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North West Bicester Eco development

Technical Appendix 6A to 6I

Ecology Surveys

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1 SUMMARY

1.1.1.1 In 2010, 2011 and 2013 ecological surveys were undertaken to inform the Masterplan for the NW Bicester Eco development site. The results of these surveys inform an ecological impact assessment that is part of the Environmental Statement that accompanies the planning application for the Eco development on the Masterplan site.

1.1.1.2 The baseline surveys that were undertaken comprise the following:

- Phase 1 Habitat Survey, hedgerow assessment and protected species walkover surveys;
- Botanical survey of the grasslands and woodland using National Vegetation Classification;
- Aquatic invertebrate surveys, including those to confirm the presence/absence of white-clawed crayfish;
- Surveys for terrestrial invertebrates, including targeted surveys for barberry carpet moth and brown hairstreak butterflies;
- Surveys for great crested newts within the Eco development site and the wider environs;
- Surveys to confirm the presence/absence of reptiles;
- Surveys for breeding birds, including barn owls;
- Surveys for over-wintering birds;
- Bat activity surveys;
- Surveys to confirm the presence/absence of roosting bats;
- Surveys to confirm the presence/absence of dormice, water voles and otters;
- Badger surveys;
- Incidental sightings of other protected/ notable species during targeted surveys identified above;
- Ground-truthing surveys to confirm the status of the known ecological constraints in 2011 and 2013; and
- Surveys to assess water quality within the River Bure.

1.1.1.3 These surveys revealed that the Masterplan site largely comprised cultivated arable farmland with a small number of grassland fields supporting improved grassland. Most of the boundary hedgerows were species-rich with a few supporting mature trees. Most of the hedgerows would be classified as ‘important’ under the Hedgerows Regulations (1997) on the basis of their floral composition and the fact that they contain features of value as recognised by these regulations. The hedgerows were not found to support dormice and it is considered that they are absent from the Masterplan site.

1.1.1.4 A small number of ponds were present in the Masterplan site. Two ponds within the southern half of the site supported a ‘medium’ population of great crested newts. Other ponds that were found to support great crested newts were located a sufficient distance from the Masterplan site boundary, that any newts using these features would not be expected to regularly forage within the Masterplan site.

1.1.1.5 A small number of ditches and watercourses were present within the Masterplan site. Water levels within these features have been found to fluctuate. Most of the hedgerow ditches were heavily shaded by the hedgerows and devoid of water for most, if not all, of the year. Three watercourses cross the site: the River Bure and its tributaries. The River Bure flows in a north to south direction starting at a point close to Home Farm and leaving the site via a culvert beneath Lord's Lane (the road that forms the eastern boundary to the Masterplan site). One tributary commences near the pond at Crowmarsh Farm (large pond south of the railway line and on the western boundary of the Masterplan site) and flows in an easterly direction towards Lord's Lane where it meets the River Bure. The other commences in Bucknell and joins the River Bure a few hundred metres south-west of Home Farm. The tributaries were not found to support water throughout the summer months. The water in the River Bure was of 'moderate' quality and found to support common and widespread aquatic invertebrates. These watercourses were not found to support native crayfish nor water voles. Otters may occasionally travel along these features whilst accessing other parts of their home range; but no confirmatory signs of otter activity were recorded during the surveys.

1.1.1.6 The Masterplan site as a whole was found to support a suite of common terrestrial invertebrate species. However, ten species recognised as being of Principal Importance on the Natural Environment and Rural Communities Act (2006) were recorded, including nine moth species and the brown hairstreak butterfly. The brown hairstreak was found to be associated with the hedgerows that supported Blackthorn; with hedgerow and/or woodland edge trees also a necessary part of their lifecycle. Most of the moths were associated with the more overgrown and 'weedy' habitats associated with the derelict buildings of Gowell Farm, with a reasonable number (five species) associated with the tree and shrub-lined lane leading to Lord's Farm. Another species of conservation concern, the white-letter hairstreak, has been found in hedgerows on land to the south of the Masterplan site. It is likely that this species may also be associated with the hedgerows that support elm that are within the Masterplan site.

1.1.1.7 Five Nationally Scarce invertebrates were recorded within the Masterplan site (one species is now considered to be Nationally Local and no longer scarce). One of these species was associated with the Exemplar site, two associated with Gowell Farm and one with the tree and shrub-lined lane to Lord's Farm. Twenty Nationally Local invertebrate species were also recorded within the Masterplan site, the parts of the site that supported the largest numbers of these species were the habitats around Gowell Farm and the lane to Lord's Farm. Although a small number of Barberry shrubs were recorded in the hedgerows, the rare moth associated with this plant, the barberry carpet, was not found to be present.

1.1.1.8 Common lizards were recorded in the field margins and it is considered likely that grass snakes may also be present, particularly in association with the watercourses and ponds.

1.1.1.9 Common pipistrelle bats have been recorded roosting in a number of the trees and buildings across the site (a total of four roosts have been confirmed within the Masterplan site with a further three confirmed roosts beyond the site boundary). Pipistrelle bats were also regularly recorded foraging and commuting across the site in association with the watercourses and hedgerows. Other bats regularly recorded commuting and foraging across the site, also in association with the hedgerows and stream corridors, included noctule, Leisler's, soprano pipistrelle and *Myotis* bats.

1.1.1.10 The Masterplan site as a whole was found to support farmland birds in reasonable numbers during the breeding season, including species of conservation concern, such as skylark, linnet, yellowhammer and song thrush. Large flocks of these birds were also recorded overwintering in stubble fields and in association with the hedgerows. The locations of the wintering flocks will be subject to change dependent on the crop rotation; crop rotations will also affect the distribution of breeding birds, but to a lesser extent. Barn owl were recorded nesting in a box,

this box together with two new boxes were relocated to the edge of the Masterplan site as part of the mitigation measures for the consented Eco development.

1.1.1.11 A number of badger setts (main setts and subsidiary setts) were found within the Masterplan site and it is likely that badgers would forage widely across the site.

2 Introduction

2.1.1.1 This report presents the baseline conditions with respect to ecology for the NW Bicester Eco development site. It presents the results of targeted ecological surveys that were undertaken by Arup and Hyder Consulting UK Limited (Hyder) to provide a baseline for an ecological impact assessment. It should be noted that at the time of the Arup surveys, the red line development boundary had not been finalised, and therefore, their surveys covered a far wider area than would be affected by the Masterplan; this included land 650 metres (m) to the west (see Drawing 6-1). At the time of the Arup surveys, access was not available to a parcel of land within the southern part of the Masterplan site, associated with Himley Farm; this area was subsequently surveyed by Hyder. Both Hyder and Arup undertook targeted surveys for particular target species or groups as listed in Table 2-1 (below). The extent of the Masterplan site is illustrated by the red boundary on Drawing 6-1. The Masterplan site also includes the part of the site that has planning consent for an Eco development known as the Exemplar site. The Exemplar site was also subject to a number of targeted surveys and the results of these surveys have been incorporated into this report where appropriate.

2.1.1.2 Table 2-1 (below) identifies the surveys that were undertaken by both Arup and/or Hyder and the dates of survey. More detail regarding the methodologies adopted can be found in Section 4 of this report. It should be noted that all surveys were undertaken by suitably experienced, and where necessary, licenced ecologists that were either employees of the respective consultancies, or specialist sub-consultants. All surveys followed the best practice guidance that was in effect at the time of the surveys (see limitations to surveys in Section 5 of this report for more details).

Table 2-1: Summary of ecological baseline surveys

Survey (including target species/group as appropriate)	Consultant	Date
Phase 1 Habitat Survey	Arup	Spring 2010
Phase 1 Habitat Survey, hedgerow assessment and protected species walkover survey of land where access was previously denied	Hyder	1st and 2nd September 2010
Botanical survey of grasslands and woodland using the National Vegetation Classification (NVC)	Arup	28th and 30th July 2010
Hedgerow assessment	Arup	July 2010
Aquatic invertebrate surveys including surveys to confirm the presence/absence of white-clawed crayfish (*Austropotamobius pallipes*)	Arup	5th August and 15th September 2010
Surveys for aquatic invertebrates	Arup	21st October 2010
Aquatic invertebrate survey to provide a pre-construction baseline for the Exemplar site (the Exemplar site is in the northern part of the Masterplan site)	Hyder	26th October 2012
Surveys for terrestrial invertebrates	Arup	3rd July and 21st October 2010

Survey (including target species/group as appropriate)	Consultant	Date
Surveys to confirm the presence/absence of barberry carpet moth (*Pareulype berberata*)	Hyder + licenced sub-consultant	27th July and 13th September 2011
Surveys to confirm the presence/absence of brown hairstreak (*Thecla betulae*) butterflies	Hyder	18th February 2011
Surveys for great crested newts (*Triturus cristatus*) within the Eco development site and the wider environs	Arup	10th - 12th, 17th, 18th, 24th - 27th May; 1st - 3rd, 8th - 11th June 2010
Surveys for great crested newts within land where access was previously denied	Hyder	12th, 13th, 26th and 27th April and 17th and 18th May 2011
Surveys to confirm the presence/absence of reptiles	Arup	July to October 2010 (1st July; 26th, 27th Aug; 21st, 22nd, 23rd, 28th,29th Sept; 5th, 7th, 13th, 19th, 20th Oct)
Surveys for breeding birds including barn owls (*Tyto alba*)	Arup	25th May to 29th July 2010
Surveys for breeding birds within land where access was previously denied	Hyder	12th April, 6th May and 24th June 2011
Surveys for over-wintering birds	Hyder	12th – 14th January, 1st – 4th February and 7th – 9th March 2011
Bat activity surveys	Arup	18th May; 10th, 23rd, 24th, 30th June; 7th, July 1st, 5th, 6th, July 2010
Bat activity survey of land where access was previously denied	Hyder	27th and 28th July and 14th September 2011
Surveys to confirm the presence/absence of roosting bats	Arup	17th May to 23rd September 2010
Surveys to confirm the presence/absence of roosting bats within buildings, where access was previously denied	Hyder	27th and 28th July and 14th September 2011

Survey (including target species/group as appropriate)	Consultant	Date
Surveys to confirm the presence/ absence of dormice (*Muscardinus avellanarius*)	Arup	June to October 2010
Surveys to confirm the presence/ absence of water voles (*Arvicola amphibius)*	Arup	7th and 16th June; and 28th August 2010
Surveys to confirm the presence/ absence of otters (*Lutra lutra*)	Arup	7th and 16th June; and 28th August 2010
Badger survey	Arup	10th May, 7th, 14th, 15th October 2010
Badger (*Meles meles*) bait marking study	Arup	May 2010
Incidental sightings of other protected/ notable species during targeted surveys identified above (brown hare (*Lepus europaeus*))	Arup and Hyder	Throughout 2010 and 2011 surveys
Ground-truthing surveys to confirm the status of the known ecological constraints	Hyder	March 2011 October 2013

3 Study area

3.1.1.1 The survey area that was adopted by Arup comprised the Masterplan site and the fields immediately adjacent (to the west, extending up to 650 m). It is understood that this extra area was surveyed as the extent of the final Masterplan had not been determined at the time. For great crested newts, the survey area was increased to include waterbodies that were within 500m of the extended Masterplan site boundary. For bats, the survey area was extended to include St Laurence Church, Caversfield, which is north of the B4100 and a known roost site for bats. The desk study extended up to approximately 5 km from the centre of the Masterplan site in order to identify records of protected species, species of conservation concern and non-statutory designated sites of nature conservation importance. A wider area of search up to 10 km was adopted to identify statutory designated sites of nature conservation importance, as requested by Natural England in response to the Scoping report that was produced for the Exemplar site development.

4 Methodologies

4.1 Desk study

The desk study was conducted within a 10 km radius of the central grid reference for the site focused on statutory designated sites of nature conservation importance. This involved a web based search, using Nature on the Map (Ref 6-1) and the Multi-Agency Geographic Information for the Countryside website (MAGIC) (Ref 6-2). In addition, data regarding distributions of notable and protected species and non-statutory designated sites of nature conservation importance was obtained from the Thames Valley Environmental Records Centre (TVERC) within a 5 km radius of the Masterplan site. Records for a 2 km search area were also obtained from other specialist groups, including: the Banbury Ornithological Society (BOS); the Barn Owl Conservation Network (BOCN); and the Oxfordshire Ornithological Society (OOS). The Butterfly

Records Officer for the Upper Thames Branch of Butterfly Conservation was contacted for all records of butterflies within the 12, 1 km grid squares within and surrounding the Masterplan site. These records were provided for the years 1995 and 2010 and information regarding the local conservation status of any butterflies of concern recorded was also provided.

4.1.1.1 Further information on brown hairstreak butterflies was obtained from the Brown Hairstreak Species Champion within the Upper Thames Branch of Butterfly Conservation, including recent survey data from 2011 within and surrounding the proposed development. The County Moth Recorder was contacted for information regarding moth species within the local area and specifically for further information on the likely presence of barberry carpet within the area.

4.1.1.2 The Local Biodiversity Action Plan (BAP) for Cherwell (Ref 6-3) was consulted for details of species of note that could be expected to occur in the area. The list of habitats and species of Principal Importance identified on Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006 (Ref 6-4) was also reviewed with regard to the habitats and species recorded as present or likely to be present within the Masterplan site.

4.2 Phase 1 habitat survey (Arup surveys)

4.2.1.1 The field survey followed standard methodology as described in the Handbook for Phase 1 Habitat Survey (Joint Nature Conservation Committee (JNCC), 2010) (Ref 6-5). The extent of each area of homogenous vegetation was mapped in the field, noting the dominant vegetation communities present, in order to produce a Phase 1 Habitat Map of the site. Evidence of protected species, or the potential to support protected species, was also noted. Based on the habitats present, at and around the site, and on professional judgement informed by the findings of the desk study, the protected and notable species most likely to be present at the site were considered to be amphibians, reptiles, badger, brown hare, white-clawed crayfish, bats, dormice, water voles, otters and birds. Therefore searches for signs of these species, including footprints, scratch marks, feeding stations, burrows, setts, spraint, droppings, foraging signs, staining, nesting or roosting places were searched for at the time of the survey. Any man-made or natural refugia were inspected and, where possible, lifted to search for sheltering wildlife such as reptiles and amphibians.

4.3 Phase 1 habitat survey and protected species walkover survey (Hyder surveys)

4.3.1.1 As described in the introduction, at the time of the Arup surveys, access was not available to a parcel of land within the southern part of the Masterplan site, associated with Himley Farm. A multi-disciplinary walkover survey was undertaken of this part of the site which comprised a Phase 1 habitat survey and protected species walkover survey.

4.3.1.2 The habitat survey involved identifying and mapping the dominant habitat types following the Phase 1 habitat survey methodology recommended by JNCC (Ref 6-5). Dominant plant species were noted, as were any uncommon species or species indicative of particular habitat types, but no attempt was made to compile exhaustive species lists. Botanical names followed Stace (1997) (Ref 6-6).

4.3.1.3 The status of each hedge with regard to the Hedgerows Regulations (1997) (Ref 6-7) was assessed using the Wildlife and Landscape Criteria. Every hedgerow within this area that was within agricultural/horticultural land use was surveyed. This involved collecting information as described in Section 4.5 (below).

4.3.1.4 The protected species survey involved a critical assessment of the value of terrestrial and aquatic habitats suitable for use by protected species or species of conservation concern. The methodologies adopted were as follows:

- An assessment was made of the water bodies present on site, for their potential to support breeding amphibians, including great crested newts. Each pond was subject to a Habitat Suitability Index (HSI) Assessment (Ref 6-8). In addition, the value of terrestrial habitat on site for use by foraging and hibernating amphibians was assessed;
- The value of the site for roosting and foraging bats was assessed, and all the mature trees and other structures were carefully scrutinised from the ground using binoculars, where appropriate, to assess their likely occupancy by roosting or hibernating bats;
- The value of the habitats within and adjacent to the site for breeding and over-wintering birds was critically assessed;
- The hedgerows and any areas of dense scrub/broad-leaved plantation, were assessed for their suitability for use by dormice;
- Areas of rough grassland and scrub within and adjacent to the site were assessed for their suitability for reptiles;
- The site was investigated for its use by badgers by searching for the characteristic signs of badger activity including setts, latrines, paths, footprints, hairs and feeding signs. The survey area was extended to the west to search adjacent areas for badger setts; and
- The value of the site for other protected species or groups was also critically assessed. This included an assessment of the value of the site for invertebrates, birds, water voles and otters.

4.4 NVC survey

4.4.1.1 Arup's Phase 1 Habitat Survey identified areas of neutral grassland and broad-leaved woodland as potential habitats of Principal Importance under Section 41 habitats of the NERC Act. A survey was undertaken to assess the value of these habitats in more detail.

4.4.1.2 The field survey involved identifying plants and sampling vegetation in accordance with the NVC methodology (Ref 6-9 and 6-10). This was undertaken between 28th July and 6th August 2010. Within the Masterplan site, three areas of grassland west of Home Farm alongside the watercourse were sampled and one area of grassland south-west of Hawkwell Farm (also alongside the watercourse) was sampled (locations shown on Drawing 6-2). Each field was sampled using five 2m x 2m quadrats. Within each quadrat, the relative plant cover of each species was recorded by eye using the DOMIN scale (Ref 6-10). Other details of the sampled vegetation were also recorded: stand area, sample area, vegetation layer cover and mean height, slope, aspect, altitude and soil description.

4.4.1.3 Three blocks of semi-natural broad-leaved woodland were also subject to NVC survey. These comprised the two woodland blocks west of Home Farm and the block of woodland south of Hawkwell Farm (as illustrated on Drawing 6-2). Five quadrats were used to sample an area of homogeneous vegetation within the woodland (five quadrats in the woodlands in Home Farm and five in the woodland south of Hawkwell Farm). Each quadrat comprised a selected canopy area, within which quadrats were located to sample the plants within understorey, field layer and ground layer area. The quadrat dimensions were:

- 50 m × 50 m for the canopy;

- 10 m × 10 m for the understorey;
- 4 m × 4 m for the field layer; and,
- 1 m × 1 m for the ground layer.

4.4.1.4 Within each quadrat, the relative plant cover of each species was assessed by eye and then assigned a score according to the DOMIN scale (Ref 6-9).Other details of the sampled vegetation were also recorded: stand area, sample area, vegetation layer cover and mean height, slope, aspect, altitude and soil description. The grasslands and woodlands that were subject to survey are illustrated on Drawing 6-2.

4.5 Hedgerow assessment

4.5.1.1 Following Arup's Phase 1 Habitat Survey, which identified a network of diverse and relatively species-rich hedgerows across the site, a hedgerow survey of the Masterplan site was undertaken in July 2010.

4.5.1.2 The selection criteria for hedgerows for further assessment were determined with consideration to any potential impacts to the hedgerows on a landscape scale. The Phase 1 Habitat Survey identified those hedgerows requiring further survey based on the diversity of the hedgerow and the following criteria:

- Hedgerows abutting and/or adjacent to watercourses;
- Hedgerows parallel to and within 15m of a watercourse;
- Hedgerows abutting and/or adjacent to woodland;
- Hedgerows adjacent to a public bridleway.

4.5.1.3 A field survey was undertaken which followed the Local Hedgerow Survey methodology as detailed in the Hedgerow Survey Handbook (Ref 6-11). This survey collects data to inform the determination of hedgerow importance as detailed in the Hedgerows Regulations 1997. The Hedgerows Regulations 1997 outline the criteria for determining "important" hedgerows. These criteria include archaeological and historical criteria as well as ecological criteria.

- The length of each hedgerow was calculated prior to the survey from Ordnance Survey 1:2,500 maps;
- For every 100m of hedge the central 30m section was surveyed, with a maximum of three 30m sections per hedgerow;
- In each 30m section, the presence of woody (tree and shrub) species and woodland (herbaceous) species within one metre, in any direction, of the outermost edges of the hedgerow was recorded;
- For the whole hedgerow, the number of standard (mature) trees was recorded;
- Other data gathered for the whole hedgerow included hedge height, width, structure, management, information on ditches and banks associated with the hedge, whether gaps formed less than 10% of the hedge and adjacent land use and connections.

4.5.1.4 A further assessment was made on site to permit the categorisation of each hedgerow using the Hedgerow Evaluation and Grading System (HEGS) (Ref 6-12). This method allows a hedgerow

to be categorised according to its significance to wildlife. Hedgerows are graded on a scale of 1-4 (high value to low value) to reflect their ecological value based on the hedgerow structure, connectivity, species diversity and associated features. To grade a hedgerow:

- The height, width, length and structure of the average cross-section of each hedgerow was assessed;
- The number, age and species of standard trees was recorded per 100m;
- Percentage gaps and the number of end connections (a value of 1 per hedgerow or other linear feature; 2 for woodland) was determined;
- A full species list was compiled of the hedge canopy and whether the hedge is native species dominant;
- Associated features such as the presence of a hedge-bank, lynchet, ditch and or grass verge were noted; and,
- A species list prepared of ground flora and notes of any notable species.

4.5.1.5 In addition, notable plant species (species of nature conservation importance) were identified during the survey if they were:

- Section 41 (NERC Act) species;
- Afforded legal protection by being listed on Schedule 8 of the Wildlife and Countryside Act 1981 (as amended); and/or,
- Listed as Critically Endangered, Endangered, Vulnerable or Near Threatened in the Vascular Plant Red Data List for Great Britain (Ref 6-13).

4.6 Aquatic invertebrate survey

Crayfish survey

4.6.1.1 Targeted crayfish surveys were undertaken during August and September 2010. The field survey comprised a habitat survey to assess the suitability of the watercourses for white-clawed crayfish, which was undertaken on 5th August and based on habitat descriptions in relevant guidance documents (Ref 6-14 and 6-15). The following information was recorded:

- Water clarity;
- Bed substrate and materials suitable for refuge;
- Potential food supply;
- Siltation;
- Observed presence of crayfish and fish;
- Any negative indicators e.g. pollution inputs.

