder F
Buzzard	*Buteo buteo*	1 flyover	Green list	Non-breeder F
Woodpigeon	*Columba palumbus*	46 + 5 flyovers	Green list	Possible S, H
Green woodpecker	*Picus viridis*	1	Green list	Possible S, H
Magpie	*Pica pica*	6	Green list	Possible H
Jay	*Garrulus glandarius*	1	Green list	Possible H
Jackdaw	*Corvus monedula*	2 flyovers	Green list	Non-breeder F
Rook	*Corvus frugilegus*	1	Green list	Non-breeder UH
Carrion crow	*Corvus corone*	7 + 1 flyover	Green list	Possible H
Blue tit	*Cyanistes caeruleus*	11	Green list	Probable P, S, H
Great tit	*Parus major*	7	Green list	Probable P, S, H
Skylark	*Alauda arvensis*	7	Red list NERC S.41	Probable A, S, H
Swallow	*Hirundo rustica*	3 flyovers	Green list	Non-breeder F, UH
Long-tailed tit	*Aegithalos caudatus*	1	Green list	Possible H
Willow warbler	*Phylloscopus trochilus*	1	Amber list	Possible S, H
Blackcap	*Sylvia atricapilla*	8	Green list	Probable A, S, H
Wren	*Troglodytes troglodytes*	14	Green list	Possible S, H
Starling	*Sturnus vulgaris*	2	Red list NERC S.41	Possible H

[1]European Ornithological Atlas Committee, 1979. *Categories of Breeding Bird Evidence*. European Ornithological Atlas Committee.

Species: British Common Name	Species: Latin name	Survey 1	Conservation Status & Protection	Breeding status[1]
Blackbird	*Turdus merula*	5	Green list	Possible H
Song thrush	*Turdus philomelos*	3	Red list NERC S.41	Possible H
Robin	*Erithacus rubecula*	14	Green list	Possible S, H
Dunnock	*Prunella modularis*	8	Amber list NERC S.41	Probable P, S, H
Meadow pipit	*Anthus pratensis*	2	Amber list	Possible H
Chaffinch	*Fringilla coelebs*	2	Green list	Possible S, H
Greenfinch	*Chloris chloris*	2	Green list	Probable P, H
Goldfinch	*Carduelis carduelis*	2 + 4 flyovers	Green list	Possible S, H
Total No. Species:		**28**		

Breeding Status evidence can be broken down into four sections, each with their own codes, as defined by the European Ornithological Atlas Committee:

Confirmed breeder
DD – distraction display or injury feigning
UN – used nest or eggshells found from this season
FL – recently fledged young or downy young
ON – adults entering or leaving nest-site in circumstances indicating occupied nest
FF – adult carrying faecal sac or food for young
NE – nest containing eggs
NY – nest with young seen or heard

Probable breeder - Evidence accumulated during the survey indicates that the bird species is breeding on site.
P – pair in suitable nesting habitat
T – permanent territory (defended over at least 2 survey occasions)
D – courtship and display
N – visiting probable nest site
A – agitated behaviour
I – brood patch of incubating bird (from bird in hand)
B – nest building or excavating nest-hole

Possible breeder - Evidence accumulated during the survey indicates that the bird species could be breeding on site, but the evidence is less conclusive than that obtained for probable breeders.
H – observed in suitable nesting habitat
S – singing male

Non-breeder
F – flying over
M – migrant
U – summering non-breeder
UH – observed in unsuitable nesting habitat

Appendix B: Static Bat Detector Results

Dates	Survey Hours	Total Av. per hour	Total Registrations	Noctule		Common Pipistrelle		Soprano Pipistrelle		Brown Long-eared		*Myotis* species		*Pipistrelle* species	
				Period Total	Peak Count	Period Total	Peak Count	Period Total	Peak Count	Period Total	Peak Count	Period Total	Peak Count	Period Total	Peak Count
21-25.05.21	44	4.6	201	6	5	165	70	13	6	1	1	15	4	1	1
22-26.07.21	46	18.9	869	46	26	788	355	22	9	7	3	6	2	0	0
13-17.09.21	62	22.3	1380	129	39	858	401	324	207	11	8	45	12	13	6