4.6.1.2 These details were also recorded during the subsequent trapping and torchlight surveys to ensure that any changes were identified.

4.6.1.3 Following the initial habitat survey, a manual survey, trapping survey and torchlight survey were carried out. The manual survey was undertaken on the 5th August 2010. In accordance with the principles of Peay (Ref 6-15) the methodology involved selecting four habitat patches over a 200m section, with 50 suitable stones turned within each habitat patch. However, in-channel refugia were limited and suitable stones were turned where present.

4.6.1.4 A trapping survey was undertaken over two days, with traps set on the afternoon of 15th September 2010 and checked and removed on the following morning. The habitat suitability assessment identified the pond at Crowmarsh Farm (location shown on Drawing 6-2, hereafter known as Crowmarsh pond) as the only suitable habitat for crayfish that had adequate depth to allow a trapping survey. TRAPPY pyramid traps, which met the standard Environment Agency requirements, were used. The traps were baited with cat food and tagged with the Environment Agency CR1 licence tags. In total, ten traps were deployed around the margin of the pond.

4.6.1.5 In addition, a torchlight survey was undertaken on the evening of 15th September 2010 along the River Bure, its tributaries and in the pond at Crowmarsh pond. This method of survey involved scanning the watercourse with a high-powered torch, in order to identify any crayfish which may be moving on the bed of the watercourse/ pond.

General surveys for aquatic invertebrates

4.6.1.6 In 2010, most of the watercourses within the Masterplan site were dry throughout the summer. Water returned to some of these features in September 2010 but flowing water was only found in the main watercourses by October 2010. Aquatic invertebrates were sampled using a hand net from three locations along the tributary of the River Bure between Crowmarsh pond and its confluence with the River Bure within the Masterplan site. Aquatic invertebrate samples were also taken from Crowmarsh pond and the stream that feeds it (most of which is outside the Masterplan site). A sample was also taken from an off-site pond in Bucknell.

4.6.1.7 Surveys for aquatic invertebrates were also undertaken in order to provide a pre-construction baseline for future monitoring during the construction for the consented Eco development on the Exemplar site. A locations plan and photographs of the sampling locations are included in the pre-construction survey report (Ref 6-16). Water samples were collected in October 2012 from three locations on the River Bure in order to establish a baseline for water quality prior to construction. All three of these sampling locations are on the Masterplan site. They comprised:

- Location 1, 60 metres downstream of the Exemplar development area (Ordnance Survey (OS) grid reference SP 57769 24730);
- Location 2 within the Exemplar development area (OS grid reference SP 57870 24884);and
- Location 3, 60 metres upstream of the Exemplar development boundary (OS grid reference SP 57970 24997).

4.6.1.8 The three sites were sampled using the standard protocol employed by the Environment Agency for sampling lotic watercourses (detailed in Environment Agency internal document No. 018_08, which has now replaced the more detailed BT001 (Ref 6-17)). This protocol involved a timed period of three minutes of active net sampling (the time being apportioned to each habitat according to the proportion of the site that it covered), accompanied by a one minute hand-search.

4.6.1.9 The net sampling was carried out using a FBA pattern pond net, fitted with a 1mm mesh collecting bag and involved a combination of kick sampling and sweeping the net through the water channel. This was accompanied by manual investigation of submerged coarse woody debris and larger stones for attached organisms (e.g. the river limpet (*Ancylus fluviatilis*)) and

searches of the water surface for surface-dwelling animals (e.g. pond skaters (*Gerris* spp.)), for a timed period of one minute in total at each site.

4.6.1.10 After collection, the samples were preserved on-site, in a solution of 90% Industrial Methylated Spirits (IMS or Denatured Ethanol B), 5% water and 5% glycerol for transportation to the laboratory and subsequent analysis.

4.6.1.11 In addition to macro-invertebrates, any fish of conservation concern incidentally observed during the surveys were also recorded.

4.6.1.12 The macro-invertebrate samples were then identified, under laboratory conditions, to species level where possible, or if this was not possible, identification was undertaken to the lowest possible taxa, using standard freshwater invertebrate sorting and identification procedures, and using industry standard identification keys.

4.6.1.13 Appropriate bio-security measures were adopted whilst undertaking all surveys within the aquatic environment, in order to avoid the inadvertent spread of crayfish plague and chytridiomycosis (a fungal disease that adversely affects amphibian populations).

4.7 Terrestrial invertebrate survey

4.7.1.1 The value of the Masterplan site as a whole for invertebrates was assessed as part of the Phase 1 habitat surveys. Targeted surveys were undertaken in order to assess the variety of species present. Initially, a site scoping study was undertaken on the 29th June 2010 which involved a walkover survey of the entire Masterplan site to determine the nature and extent of detailed survey work required. Subsequent visits were undertaken between 3rd July and 21st October 2010 to carry out moth recording, terrestrial sampling and aquatic sampling. These surveys were undertaken by Colin Plant, a recognised invertebrate specialist, and are described in detail in the Invertebrate Survey Report (Appendix 6F).

4.7.1.2 On all visits, terrestrial invertebrates were recorded by direct observation of both species and their signs. Active sampling was also undertaken using sweep-netting, beating trees and bushes and suction sampling. In addition, passive sampling using pitfall trapping and actinic light trapping was undertaken.

4.7.1.3 Targeted surveys for the barberry carpet moth and the brown hairstreak butterfly were also undertaken. Barberry carpet moth surveys were carried out by a specialist entomologist (Martin Townsend) following the identification of six stands of Barberry (*Berberis vulgaris*) within the Masterplan site. The presence of the larvae was surveyed using the Bignell pattern beating tray, which is held under the vegetation. The vegetation was then tapped lightly to dislodge larvae and other insects and the contents of the tray were then examined. Since the moth has two generations in a year, the Barberry bushes were sampled twice, once on the 27th July and once on the 13th September 2011. A survey for the brown hairstreak butterfly was undertaken on 18th February 2011, and involved searching for the eggs of this species on Blackthorn (*Prunus spinosa*).

4.8 Great crested newt survey

4.8.1.1 Surveys for great crested newts were carried out in May 2010. The survey area included the waterbodies up to 650m west of the current site boundary plus a 500m buffer zone.

4.8.1.2 A Habitat Suitability Index (HSI) assessment of all waterbodies (where access permitted) within the survey area (as above) was undertaken. The HSI scoring system (Ref 6-8) was used, which scores a water body against ten habitat suitability indices. These indices include water quality,

the likely presence/absence of fish and aquatic plant cover. From these ten suitability indices a geometric mean is calculated, which gives an overall numerical index, ranging between zero and one. A score of near zero indicates highly sub-optimal habitat whilst a score near one represents optimal habitat for use by breeding newts. However, the HSI is not a substitute for undertaking newt surveys and if a water body is awarded a high HSI score, this does not guarantee that great crested newts will be present, only that they are more likely to be present in this water body than in a sub-optimal water body. As such, HSI scores alone were not used to rule the ponds in or out from further survey. A total of 13 waterbodies were assessed in this way, and 12 were considered suitable for survey (Ponds labelled P1 to P13 on Drawing 6-2). Pond 11 was dry by late May 2010 and thus, considered unsuitable for use by breeding great crested newts in 2010. This pond is on the edge of Bucknell (475 m north- west of the Masterplan site boundary) and was not subject to further survey in subsequent years due to the distance between the pond and the Masterplan site.

4.8.1.3 Suitable waterbodies were then subject to presence/ likely absence surveys in accordance with the Great Crested Newt Mitigation Guidelines (Ref 6-18). Surveys were carried out by licenced surveyors between 10th and 25th May 2010. The waterbodies were surveyed using four of the following techniques, whichever were the most suitable at a particular waterbody:

- Bottle trapping involved setting bottle traps (comprising 2-litre plastic drinks bottles with the top end cut off and inverted inside the main body of the bottle) along the waterbody/ditch margins. These were supported in each waterbody on canes stuck into the sediment. Traps were set at two metre intervals whenever access allowed informing population size class estimates. Traps were set in the evening and checked early the following morning during each survey. All amphibians captured were identified to species level and sexed.

- Sweep netting involved using a standard pond net with 2 mm x 4 mm mesh during the day to sweep the water column and aquatic vegetation. Where possible, 15 minutes of sweeping was undertaken for each 50 metres of shoreline. Once the presence of great crested newts was confirmed, netting ceased, as the survey technique can only be used for determining presence or absence, not for producing population size class estimates.

- Egg searching involved checking marginal and aquatic vegetation around the ponds for great crested newt (and other newt species') eggs. Newts often wrap their eggs in the leaves of vegetation around the margins of ponds. Great crested newt eggs can be relatively easily distinguished from smooth or palmate newt (*Lissotriton vulgaris* or *L. helveticus*) eggs by their larger size and different colouration. Once great crested newt eggs were found in any pond, no further egg searches were undertaken, as the survey technique can only be used for determining presence or absence, not for producing population size class estimates.

- Torchlight surveys comprised a single walk around the waterbodies at night at a measured pace using a bright torch to locate and identify amphibians. During the survey all animals observed were counted, sexed and identified to species where possible.

- Refuge searching involved checking natural and artificial refugia around the waterbodies for the presence of newts. Refugia include logs, debris, bark, moss, stones/rocks etc. This is usually most effective as an additional method, to supplement other surveys such as bottle trapping.

4.8.1.4 Four survey visits were undertaken to each waterbody; where great crested newts were recorded, a further two visits were undertaken to make six in total.

4.8.1.5 Due to access restrictions during 2010, Arup were unable to carry out surveys of ponds within a parcel of land associated with Himley Farm. The walkover survey of this land undertaken by Hyder revealed the presence of two ponds (labelled P14 and P15 on Drawing 6-2) both potentially suitable for use by breeding amphibians. As such, great crested newt surveys of these ponds were undertaken on the following dates: 12th, 13th, 26th and 27th April and 17th and 18th May 2011 in accordance with the field survey methodology described above. .

4.8.1.6 Appropriate bio-security measures were adopted whilst undertaking the surveys, in order to avoid the inadvertent spread of waterbourne diseases such as chytridiomycosis and crayfish plague. Although surveys were targeted to establish the presence/absence of great crested newts the presence of other amphibians was also recorded incidentally during the surveys.

4.9 Reptile survey

4.9.1.1 The Phase 1 habitat surveys identified habitat suitable for supporting reptiles. The criteria for habitat suitability followed the guidance from the National Amphibian and Reptile Recording Scheme (Ref 6-19) and the Herpetofauna workers' manual (Ref 6-20). The following features were considered suitable:

- Variable vegetation structure;
- Extent of habitat large enough to support a population of reptiles;
- The aspect offers sunny, sheltered locations preferably south-facing;
- Natural and/or artificial refugia;
- Variable undulating topography;
- Connectivity between suitable habitat patches;
- Historic land-use of the site.

4.9.1.2 Suitable habitats were identified including areas of scrub, woodland with glades, hedgerow banks, partially vegetated embankments, semi-improved grassland, vegetated watercourses and the unmanaged habitats associated with Gowell Farm. Reptiles also need areas for egg laying sites and refugia such as log-piles, compost heaps and rubble.

4.9.1.3 Following the habitat assessment, targeted reptile surveys were undertaken in accordance with best practice guidelines contained within the Herpetofauna workers' manual (Ref 6-20). This involved the use of artificial refugia, such as corrugated metal and roofing felt sheets. A total of 62 refugia were deployed in potentially suitable habitat initially, increasing to 77 refugia for the second visit onwards. Twenty survey visits were carried out between July and October 2010 over a period of 13 days. Refugia were also deployed within the Exemplar site and checked on 10 occasions during the period May to September 2010.

4.9.1.4 The population estimate was based on general population assessment criteria provided by Froglife (Ref 6-21) which is based on the number of adults seen by observation or under refugia by one person in one day, and assumes a density of up to 10 refugia per hectare.

4.10 Breeding bird survey

4.10.1.1 A breeding bird survey was carried out by an experienced surveyor, who undertook three survey visits between 25th May and 29th July 2010. This survey period allowed for the detection of summer migrant arrivals as well as those species present year-round.

4.10.1.2 All survey work was carried out in suitable conditions (avoiding heavy rain, fog or strong wind) and at the optimal time for recording activity (between 4 hours after sunrise and 4 hours before sunset). The survey methodology broadly followed standard survey guidance described in the Common Bird Census Instructions (Ref 6-22). During each survey visit, the surveyor systematically walked the field boundaries and habitat features within the Masterplan site (excluding the area where access was not available). A pair of 10x42 binoculars was used to observe signs of breeding activity. The identity and location of all birds seen or heard were recorded onto large scale maps using standard British Trust for Ornithology (BTO) species codes.

4.10.1.3 The following signs of bird breeding activity were also recorded:

4.10.1.4 Possible Breeding

- Observed in suitable nesting habitat;
- Singing male.

4.10.1.5 Probable Breeding

- Pair in suitable nesting habitat;
- Courtship and display;
- Visiting a probable nest site;
- Agitated behaviour;
- Confirmed Breeding;
- Used nest or eggshells;
- Recently fledged young;
- Adults entering or leaving an occupied nest;
- Adults carrying faecal sac of food for young;
- Nest containing eggs;
- Nest with young.

4.10.1.6 Access was not available to a parcel of land associated with Himley Farm during 2010. As such, Hyder undertook breeding bird surveys of this area on three occasions during 2011 (12th April, 6th May and 24th June) in accordance with the survey methodology described with one modification regarding the timing. The surveys commenced just after dawn until 9am under optimal weather conditions

4.10.1.7 On each of the surveys, an experienced ornithologist walked a transect route across the site, identifying any birds present by sight or song. The behaviour of each bird identified was recorded in order to indicate whether the individual was likely to be breeding on site (as described above). Particular attention was paid to species of ‘conservation concern’ or those receiving special protection, that is those that receive protection under Schedule 1 of the Wildlife and Countryside Act (WCA) 1981 (as amended), Section 41 (NERC Act) species and those that are of high conservation concern in the UK (red or amber listed in the 2009 Birds of Conservation Concern (BoCC) (Ref 6-23).

4.11 Wintering bird survey

4.11.1.1 Wintering bird surveys were carried out by Hyder on three occasions from early morning to late afternoon between January and March 2011. On each occasion, approximately three days were required to survey the site (12th – 14th January, 1st – 4th February and 7th – 9th March 2011). The site was walked systematically by an experienced surveyor. Binoculars were used to observe birds, and the identity and locations of all birds seen or heard were recorded onto large scale maps using standard BTO species and activity recording codes as presented in Appendix 1 of *Bird Monitoring Methods* (Ref 6-24)). In addition, the site was visited at dawn and dusk each month to ascertain whether barn owls foraged within the Masterplan site.

4.12 Bat roost surveys

4.12.1.1 The field survey comprised an initial scoping site visit, followed by emergence/re-entry surveys and activity surveys. The scoping survey identified features with the potential to support roosting bats and those features likely to be of value to commuting and foraging bats for subsequent transect surveys. Potential roost sites were identified following standard survey guidance, such as that provided by the Bat Workers Manual (Ref 6-25) and the Bat Survey – Good Practice Guidelines that were current at that time (Ref 6-26).

4.12.1.2 Each potential roost site identified was subject to three independent surveys, two at dusk and one at dawn. Where possible, these surveys were spread across a number of weeks or months, such that seasonal changes in bat activity could be taken into account. In addition, remote surveys using Anabat detectors installed overnight were also undertaken. Where Anabats were used, some sites were surveyed twice because of the considerable volume of data collected using this equipment. In addition, dusk and dawn surveys were carried out by bat surveyors using hand-held heterodyne and time expansion detectors. The dusk surveys were timed to occur between 30 minutes prior to sunset until 90 minutes after sunset. The dawn surveys were undertaken between 120 minutes prior to sunrise until sunrise. All surveys were carried out in suitable weather conditions. Where recorded, data was analysed using computer programmes to confirm the bat species. Observations such as bat characteristics, species, numbers, flight directions, height and other behaviours, such as feeding buzzes, were noted during the surveys. These surveys were undertaken in the period 17th May to 23rd September 2010.

4.12.1.3 Access to the parcel of land associated with Himley Farm was granted in July 2010. At that time the owner of Himley Farm confirmed that the barn supported a brown long-eared bat (*Plecotus auritus*) roost. Precise details of the roost were not available but it was understood that small numbers of bats used the roost (possibly only two bats). Several of the other farm buildings also had the potential to support roosting bats.

4.12.1.4 Two dusk emergence surveys (27th July and 14th September) and one dawn re-entry survey (28th July) were undertaken of the buildings associated with Himley Farm. Each surveyor carried a Pettersson D240 time-expansion bat detector, with the frequency set to 45kHz. The detector was connected to a digital recorder and any bat calls heard were recorded using time-expansion. A voice recording was made to accompany each bat recording, describing the time, location and, if seen, behaviour of the bat. The bat calls recorded were analysed using the 'Batsound' computer programme to identify the species.

4.13 Bat activity surveys

4.13.1.1 For the purposes of the Arup survey, the Masterplan site was walked using four transects (north, central-west, central-east and south). Each transect route was walked on two separate occasions following a roost emergence survey, thus they were surveyed from 90 minutes after

dark, for a further 90 minutes. The surveys were carried out in suitable weather conditions and the various observations listed above were noted. These surveys were undertaken between 18th May and 6th July.

4.13.1.2 As described previously, access was not available to a parcel of land associated with Himley Farm during 2010. The hedgerow network in this area was considered to provide suitable foraging and commuting routes for bats roosting nearby. Following the emergence surveys on the 27th and 28th of July and on 14th September 2011, activity surveys were carried out which involved walking a pre-determined transect focusing on features of potential value to foraging and commuting bats, namely the hedgerows. The survey methodology employed followed the guidelines that were in use at that time (Ref 6-26). For the purposes of this survey, three transects were walked within the survey area. Each surveyor carried a Pettersson D240 time-expansion bat detector, with the frequency set to 45kHz. The surveyors walked at a slow pace and stopped, for three minutes at a time, at evenly spaced 'listening points' along the way. At each listening point, the surveyor pressed the time expansion button on the detector repeatedly in order to improve the chances of hearing bat species calling at lower or higher frequencies than 45kHz. All bat calls heard whilst walking or whilst at the listening points were recorded and analysed using the 'Batsound' computer programme to identify the species

4.14 Dormouse survey

4.14.1.1 The field survey followed the methodology outlined in the Dormouse Conservation Handbook (Ref 6-27). This involved installing dormouse nest tubes within suitable habitat at a density of one per 20m of hedgerow and woodland edge habitat. The tubes were deployed in various locations these included:

- the hedgerows associated with the consented Eco development (the Exemplar site);
- the woodland west of Home Farm;
- the vegetation alongside the River Bure within the Exemplar site;
- two hedgerows north of Hawkwell Farm;
- the vegetation alongside the tributary of the River Bure to the east of Hawkwell Farm; and
- the edge of the plantation west of Himley Farm.

4.14.1.2 The tubes were checked for signs of dormouse activity on a monthly basis between early May and October inclusive. In addition, a search for characteristically chewed Hazel (*Corylus avellana*) nuts was undertaken in late October.

4.15 Water vole survey

4.15.1.1 A field survey for water voles was undertaken on the 7th and 16th June and 28th August 2010. This involved undertaking a habitat suitability assessment to determine the likely locations of water voles; flow conditions, food availability and cover; water quality and signs of mink (*Neovison vison*) were recorded. Following this, a more detailed survey for water voles was undertaken in the most suitable areas. This followed standard survey methodology as described in the Water Vole Conservation Handbook (Ref 6-28) and involved recording the following field signs:

- Faeces/latrines

- Feeding stations
- Burrows
- Nests
- Footprints.

4.16 Otter survey

4.16.1.1 A field survey for otters was undertaken on the 7th and 16th June and 28th August 2010. This involved surveying suitable habitat for signs of use by otter including:

- Spraints;
- Footprints;
- Feeding remains;
- Otter paths;
- Otter holts and couches.

4.17 Badger surveys

4.17.1.1 The Exemplar site was surveyed for signs of badger activity on 10th May 2010, and of the remainder of the Masterplan site (where access was available) on the 7th, 14th and 15th October 2010. This involved walkover surveys and visual examinations of the site and immediate surrounds. Characteristic signs of badger activity were searched for including:

- Badger setts;
- Possible badger paths;
- The presence of dung pits and latrines;
- The presence of badger footprints or hair.

4.17.1.2 A badger bait marking study was also undertaken within the to determine whether one or more badger social groups were using the large badger setts west of Home Farm. This followed recognised methodologies described in the RSPCA's 'The Problems with Badgers' publication (Ref 6-29). The bait marking study was undertaken by using a bait mix consisting of peanuts, syrup and small, coloured plastic beads, which was left outside the various sett entrances at the two sett locations. The bait marking study was undertaken over a two week period which commenced on 11th May 2010. During this time bait mixes, as detailed above, were put out at the various entrances to the two badger setts every second or third day. Field surveys were undertaken at similar intervals to check for badger latrines and dung pits containing coloured beads from either of the two bait mixes.

4.17.1.3 Access was not available to a parcel of land to the south of the site associated with Himley Farm. A badger survey of this area was undertaken during the multi-disciplinary walkover survey undertaken by Hyder in September 2010, which involved searching for badger field signs, as listed in paragraph 4.17.11.

4.18 Other mammals of conservation concern

4.18.1.1 Incidental observations of other species of conservation concern such as brown hare were made during the surveys described above.

4.19 Ground-truthing survey

4.19.1.1 The Masterplan site was resurveyed in March 2011 and October 2013 to confirm that the site remained as previously recorded and confirm that no new constraints have appeared since the 2010 surveys.

5 Limitations and assumptions

Limitations to survey

5.1.1.1 A full survey season was available for the surveys and therefore they were all undertaken at the appropriate time of year and under appropriate weather conditions. Weather conditions did affect the aquatic invertebrate surveys to the extent that it was not possible to sample for aquatic invertebrates within the watercourses during the summer months due to the lack of water in these features. However, it appears that these watercourses regularly experience such events and that the aquatic fauna present are adapted to such conditions. It is considered that data collected in 2010 is representative of conditions on site; this is further validated by the results of the aquatic invertebrate samples that were taken in 2012. Although Anabats were placed outside potential tree roosts on three occasions, the equipment failed to work on the second and third occasions when placed outside three of the potential tree roosts. Whilst it is possible, therefore, that these three trees may contain tree roosts that were not detected it was not considered necessary to survey these features further because the trees are located within hedgerows and these hedgerows, together with an appropriate buffer zone, would be retained within the Masterplan layout.

Extent of data

5.1.1.2 The Masterplan site has been surveyed comprehensively, and the survey area extended where appropriate in order that potential impacts of the Bicester Eco development can be assessed. A large pond located within the grounds of Caversfield House approximately 140m north-west of the Masterplan site boundary and a pond located approximately 350m to the east of the site were identified from Ordnance Survey maps but due to access restrictions could not be comprehensively surveyed for great crested newts. However, the large pond in Caversfield House is understood to support fish and therefore considered unsuitable for use by great crested newts. Given the distance between the site and the pond to the east, and its separation from the site by two busy roads, it was considered unlikely that great crested newts (should they be present), would regularly forage within the Masterplan site. Therefore, the lack of survey data from these two ponds will not prevent an assessment of the impacts of the development on great crested newts to be made, and is not considered to constitute a significant gap in the data.

Life span

5.1.1.3 There is no guidance as to how long ecological survey results remain valid (although Natural England usually request that data relating to European protected species should be less than three years old. Provided that the existing management of the land continues, the survey information collated should be sufficient to inform the impact assessment. This approach has been further validated by the October 2013 walkover survey that revealed that the conditions on the site had not altered. Given the phased nature of the development and the length of the ‘build-out’ time, pre-construction surveys will need to be undertaken prior to any development

taking place for each Phase of the development to ensure legal compliance. The results of these surveys would inform the detail of the Construction Environmental Management Plan and any bespoke ecological methods statements that might be required.

Changes to best practice guidelines

5.1.1.4 Since the surveys were undertaken in 2010 and 2011 the best practice bat survey guidelines have been updated (Ref 6-30). In order to comply with these revised guidelines, the bat activity surveys undertaken by Arup would need to be supplemented by autumn surveys. However, Hyder carried out a bat activity survey in autumn, and although it only covered part of the Masterplan site, the survey results (species and numbers of bats) were similar to those revealed during the Arup surveys. It is therefore not considered necessary to undertake further surveys to inform the impact assessment.

6 Results

6.1 Designated sites

Sites of International Importance

6.1.1.1 There are no statutory designated sites of International or European importance to nature conservation within 10km of the Masterplan site. The closest is a collection of meadows called Oxford Meadows Special Area of Conservation (SAC), which are located 14 km from the southern boundary of the Masterplan site and separated from the site by major roads and the M40 motorway. These meadows are of value for the lowland hay meadow plant communities that they support that include uncommon and rare plant species. These hay meadows are not hydrologically linked to the Masterplan site and the Masterplan site does not support the plant communities that this site has been designated for.

Sites of National Importance

6.1.1.2 There are no statutory designated sites of National importance to nature conservation within the Masterplan site (known as Sites of Special Scientific Interest or SSSI). There are five SSSIs within 5 km of the Masterplan site, as listed in Table 6-1 below. Of these, Ardley Cutting & Quarry, Weston Fen, and Wendlebury Meads & Mansmoor Closes have been designated (at least in part) for their biological interest and therefore, are considered to be of National importance to nature conservation. Stratton Audley Quarries, Ardley Trackways and Ardley Cutting & Quarry are geological SSSIs.

6.1.1.3 Ardley Cutting & Quarry is partially located on the mainline railway line that bisects the Masterplan site. This site is therefore linked to the Masterplan site via the railway. However, the railway is not accessible to the public and there are no public rights of way within the SSSI. In addition, the railway embankment within the Masterplan site is scrub and tree covered embankment. There are small open areas that are likely to support the calcareous grassland species for which the SSSI is designated; but it's unlikely that the embankment supports the rare invertebrates associated with the SSSI. This SSSI supports great crested newts, which were also recorded within the Masterplan site. However, the ponds within the Masterplan site boundary that were found to support great crested newts were almost 3 km from the quarry pools. Furthermore, the absence of great crested newts was confirmed from the ponds that are between the quarry pools and the ponds on the Masterplan site that support great crested newts. Consequently, it is not considered that the great crested newt meta-population within the Masterplan site have close links to the SSSI newt population.

6.1.1.4 There are a further nine SSSIs within 10 km of the Masterplan site; two of these, Kirtlington Quarry and Shipton-on-Cherwell and Whitehill Farm Quarries, are geological SSSIs with the

remaining eight sites being designated for their biological interest, and therefore, are considered to be of National importance to nature conservation. These SSSIs are listed, together with the reasons for designation and their location with respect to the Masterplan site, in Table 6-2 below.

6.1.1.5 It should be noted that the Masterplan site was not found to contain the habitats that the biological SSSIs have been designated for. Although a number of these SSSI are located alongside watercourses or associated with water features only Otmoor has hydrological links to the River Bure (the river that passes through the Masterplan site). The town of Bicester and a number of water treatment works are located between the Masterplan site and Otmoor.

Table 6-1: Statutory designated sites (SSSI) within 5 km

Site Name	Reason for designation	Location
Ardley Cutting & Quarry	A railway cutting and quarry of geological and biological importance. It is one of the largest limestone grasslands in the Oxfordshire Cotswold. It supports a valuable calcareous grassland flora, a valuable woodland flora and the seasonally wet pool in the quarry base is contiguous with wetland vegetation. The site as a whole is of value to invertebrates and supports a large population of great crested newts.	A linear site that at its closest point is 315m north-west of the Masterplan site. The M40 motorway and a number of minor roads cross this SSSI.
Ardley Trackways	A series of working quarries that form a geological site of value for its strata and fossil record.	1.3km east of the Masterplan site. Separated from the Masterplan site by the M40 motorway.
Stratton Audley Quarries	A geological site of value for its strata and fossil record.	1.9 km east of the Masterplan site. Separated from the Masterplan site by built development and the main 'A' road the A4421. The A4421 is one of the major routes into Bicester.
Weston Fen	A calcareous fen that supports valuable habitats including reed bed, marshy grassland, carr woodland, calcareous grassland, stream and semi-natural broad-leaved woodland. These habitats support rare beetles, a rare marsh snail and breeding read warblers.	4.6 km south-west of the Masterplan site. Separated from the Masterplan site by the M40 motorway.
Wendlebury Meads & Mansmoor Closes	Unimproved neutral meadows that support a diverse and valuable flora, of value to birds and butterflies. (The closes are also of landscape and archaeological importance.)	4.7 km south of the Masterplan site separated from it by the main road linking Bicester to Oxford (the A41) and the M40 motorway.

Table 6-2: Statutory designated sites (SSSI) between 5km and 10km of the Masterplan site

Site Name	Reason for designation	Location
Arncott Bridge Meadows	Hay meadows in the River Ray floodplain comprising unimproved neutral grassland that support a diverse and valuable flora that includes rare and uncommon plant species.	6.5 km south-east of the Masterplan site separated from it by the main road linking Bicester to Oxford (the A41).
Kirtlington Quarry	A geological site of value for its fossil record.	6.8 km south-west of the Masterplan site separated from the site by the M40 motorway and the town of Kidlington.
Otmoor	Herb-rich damp grassland on the floodplain of the River Ray, with woodland pools and ditches. Of importance to invertebrates. Also of importance to breeding and overwintering wildfowl and waders. Also of value to raptors and passerines.	8 km south of the Masterplan site separated from it by the main road linking Bicester to Oxford (the A41) and the M40 motorway.
Bestmoor	Semi-improved floodplain meadow that supports rear and uncommon plants. Of value to wintering wildfowl, hoverflies and damselflies.	8.3 km north-west of the Masterplan site, separated from it by the M40 motorway and the Oxford Canal.
Whitecross Green & Oriel Woods	Ancient woodland that supports a diverse and valuable flora also of value to invertebrates and rare butterflies in particular.	8.6 km south of the Masterplan site separated from it by the main road linking Bicester to Oxford (the A41) and the M40 motorway.
Long Herdon Meadow	Flood meadow that supports a diverse and valuable grassland flora. Winter flooding of value to wading birds, of potential value to breeding snipe (*Gallinago gallinago*) and curlew (*Numenius arquata*). Rare damselflies also recorded.	8.7km east of the Masterplan site. Separated from the Masterplan site by Bicester.
Murcott Meadows	These meadows support unimproved grassland of value to flora and fauna, a small block of woodland of value to a rare species of butterfly and a pond of value to invertebrates.	9 km south of the Masterplan site

Site Name	Reason for designation	Location
Shipton-on-Cherwell and Whitehill Farm Quarries	A geological site of value for its fossil record.	9.5 km to the south-west
Tingewick Meadows	These meadows support a diverse range of habitat including calcareous and neutral grassland, fen vegetation and ditches rich in bryophytes. Also of value to invertebrates.	9.5 km north-east of the Masterplan site, separated from the site by the main road the A4421.

Sites of County Importance

6.1.1.6 There are no non-statutory designated sites of County Importance to nature conservation within the Masterplan site. In Oxfordshire, these sites are known a Local Wildlife Sites (LWS). There are eighteen LWSs within 5km of the Masterplan site (two of which include proposed extensions), and a further five proposed LWSs. Such sites have been assessed as being of County importance by an expert panel in accordance with their guidelines.

6.1.1.7 In addition, Bure Park Local Nature Reserve (a statutory designated site) is situated 20m east of the Masterplan site separated from it by Howes Lane (the main ring road around Bicester the A4095). This site supports a mosaic of habitats (grassland, watercourse, ponds, scrub and woodland) with records of water voles and great crested newt.

6.1.1.8 Table 6-3 below provides further details regarding LWS and their location relative to the Masterplan site.

Table 6-3: Non-statutory designated sites (LWS)

Site Name	Reason for designation	Location
Bicester Airfield (and proposed extension)	Areas of species-rich grassland and rough grassland.	1km to the east of the site. Linked to the Masterplan via A4095 and minor roads.
Twelve Acre Copse	Ancient semi-natural woodland.	1.2km north-west of the Masterplan site, linked to the Masterplan site by the minor road the B4100.
Trow Pool	Fishing lake, signs of otter activity recorded.	1.2km west of the Masterplan site, separated from the Masterplan site by the M40 motorway. Linked to the Masterplan site by public footpaths and minor roads.
Stratton Audley Quarries	Wetland and limestone grassland, also a SSSI see above.	1.7km from Masterplan site.
Ardley Fields Quarry	Proposed LWS	1.8km to the north-east of the Masterplan site.
Stoke Little Wood	Ancient semi-natural and ancient replanted woodland.	2km north-west of the Masterplan site, linked to the Masterplan site by the minor road the B4100.

Site Name	Reason for designation	Location
Jarvis Lane	Proposed Local Wildlife Site	2.2km east of the Masterplan site, linked to the Masterplan by the A4421 and minor roads and tracks.
Bicester Wetland Reserve	Wetland and grazing marsh of value to wildfowl and waders.	2.2km south-east of the Masterplan site. Separated from the Masterplan site by the A41 main road, site not readily accessible by foot with no public rights of way, access also restricted to members of the ornithological society.
Stoke Wood	Ancient semi-natural and ancient replanted woodland. Woodland Trust reserve.	2.5km north-west of the Masterplan site, linked to the Masterplan site by the minor road the B4100 and public footpaths.
Skimmingdish Lane Fields	Proposed Local Wildlife Site	2.5km south-east of the Masterplan site, linked to the Masterplan site by a series of minor roads and the A4095.
Gavray Drive Meadows	Lowland meadows of value to hairstreak butterflies.	2.6km south-east of the Masterplan site, separated from the Masterplan site by Bicester. Linked to the Masterplan site by the mainline railway. Linked to the Masterplan site via minor roads and paths.
Graven Hill	Ancient semi-natural woodland.	3.2km south-east of the Masterplan site. Separated from the Masterplan site by the A41 main road. No public rights of way across this former Ministry of Defence Site.
Upper Heyford Airfield (and proposed extension)	Calcareous grassland.	3.4km north-west of the Masterplan site, separated from the Masterplan site by the M40 motorway, with no public footpath leading to or across the airfield.
Stoke Bushes	Ancient semi-natural and ancient replanted woodland.	3.5km north of the Masterplan site, linked to the Masterplan site via minor roads and the local footpath network.
Meadows NW of Blackthorn Hill	A group of ridge and furrow meadows enclosed by hedgerows.	4.5km to the south-east of the Masterplan site, linked to the Masterplan site via A4095 and minor roads.
Kirklington Park	Proposed Local Wildlife Site	4.6km south west of Masterplan site, linked to the Masterplan site by the A4095.
Warmough Copse	A small fragment of ancient coppice woodland.	4.6km south of the Masterplan site. Is close to the A41.
Cutter's Brook Meadows	Two hay meadows on the floodplain of the River Ray	4.6km to the south-east of the Masterplan site, linked to the Masterplan site via A4095 and minor roads.
Hopyard Spinney	Ancient semi-natural woodland and wetland habitat.	4.9km north-east of Masterplan site, linked to the Masterplan site by the A4095 and the A4421.

Site Name	Reason for designation	Location
Meadow east of Fringford	Wet meadow that has been planted with poplars.	4.9km north east of Masterplan site, linked to the Masterplan site by the A4095 and A4421.
Kirklington Park Lake (North)	A small lake supporting a rich variety of aquatic plants.	4.9km south west of Masterplan site, linked to the Masterplan site by the A4095.
Field by Beacon Hill Ditch	Proposed Local Wildlife Site	4.9km south-west of the site.
Pool Spinney	An area of wet woodland.	5km north-east of the Masterplan site, linked to the Masterplan site by the A4095 and the A4421.

6.2 Plants and habitats

Notable plant species

6.2.1.1 TVERC provided records for a number of notable plant species within the 5km area of search. None of these records relate to the Masterplan site itself, but there is the potential that two of these species: Meadow Clary (*Salvia pratensis*) and Bluebell (*Hyacinthoides non-scripta*) could be present within suitable habitats on the Masterplan site. The former may be present on the railway embankment, although most of the grassland was covered by scrub and thus unsuitable for this species. Bluebell could be present within the hedgerows, but Bluebells were not recorded on site during the botanical surveys of the hedgerows or the woodlands on the Masterplan site. It would appear that the hedgerows and woodlands are unlikely to support a natural population of native Bluebells, which are generally found in habitats of long standing.

General site description

6.2.1.2 The surveys revealed that the site comprised predominantly arable fields cropped with cereals, legumes and Oil-seed Rape (*Brassica napus*). These fields had narrow or absent field margins of limited intrinsic nature conservation value. The most commonly recorded species in the field margins were species associated with unmanaged and/or nutrient-rich soils and common arable weeds. These included False Oat-grass (*Arrhenatherum elatius*), Common Couch (*Elytrigia reptans*), Common Nettle (*Urtica dioica*), Pineappleweed (*Matricaria discoidea*), Scented Mayweed (*Tripleurospermum odoratum*) and Scarlet Pimpernel (*Anagalis arvensis*). The fields that surrounded Himley Farm were less intensively managed and supported more ruderal weed species and common arable weeds, these included Creeping Thistle (*Cirsium arvense*), Smooth Sow-thistle (*Sonchus oleraceus*), Scarlet Pimpernel (*Anagalis arvensis*), Common Poppy (*Papaver rhoeas*), Round-leaved Fluellen (*Kickxia spuria*) and Sharp-leaved Fluellen (*Kickxia elatine*). Some of the arable fields had a sown grass margin that was less diverse.

6.2.1.3 The Masterplan site is bisected by the mainline railway that links Bicester to Banbury. At the point that the railway crosses the Masterplan site, the railway is on an embankment covered by trees and scrub. Most of the farmsteads were occupied with gardens that contained regularly mown (amenity) grassland. However, the buildings and land adjacent to Gowell Farm in the southern half of the Masterplan site were derelict and unmanaged.

6.2.1.4 A number of semi-natural habitats were identified within the Masterplan site, these comprised:

- semi-natural and plantation broadleaved woodland;
- species-rich hedgerows supporting five or more woody species;

- running water;
- standing water;
- ponds; and
- improved grassland.

Woodland

6.2.1.5 Within the Masterplan site, there were two blocks of semi-natural broad-leaved woodland (both west of Home Farm), one block of semi-mature broad-leaved plantation (close to Hawkwell Farm) and several belts of broad-leaved plantation woodland (close to Himley Farm, Aldershot Farm and Home Farm). Woodlands and farm locations are shown on Drawings 6-1.

6.2.1.6 Most of the canopy trees in the two blocks of woodland to the west of Home Farm had been felled. The Ash (*Fraxinus excelsior*) trees had been replaced by recently planted Scots Pine (*Pinus sylvestris*) and Norway Maple (*Acer platanoides*). The canopy comprised a small number of retained Ash trees, but the shrub layer of Hawthorn (*Crataegus monogyna*), elm (*Ulmus* sp.) and Elder (*Sambucus nigra*) formed the main canopy of these woodlands. The ground flora largely comprised Dog's Mercury (*Mercurialis perennis*) and Common Nettle (*Urtica dioica*) (for further details of other common plant species recorded in these woodlands see the quadrat data presented in Appendix 6B). Analysis of the detailed botanical survey results revealed that these woodlands most closely resembled the NVC woodland plant community W8d Ash-Field Maple (*Acer campestre*) – Dog's Mercury woodland Ivy (*Hedera helix*) sub-community. However, the ground flora had been adversely affected by ground disturbance associated with tree felling, replanting and historical use as a site in which to rear game birds.

6.2.1.7 It would appear that the woodland close to Hawkwell Farm would have had a canopy of Ash trees. Once again these trees had been felled, but this time they had been replaced with Grey Poplar (*Populus* x *canescens*) trees. The understorey was Hawthorn-dominated, with Wild Privet (*Ligustrum vulgare*), Ash and Field Maple also recorded. The dominant ground flora species were Ivy and Dog's Mercury (see Appendix 6B for more details). This woodland is considered to most closely resemble W8e Ash-Field Maple-Dog's Mercury woodland Herb-Robert (*Geranium robertianum*) sub-community. These woodlands did not support particularly diverse or valuable ground floras. They did not support the diversity of plant species associated with ancient woodlands. It would appear that these woodlands are not ancient in origin, and this was confirmed by the mapping available of the MAGIC website (Ref 6-2).

6.2.1.8 The belts of broad-leaved plantation woodland appeared to be approximately 20 years old, and supported a diverse mix of native broad-leaved trees and shrubs, including Ash, Pedunculate Oak (*Quercus robur*), Hazel, Field Maple (*Acer campestre*) and Cherry (*Prunus* sp.). Ground flora where the trees and shrubs were less dense was dominated by common grasses and ruderal herbs associated with unmanaged grasslands on nutrient-rich soils. These included False Oat-grass with Cock's-foot (*Dactylis glomerata*), Common Nettle and Cleavers (*Galium aparine*). Again the woodland did not support a diverse or valuable ground flora.

6.2.1.9 None of the woodlands within the Masterplan site would be classified as Section 41 (NERC Act) habitats. However, the LBAP does recognise that woodlands are a scarce resource in this part of the Cherwell District.

Grasslands

6.2.1.10 Most of the grasslands within the site were found to support improved grassland. These grasslands support a limited diversity of common grass species of limited nature conservation value, with very few forbs (non-grass species). The quadrat data collected from the improved

grassland fields associated with Home Farm and Hawkwell Farm is presented in Appendix 6C, Drawing 6-2 shows the location of these fields.

6.2.1.11 None of the grasslands within the Masterplan site would be classified as Section 41 (NERC Act) habitats.

Hedgerows

6.2.1.12 A total of 83 hedgerows were targeted for detailed survey by Arup in 2010. The majority of these were of high or very high ecological value under the HEGS assessment and considered to be 'important' under the Wildlife and Landscape Criteria of the Hedgerows Regulations (1997). A further 26 hedgerows were assessed by Hyder using the Hedgerows Regulations and once again, the majority were considered to be 'important' under these regulations.

6.2.1.13 The majority of the hedgerows within the Masterplan site were species-rich supporting five or more woody species. The hedgerows largely comprised Hawthorn, Blackthorn and Elm with additional species including Elder (*Sambucus nigra*), Buckthorn (*Rhamnus cathartica*) Crab-apple (*Malus sylvestris sens. lat*.), Dogwood (*Cornus sanguinea*), Field-rose (*Rosa arvensis*) and Wayfaring-tree (*Viburnum lantana*). Many of the hedgerows were associated with dry ditches that were shaded by the hedgerow shrubs. The hedgerow ground floras were species-poor, and largely comprised False Oat-grass and Common Nettle. Common hedgerow ground flora species and climbing plants were recorded in some of the hedgerows, including Lord's and Ladies (*Arum maculatum*), Dog's Mercury, Hedge Woundwort (*Stachys sylvestris*), Garlic Mustard (*Alliaria petiolata*), Honeysuckle (*Lonicera periclymenum*), Black Bryony (*Tamus communis*), White Bryony (*Bryonia dioica*) and Ivy.

6.2.1.14 Several of the hedgerows supported mature and semi-mature trees. The most commonly recorded tree species were Ash, Pedunculate Oak, Horse-chestnut (*Aesculus hippocastanum*) and willow (*Salix* sp.). More detail regarding the composition of the hedgerows that were subject to survey is presented in Appendix 6D; Drawing 6-2 shows the locations of the hedgerows that were surveyed.

6.2.1.15 Barberry (*Berberis vulgaris*) was recorded in six locations in five hedgerows within the Masterplan site (five hedgerows were in the northern half of the site one in the southern half). Although this plant is not rare or uncommon it is noteworthy since it is the food plant of a protected moth (the barberry carpet) see Terrestrial Invertebrates (below).