Appendix C: HSI Results of the Ponds

Suitability Index	Criteria	Definition	Possible Score	P1	P2
SI_1	Geographic Location	Zone A - optimal	1	1	1
		Zone B - marginal	0.5		
		Zone C - unsuitable	0.01		
SI_2	Pond Area	Pond surface area to the nearest $50m^2$	*	0.8	0.8
SI_3	Permanence	Never Dries	0.9	0.9	0.9
		Rarely dries (Dries no more than 2/10 years or in drought	1		
		Sometimes dries (Dries between 3/10 years to most years)	0.5		
		Dries annually	0.1		
SI_4	Water Quality	Good (abundant & diverse invertebrate community)	1	0.01	0.33
		Moderate (moderate invertebrate community)	0.67		
		Poor (low invertebrate diversity, few submerged plants)	0.33		
		Bad (clearly polluted, pollutant tolerant invertebrates present, no submerged plants)	0.01		
SI_5	Shade	% shade of pond perimeter to at least 1m from the shore	*	1	0.6
SI_6	Waterfowl	Absent (no evidence of waterfowl, excluding moorhen)	1	0.01	0.67
		Minor (waterfowl present, though little impact)	0.67		
		Major (severe impact of waterfowl)	0.01		
SI_7	Fish	Absent (no records of fish stocking and no fish seen during survey)	1	1	0.67
		Possible (no evidence of fish, but conditions suggest	0.67		
		Minor (small numbers of crucian carp, goldfish or	0.33		
		Major (dense populations of fish present)	0.01		
SI_8	Pond Count	No. ponds within 1 km of survey pond not separated by major barriers and divided by 3.14	*	0.32	0.32
SI_9	Terrestrial	Good (extensive habitat offering good opportunities for foraging and shelter surrounding pond)	1	0.33	0.67
		Moderate (habitat offering opportunities for foraging and shelter, but not extensive and does not completely surround pond)	0.67		
		Poor (habitat with poor structure, offering limited opportunities for foraging and shelter)	0.33		
		None (No suitable habitat around pond)	0.01		
SI_{10}	Macrophytes	% pond surface area occupied by macrophyte cover (excluding duckweed) and submerged plants reaching the surface	*	0.3	0.9
HSI Score = $(SI_1*SI_2*SI_3*SI_4^*SI_5*SI_6^*SI_7*SI_8*SI_9*SI_{10})^{1/10}$				0.27	0.64
Pond Suitability (<0.5 = poor; 0.5-0.59 = below average; 0.6-0.69 = average; 0.7-0.79 = good; >0.8 = excellent)				Poor	Average

Client: Hayley Tomlin,
FPCR Environment and Design Ltd

ADAS
Spring Lodge
172 Chester Road
Helsby
WA6 0AR

Tel: 01159 516747
Email: Helen.Rees@adas.co.uk

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Sample ID: ADAS-0491	Condition on Receipt: Low Sediment	Volume: Passed
Client Identifier: 10048	Description: pond water samples in preservative	
Date of Receipt: 23/04/2021	Material Tested: eDNA from pond water samples	

Determinant	**Result**	**Method**	**Date of Analysis**
Inhibition Control[†]	2 of 2	Real Time PCR	26/04/2021
Degradation Control[§]	Within Limits	Real Time PCR	26/04/2021
Great Crested Newt*	0 of 12 (GCN negative)	Real Time PCR	26/04/2021
Negative PCR Control (Nuclease Free Water)	0 of 4	Real Time PCR	As above for GCN
Positive PCR Control (GCN DNA 10^{-4} ng/µL)[#]	4 of 4	Real Time PCR	As above for GCN
Report Prepared by:	Dr Helen Rees	Report Issued by:	Dr Ben Maddison
Signed:		Signed:	
Position:	Director: Biotechnology	Position:	MD: Biotechnology
Date of preparation:	29/04/2021	Date of issue:	29/04/2021

eDNA analysis was carried out in accordance with the stipulated methodology found in the Technical Advice Note (WC1067 Appendix 5 Technical Advice Note) published by DEFRA and adopted by Natural England.

** If all PCR controls and extraction blanks give the expected results a sample is considered: negative for great crested newt if all of the replicates are negative; positive for great crested newt if one or more of the replicates are positive.*

[†] Recorded as the number of positive replicate reactions at expected C_t value. If the expected C_t value is not achieved, the sample is considered inhibited and is diluted as per the technical advice note prior to amplification with great crested newt primer and probes.

[§] No degradation is expected within time frame of kit preparation, sample collection and analysis.

[#]Additional positive controls (10^{-1}, 10^{-2}, 10^{-3} ng/µL) are also routinely run, results not shown here.

Appendix 1: Interpretation of results

Sample Condition

Upon sample receipt we score your samples according to quality: good, low sediment, medium sediment, high sediment, white precipitate, and presence of algae.

There are three reasons as to why sediment should be avoided:

1. It is possible for DNA to persist within the sediment for longer than it would if it was floating in the water which could lead to a false positive result i.e. in this case GCN not recently present but present a long time ago
2. In some cases sediment can cause inhibition of the PCR analysis used to detect GCN eDNA within samples which could lead to an indeterminate result.
3. In some cases sediment can interfere with the DNA extraction procedure resulting in poor recovery of the eDNA which in turn can lead to an indeterminate result.

Algae can make the DNA extraction more difficult to perform so if it can be avoided then this is helpful.

Sometimes samples contain a white precipitate which we have found makes the recovery of eDNA very difficult. This precipitate can be present in such high amounts that it interferes with the eDNA extraction process meaning that we cannot recover the degradation control (nor most likely the eDNA itself) at sufficient levels for the control to be within the acceptable limits for the assay, therefore we have to classify these type of samples as indeterminate.

What do my results mean?

A positive result means that great crested newts are present in the water or have been present in the water in the recent past (eDNA degrades over around 7-21 days).