6.2.1.16 Hedgerows are a Section 41 (NERC Act) habitat.

Ponds

6.2.1.17 There were four ponds within the Masterplan site: the largest was Crowmarsh pond (Pond 6), with two small ponds associated with Himley Farm (P14 and P15), and one recorded to the north-west of Hawkwell Farm (P10). Pond locations shown on Drawing 6-2.

6.2.1.18 Crowmarsh pond had a deep layer of silt at the bottom. It supported a diverse wetland flora that included Fennel-leaved Pondweed (*Potamogeton pectinatus*), Opposite-leaved Pondweed (*Groenlandia densa*), Horned Pondweed (*Zannichellia palustris*), Water Mint (*Mentha aquatica*), False Fox-sedge (*Carex otruabae*), Common Spike-rush (*Eleocharis palustris*) and Brooklime (*Veronica beccabunga*). The small pond to the north-west of Hawkwell Farm (pond 10 on Drawing 6-2) supported Common Water-starwort (*Callitriche stagnalis*) and Pond Water-crowfoot (*Ranunculus peltatus*).

6.2.1.19 The northern pond at Himley Farm was a small pond approximately 10m by 5m in area within an arable field (P14 on Drawing 6-2). In September 2011, the bottom of the pond was damp but held no water; the damp mud was covered with Water-crowfoot (*Ranunculus sp.)*. Emergent

and marginal vegetation included Branched Bur-reed (*Sparganium erectum*) and Water Mint (*Mentha aquatic*a). The banks of the pond were covered with Great Willowherb (*Epilobium hirsutum*) and False Oat-grass. This pond held water in spring 2011 and in October 2013.

6.2.1.20 The southern pond at Himley Farm was a small pond approximately 20m by 4m in area, with island in the middle and surrounded by heaps of spoil (P15 on Drawing 6-2). This pond was surrounded by an earth bank which was almost vertical along the southern edge. Emergent vegetation included Hard Rush (*Juncus inflexus*), Soft-rush (*Juncus effusus*), Water Mint, Common Club-rush (*Schoenoplectus lacustris*). Scrub comprising Goat Willow (*Salix caprea*), Crack-willow (*Salix fragilis*) and Bramble was present around the pond, with mature Crack-willow trees present around the western edge of the pond. Tall ruderal species including Great Willowherb and Common Nettle were also present.

6.2.1.21 Ponds are a Section 41 (NERC Act) habitat.

Watercourses

6.2.1.22 The River Bure and two tributaries of this watercourse cross the Masterplan site. The upper reaches of the tributaries are winterbournes and were dry for large parts of the year. Where water is present, common wetland plants have been recorded, including Lesser Water-parsnip (*Berula erecta*), Fool's Watercress (*Apium nodiflorum*), Reed Sweet-grass (*Glyceria maxima*), Common Reed (*Phragmites australis*), Bittersweet (*Solanum dulcamara*), Meadowsweet (*Filipendula ulmaria*) and Marsh Marigold (*Caltha palustris*).

6.2.1.23 Rivers are a Section 41 (NERC Act) habitat.

6.3 Aquatic invertebrates

6.3.1.1 The desk study revealed that North-American signal crayfish (*Pacifastacus leniusculus*) were present in the catchment of the River Bure. A dead signal crayfish was recorded close to Crowmarsh pond and the targeted surveys did not reveal the presence of white-clawed crayfish in the Masterplan site or the wider survey area. Given the negative survey result, and the fact that signal crayfish and native crayfish rarely co-exist, it is considered extremely unlikely that white-clawed crayfish are present within the Masterplan site.

6.3.1.2 Historical records were provided of four species classified as Nationally Scarce (Notable) Nb and three species listed by TVERC as being on the pre-1994 IUCN Red List species. Of the three on the pre-1994 IUCN Red List, one is now classified as Regionally Extinct: a whirligig (*Gyrinus natator*); one is listed as Critically Endangered on the current UK Red List: a crawling water beetle (*Haliplus furcatus*); and one is now considered to be Nationally Scarce: a long-toed water beetle (*Dryops similaris*). The records of the latter two species were located over 4km from the Masterplan site and it is considered unlikely that they would be present within it as they require fen vegetation that is not found within the Masterplan site.

6.3.1.3 The majority of other records provided related to aquatic invertebrates within the SSSIs that were closest to the Masterplan Site, including Ardley Cutting and Quarry SSSI and Stratton Audley Quarry SSSI, and all records (with the exception of one water beetle) were located within waterbodies that are at least 2km from the Masterplan site or located beyond a barrier to movement, such as the M40 or the urban conurbation of Bicester. The only record within close proximity was a Nationally Scarce (Notable) Nb scavenger water beetle (*Hydrochus angustatus*). This species was recorded within a pond in Bucknell, approximately 480m from the Masterplan site; this was a single historical record dated from 1988, and if present on the Masterplan site it would be associated with the ponds.

6.3.1.4 The 2010 aquatic invertebrate surveys revealed that the tributary of the River Bure supported a small number of common and widespread species. Twenty two aquatic invertebrate species were recorded within Crowmarsh pond, 10 species were recorded in the tributary of the River Bure with the sample taken from closest to the confluence with the Bure supporting nine of these species. The spring/ stream that fed Crowmarsh pond supported the fewest species, only two.

6.3.1.5 The aquatic invertebrate samples that were taken to provide a baseline for the consented Eco development on the Exemplar site revealed that water quality within the River Bure was reasonable in all three sections of the river. The water was relatively clean and clear, although there were some signs of localised enrichment associated with cattle crossing the river upstream of the sampling sites. Limited aquatic plants were recorded within the channel and small amounts of filamentous algae were recorded in places.

6.3.1.6 All of the aquatic invertebrates that were recorded within the River Bure were relatively common species and no species of conservation concern were recorded. Species that are sensitive to water pollution were recorded in the samples indicating that the water was of 'moderate' quality. The samples of the Bure that were taken revealed that it supported between 19 and 21 species. In contrast to the tributary of the Bure the most diverse sample was the upstream sample (Sample location 1 on Drawing 6-2).

6.3.1.7 The data collected during the 2011 surveys is presented in full in Appendix 6E, with the data collected in 2010 presented in the report presented in Appendix 6F. The watercourses were not found to support a valuable aquatic invertebrate fauna.

6.4 Terrestrial invertebrates

6.4.1.1 Records of 15 butterfly species and 26 moth species were recorded within 5km of the Masterplan site were provided by TVERC. The majority of these species (24) are listed on Section 41 of the NERC Act.

6.4.1.2 TVERC provided records of the following species of conservation concern (species of Principal Importance on Section 41 NERC Act species) within 5km of the proposed scheme: dingy skipper (*Erynnis tages*); grizzled skipper (*Pyrgus malvae*); brown hairstreak; white-letter hairstreak (*Satyrium w-album*); wall (*Lasiommata megera*); small blue (*Cupido minimus*); small heath (*Coenonympha pamphilus*); grayling (*Hipparcia semele*); wood white (*Leptidea sinapis*); white admiral (*Limenitis camilla*); marsh fritillary (*Euphydryas aurinia*) and pearl-bordered fritillary (*Boloria euphrosyne*). Only one historical record of each of the latter two species was provided. Another species of conservation concern (as defined by Butterfly Conservation) that was identified within the search area was adonis blue (*Polyommatus bellargus*), this species is not listed on the NERC Act. In addition, a single record dating from 2000 was provided of the Scarce four-dot pin-palp (*Bembidion quadripustalatum*), recorded from Bicester Wetland Reserve. This ground beetle is listed on Section 41 of the NERC Act; however, it is considered unlikely to occur on the Masterplan site as its preferred habitat is wet mud margins in a wetland mosaic habitat.

6.4.1.3 The Upper Thames Branch of Butterfly Conservation also provided butterfly records from the 12 1km squares overlapping the Masterplan site boundary, dating from 1995 to 2010. A good range of species records were provided, a total of 27 species. These were predominantly common species, but records for four species of local concern were revealed, including: brown hairstreak records from Bure Park as recently as 2010; records of white-letter hairstreak from the Whitelands Farm area to the south of the proposed development dated 1997, and from habitats along the B4030 Middleton Stoney Road adjacent to the southern portion of the Masterplan site, dating from 2008.

6.4.1.4 The habitats within the site that were of potential value to invertebrates, and which were targeted for survey were the hedgerows, the watercourses and one of the arable field margins that supported areas of longer grass. No legally protected invertebrates were recorded during the surveys. The desk study revealed that there were no nearby records for barberry carpet and no larvae of the barberry carpet moth were identified on either of the targeted site visits. It is therefore considered unlikely that this species is present within the Masterplan site.

6.4.1.5 Eight moth species and one butterfly species of conservation concern (Section 41 NERC Act species) were recorded during the targeted invertebrate surveys these were:

- beaded chestnut (*Agrochola lychnidis*) (Gowell Farm and lane to Lord's Farm);
- green brindled crescent (*Allophyes oxyacanthae*) (lane to Lord's Farm);
- centre-barred sallow (*Atethmia centra*go) (Gowell Farm, lane to Lord's Farm and Crowmarsh Farm woodland);
- small phoenix (*Ecliptoptera silaceata*) (lane to Lord's Farm);
- ghost moth (*Hepialus humuli*) (Gowell Farm);
- dot moth (*Melanchra persicariae*) (Gowell Farm);
- cinnabar moth (*Tyria jacobaeae*) (Gowell Farm);
- sallow (*Xanthia icteritia*) (lane to Lord's Farm); and
- small heath butterfly (Coenonympha pamphilus) (Gowell Farm).

6.4.1.6 Six of these species were recorded in the vicinity of Gowell Farm. Whilst five of the moths were recorded on the tree and shrub-lined lane leading to Lord's Farm. The micro moth *Stigmell samiatella* a Red Data Book species (Refs 6-31 and 6-32) was also recorded in a tree close to Gowell Farm.

6.4.1.7 Five Nationally Scarce (Nationally Notable - Nb) invertebrates were recorded during the invertebrate surveys. These were: the shaded pug moth (*Eupithecia subumbrata*) - recorded on the edge of an arable field to the west of Home Farm; Roesel's bush-cricket (*Metrioptera roeseli*)- also recorded on the edge of the same arable field and on the lane leading to Lord's Farm; the bark beetle (*Kissophagus hederae*) on the lane leading to Lord's Farm; *Phyllonorycter platanoidella* a micro-moth in the vicinity of Gowell Farm; and the blue and red leaf beetle (*Podagica fuscicornis*) also recorded in the vicinity of Gowell Farm. It should be noted that Roesel's bush-cricket has undergone a substantial increase in its range over recent years due to climate change, and is generally now generally considered to be a Nationally Local species rather than Nationally Notable.

6.4.1.8 In addition, 21 Nationally Local invertebrates were recorded during the invertebrate surveys, one of these species a soldier fly (*Oplodontha viridula*) was recorded in Grunthill Copse which is not within the Masterplan site. The habitats around Gowell Farm supported the largest number of these species (11); this is followed by the hedgerows that supported nine of these species; the other parts of the site supported between two and four of these species. The most ubiquitous of the Nationally local species was a leaf beetle (*Aphthona euphorniae*), which was found in all parts of the Masterplan site that were subject to survey. See Appendix 6F for more details.

6.4.1.9 Brown hairstreak eggs were identified during the targeted surveys and suitable habitat for this species (Blackthorn shrubs for egg-laying within the hedgerows and mature trees for display

and mating) was present across the Masterplan site. Elm (*Ulmus* sp.) was recorded in many of the hedgerows in the southern part of the Masterplan site. Given that this is the foodplant of the white-letter hairstreak and the fact that these butterflies have been recorded in hedgerows close to the southern boundary of the Masterplan site it would appear likely that this Section 41 (NERC Act) species would be present within the hedgerows on the Masterplan site.

6.4.1.10 The Masterplan site as a whole comprises habitats with limited structural diversity and limited botanical diversity that consequently support a limited diversity of terrestrial invertebrates. The parts of the site that were of greatest value to invertebrates were the hedgerows, the 'weedy' habitats associated with Gowell Farm and the more mature trees and shrubs associated with the access track leading to Lord's Farm.

6.5 Fish

6.5.1.1 Although targeted surveys for fish were not undertaken a shoal of roach (*Rutilus rutilus*) were noted within the southern pond associated with Himley Farm (Pond 15 on Drawing 6-2). Three-spined stickleback (*Gastreosteus aculeatus*) were also recorded in Crowmarsh pond (P6 on Drawing 6-2). Fish species recorded incidentally during the aquatic invertebrate surveys of the River Bure included three-spined stickleback, ten-spined stickleback (*Pungitius pungitius*), and Bullhead (*Cottus gobio*); a species associated with good water quality for which a Special Area of Conservation can be designated under the Habitats Directive.

6.6 Great crested newts

6.6.1.1 A medium population of great crested newts were found to be present within the ponds associated with Himley Farm, within the Masterplan site boundary; these are ponds P14 and P15 on Drawing 6-2.

6.6.1.2 A population of great crested newts was also found to be present within four ponds at Bucknell, outside the Masterplan site boundary; Ponds 2, 5, 7 and 9 on Drawing 6-2. Ponds P2, P5 and P9 are over 500 metres from the Masterplan site boundary and it is considered unlikely that the great crested newts associated with these ponds would forage within the Masterplan site. Pond P7 is 240m from the western boundary of the Masterplan site. Great crested newts typically forage within 250 metres of their breeding pond, therefore there is the potential that newts associated with this pond may forage within suitable habitat (in this case the bases of the hedgerows) on the edge of the Masterplan site. The arable fields on the edge of the Masterplan site represented sub-optimal habitat for foraging newts and as such it is extremely unlikely that these fields would be of value to these newts.

6.6.1.3 Great crested newts are known to breed in a pond on Bure Park. However, it is considered unlikely that these newts would forage on the Masterplan site since the pond is over 300 m from the Masterplan site boundary and separated from the site by residential development and Lord's Lane.

6.6.1.4 Great crested newts were absent from the other five ponds that were subject to survey. Great crested newts are a Section 41 (NERC Act) species; individual great crested newts, their breeding sites and resting sites receive full protection under UK and European legislation. The HSI scores and pond descriptions are presented in Appendix 6G.

6.6.1.5 Smooth newts (*Lissotriton vulgaris*) and/or common frog (*Rana temporaria*) were recorded within 11 ponds (P1, P2, P3, P5, P6, P7, P9, P10, P13, P14 and P15 on Drawing 6-2). Common toad (*Bufo bufo*) a Section 41 (NERC Act) species was not recorded on site during the surveys and it would appear that they do not breed within any of the features that were

surveyed. Common toad more typically breed in deep/ large water bodies that were not present within the Masterplan site.

6.7 Reptiles

6.7.1.1 The targeted surveys for reptiles revealed the presence of small numbers of common lizards (*Zootaca vivipara*) within suitable habitats across the site, including the western boundary of the site, the railway embankment, Crowmarsh pond, Gowell Farm, in a strip of ruderal vegetation parallel with Howes Lane and on a field margin south of Aldershot Farm. Their presence was also confirmed from direct observation during the walkover surveys of the farmland around Himley Farm. The maximum count on any single visit was a single adult and three juvenile common lizards at two separate locations. It is considered likely that small numbers of common lizard would be present in other areas of suitable habitat (the unmanaged field margins and stream corridors) across the Masterplan site.

6.7.1.2 There are historical records for grass snake (*Natrix natrix*) at Himley Farm (dating from 1995 and 2003) and a grass snake was recorded on the northern boundary of the woodland to the west of Home Farm. It is considered likely that grass snakes would be present in other areas of suitable habitat, in particular, within the areas of grassland adjacent to the ponds and watercourses. Few areas of habitat suitable for use by slow-worm (*Anguis fragilis*) were recorded within the Masterplan site. There was very little tussocky grassland and scrub and the woodlands represented sub-optimal habitat for this species. The railway embankment represented suitable habitat and it is likely that the south facing bank, at least, would support slow-worms, assuming that they are present in the locality (the desk study did not reveal any records for slow-worms).

6.7.1.3 All three common species of reptile are identified as species of Principal Importance under Section 41 of the NERC Act. They are also protected under UK legislation.

6.8 Breeding birds

6.8.1.1 One legally protected bird species, barn owl, has been recorded nesting within the Masterplan site. Barn owls have nested in specifically designed barn owl nest boxes located on trees to the west of Home Farm. Two boxes were relocated in 2013 to the edge of the Masterplan site to ensure that nesting barn owls are not disturbed by the construction works associated with consented Eco development within the Exemplar site or subsequent development associated with the wider Masterplan. At the time that the boxes were moved one contained barn owl remains. Barn owl pellets were also found within one of the barns at Himley Farm; however, their nest box had been removed in advance of the 2011 survey. There was no evidence that barn owl used other suitable features within the other out-buildings associated with Himley Farm. Barn owls are specially protected under Schedule 1 of the Wildlife and Countryside Act.

6.8.1.2 Eleven species of birds of conservation concern (BOCC Red list) (Ref 6-22) and species of Principal Importance under Section 41 of the NERC Act were found to be nesting or identified as probable nesting on or close to the Masterplan site in the surveys undertaken in 2010. These were:

- skylark (*Alauda arvensis subsp. arvensis*), 15 pairs associated with the arable fields;
- linnet (*Carduelis cannabina subsp. autochthona/cannabina*), 14 pairs associated with the hedgerows;
- cuckoo (*Cuculus canorus*), at Gowell Farm;

- yellowhammer (*Emberiza citrinella*), 44 pairs associated with hedgerows across the Masterplan site;
- yellow wagtail (*Motacilla flava subsp. flavissima*), one pair at Crowmarsh Farm;
- spotted flycatcher (*Muscicapa striata*) in a shed near Lower Farm in Bucknell outside the Masterplan site;
- marsh tit (*Poecile palustris subsp. palustris/dresseri*), one pair in woodland west of Home Farm;
- starling (*Sturnus vulgaris*), three pairs associated with trees and farm building;
- songthrush (*Turdus philomelos subsp. clarkei*), 16 pairs associated with the hedgerows;
- lapwing (*Vanellus vanellus*), two pairs in fields beyond the Masterplan site boundary; and
- house sparrow (*Passer domesticus*), 7 pairs associated with the farm buildings.

6.8.1.3 The 2011 surveys of the land around Himley Farm revealed that within this part of the Masterplan site, four species of Birds of Conservation Concern (BOCC Red list) (Ref 6-22) and Section 41 (NERC Act) species were found to be nesting or probable nesting. These were: 13 pairs of skylark; 14 pairs of linnet; one pair of song thrush and 24 pairs of yellowhammer.

6.8.1.4 Ten species listed on the BOCC Amber list (Ref 6-22) were also recorded in the 2010 surveys:

- stock dove (*Columba oenas*), two pairs Crowmarsh Farm;
- reed bunting (*Emberiza schoeniclus*), one pair Crowmarsh pond;
- kestrel (*Falco tinnunculus*), one pair west of Home Farm;
- swallow (*Hirundo rustica*) , 11 pairs associated with farm buildings;
- green woodpecker (*Picus viridis*) two pairs were recorded one by Hawkwell Farm and one by Lord's Farm;
- willow warbler (*Phylloscopus trochilus*), four pairs;
- dunnock (*Prunella modularis* subsp. *occidentalis*), 39 pairs;
- bullfinch (*Pyrrhula pyrrhula* subsp. *pileata*), seven pairs;
- common whitethroat (*Sylvia communis*), 37 pairs; and
- mistlethrush (*Turdus viscivorus*), one pair Aldershot Farm.

6.8.1.5 Dunnock, bullfinch and reed bunting are also Section 41 NERC Act species. Two pairs of dunnock and up to 12 pairs of whitethroat were recorded in the land around Himley Farm in 2011. Other BOCC Amber list species that were recorded around Himley Farm in 2011 included mallard (*Anas platyrhynchos*), stock dove (*Columba oenas*), swallow (*Hirundo rustica*), herring gull *(Larus argentatus*) and wheatear (*Oenanthe oenanthe*). The latter two species were not breeding within the Masterplan site.

6.8.1.6 In addition, the desk study also revealed records for two BOCC Red list and Section 41 NERC Act species within the Masterplan site in previous years. These were: corn bunting (*Emberiza calandra subsp. calandraon*), a pair of which nested on the site in 2007; and grey partridge (*Perdix perdix*), which were re-introduced to the site in 2010. Neither of these species were recorded during the 2010 and 2011 breeding bird surveys. A list of the birds recorded during the 2010 and 2011 surveys, together with their conservation status is presented in Appendix 6H.

6.9 Wintering birds

6.9.1.1 The wintering bird surveys showed moderate numbers of yellowhammer (flocks of up to 150), skylark (flock of up to 24), redwing (flocks up to 50) and fieldfare (flocks of up to 150). Low to moderate numbers of other bird species of conservation concern that were recorded during the surveys included:

- Mallard (two birds);
- linnet (up to 40 birds);
- reed bunting (three birds);
- kestrel (single birds);
- herring gull (*Larus argentatus*) (single birds recorded flying over the site);
- red kite (*Milvus milvus*) (single birds recorded flying over the site);
- marsh tit (two birds);
- house sparrow (up to twelve birds);
- grey partridge (two birds);
- green woodpecker (one bird);
- dunnock (21 birds);
- bullfinch (up to five birds);
- starling (usually small flocks but a flock of up to 100 birds were recorded on one occasion);
- song thrush (up to three birds); and
- a flock of 100 lapwing flew over the site.

6.9.1.2 The distribution of wintering birds reflected the field and hedgerow management, with stubble fields and the less heavily trimmed hedgerows supporting higher numbers. No barn owls were recorded within the Masterplan site during the surveys. A list of the birds recorded during the 2011 wintering bird surveys, together with their conservation status is presented in Appendix 6I.

6.9.1.3 As identified above, red kite (a species specially protected under Schedule 1 of the Wildlife and Countryside Act, whilst breeding) were observed flying over the site during the wintering bird surveys; but they were not recorded nesting on the Masterplan site during the breeding bird surveys. It is considered unlikely that red kite would nest within the small woodlands that are

present within the Masterplan site since they require large trees for nesting, which are absent from the Masterplan site. Similarly, although both fieldfare and redwing are listed on Schedule 1 of the Wildlife and Countryside Act, and therefore specially protected whilst nesting, and both were recorded on site during the wintering bird surveys, neither species would breed within the Masterplan site since they do not breed in southern Britain.

6.9.1.4 Eleven BOCC Red list (Ref 6-22) species were recorded overwintering within the Masterplan site: skylark, linnet, yellowhammer, herring gull, marsh tit, house sparrow, grey partridge, starling, redwing, song thrush and lapwing. Skylark, linnet, yellowhammer, herring gull, marsh tit, house sparrow, grey partridge, starling, song thrush and lapwing are also species of Principal Importance (Section 41 NERC Act species) as are reed bunting and dunnock which as identified previously were also recorded during the wintering bird surveys.

6.10 Bats

6.10.1.1 The desk study revealed records for common pipistrelle (*Pipistrellus pipistrellus*), brown long-eared and Natterer's bat (*Myotis nattereri*) within 5km of the Masterplan site. There are also known common pipistrelle and brown long-eared bat roosts approximately 2km south of the Masterplan site. The known roosts for Leisler's bat (*Nyctalus leisleri*) and serotine (*Eptesicus serotinus*) are greater than 10km from the Masterplan site.

6.10.1.2 The Arup surveys identified 28 trees within the Masterplan site as potentially suitable for use by roosting bats; but none of the trees within the land around Himley Farm contained features suitable for use by roosting bats (most were too young to contain suitable crevices or holes).

6.10.1.3 Targeted emergence surveys were undertaken in 2010 to confirm the use of these trees by roosting bats. Both hand-held and automatic bat detectors (Anabats) were used to determine the presence/absence of bats within these trees. As identified in paragraph 5.1.1 (limitations and assumptions) the automatic bat detectors that were located outside three trees failed to operate on two of the three occasions that they were deployed. It is therefore possible that these trees do support roosting bats. However, it is considered unlikely that these trees support large or significant roosts since these would have been detected during the activity surveys.

6.10.1.4 The presence of roosting bats was confirmed in two trees within the Masterplan site both were in the northern half of the site; their locations are shown on Drawing 6-3, they comprise:

- A small common pipistrelle bat roost within an artificial bat roosting box on a mature tree along the River Bure to the south-west of Home Farm (within the consented Eco development site); and
- Small numbers of common pipistrelle bats within a mature Ash tree on the edge of the woodland to the west of Home Farm.

6.10.1.5 The level of bat activity that was recorded close to the two mature trees on the watercourse south of Hawkwell Farm may indicate that these trees could support a common pipistrelle roost. Similarly, the levels of bat activity close to Crowmarsh Farm indicate that bats may roost in the trees or buildings close to this property.

6.10.1.6 A number of the buildings within the Masterplan site were identified as containing features potentially suitable for use by roosting bats. These included the buildings associated with Home Farm; Hawkwell Farm; Gowell Farm; Crowmarsh Farm; Aldershot Farm and Himley Farm. In addition the bungalow to the south of Himley Farm known as Lovelynch House and the farmhouse associated with Lord's Farm also contained features potentially suitable for use by roosting bats.

6.10.1.7 The surveys revealed:

- A bat roost used by small numbers of common pipistrelle bats within a modern farmhouse at Home Farm;
- A bat roost used by small numbers of common pipistrelle bats within a barn at Himley Farm; the landowner identified that previously this barn has supported a brown long-eared bat roost but no evidence of use by this species was recorded during any of the surveys;
- Five or more common pipistrelle bats were recorded close to the buildings associated with Lord's Farm shortly after dusk. This indicates that the buildings may support a bat roost, although its location was not confirmed during the surveys;
- The level of bat activity associated Crowmarsh Farm may also indicate that these buildings support a pipistrelle and/or *Myotis* bat roost, but once again the surveys were inconclusive; and
- Although access to Lovelynch House was not provided the activity surveys did not reveal large numbers of bats appearing close to this property shortly after dusk. It would appear, therefore, that the property does not support a large or significant roost.

6.10.1.8 In addition, three roosts were confirmed outside of the Masterplan site boundary as follows. These are shown on Drawing 6-3:

- Individual common pipistrelle bats within two adjacent mature oak trees;
- A roost of brown long-eared bats and other unconfirmed species within St Laurence Church, Caversfield.

6.10.1.9 The majority of the bat activity was associated with the stream corridors and largely comprised foraging and commuting common pipistrelle bats, but regular activity of soprano pipistrelle, brown long-eared, serotine, noctule, Leisler's and *Myotis* species were also recorded. A single Narthusius' pipistrelle (*Pipistrellus nathusii*) was recorded close to Crowmarsh pond. A number of hedgerows were also revealed to be key features for foraging and commuting bats.

6.10.1.10 The activity surveys that were undertaken in the land around Himley Farm revealed that small numbers of common and soprano pipistrelle (*Pipistrellus pygmaeus*) bats were foraging along the hedgerows, other bats recorded included noctule (*Nyctalus noctula*) and *Myotis*. Although no distinct commuting routes were recorded across this part of the Masterplan site, it would be appropriate to maintain corridors of vegetation suitable for use by commuting bats in order that bats roosting nearby can cross the site to access suitable foraging habitat to the south and west of the land around Himley Farm.

6.10.1.11 All bat species are fully protected under UK and European legislation. In addition, soprano pipistrelle, brown long-eared bat and noctule are Section 41 (NERC Act) species of Principal Importance.

6.11 Dormice

6.11.1.1 No evidence of dormice was found during the targeted surveys undertaken within the Masterplan site. No records of this species were obtained from TVERC and the links between the site and suitable habitat within the wider area were limited. It is therefore considered that dormice are absent from the Masterplan site.

6.12 Water voles

6.12.1.1 There are records dating from 2003 for water voles on the River Bure downstream of the Masterplan site. However, the only suitable habitat for water voles within the Masterplan site was the upstream extent of the tributary of the River Bure near Crowmarsh Farm. This section of watercourse supported vegetated clay banks and appeared to have good water quality; however, no signs of water vole activity were recorded in this location during the surveys. Within the Masterplan site, the River Bure was heavily shaded by trees and shrubs and largely lacked any emergence vegetation suitable for foraging water voles. Whilst unshaded sections of the tributaries contained areas of suitable vegetation, these watercourses were largely dry throughout the spring and summer months, and therefore, at best, sub-optimal for use by water voles. Given the isolated nature, and the limited extent of suitable habitat it is considered unlikely that the tributaries of the River Bure supports water voles and no signs of water vole activity were recorded during the targeted surveys. Water voles are therefore considered to be absent from the Masterplan site, but have the potential to colonise the site in future if suitable habitat were created that is sufficiently close to extant populations.

6.13 Otters

6.13.1.1 There are records for otters in the locality, with spraint recorded close to the fishery at Trow Pool. Trow Pool is 1.7km west of the Masterplan site boundary and not linked to the Masterplan site by a watercourse. The River Bure and its tributaries provided cover for otters and it is considered likely that otters would use these features whilst travelling across their home range. However, within the Masterplan site, the tributaries appeared to hold very little water for most of the year and the River Bure appeared to support few fish and other prey items suitable for otters. It is therefore considered that these features would be of limited value to foraging otters. The tree and shrub lined banks did provide suitable resting sites for otters, but no signs of otter activity were recorded during the survey.

6.13.1.2 Based on the survey data and conditions on the site, the Masterplan site is considered to be of limited value to otters. However, Otters are a highly mobile species, it is considered appropriate to ensure that otters are able to travel along the watercourses within the Masterplan site to enable them to gain access to more valuable habitats within their range. Otters are fully protected under UK and European legislation; they are also a species of Principal Importance (NERC Act Section 41 species).

6.14 Badgers

6.14.1.1 A ‘main’ badger sett was located on the east-west stream corridor to the west of Home Farm. This sett comprised at least twenty five entrance holes. A further large sett (that appeared to be functioning as a subsidiary sett) was located in woodland approximately 200m west (sett also comprising at least twenty five entrances). These sett locations are illustrated on Drawing 6-3. Two ‘outlying’ setts were also recorded between these two setts one on the bank of the tributary and the other close to the woodland on an old ditch line. Bait-marking studies undertaken for the consented Eco development identified that the two large setts are likely to belong to the same social group of badgers. Signs of badger activity were largely focused within the woodland and grassland habitats with few signs of badger activity recorded within the arable land.

6.14.1.2 In addition, two larger setts that could represent ‘small main’ setts have been identified. One is located to the south of Crowmarsh Farm along a field margin. This sett comprised at least ten entrance holes; six of which were well-used when surveyed in 2011. The other is further south on a field boundary to the west of, and outside, the Masterplan site boundary. This sett

comprised five entrance holes; two of which were well-used in September 2011. Both of these setts are shown on Drawing 6-3.

6.15 Other mammals of conservation concern

6.15.1.1 Records were provided for brown hare in the locality and small numbers of brown hare were recorded within the Masterplan site. Whilst there are no records for hedgehog (*Erinaceus europaeus*), polecat (*Mustela putorius*) and harvest mouse (*Micromys minutus*) in close proximity to the Masterplan site, records were provided for hedgehog and polecat in the locality. It is likely that hedgehogs would forage across the Masterplan site, most likely in association with the hedgerows and other linear features. The Masterplan site comprised habitats that are sub-optimal for polecat which is more typically associated with woodland areas. Harvest mouse (*Micromys minutus*) could be present within the hedgerows associated with the Masterplan site. However, given that the intensity of the management of the arable fields and grasslands the site is considered to be sub-optimal for this species. In England, hedgehog, polecat and harvest mouse are all species of Principal Importance (NERC Act Section 41 species).

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Appendix 6B Botanical data (Woodland)

Home Farm Wood W8d

Survey date: 28th July 2010	**Description of Sample Site:** Replanted wood with some remaining ash in the canopy, stumps and felled trunks. Sparse leaf litter and few areas of bare ground due to extensive moss cover.
Altitude: 90m	**Slope:**Level
Aspect: None	**Soil:** silty-clay
Stand Area: 300m × 80m	**Sample Area:** Canopy 50 x 50m, understorey 10 x 10m, field layer 4m x 4m and ground layer 1m x 1m
Layers (Mean Height) Canopy 20m Understorey 8m Field 1m Ground 50mm	**Layers (Cover)** Canopy 40% Understorey 70% Field 50% Ground 80%

Plant Species	**1**	**2**	**3**	**4**	**5**	**Plant Species**	**1**	**2**	**3**	**4**	**5**
Canopy						**Field Layer**					
Acer campestre			3	6		*Fraxinus excelsior*	2	4	2		
Fraxinus excelsior	5	5	5	4	5	*Geum urbanum*	2				
Understorey						*Glechoma hederacea*	3		3		2
Acer campestre				2	4	*Hedera helix*			4	7	8
Corylus avellana		2				*Mercurialis perennis*	7	5	5	3	4
Crataegus monogyna	5	8			5	*Rosa canina*					1
Sambucus nigra	7	3	7	4	3	*Rubus fruticosus* agg.	2				
Ulmus procera		2				*Sambucus nigra*			2		
Field Layer						**Stachys sylvatica**					**2**
Alliara petiolata					2	*Tamus communis*					1
Anthriscus sylvestris		5	6	6	7	*Urtica dioica*	5	4	5	2	3
Arctium lappa	1					*Viola riviniana/reichenbachiana*			2		
Arum maculatum	2	2	2	2	2	**Ground Layer**					
Bromopsis ramosa				2	3	*Hypnum cupressiforme*	2	2		1	
Dryopteris dilatata			1			*Thamnobryum alopecurum*	6	8	4	6	2

Hawkwell Farm Wood W8e

Survey date: 30th July 2010	**Description of Sample Site:** Ash woodland partially planted with grey poplar. The wood is adjacent to a stream and is subject to flooding.
Altitude: 83m	**Slope:** Level
Aspect: None	**Soil:** Silty-clay
Stand Area: 250m × 60m	**Sample Area:** Canopy 50 x 50m, understorey 10 x 10m, field layer 4m x 4m and ground layer 1m x 1m
Layers (Mean Height) Canopy 23m Understorey 7m Field 1m Ground 50mm	**Layers (Cover)** Canopy 85% Understorey 75% Field 50% Ground 80%

Plant Species	**1**	**2**	**3**	**4**	**5**	**Plant Species**	**1**	**2**	**3**	**4**	**5**
Canopy						**Field Layer**					
Fraxinus excelsior	3	3	4	7	8	*Deschampsia flexuosa*				1	
Populus × canescens	8	8	7	3		*Fraxinus excelsior*				1	1
Understorey						*Galium aparine*				2	
Acer campestre	3	3	3	2	2	*Geranium robertianum*	3	2	3	4	5
Crataegus monogyna	6	5	6	6	5	*Geum urbanum*	2				
Fraxinus excelsior	3	3	4	4	5	*Melica uniflora*	2				
Ilex aquifolium		*2*	*1*			*Mercurialis perennis*	5	5	5	6	6
Ligustrum vulgare	5	4	3	3	2	*Ribes rubrum*			*2*	*4*	*4*
Populus × canescens	3	4	2			*Rubus fruticosus* agg.	3	3	2		2
Rosa canina	2	2				*Stachys sylvatica*		2	2	2	2
Sambucus nigra	1			4	3	*Tamus communis*	3				
Ulmus procera	4	4	4		1	*Urtica dioica*		3	3	5	4
Field Layer						**Ground Layer**					
Ajuga reptans			3	3	3	*Hedera helix*	6	6	7	6	8
Arum maculatum		2	3	3	3	*Eurhynchium striatum*	2	3	2		
Bromopsis ramosa	4	3	3	1	2	*Kindbergia praelonga*	3	7	5	6	4
Carex sylvatica	3	2	2	3	2						
Circaea lutetiana	4	4	5								

Appendix 6C Botanical data (Grassland)

Hawkwell Farm Grassland MG7e

Survey date: 30th July 2010	**Description of Sample Site:** Cattle grazed pasture adjacent to a stream and subject to flooding.
Altitude: 83m	**Slope:** Level
Aspect: None	**Soil:** silty-clay
Stand Area: 600m x 50m	**Sample Area:** 2m x 2m

Plant Species	**1**	**2**	**3**	**4**	**5**	**Plant Species**	**1**	**2**	**3**	**4**	**5**
Agrostis capillaris	5	5	4	3	3	*Poa pratensis*	5	4	3		4
Agrostis stolonifera				1	1	*Ranunculus repens*				4	3
Brachythecium rutabulum				1	3	*Rumex crispus*	1				
Cirsium arvense		1			1	*Rumex obtusifolius*					1
Dactylis glomerata	4	4	3	3	3	*Taraxacum officinale* agg.				1	2
Festuca rubra	5	5	5	4	4	*Trifolium repens*				2	
Holcus lanatus	6	5	5	5	5	*Urtica dioica*	1		1		
Lolium perenne	6	5	5	5	4						
Plantago major					1						

Home Farm Grassland MG7d (Field 1)

Survey date: 30th July 2010						**Description of Sample Site:** Cattle grazed pasture adjacent to a stream and subject to flooding.						
Altitude: 90m						**Slope:** Level						
Aspect: None						**Soil:** silty-clay						
Stand Area: 260m x 90m						**Sample Area:** 2m x 2m						
Plant Species	**1**	**2**	**3**	**4**	**5**	**Plant Species**	**1**	**2**	**3**	**4**	**5**
Agrostis capillaris	3	4	3	2	2	*Juncus inflexus*			3	4	
Agrostis stolonifera	2	1	2			*Lolium perenne*					2
Bromus hordeaceus		2				*Phleum pratense*	1				
Cardamine pratensis			2	1		*Poa pratensis*	2				
Carex hirta			2	4	1	*Potentilla reptans*	2	1			
Dactylis glomerata		2			1	*Ranunculus repens*		2	2	1	
Deschampsia cespitosa				2	4	*Rumex acetosa*	2	1		1	
Epilobium hirsutum			2	1		*Sonchus oleraceus*	1		1	1	
Festuca pratensis	2	2	2	1	1	*Taraxacum officinale* agg.	2			1	2
Festuca rubra	4	3	3	3	3						
Holcus lanatus	3	4	5	4	3						

Home Farm Grassland MG7d (Field 2)

Survey date: 28th July 2010						**Description of Sample Site:** Cattle grazed pasture adjacent to a stream and subject to flooding.						
Altitude: 90m						**Slope:** Level						
Aspect: None						**Soil:** silty-clay						
Stand Area: 260m x 50m						**Sample Area:** 2m x 2m						
Plant Species	**1**	**2**	**3**	**4**	**5**	**Plant Species**	**1**	**2**	**3**	**4**	**5**
Agrostis capillaris	3	3	4	2	3	*Juncus effusus*					1
Agrostis stolonifera	1	1	2		1	*Juncus inflexus*				3	3
Anthoxanthum odoratum	2	2	3		2	*Lolium perenne*	2	1			
Cirsium arvense	1	1				*Ranunculus repens*	2	1			
Dactylis glomerata	3	2				*Rumex acetosa*				1	2
Deschampsia cespitosa	4	2	3	4		*Rumex obtusifolius*					2
Equisetum arvense	2					*Taraxacum officinale* agg				1	3
Festuca pratensis	3	4	2	2							
Festuca rubra	5	4	3	2	4						

Home Farm Grassland MG7c (Field 3)

Survey date: 28th July 2010						**Description of Sample Site:** Cattle grazed pasture adjacent to a stream and subject to flooding.						
Altitude: 88m						**Slope:** Level						
Aspect: None						**Soil:** silty-clay						
Stand Area: 240m x 60m						**Sample Area:** 2m x 2m						
Plant Species	**1**	**2**	**3**	**4**	**5**	**Plant Species**	**1**	**2**	**3**	**4**	**5**
Agrostis capillaris	3	4	2	2	2	*Hordeum secalinum*				2	2
Alopecurus pratensis	3	1				*Leontodon autumnalis*		2		1	
Arrhenatherum elatius	4	4				*Lolium perenne*	3	2	4	4	4
Brachythecium rutabulum				1	2	*Phleum pratense*					1
Bromus hordeaceus		2	2			*Potentilla reptans*				3	
Convolvulus arvensis		3			2	*Rumex acetosa*					1
Dactylis glomerata	4	4	1	4	3	*Rumex obtusifolius*			1		
Deschampsia cespitosa				1		*Taraxacum officinale* agg				1	1
Festuca pratensis			4	1	1	*Trifolium pratense*	2				
Festuca rubra	5	4	4	4	4	*Urtica dioica*				1	1
Holcus lanatus				3	1						

Appendix 6D Botanical data (Hedgerows)

Woody species recorded in 30 metre sample of hedgerow during Arup surveys in 2010.