A negative result means that DNA from the great crested newt has not been detected in your sample.

On occasion an inconclusive result will be issued. This occurs where the DNA from the great crested newt has not been detected but the controls have indicated that either: the sample has been degraded and/or the eDNA was not fully extracted (poor recovery); or the PCR inhibited in some way. This may be due to the water chemistry or may be due to the presence of high levels of sediment in samples which can interfere with the DNA extraction process. A re-test could be performed but a fresh sample would need to be obtained. We have successfully performed re-tests on samples which have had high sediment content on the first collection and low sediment content (through improved sample collection) on the re-test. If water chemistry was the cause of the indeterminate then a re-test would most likely also return an inconclusive result.

The results will be recorded as indeterminate if the GCN result is negative and the degradation result is recorded as:

1. evidence of decay - meaning that the degradation control was outside of accepted limits
2. evidence of degradation or residual inhibition - meaning that the degradation control was outside of accepted limits but that this could have been due to inhibitors not being removed sufficiently by the dilution of inhibited samples (according to the technical advice note)

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Sample ID: ADAS-0495	Condition on Receipt: Good	Volume: Passed
Client Identifier: not supplied	Description: pond water samples in preservative	
Date of Receipt: 23/04/2021	Material Tested: eDNA from pond water samples	

Determinant	**Result**	**Method**	**Date of Analysis**
Inhibition Control[†]	2 of 2	Real Time PCR	27/04/2021
Degradation Control[§]	Within Limits	Real Time PCR	27/04/2021
Great Crested Newt*	0 of 12 (GCN negative)	Real Time PCR	27/04/2021
Negative PCR Control (Nuclease Free Water)	0 of 4	Real Time PCR	As above for GCN
Positive PCR Control (GCN DNA 10^{-4} ng/µL)[#]	4 of 4	Real Time PCR	As above for GCN

Report Prepared by:	Dr Helen Rees	Report Issued by:	Dr Ben Maddison
Signed:		Signed:	
Position:	Director: Biotechnology	Position:	MD: Biotechnology
Date of preparation:	29/04/2021	Date of issue:	29/04/2021

eDNA analysis was carried out in accordance with the stipulated methodology found in the Technical Advice Note (WC1067 Appendix 5 Technical Advice Note) published by DEFRA and adopted by Natural England.

** If all PCR controls and extraction blanks give the expected results a sample is considered: negative for great crested newt if all of the replicates are negative; positive for great crested newt if one or more of the replicates are positive.*

[†] Recorded as the number of positive replicate reactions at expected C_t value. If the expected C_t value is not achieved, the sample is considered inhibited and is diluted as per the technical advice note prior to amplification with great crested newt primer and probes.

[§] No degradation is expected within time frame of kit preparation, sample collection and analysis.

[#]Additional positive controls (10^{-1}, 10^{-2}, 10^{-3} ng/µL) are also routinely run, results not shown here.

Appendix 1: Interpretation of results

Sample Condition

Upon sample receipt we score your samples according to quality: good, low sediment, medium sediment, high sediment, white precipitate, and presence of algae.

There are three reasons as to why sediment should be avoided:

1. It is possible for DNA to persist within the sediment for longer than it would if it was floating in the water which could lead to a false positive result i.e. in this case GCN not recently present but present a long time ago
2. In some cases sediment can cause inhibition of the PCR analysis used to detect GCN eDNA within samples which could lead to an indeterminate result.
3. In some cases sediment can interfere with the DNA extraction procedure resulting in poor recovery of the eDNA which in turn can lead to an indeterminate result.

Algae can make the DNA extraction more difficult to perform so if it can be avoided then this is helpful.

Sometimes samples contain a white precipitate which we have found makes the recovery of eDNA very difficult. This precipitate can be present in such high amounts that it interferes with the eDNA extraction process meaning that we cannot recover the degradation control (nor most likely the eDNA itself) at sufficient levels for the control to be within the acceptable limits for the assay, therefore we have to classify these type of samples as indeterminate.

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Client: Nick Grant,
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Sample ID: ADAS-707	Condition on Receipt: Low Sediment	Volume: Passed
Client Identifier: P1, 10048	Description: pond water samples in preservative	
Date of Receipt: 19/05/2023	Material Tested: eDNA from pond water samples	

Determinant	**Result**	**Method**	**Date of Analysis**
Inhibition Control[†]	2 of 2	Real Time PCR	23/05/2023
Degradation Control[§]	Within Limits	Real Time PCR	23/05/2023
Great Crested Newt*	0 of 12 (GCN negative)	Real Time PCR	23/05/2023
Negative PCR Control (Nuclease Free Water)	0 of 4	Real Time PCR	As above for GCN
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Report Prepared by:	Dr Helen Rees	Report Issued by:	Dr Ben Maddison
Signed:		Signed:	
Position:	Director: Biotechnology	Position:	MD: Biotechnology
Date of preparation:	23/05/2023	Date of issue:	23/05/2023

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