Hedgerow Number	Apple, crab	Ash	Alder Buckthorn	Blackthorn	Cherry, wild	Dogwood	Elder	Elm	Guelder-rose	Hawthorn	Hazel	Holly	Maple, field	Oak	Privet, Wild	Rose	Sycamore	Wayfaring-tree	Willow	Other
1		✓		✓			✓	✓		✓					✓	✓	✓			✓
2				✓	✓			✓		✓			✓		✓	✓	✓		✓	
3		✓		✓				✓		✓			✓		✓	✓				
4		✓				✓	✓	✓		✓			✓		✓					
5		✓		✓			✓	✓		✓					✓	✓				
6	✓	✓		✓				✓		✓	✓		✓	✓	✓	✓		✓		
7							✓			✓						✓				
8		✓		✓		✓	✓	✓		✓					✓	✓				
9			✓	✓			✓	✓		✓						✓	✓			
10		✓					✓	✓		✓					✓	✓	✓			
11							✓			✓			✓		✓	✓				
12				✓		✓	✓	✓		✓			✓			✓		✓		
13		✓		✓		✓	✓		✓	✓	✓		✓		✓	✓		✓	✓	
14	✓	✓		✓			✓			✓			✓		✓	✓		✓		
15				✓		✓				✓			✓		✓	✓			✓	
16		✓		✓		✓				✓			✓		✓	✓		✓	✓	
17				✓		✓	✓			✓			✓		✓					
18		✓	✓	✓			✓	✓		✓						✓				
19				✓			✓	✓		✓	✓		✓		✓	✓		✓		
20		✓		✓			✓	✓		✓			✓		✓	✓	✓			
21	✓	✓		✓		✓	✓	✓		✓	✓		✓		✓	✓	✓	✓	✓	
22				✓			✓	✓		✓					✓	✓				

Hedgerow Number	Apple, crab	Ash	Alder Buckthorn	Blackthorn	Cherry, wild	Dogwood	Elder	Elm	Guelder-rose	Hawthorn	Hazel	Holly	Maple, field	Oak	Privet, Wild	Rose	Sycamore	Wayfaring-tree	Willow	Other
23	✓			✓		✓	✓	✓		✓			✓		✓				✓	
24	✓	✓		✓			✓	✓		✓			✓			✓				
25	✓	✓		✓			✓	✓		✓	✓		✓			✓				
26	✓	✓		✓			✓	✓		✓			✓			✓				
27		✓		✓		✓	✓	✓		✓			✓			✓		✓		✓
28		✓		✓		✓	✓			✓	✓		✓			✓				
29	✓			✓			✓	✓		✓			✓	✓		✓				
30				✓			✓			✓										
31				✓			✓			✓	✓		✓			✓			✓	
32		✓					✓	✓		✓			✓		✓					✓
33	✓	✓	✓	✓		✓	✓	✓		✓			✓			✓		✓		
34			✓	✓				✓		✓			✓		✓	✓		✓		
35	✓	✓	✓	✓			✓	✓		✓			✓		✓	✓	✓	✓		
36		✓	✓				✓	✓		✓			✓		✓	✓	✓			
37	✓	✓	✓	✓			✓	✓		✓			✓		✓					
38		✓	✓	✓		✓				✓					✓	✓				
39		✓	✓	✓			✓			✓			✓			✓				
40	✓	✓	✓				✓			✓					✓	✓		✓		
41			✓							✓										
42	✓	✓	✓	✓			✓	✓		✓			✓		✓					
43	✓		✓	✓		✓	✓			✓						✓				
44			✓					✓		✓						✓				
45			✓	✓						✓			✓			✓				
46							✓			✓				✓						

Hedgerow Number	Apple, crab	Ash	Alder Buckthorn	Blackthorn	Cherry, wild	Dogwood	Elder	Elm	Guelder-rose	Hawthorn	Hazel	Holly	Maple, field	Oak	Privet, Wild	Rose	Sycamore	Wayfaring-tree	Willow	Other
47	✓		✓	✓			✓			✓						✓				
48	✓	✓	✓	✓		✓	✓	✓		✓	✓		✓		✓	✓	✓			
49	✓	✓	✓	✓		✓	✓			✓	✓		✓		✓	✓	✓	✓		
50		✓	✓				✓			✓			✓		✓	✓				
51			✓				✓			✓	✓		✓		✓	✓		✓	✓	
52		✓	✓	✓			✓	✓	✓	✓			✓		✓	✓				
53			✓			✓	✓	✓		✓			✓			✓		✓		
54		✓	✓				✓	✓		✓			✓		✓					
55	✓	✓	✓				✓	✓		✓			✓		✓					
56			✓			✓	✓			✓			✓					✓		
57			✓				✓	✓		✓			✓							
58			✓			✓	✓			✓										
59			✓			✓	✓			✓			✓		✓	✓		✓		
60		✓	✓				✓			✓									✓	
61							✓			✓										
62	✓		✓			✓	✓			✓	✓		✓			✓		✓		
63	✓	✓	✓			✓	✓	✓		✓			✓		✓	✓				
64	✓						✓	✓		✓										
65							✓	✓		✓			✓		✓	✓				

Associated features	Hedgerow number
Bridleway	8,10,33,35,36,37,38,48,49,50,51
Historic civic boundary	23,26,64

Hedgerow Number	HEGS Value	Important hedgerows	Hedgerow Number	HEGS Value	Important hedgerows	Hedgerow Number	HEGS Value	Important hedgerows
1	Moderate – High	✓	23	Very High	✓	45	High – Very High	-
2	Very High	✓	24	Very High	✓	46	Moderate – High	-
3	High	✓	25	High – Very High	✓	47	High – Very High	✓
4	High – Very High	✓	26	High – Very High	✓	48	Very High	✓
5	High – Very High	✓	27	Very High	✓	49	Very High	✓
6	High – Very High	✓	28	High – Very High	✓	50	High – Very High	✓
7	Moderate – High	-	29	High – Very High	✓	51	Very High	✓
8	High – Very High	✓	30	High	-	52	High – Very	✓
9	High – Very High	✓	31	High – Very High	✓	53	High – Very High	✓
10	High – Very High	✓	32	High – Very High	✓	54	High	✓
11	High – Very High	-	33	Very High	✓	55	High – Very High	✓
12	High – Very High	✓	34	High – Very High	✓	56	High – Very High	-
13	Very High	✓	35	Very High	✓	57	High – Very High	-
14	Very High	✓	36	High – Very High	✓	58	High – Very High	-
15	High – Very High	✓	37	High – Very High	✓	59	High – Very High Important	✓
16	High – Very High	✓	38	High	✓	60	High – Very High -	-
17	High	-	39	High	✓	61	Moderate – High -	-
18	High	✓	40	High – Very High	✓	62	High – Very High	✓
19	High – Very High	✓	41	Moderate – High	-	63	Very High	✓
20	High – Very High	✓	42	High	✓	64	Moderate – High	✓
21	Very High	✓	43	High – Very High	✓	65	Moderate	-
22	High – Very High	-	44	Moderate – High	-			

Exemplar results

Hedgerow Number	Apple, crab	Ash	Alder Buckthorn	Blackthorn	Cherry, wild	Dogwood	Elder	Elm	Guelder-rose	Hawthorn	Hazel	Holly	Maple, field	Oak	Privet, Wild	Rose	Sycamore	Wayfaring-tree	Willow	Other
1	✓	✓		✓		✓	✓	✓		✓	✓				✓	✓		✓		
2	✓	✓		✓			✓	✓		✓			✓		✓	✓				✓
3	✓			✓			✓	✓		✓	✓		✓		✓	✓		✓		
4	✓			✓			✓			✓			✓		✓	✓				
5	✓			✓			✓	✓	✓	✓			✓							
6	✓			✓			✓	✓		✓					✓	✓				✓
7	✓			✓			✓	✓		✓			✓							
8	✓	✓		✓		✓	✓	✓		✓			✓		✓	✓		✓		
9							✓	✓		✓					✓					
10	✓			✓			✓	✓		✓			✓		✓	✓		✓		✓
11	✓			✓			✓	✓		✓			✓			✓		✓		
12				✓			✓			✓						✓				✓
13				✓			✓	✓		✓			✓			✓				
14		✓		✓			✓	✓		✓			✓			✓				
15				✓			✓	✓		✓			✓			✓				
16	✓			✓			✓	✓		✓			✓			✓		✓	✓	
17		✓		✓			✓			✓										
18		✓		✓			✓	✓		✓			✓		✓	✓		✓		✓
19	✓			✓			✓	✓		✓						✓				

Associated features	Hedgerow number
Historic Parish boundary	1, 8
Mediaeval Field Boundary	11

Hedgerow Number	HEGS Value	Important hedgerows
1	Very High	✓
2	High – Very High	✓
3	Very High	✓
4	High – Very High	✓
5	Moderate – High	✓
6	High – Very High	✓
7	High	-
8	Very High	✓
9	Moderate – High	-
10	Very High	✓
11	Very High	✓
12	Moderate – High	-
13	High	-
14	High – Very High	✓
15	High – Very High	✓
16	Very High	✓
17	High – Very High	-
18	Very High	✓
19	High – Very High	-

Woody species recorded in hedgerows during Hyder surveys in 2010.

Hedgerows Regulations (1997) Record Sheet

(see accompanying notes for an explanation of the terms and definitions used)

Complete the table by using a '✓' for each feature present along each hedgerow.

Hedge No.	H1a	H1b	H2	H3a	H3b	H4	H5	H6	H7a	H7b
Important	✓	✓	✓	✓	✓	✓	✓	✓	x	x
Bridleway/path	x	x	x	x	x	x	x	x	x	x
Pn/Sot/Tic/Tip	x	x	x	x	x	x	x	x	x	x
No. woody spp./30m	6	7	6	6	7	7	7	6	5	5
Bank/wall	x	x	x	x	x	x	x	x	x	x
Intact	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Trees	✓	✓	✓	X	✓	x	✓	x	x	x
3 flora spp.	x	x	x	x	x	x	x	x	x	x
Ditch	✓	✓	✓	✓	✓	✓	x	✓	✓	✓
Connect ≥ 4 points	x	x	4 ✓	4 ✓	4 ✓	x	x	4 ✓	4 ✓	4✓
Parallel hedge	x	x	x	x	x	x	x	x	x	x
Woody ssp present	Um Fe Cm Ros Ps Liv	Um Fe Cm Ros Ps Liv Sn	Fe Cm Ps Ac Ms Rc	Fe Cm Ps Ac Ros Um	Fe Cm Ps Ac Um Ca Sn	Ps Cm Ros Fe Rc Sn Liv	Cm Sn Ca Ac Ros Ps Rc	Fe Um Ps Cm Ros Sn	Um Ros Cm Ps Fe	Fe Um Ros Cm Sn

H1: Hedge approx 100m in length dominated by Cm, Ps and Um with mature trees, predominantly Fe.

H2: Hedge forming eastern edge of block of plantation woodland.

Hedge No.	H8	H9a	H9b	H9c	H10	H11	H12	H13	H14	H15
Important	✓	✓	✓	✓	✓	✓	✓	x	x	✓
Bridleway/path	x	x	x	x	x	x	x	x	x	x
Pn/Sot/Tic/Tip	x	x	x	x	x	x	x	x	x	x
No. woody spp./30m	6	7	8	7	7	6	6	3	5	7
Bank/wall	x	x	x	x	x	x	x	x	x	x
Intact	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Trees	✓	x	x	✓	x	✓	X	✓	x	✓
3 flora spp.	x	x	x	x	x	x	X	x	x	x
Ditch	✓	x	x	✓	✓	✓	✓	x	x	✓
Connect ≥ 4 points	4 ✓	4 ✓	4 ✓	4 ✓	4 ✓	4 ✓	4 ✓	x	x	4 ✓
Parallel hedge	x	x	x	x	x	x	x	x	x	x
Woody ssp present	Um Ros Fe Cm Ms Ps	Ms Ca Fe Ps Sn Ac Vl	Fe Ps Sn Ac Ms Um Ros Ca	Ps Cm Ac Fe Ms Rc Sn	Ac Um Cm Ros Fe Ps Rc	Um Ros Sn Cm Ac Liv	Fe Um Cm Rc Ros Ps	Ps Fe Ms	Ps Rc Cm Fe Um	Fe Um Ps Sn Ms Ros Cos
Notes see below	*	*			*	*	*	*	*	*

H8: Hedge approx 100m in length dominated by Um,

H9: Hedge approx 250m in length dominated by Ac

H10: Hedge approx 75m dominated by Cm and Ps

H11: Hedge approx 75m dominated by Cm

H12: Hedge dominated by Um

H13: Hedge dominated by Ps

H14: Hedge dominated by Ps

H15: Hedge approx 60m dominated by Ps

Hedge No.	H16	H17a	H17b	H18a	H18b	H19	H20a	H20b	H21a	H21b
Important	✓	✓	✓	✓	x	✓	x	x	✓	x
Bridleway/path	x	x	x	x	x	x	x	x	x	x
Pn/Sot/Tic/Tip	x	x	x	x	x	x	x	x	x	x
No. woody spp./30m	7	7	7	7	6	7	6	5	8	5
Bank/wall	x	x	x	x	x	x	x	x	x	x
Intact	✓	✓	✓	✓	✓	✓	x	X	x	✓
Trees	x	x	x	x	X	X	✓	✓	x	✓
3 flora spp.	x	x	x	x	X	X	x	x	x	x
Ditch	✓	✓	✓	X	X	✓	x	x	x	x
Connect ≥ 4 points	4 ✓	4 ✓	4 ✓	4 ✓	4 ✓	x	4 ✓	4 ✓	4 ✓	4 ✓
Parallel hedge	x	x	x	x	x	x	x	x	x	x
Woody ssp present	Cm Sn Ac Um Fe Ps Ms Rc	Cm Um Ps Ros Liv Sn Ac	Fe Ros Ac Cm Sn Cos Um	Fe Cm Sn Ps Ros Ac Ms	Ac Fe Cm Ps Ros Um	Fe Um Cm Ps Rc Sn Ros	Cm Rc Ps Ms Sn Ros	Ps Cm Sn Fe Ros	Um Cm Sn Fs Ms Ps Fe Ros	Cm Sn Ros Ps Ee
Notes see below	*	*		*		*	*		*	

H16: Hedge approx 100m in length dominated by Ps

H17: Hedge approx 150m dominated by Um and Cm adjacent to dry ditch with Bramble and tall ruderal species adjacent

H18: Hedge approx 200m in length dominated by Ps with frequent Bramble

H19: Hedge approx 70m dominated by Cm

H20: Hedge approx 200m in length dominated by Ps and Cm with Um and Sycamore (*Acer pseudoplatanus*

H21: Hedge approx 200m in length dominated by Cm

Hedge No.	H22	H23	H24	H25a	H25b	H26a	H26b
Important	x	x	✓	✓	✓	x	x
Bridleway/path	x	x	x	x	x	x	x
Pn/Sot/Tic/Tip	x	x	x	x	x	x	x
No. woody spp./30m	4	4	7	7	7	5	4
Bank/wall	x	x	x	x	x	x	x
Intact	✓	✓	✓	✓	✓	✓	✓
Trees	✓	✓	x	✓	✓	x	x
3 flora spp.	x	x	x	x	x	x	x
Ditch	✓	x	✓	x	x	✓	✓
Connect ≥ 4 points	x	4 ✓	4 ✓	4 ✓	4 ✓	x	x
Parallel hedge	x	x	x	x	x	x	x
Woody ssp present	Cm Ps Um Ms	Fe Cm Ac Sn	Fe Ros Cm Um Ps Rc Ms	Fe Um Ms Ac Cm Ps Ros	Cm Ps Ac Ros Sn Fe Um	Um Ps Fe Cm Sn	Um Ps Cm Ms
Notes see below	*			*		*	

H22: Hedge approx 100m in length dominated by Cm, Ps and Um

H25: Hedge approx 200m in length with semi-mature trees including Fe and Ms

H26: Hedge approx 150m in length dominated by Ps

Accompanying Notes for Hedgerows Regulations (1997) Record Sheet

These Regulations only apply to hedgerows adjacent to land in agricultural/horticultural use. A hedgerow may be classified as 'important' for archaeological/historical reasons, or according to Wildlife and Landscape criteria. To be classified as 'important' under the Wildlife and Landscape criteria, the hedgerow must be over 30 years old and should comprise one of the following:

- *at least 7 woody species/30m;
- *at least 6 woody species/30m and at least 3 features;
- *at least 6 woody spp/30m including any one of Pn/Sot/Tic/Tip (see below);
- *at least 5 woody species and at least 4 features;
- or if adjacent to a bridleway/footpath, at least 4 woody species and at least 2 features.

*If the hedgerow is situated wholly or partly in one of the counties listed in Criteria 7 sub-paragraph (2) of the Regulations, the number of woody species should be reduced by one.

(N.B. A hedgerow may also be classified as 'important' due to the presence/recorded presence of particular animal and plant species (see Criteria 6 sub-paragraphs (1)-(4) of the Regulations for details).)

The **woody species** 'recognised' by the Hedgerows Regulations are listed below, along with the species codes to be used on the record sheet:-

Spp code	Latin name	English name	Spp code	Latin name	English code
Ac	*Acer campestre*	Field Maple	**Pa**	*Prunus avium*	Wild Cherry
Ag	*Alnus glutinosa*	Alder	**Pp**	*Prunus padus*	Bird Cherry
Bpe	*Betula pendula*	Silver Birch	**Ps**	*Prunus spinosa*	Blackthorn
Bpu	*Betula pubescens*	Downy Birch	**Pyc**	*Pyrus communis*	Pear
Bxs	*Buxus sempervirens*	Box	**Qp**	*Quercus petraea*	Sessile Oak
Cb	*Carpinus betulus*	Hornbeam	**Qr**	*Quercus robur*	Pedunculate Oak
Cos	*Cornus sanguinea*	Dogwood	**Rc**	*Rhamnus catharticus*	Buckthorn
Ca	*Corylus avellana*	Hazel	**Ruv**	*Ribes uva-crispa*	Gooseberry
Cla	*Crataegus laevigata*	Midland Hawthorn	**Ros**	*Rosa* sp(p)	Rose
Cm	*Crataegus monogyna*	Hawthorn	**Rac**	*Ruscus aculeatus*	Butcher's-broom
Cys	*Cytisus scoparius*	Broom	**Sx**	*Salix* sp(p)	Willow
Dl	*Daphne laureola*	Spurge-laurel	**Sxca**	*Salix caprea*	Goat Willow
Ee	*Euonymus europaeus*	Spindle	**Sxf**	*Salix fragilis*	Crack-willow
Fs	*Fagus sylvatica*	Beech	**Sxv**	*Salix viminalis*	Osier
Fa	*Frangula alnus*	Alder Buckthorn	**Sn**	*Sambucus nigra*	Elder
Fe	*Fraxinus excelsior*	Ash	**Sac**	*Sorbus aucuparia*	Rowan
Hr	*Hippophae rhamnoides*	Sea-buckthorn	**Sor**	*Sorbus* sp(p)	Whitebeam
Ia	*Ilex aquilfolium*	Holly	**Sot**	*Sorbus torminalis*	Wild Service-tree
Jr	*Juglans regia*	Walnut	**Tb**	*Taxus baccata*	Yew
Jc	*Juniperus communis*	Common Juniper	**Tic**	*Tilia cordata*	Small-leaved Lime
Liv	*Ligustrum vulgare*	Wild Privet	**Tip**	*Tilia platyphyllos*	Large-leaved Lime

Ms	*Malus sylvestris*	Crab Apple	**Ue**	*Ulex europaeus*	Gorse
Pal	*Populus alba*	White Poplar	**Ug**	*Ulex gallii*	Western Gorse
Pn	*Populus nigra sub-species betulifolia*	Black-poplar	**Umi**	*Ulex minor*	Dwarf Gorse
Pot	*Populus tremula*	Aspen	**Um**	*Ulmus* sp(p)	Elm
Pcan	*Populus x canescens*	Grey Poplar	**Vl**	*Viburnum lantana*	Wayfaring-tree
			Vop	*Viburnum opulus*	Guelder-Rose

The presence of a number of **features** along a hedgerow influences the classification under the Regulations. The terms used on the record sheet are explained below, and their presence is indicated by a '✓':

Bank/wall — The hedgerow is supported along at least half of its length by a bank/wall.

Intact — The hedgerow contains less than 10% gaps along its length.

Trees — The hedgerow supports at least 1 standard tree per 50 m length of hedgerow (standard trees are defined as those which when measured at 1.3m above ground level have a diameter of at least 20 cm, or 15 cm for multi-stemmed trees).

3 flora spp. — The hedgerow supports at least 3 of the valuable ground flora species defined by the Regulations. The hedgerow is considered to support a plant if it is rooted within 1m (in any direction) of the hedgerow.

Ditch — There is a ditch along at least half of the length of the hedgerow.

Connections ≥4 points — A hedgerow must score 4 or more 'connections points', where connections with an adjoining hedgerow(s) score 1 point each, and a connection with a pond or woodland (in which the majority of the trees are broad-leaved) scores 2 points each. A hedgerow is considered to be connected if it meets the feature or if it has a point within 10 m of it and would meet it if the line of the hedgerow continued.

Parallel hedge — A parallel hedgerow is present within 15m.

An explanation of additional terms used on the Hedgerows Regulation Record Sheet follows:

Hedge No. — Hedgerow Number (within survey area/ site)

Important — Would the hedgerow be classified as 'important' under the Hedgerows Regulations?

Bridleway/path — The hedgerow runs parallel to a designated bridleway/footpath.

Pn/Sot/Tic/Tip — The presence of these trees within the hedgerow influences the classification. An explanation of the species codes is shown above.

Woody species — A list of the woody species found along the hedgerow (this is likely to list more species than are present along 30 m length(s)).

Appendix 6E Aquatic Invertebrates recorded in 2012

Sample Location 1: Downstream of Exemplar Site (Grid reference SP 57769 24730)) location shown on Drawing 6-2

Taxa	Family	Species	Number	Relative Abundance
Gastropod	Planorbidae	*Anisus vortex*	20	0.061728395
		Bathyomphalus contortus	5	0.015432099
	Lymnaeidae	*Lymnaea palustris*	16	0.049382716
		Lymnaea peregra	169	0.521604938
Bivalve	Sphaeroidea	*Sphaerium corneum*	1	0.00308642
Malacostraca	Aesllidae	*Asellus aquaticus*	24	0.074074074
	Gammaridae	*Gammarus pulex*	30	0.092592593
Ephemeroptera	Baetidae	Baetis rhodani	26	0.080246914
Coleoptera	Gyrinidae	*Gyrinus substriatus*	1	0.00308642
	Haliplidae	*Haliplus lineatocollis*	2	0.00617284
	Hydrophilidae	*Laccobius bipunctatus*	1	0.00308642
	Dytiscidae	*Agabus didymus*	1	0.00308642
		Dyticidae spp Larve	2	0.00617284
Tricoptera	Limnephilidae	*Micropterna sequax*	14	0.043209877
Oligocheata	Oligochaeta	*Oligocheat worm*	5	0.015432099
Diptera	*Tipulidae*	*Tipulidae spp*	4	0.012345679
	Simulidae	*Simulidae spp*	1	0.00308642
	Chironomidae	*Chironomidae spp.*	2	0.00617284
No. identified Taxa			18	
Total number of invertebrates			324	

Sample Location 2: Exemplar Site (Grid reference SP 57870 24884) location shown on Drawing 6-2

Taxa	Family	Species	Numbers	Relative Abundance
Gastropod	Hydrobiidae	*Potamopyrgus antipodarum*	1	0.001302
	Planorbidae	*Anisus vortex*	70	0.091146
		Bathyomphalus contortus	25	0.032552
	Lymnaeidae	*Lymnaea palustris*	66	0.085938
		Lymnaea peregra	415	0.540365
Bivalve	Sphaeroidea	*Sphaerium corneum*	11	0.014323
		Pisidium casertanum	5	0.00651
		Pisidium milum	5	0.00651
Malacostraca	Aesllidae	*Asellus aquaticus*	127	0.165365
	Gammaridae	*Gammarus pulex*	17	0.022135
Ephemeroptera	Baetidae	Baetis rhodani	1	0.001302
Coleoptera	Dytiscidae	*Agabus bipustulatus*	3	0.003906
		Dyticidae spp Larve	3	0.003906
Tricoptera	Limnephilidae	*Micropterna sequax*	1	0.001302
		Limnephilus lunatus	1	0.001302
		Limniphilidae spp case only	6	0.007813
Oligocheata	Oligochaeta	*Oligocheat worm*	5	0.00651
Diptera	*Tipulidae*	*Tipulidae spp*	2	0.002604
	Chironomidae	*Chironomidae spp.*	4	0.005208
No. identified Taxa			19	
Total number of invertebrates			768	

Sample Location 3: Upstream of Exemplar Site (Grid reference SP 57970 24997) location shown on Drawing 6-2

Taxa	Family	Species	Numbers	Relative abundance
Gastropod	Planorbidae	*Anisus vortex*	62	0.063917526
		Bathyomphalus contortus	12	0.012371134
		Planorbis carinatus	2	0.002061856
	Lymnaeidae	*Lymnaea palustris*	25	0.025773196
		Lymnaea peregra	215	0.221649485
Bivalve	Sphaeroidea	*Sphaerium corneum*	41	0.042268041
		Pisidium casertanum	57	0.058762887
Malacostraca	Aesllidae	*Asellus aquaticus*	408	0.420618557
	Gammaridae	*Gammarus pulex*	66	0.068041237
Ephemeroptera	Baetidae	*Baetis rhodani*	13	0.013402062
Odonata	Aeshnidae	*Aeshna cyanea*	1	0.001030928
Coleoptera	Gyrinidae	*Gyrinus substriatus*	1	0.001030928
	Dytiscidae	*Agabus sturmii*	2	0.002061856
		Agabus didymus	5	0.005154639
		Dyticidae spp Larve	1	0.001030928
Tricoptera	Limnephilidae	*Micropterna sequax*	20	0.020618557
		Limnephilus lunatus	1	0.001030928
		Limniphilidae spp case only	26	0.026804124
Oligocheata	Oligochaeta	*Oligocheat worm*	8	0.008247423
Diptera	*Tipulidae*	*Tipulidae spp*	1	0.001030928
	Chironomidae	*Chironomidae spp.*	3	0.003092784
No. identified Taxa			21	
Total number of invertebrates			970	

Appendix 6F Terrestrial and Aquatic Invertebrates recorded in 2010

(Report produced by Colin Plant Associates)

Commissioned by
ARUP
13 Fitzroy St
London
W1T 4BQ

BICESTER ECO-TOWN
MASTERPLAN & EXEMPLAR SITE
INVERTEBRATE SURVEY REPORT

Report number BS/2541/10

October 2010

Prepared by

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1 INTRODUCTION AND METHODOLOGY

1.1 **Colin Plant Associates (UK)** were commissioned during June 2010 by **Arup** to undertake an investigation of invertebrates on an area of land to the north-west of Bicester in Oxfordshire upon which it is proposed to develop new housing.

1.2 An initial site visit was made on 29th June 2010, when a walk-over survey of the entire site was undertaken in order to determine the nature and extent of detailed survey work required. Subsequent visits were undertaken on

Date	Session	Activity
3 – 4 July	overnight	moth recording
4 July	day	terrestrial sampling;
16 – 17 July	overnight	moth recording
17 July	day	terrestrial sampling;
1 – 2 August	overnight	moth recording
2 August	day	terrestrial sampling;
22 – 23 August	overnight	moth recording
23 August	day	terrestrial sampling;
26 – 27 September	overnight	moth recording
27 September	day	terrestrial sampling;
7 – 8 October	overnight	moth recording
8 October	day	terrestrial sampling; aquatic sampling
21 October	day	terrestrial sampling; aquatic sampling

1.3 On all visits, terrestrial invertebrates were recorded by direct observations of both species and their signs (such as leaf mines and plant galls). In addition active sampling was also undertaken as follows:

Sweep-netting. A stout hand-held net is moved vigorously through vegetation to dislodge resting insects. The technique may be used semi-quantitatively by timing the number of sweeps through vegetation of a similar type and counting selected groups of species. This technique is effective for many invertebrates, including several beetle families, most plant bug groups and large number of other insects that live in vegetation of this type.

Beating trees and bushes. A cloth tray, held on a folding frame, is positioned below branches of trees or bushes and these are sharply tapped with a stick to dislodge insects. The same technique can be applied to tall perennial herbs and other plants that tower over a sward. Black or white trays are used depending upon which group of invertebrates has been targetted for search. Insects are collected from the tray using a pooter. This technique is effective in obtaining records of most arboreal species, including many beetle groups, bugs, caterpillars of Lepidoptera, spiders and others. It can be undertaken at any site where there are trees or bushes present although is rendered ineffective if the vegetation is wet or if the weather is windy.

Suction Sampling consists of using a converted leaf blower to collect samples from grass and other longer ground vegetation. The sample is then everted into a net bag and the invertebrates removed with a pooter. The advantage of suction sampling is that it catches species which do not fly readily or which live in deep vegetation. It is particularly productive for Coleoptera, some Diptera and Arachnida.

1.4 We also undertook passive sampling. This is effective because it does not depend upon the physical presence of the surveyor and it records species throughout the entire trap period.

Pitfall trapping. Vending-machine cups or similar are placed in the ground with the rim flush with, or slightly below, the surface. A fluid is added, containing ethylene glycol, sodium chloride and formalin with a little detergent to reduce surface tension. Holes made in the sides of the cups a couple of centimetres below the rim permit flood or rain water to drain without the traps over-flowing and the catch becoming lost. Invertebrates simply fall into the traps.

Pitfall traps were established in compartment T1 (Gowell Farm area). This area was selected as being representative, in part because it was the least likely zone to be disturbed by harvest, ploughing or other activities that would destroy the traps.

1.5 A**ctinic light trapping**. Normally, nocturnal recording of moths would involve operating 125-watt mercury vapour lamps from a portable generator. However, in order to trap a large number of separate sites on the same night, such a technique would have been difficult because of both the need to refuel generators and the potential security issues relating to the use of the very obvious lights. We therefore used small size actinic traps, operated from 12 volt burglar-alarm batteries, and left these running from early evening to the following morning. These units are discrete because, whilst still having an output in the safe zone of the UV range, their light output in the visible part of the spectrum is reduced; thus, they can be tucked away in undergrowth at the side of a track without passers-by noticing them. For the same reasons of light emission, they attract moths and other insects from a much shorter distance and so the resultant catch is usually more representative of the habitat selected, in comparison with that in mercury vapour traps which attract flying species from a much wider area of the countryside.

1.6 A formal search was undertaken for existing data was not specifically requested. After we had made an initial visual inspection of the habitats present on site we determined that this was likely to be unproductive. Nevertheless, during the course of the project we approached a number of key colleagues informally; as a result of this we are satisfied that no important invertebrate data has been overlooked.

2 OVERVIEW OF INVERTEBRATE HABITATS ON THE SITE

2.1 Preamble

2.1.1 The site is extensive, extending approximately three kilometres across at its widest points, although it is of an irregular shape. It occupies an area of level and slightly undulating lowland in the central part of England where it is separated from any maritime influence.

2.1.2 The lowest point of the site is marked by the 80 metre contour immediately north-east of Lord's Farm in the south, whilst the 100 metre contour runs through the churchyard at Bucknell village in the highest point to the north.

2.1.3 The soil appears to be based upon a clay component and does not seem to drain particularly rapidly after rainfall. The soil is evidently nutrient-rich and much of the site is given over to arable crop production.

2.1.4 Wildlife habitats here will be governed by these over-riding ecological parameters. They are now examined, specifically as they affect invertebrate ecology.

2.2 Terrestrial invertebrate habitats

2.2.1 Terrestrial habitats within the surveyed area are dominated by the overwhelmingly arable landscape. Most fields are ploughed annually and sown with a crop; those few which are not so treated are mostly pasture for cattle or sheep and so are often closely-grazed.

2.2.2 Hedges, rather than fences, define the field boundaries in most places. However, most of these hedges are likely to be of low value as invertebrate habitats – at least on a permanent basis. This is because almost all hedges are either trimmed or flailed, thus removing both invertebrates and their sources of food.

2.2.3 Recent research by personnel at Oxford University has shown that hedges, even poorly-structured monocultural ones, support a greater numerical abundance (though not necessarily a greater species diversity) of insects if there are standard trees retained within their lengths. A few of the hedges on the site do contain standard trees, mostly ash or oak and some of these appear to be mature and contain amounts of aerial dead timber (an important micro-habitat for invertebrates).

2.2.4 Marginal areas of fields are, in general, narrow or absent and when they are present they appear to be dominated by rank grasses. In general, most field margins appear to provide rather poor quality invertebrate habitats.

2.2.5 For similar reasons, transitional edge habitats, where there is a gradual physical change in height from low grassland to tall woodland, are very poorly represented and in most areas appear absent.

2.2.6 Woodland is represented by a number of small units. Most of these appear on the 1945 aerial photographs and so may be of some age, though the bulk of trees are young in comparison. Ash is the dominant tree in the landscape and is the main feature of these woodland units, usually joined by oaks and occasionally other trees.

2.2.7 These woodland units are widely spaced within the arable landscape and are joined only by relatively poor-quality hedges or else are quite isolated. Continuous woodland does not feature on the site and so true woodland invertebrates are probably absent.

2.2.8 Consequent upon this, and perhaps also upon the use of the small woodland units for pheasant rearing, the dead wood resource is minimal and other saproxylic habitats are also very poorly represented.

2.2.9 Other micro-habitat features are generally scarce. In the derelict yard of Gowell Farm, the remnants of a long-disused muck pile generated a healthy list of common rove beetles showing there to be a reservoir of such species in the area, but suitable habitat elsewhere on the site could not be found.

2.3 Aquatic invertebrate habitats

2.3.1 Both running water and static ponds are represented on the site and are now briefly discussed.

2.3.2 Most of the streams on the site were dry in the summer months and are generally regarded as being winterbournes. As such, their invertebrate complement will be minimal (although permanent winterbournes may develop a small but specialist fauna of water beetles in particular).

2.3.3 In summer months, searching for aquatic invertebrates in the dried or near dry courses will, quite obviously, be unproductive. Searching in the winter, though before the frosts, would probably reveal the greatest number of species.

2.3.4 During 2010, the return of water to the bulk of water courses started in September. Examinations undertaken in early October up to and including the final visit on 21st October 2010, showed that some of the watercourses remained dry, others were damp but lacked flowing water. Only the main stream, that flowing from near Crowmarsh Farm to pass under the railway embankment in the vicinity of Aldershot Farm before passing woodland south of Hawkwell Farm and so beyond the site boundary beneath Lord's Lane, contained a flow of water.

2.3.5 Two ponds were indicated to us in maps of the site. One is in the vicinity of Crowmarsh Farm (compartment A2 in the list below); the other is in the vicinity of Lower Farm, to the north (compartment A6).

3 SELECTION OF HABITAT AREAS FOR DETAILED EXAMINATION

3.1 It has been indicated above that largest part of the site is evidently unsuitable for invertebrates; this requires no sampling. However, the several small and localised habitat units across the site are of potential invertebrate interest and sampling of these was undertaken.

3.2 These terrestrial sample areas are defined in Map 1 where they are given recording compartment numbers that repeat in the species inventory at Appendices 1 and 2. These areas are now introduced in greater detail.

Terrestrial habitat compartment T1: Gowell Farm area

Gowell Farm is abandoned and the buildings are derelict. The concrete farmyard has been invaded by ruderal vegetation and scrub to provide a mosaic of young habitat that is poorly-represented elsewhere in the surveyed area.

Tree species here seem rather more varied than in the ash-dominated woodland units and include Elder, hawthorn, Sycamore, Turkey Oak, Damson, Sweet Chestnut, Birch and others.

Hedges here are overgrown and provide a stark, but ecologically welcome, contrast with the manicured hedges elsewhere on the site. The twigs of the hedgerow plants have become colonised with various lichens. A long-abandoned muck pile is still evident in a few places.

A mature oak tree, containing a reasonable quantity of aerial dead timber, guards the entrance to the farmyard on the southern side of the access track.

Actinic moth traps were operated by us in this compartment on selected dates.

Terrestrial habitat compartment T2

This appears to be a section of the former road. It is now isolated on the north side of the existing road and the marginal trees and bushes have become overgrown to provide something approaching a structured edge habitat – a feature that is very poorly represented on the site overall.

Trees here include Elm, Ash, Field Maple, birches, hawthorns, willows and poplars and are adorned with Ivy and occasional Hop plants. Non-natives such as cherry and Snowberry are also evident in a few places, but do not detract from the likely raised ecological value of this compartment.

Brambles dominate the under-storey in most places but there are also tall perennial herbs such as Great Willow-herb and other species that will inevitably add to the invertebrate biodiversity of this small area.

Actinic moth traps were operated by us in this compartment on selected dates.

Terrestrial habitat compartment T3

This is a small woodland unit typical of the many others on the site. It is dominated by Ash but other trees are also present. In general, the lower layers of flora beneath the canopy are restricted but at the edges in particular there is greater diversity of plant life and so potentially raised invertebrate interest.

Terrestrial habitat compartment T4

This is a zone of unmown vegetation with between a hedge and an arable field. As an invertebrate habitat it is likely to be poor, but it is a habitat type that is rare on the site and so was sampled.

Terrestrial habitat compartment T5

This is another Ash-dominated woodland, not dissimilar to compartment T3. Other ttrees here included elm and Elder and as always there is a dominance of brambles on the ground beneath the trees. However, unlike in T3, we were able to operate actinic moth traps in this unit on some visits.

Terrestrial habitat compartment T6: Grunthill Copse

This small woodland unit has a better mix of trees incorporated with the Ash that forms its basis. Deciduous oaks, elm, hawthorn, Field Maple and Beech all feature. These are joined by bramble and wild rose and there were also patches covered by White Bryony.

Actinic moth traps were operated by us in this compartment on selected dates.

Terrestrial habitat compartment T7

This is the small, Ash-dominated woodland behind the pond at Crowmarsh Farm. It is relatively small and uninteresting from an invertebrate viewpoint but it provides screening and micro-climate control for the adjacent pond.

Actinic moth traps were operated by us in this compartment on selected dates.

Terrestrial habitat compartment T8

This compartment does not feature in Map 1. It is a catch-all category for records of invertebrates made casually along hedgerows within the surveyed area.

3.3 The aquatic sample areas are also indicated in Map 1 where they are given recording compartment numbers that repeat in the species inventory at Appendices 2 and 3. These areas are now introduced in greater detail.

Aquatic habitat compartment A1

This section of the stream, near its source at a spring, flows across arable fields in a shallow channel that is bordered on each side by a strip of rank grassland vegetation extending about one metre. Te channel is largely dominated by grasses and other invading terrestrial vegetation and no aquatic macrophytes were evident during sampling sessions.

Aquatic habitat compartment A2

This is the pond that separates Compartments A1 and A3. It was created artificially by mechanical excavation of the stream and is up to 4 metres deep in places (unconfirmed third party information). There is a zone of marginal vegetation that may be of value to invertebrates.

Aquatic habitat compartment A3

This is a section of the main stream as it runs under the cover of a hedge. It is largely shaded and there are no aquatic macrophytes evident.

Aquatic habitat compartment A4

This section of the main stream flows beneath the cover of another overgrown hedge and is equally shaded and devoid of aquatic plants.

Aquatic habitat compartment A5

This downstream section of the watercourse is also heavily shaded but as it emerges into young woodland light penetrates from the side. In this area it flows fairly rapidly over a gravel substrate but is sufficiently shallow that young pheasants released into the wood in the autumn simply walk across it when the surveyor approaches!

Aquatic habitat compartment A6

This ornamental pond does not feature on 1945 aerial photographs and so is evidently a more recent artificial construction.

4 RESULTS OF TERRESTRIAL INVERTEBRATE SAMPLING

4.1 Summary

4.1.1 Appendix 1 reports the complete list of insect taxa encountered during the survey. The list is annotated with formal National Status codes where these are better than "nationally common" and these status codes are explained in Appendix 2.

4.1.2 A total of 560 invertebrate species was recorded. This is an acceptable total for the effort input and indicates that the level of sampling achieved is adequate to permit an assessment of the site. The more noteworthy amongst these are now briefly discussed.

4.2 Species of conservation interest

4.2.1 Several categories of invertebrates are of raised significance in an ecological assessment. These categories are explained in Appendix 2 and the corresponding species are now examined.

Legally Protected Species

4.2.2 No invertebrate species that are afforded direct legal protection under any UK or European legislation were encountered during the survey.

UK Biodiversity Action Plan Priority Species

4.2.3 One UK BAP species was recorded during the survey.

The Small Heath Butterfly *Coenonympha pamphilus* is a grassland species that has declined in recent years. It was added to the UK BAP list at the end of 2007 though there are disagreements over the need for this action. It remains widespread, though it has declined numerically so that whereas twenty years ago it was usual to see dozens if an afternoon it is now more likely that less than twenty or so will be seen.

At Bicester, we saw only very few examples in the area around Gowell Farm (Compartment T1).

4.2.4 The list of UK Biodiversity Action Plan Priority Species *of moths* is divided into two sections. In the first, a total of 81 species are afforded the status of UK BAP Priority Species; none of these is recorded in the surveyed area nor is any likely to be present.

4.2.5 The second section is a list of 69 species that have declined in population by a significant amount in the past 25 years. These are not yet rare and are flagged as UK BAP species "**for research only**". They were inadvertently included in the overall BAP list by non-specialists.

4.2.6 This has resulted a confusing situation; these species were not intended to be affected by the requirements of *Planning Policy Statement 9: Biodiversity and Geological Conservation*, published by the Office of the Deputy Prime Minister during 2005, which requires Local Authorities to take measures to protect the habitats of UK BAP species from further decline through policies in local development documents. They were merely flagged for special attention.

4.2.7 At Bicester, we have recorded 9 such "Research Only" moth species; several others are confidently predicted to be present.

Species	English name	Caterpillar feeds on	In terrestrial habitat area							
			1	2	3	4	5	6	7	8
Agrochola lychnidis	Beaded Chestnut	deciduous trees and shrubs and herbaceous plants (requires both)	+	+						
Allophyes oxyacanthae	Green Brindled Crescent	rosaceous trees and shrubs		+						
Atethmia centrago	Centre-barred Sallow	ash - buds then flowers	+	+			+	+	+	
Ecliptopera silaceata	Small Phoenix	willow herbs, enchanter's nightshade		+						
Hepialus humuli	Ghost Moth	roots of grasses and herbaceous plants	+							
Hydraecia micacea	Rosy Rustic	herbaceous plants, especially docks, feeding in the rootstock	+							
Melanchra persicariae	Dot Moth	herbaceous plants	+							
Tyria jacobaeae	Cinnabar Moth	Ragwort	+							
Xanthia icteritia	Sallow	sallow/willow catkins - then on herbaceous plants		+						

Red Data Book Species

4.2.8 One species listed in the British Red Data Books (Shirt, 1987; Bratton, 1991) or which has been elevated to the status of Critically Endangered, Endangered, Nationally Vulnerable or Near Threatened (formerly Nationally Rare) by subsequent formal reviews is recorded in the present survey.

Stigmella samiatella is a minute micro-moth whose caterpillars feed internally in the leaves of Sweet Chestnut trees, leaving a whitish galley – or "mine". It was provisionally placed in Red Data Book category 3, but has since proved to be widespread and common in the south of England wherever Sweet Chestnut grows. This may reflect a genuine range expansion, rather than it having been overlooked, but either way the status is not at all warranted.

Mines were found on a tree at Gowell Farm (compartment T1).

Nationally Scarce Species

4.2.9 No species recorded feature in the Nationally Scarce (formerly Nationally Notable - Na) category (see Appendix 2).

4.2.10 Five species recorded feature in the Nationally Scarce (formerly Nationally Notable - Nb) category (see Appendix 2).

The Shaded Pug moth (*Eupithecia subumbrata*) feeds as a caterpillar on a wide range of herbaceous plants. It is widespread across south-eastern England, though less frequent elsewhere, but it is only locally distributed and some apparently suitable sites do not seem to support it. On the basis that it might be declining, the Nationally Scarce status may be warranted.

Two adults were caught in an actinic trap at compartment T4.

The bark beetle *Kissophagus hederae* feds as a grub in the dead wood of mature ivy, and is usually only found in larger branches of the plant. This implies that established ivy, of some age is required so that this is in some way an indicator of habitat stability. Like many other species it is probably overlooked, but it appears to be genuinely absent from a great many sites examined.

We recorded adults in compartment T2.

Roesel's Bush-cricket *Metrioptera roeselii* has, recent years, undergone a very large expansion of range that is almost certainly climate-driven. In most years the insects develop without the ability to fly, but in favourable (hot) summers the females develop winged forms that are able to disperse after mating and establish populations in new areas. In the south-east of England, this cricket is present in considerable abundance in grassland habitats, including set-a-side, field margins, road verges and lightly grazed pastures where there is plenty of vegetation cover. The Nationally Notable status is no longer warranted and an unpublished document on the Internet has indeed reduced its status to Nationally Local.

We recorded adults at compartments T2 and T4 and also one in the rank grass that flanks aquatic compartment A1.

Phyllonorycter platanoidella is a leaf-mining micro moth that is very much under-recorded. In the south of Britain, it is widespread and expected wherever Norway Maple is established and its status is not warranted. There is debate over whether this is a separate species from some other *Acer*-feeding *Phyllonorycter* species.

We found abundant mines of this moth on fallen leaves at Gowell Farm (compartment T1).

The blue and red leaf beetle *Podagrica fuscicornis* feeds as a grub in the flowers and seeds of mallow (*Malva* species). The plant has become a common feature of verges, hedgerows and other sites and the distinctive beetle has become quite frequent in the past few years.

We found examples at Gowell Farm (compartment T1); the host plant does not appear to be widespread across the survey area. .

Nationally Local Species

4.2.11 Twenty-one species are listed formally as Nationally Local (see Appendix 2). These are:

Species	English name	Habitat associations	In terrestrial compartment							
			1	2	3	4	5	6	7	8
Amara lunicollis	a ground beetle	grasslands, open woodland, gardens etc	+							
Andrena flavipes	a solitary bee	nests colonially, usually tunnelling into a vertical face								+
Anomoia purmunda	a picture-winged fly	Larva feeds in the flesh of hawthorn berries	+	+				+		+
Aphodius granarius	a beetle	dung, rotting vegetation (compost heaps) and carcasses	+							
Aphthona euphorbiae	a leaf beetle	widely polyphagous	+	+	+	+	+	+	+	+
Ceratapion carduorum	a seed weevil	Thistles	+							
Cordylepherus (Malachius) viridis	a beetle	a common grassland species	+			+				+
Crepidodera plutus	a leaf beetle	Willows, especially Crack Willow - rarely on poplars		+						
Curculio glandium	a weevil	Oak trees	+							+
Curculio pyrrhoceras	a weevil	oak - causing leaf galls								+
Dorytomus tortrix	a weevil	in catkins of aspen and sallow		+						
Hylaeus annularis	a yellow-faced bee	nests in hollow plant stems, such as docks, etc	+							
Lasioglossum leucopus	a solitary bee	excavates nest burrow in level ground – preferring ruderal sites	+			+				+
Ledra aurita	Hippopotamus froghopper	Oak trees					+			
Nicrophorus vespilloides	a beetle	carrion	+							
Oplodontha viridula	a soldier fly	marshes and pond margins						+		
Phyllobius maculicornis	a weevil	polyphagous on leaves of deciduous trees and shrubs		+				+		+
Psylliodes chrysocephala	a weevil	various Cruciferae		+						
Pterostichus (Poecilus) cupreus	a ground beetle	open grassy habitats - usually where damp	+						+	
Rhamphus oxyacanthae	a beetle	larva mines in leaves of hawthorn		+						
Sicus ferrugineus	a parasitic fly	parasitic fly on bumble bees			+	+	+			+

4.3 Other species of interest

4.3.1 A third party report from a source regarded as reliable indicates the presence of the **White-letter Hairstreak butterfly (*Satyrium w-album*)** in association with a hedge containing elm re-growth in the extreme south-east corner of the site opposite Bignell Park. This butterfly declined drastically across Britain in the aftermath of the Dutch Elm Disease outbreak in the late 1970s and became extremely rare for several years. More recently it has apparently adapted to feeding (as a caterpillar) on elm suckers rather than requiring mature, flowering trees and has made a reasonable recovery. At 2010 it is widespread but rather local across southern and central England and is extending northwards, though it is absent from many apparently suitable sites and is nowhere numerically common.

5 RESULTS OF AQUATIC INVERTEBRATE SAMPLING

5.1 The species obtained by sampling representative aquatic habitats are presented in Appendix 3.

5.2 A rather low number of generally widespread and common species is recorded. This reflects the low quality of aquatic habitat on the site and is discussed below.

6 DISCUSSION

6.1 The initial impression of the whole site is that it is unlikely to be an invertebrate "hot-spot". Arable fields dominate the entire landscape which is punctuated only by small and rather isolated tree groups, not really woodlands, and rarely other by features. A reasonable network of hedges provides for movement of animals across the land, but most are regularly trimmed so that their intrinsic value to invertebrates is regularly curtailed. Most water courses are dry in the summer and in any event are mostly lost beneath hedges.

6.2 Invertebrate data obtained by us during the survey have done more to support this visual impression than they have to alter it. The number of recorded invertebrate species is relatively high, and this certainly reflects an adequate recording effort within the available time window, but the composition of the species assemblage reveals a startling lack of species of conservation interest.

6.3 By definition, such more interesting species are less frequently found than the others in the list and the reason for their rarity, in a great many cases, is vested in their specialist ecologies. A phytophagous (vegetarian) insect that can feed on a wide range of plants is clearly more likely to be widespread in distribution and numerically abundant than one which is restricted to either a single family of plants or perhaps to a single species.

6.4 Finding these species on a site is key to assessing its overall ecological value, but proving an absence is rather more tricky than demonstrating a presence. It is frequently said that an experienced entomologist should be able to find at least one noteworthy species on almost any site in southern Britain, and this is probably true, and so the number of such rare species within the recorded assemblage, as well as an examination of their ecological associations, is also important.

6.5 Several noteworthy species have, in fact, been found in the present survey. However, only two of these truly warrant their status – The Shaded Pug moth and the beetle *Kissophagus hederae*, which is associated with mature ivy. This is a very low total and it is, of course, inevitable that further survey will not only generate a longer species list but also that this might contain further interesting species. However, we are not of the opinion that the conclusions based on the present results would alter if extensive and detailed species listing was indeed undertaken.

6.6 Overall, therefore, we are of the opinion that the survey area supports a bare minimum of invertebrate interest. There are small areas of slightly better invertebrate habitat in the form of tree groups, water bodies and some other habitats and it is these that support the entire of the recorded invertebrate assemblage. These are now briefly discussed.

6.7 Tree groups are few, far between (isolated) and with the exception of compartment T2, apparently of low floral diversity. All appear to be dominated by Ash. The trees, generally, grow close together restricting the ground flora by reducing light penetration. Their boundaries with adjacent fields are mostly abrupt and transitional zones (edge habitats) are generally absent.

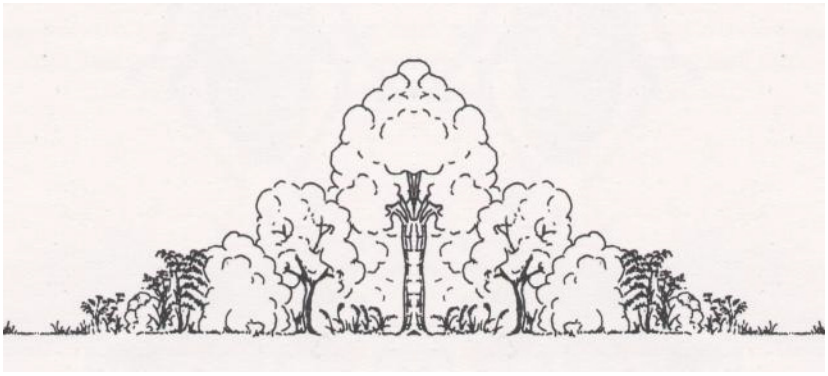
6.8 The single exception to this generalisation is the developing woodland in compartment T2. This is a section of the former main road that has now become isolated and is no longer subjected to management. Trees are growing to maturity, hedges have become overgrown and scrub is marching out from the edges across the former roadside verges where there is a greater diversity of herbs than can be found in most other parts of the site.

6.9 It is unsurprising to discover that this compartment has the highest species total of all the recorded compartments, with precisely 300 listed in Appendix 1. What this shows, quite clearly, is that areas of the site that are neglected – no longer managed – will develop a raised invertebrate value in a relatively short period of time. As if to prove this theorem, another abandoned area of the site, that around Gowell Farm (compartment T1), records the second highest invertebrate species diversity, with 294 taxa listed during 2010. Other areas of the site record significantly reduced species lists.

6.10 The network of hedges on the site is variable in quality. Almost all are either flailed or clipped on an annual basis. However, where hedges have grown very tall, this management is, in some sections, limited to the lower two or three metres; in these situations the uncut tops of the hedges present a better prospect for invertebrates.

6.11 Cutting hedges reduces intrinsic invertebrate interest for several reasons. Clearly, it directly removes the insects themselves. In the summer, this might be the actively feeding adults, whilst in the winter eggs, larvae, pupae and hibernating adults are lost. Since there is no evidence of the arisings being retained on this site, then there is no opportunity for mobile forms to return to the hedge. Additionally, it drastically reduces the food resource of many insects, notably nectar and pollen, by direct removal of flowering potential. As well as this it eliminates the transitional "edge habitat" zone that is of immense importance to invertebrates and other animal groups.

6.12 The best edges are those that are gradual, with the vertical component rising gradually through long grass, tall herbs and larger bushes to mature trees. This is illustrated in the following diagram:



6.13 Such edge habitats provide physical support for migration of invertebrates around the landscape; where the floral component is comprised of native rather than non-native species these edge habitats will also support a raised intrinsic invertebrate interest.

6.14 Most of the hedges on site appear to be poorly structured in this way and, in general, fields seem to be ploughed to within a metre or less of the base of their boundary hedges. They do nevertheless connect otherwise isolated areas of potential interest and their continued presence will be essential in the facilitation of movement of invertebrates around the landscape at Bicester. They ought to be retained and enhanced, or else replaced, in any proposed development.

6.15 Water-bodies on the site are few. Most ponds probably vanished a long time ago; no additional examples can be seen on 1945 aerial photographs. The largest pond currently extant (compartment A6) is entirely artificial, of recent creation and low in aquatic invertebrate interest.

6.16 Of potentially higher invertebrate ecology interest are the flowing water-courses. That which arises more or less on the boundary line of the survey area to the west of Crowmarsh Farm is spring-fed and so flows for most of the year, albeit rather slowly in the summer.

6.17 Most of the others were dry in the summer of 2010 and these may be seasonal features. Seasonal watercourses can develop a small but specialist invertebrate interest; unfortunately this could not be examined within the seasonal window available to us.

7 CONCLUSIONS

7.1 Overall, we are not able, on the basis of available data, to raise any specific invertebrate ecology-based objection to the proposed development of the Bicester site other than to comment that the overall reduction of open greenspace is inevitably detrimental to invertebrate ecology at the landscape level.

7.2 Nevertheless, the example of recording compartments T1 and T2 that withdrawal of management from this heavily manicured landscape will permit recolonisation by communities of invertebrates can be drawn upon to increase the value of any ecological mitigation package embarked upon for non-invertebrate reasons.

7.3 In particular, attention to the network of hedges would be valuable. Ideally, the network would be retained within the proposed development and wherever possible a more favourable hedgerow management regime should be installed. Not cutting one side of the hedge is desirable in some places; elsewhere a rotational cutting of hedges such that no section is cut more frequently than once every five years might be appropriate.

7.4 Retained tree groups could usefully be allowed to expand to occupy larger areas and to develop less well-defined boundaries. Incorporating these into amenity areas might allow for the development of better-structured edge habitats.

8 REFERENCES QUOTED IN THIS REPORT AND ITS APPENDICES

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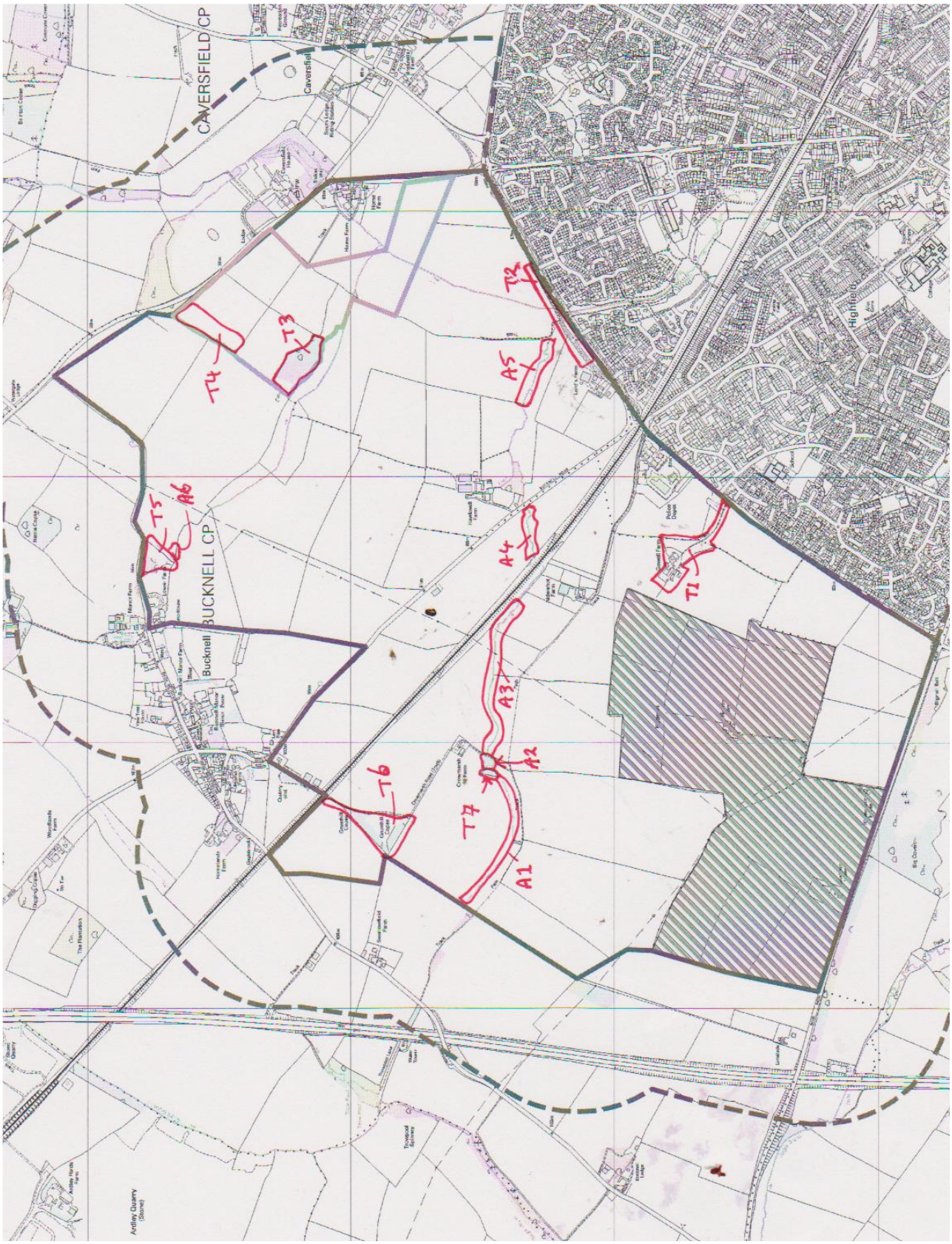
UK Biodiversity Group	1999	*Tranche 2 action plans. Volume iv - invertebrates*. English Nature.

APPENDICES

MAP 1: THE SURVEYED AREA, SHOWING THE POSITIONS OF THE RECORDING COMPARTMENTS AND THEIR NUMBERS



APPENDIX 1: TERRESTRIAL INVERTEBRATE SPECIES RECORDED

National status codes are explained in Appendix 2.

Group / species	English name if available	National status	Ecological associations	Where found (see text section 3)							
				1	2	3	4	5	6	7	8
ARACHNIDA: ARANEA	**SPIDERS**										
Araneidae											
Araneus diadematus	the garden spider		ubiquitous								+
Linyphiidae											
Lepthyphantes tenuis	a spider		ubiquitous - often in grassland, but also a pioneer species	+			+				
Linyphia triangularis	a money spider		almost ubiquitous	+			+				
Pisauridae				+							
Pisaura mirabilis	a spider		more or less ubiquitous, but likes tall vegetation								
ARACHNIDA: ACARI	**GALL MITES**										
Eriophyidae											
Aceria crataegi			causes galls on leaves of hawthorn	+	+				+		+
Aceria macrorhynchus			makes galls on Sycamore leaves	+							
Aceria pseudoplatani			causes galls on leaves of sycamore								+
Phyllocoptes goniothorax			causes galls on leaves of hawthorn	+	+				+		
ARACHNIDA: OPILIONES	**HARVESTMEN**										
Leiobunidae											
Leiobunum rotundum			Ubiquitous - under stones, logs etc		+						
Phalangiidae					+						
Oligolophus tridens			ubiquitous species								
COLEOPTERA	**BEETLES**										
Anobiidae											
Anobium punctatum			larvae feed in dead timber	+	+						+
Ptilinus pectinicornis			larvae feed in dead tree branches and other dead timber		+						+
Anthicidae											
Anthicus antherinus			larvae in decaying grass litter - adults at flowers							+	
Apionidae	**Seed weevils**										
Apion frumentarium			broad-leaved docks	+							

Group / species	English name if available	National status	Ecological associations	Where found (see text section 3)							
				1	2	3	4	5	6	7	8
Ceratapion carduorum		Local	Thistles	+							
Ceratapion gibbirostre			thistles - in the stems		+					+	
Malvapion malvae			Malvaceae - especially Malva sylvestris		+						
Perapion violaceum			dock plants, the larvae mining the stems; widespread and common	+							
Protapion apricans			bird's-foot Trefoil and perhaps other legumes; widespread and common	+	+						+
Protapion assimile			clover, especially red clover; widespread and common								+
Protapion dichroum			Trifolium - widespread and almost ubiquitous								+
Protapion trifolii			various clovers; widespread and common								
Trichapion simile			Associated with birch foliage		+						
Byturidae											
Byturus tomentosus	the raspberry beetle		Brambles and raspberries	+	+	+		+	+	+	+
Cantharidae	**Soldier beetles**										
Cantharis cryptica			tall vegetation, especially at the woodland/grassland interface	+	+	+	+	+	+	+	+
Malthinus seriepuncatatus			broad-leaved woodland species		+						+
Malthodes minimus			woodland and scrub								+
Rhagonycha fulva			tall, rank vegetation in lowland areas	+	+	+	+	+	+	+	+
Rhagonycha lignosa			an arboreal species	+	+	+		+	+	+	+
Rhagonycha limbata			dry grasslands (formerly called Rhagonycha femoralis)	+	+		+				
Carabidae	**Ground beetles**										
Amara (Curtonotus) aulica			dry, well-vegetated sites, the adults climbing stems of Compositae at night to feed on the seed heads	+							
Amara communis			phytophagous species of open sites, hiding under leaf rosettes, stones, etc	+							
Amara familiaris			Phytophagous species of gardens and other open, dry and sunny habitats	+							
Amara lunicollis		Local	grasslands, open woodland, gardens etc	+							
Amara similata			phytophagous on ruderal vegetation, especially on waste ground	+							
Bradycellus verbasci			prefers light soils in open situations, including arable	+							
Carabus violaceus			fairly widespread in most habitats	+							
Demetrias atricapillus			amongst leaf litter and in grasslands	+							
Dromius quadrimaculatus			arboreal species of deciduous trees and occasionally on conifers	+	+				+		

Group / species	English name if available	National status	Ecological associations	Where found (see text section 3)							
				1	2	3	4	5	6	7	8
Harpalus (Ophonus) puncticeps			phytophagous species of open, ruderal habitat	+							
Harpalus (Pseudophonus) rufipes			ubiquitous	+							
Loricera pilicornis			ubiquitous, but especially near water and in damp grassland; feeds on springtails					+		+	
Nebria brevicollis			ubiquitous late summer and autumn species	+						+	
Notiophilus biguttatus			most open ground habitats	+						+	
Pterostichus (Poecilus) cupreus		Local	open grassy habitats - usually where damp	+						+	
Pterostichus madidus			ubiquitous	+						+	
Pterostichus melanarius			ubiquitous	+							
Pterostichus nigrita s. str.			wet, well-vegetated habitats, river banks and damp woodland	+						+	
Pterostichus strenuus			most habitats that are not too dry	+							
Trechus quadristriatus			ubiquitous in most open habitats during autumn	+	+						
Cerambycidae	**longhorn beetles**										
Clytus arietis			in dead wood - usually birch or willow, adults at flowers		+						
Grammoptera ruficornis			larvae in twigs and small branches; adults at flowers		+						
Rhagium mordax			larvae feed internally in well-rotten stumps and other timber, especially oak	+							
Tetrops praeustus			feed on a wide variety of deciduous trees						+		+
Chrysomelidae	**leaf beetles**										
Altica lythri			Associated with various willow-herbs (Onagraceae)		+						
Aphthona euphorbiae		Local	widely polyphagous	+	+	+	+	+	+	+	+
Cassida rubiginosa			various thistles, burdock and other Asteraceae	+							
Chaetocnema hortensis			feeds on various grasses		+						
Crepidodera aurata			willows - rarely on poplars		+						
Crepidodera aurea			poplars - occasionally on willows		+						
Crepidodera fulvicornis			Salix species		+						
Crepidodera plutus		Local	Willows, especially Crack Willow - rarely on poplars		+						
Galerucella lineola			Alder, Hazel and willows		+						
Gastrophysa viridula			larvae feed on dock leaves in damp meadows and elsewhere							+	
Lochmaea crataegi			Hawthorn - larvae mine the berries. Occasionally on Blackthorn or Rowan		+				+		+
Longitarsus flavicornis			ragworts								+
Longitarsus luridus			widely polyphagous								+
Longitarsus parvulus			feeds on many plant species								+

Group / species	English name if available	National status	Ecological associations	Where found (see text section 3)							
				1	2	3	4	5	6	7	8
Oulema melanopa s. str.			feeds on grasses - very common	+							+
Phaedon tumidulus			on various Apiaceae, especially cow parsley, angelica, hogweed etc								+
Phyllodecta (Phratora) vulgatissima			willows and perhaps poplars and Aspen		+						
Phyllodecta (Phratora) vitellinae			willows and poplars, including Aspen		+						
Phyllotreta atra			various Brassicaceae	+	+		+				
Phyllotreta diademata			various Brassicaceae				+				
Phyllotreta nigripes			various Brassicaceae		+		+				
Phyllotreta undulata			various Brassicaceae	+	+		+				
Plagiodera versicolora			Crack willow and other willows, occasionally Black Poplar		+						
Podagrica fuscicornis		NS(Nb)	mallow (Malva species)		+						
Psylliodes chrysocephala		Local	various Cruciferae		+						
Psylliodes dulcamarae			Woody nightshade (Solanum dulcamara)								+
Psylliodes napi			various Cruciferae	+							
Sphaeroderma rubidum			feeds on thistles and other Asteraceae	+							
Sphaeroderma testaceum			mainly on thistles	+							
Ciidae											
Cis boleti			fungi - in both brackets and caps		+						+
Coccinellidae											
Adalia 10-punctata	10-spot ladybird		predatory on other insects	+	+		+	+	+		+
Adalia 2-punctata	2-spot ladybird		predatory on other insects	+	+	+	+	+	+	+	+
Anisostica 19-punctata	19-spot ladybird		wetland habitats							+	
Chilocoris renipustulatus	kidney-spot ladybird		trees, especially on willows in wet areas		+						
Coccinella 7-punctata	7-spot ladybird		predatory on other insects	+	+	+	+	+	+	+	+
Halyzia 16-guttata	Orange ladybird		predatory on other insects	+	+	+	+	+	+	+	+
Harmonia axyridis	Harlequin ladybird		a recent colonist in Britain	+	+	+	+	+	+	+	+
Propylea 14-punctata	14-spot ladybird		predatory on other insects	+	+	+	+	+	+	+	+
Rhyzobius litura	a spotless ladybird		predatory on other insects				+				+
Subcoccinella 24 - punctata	24-spot ladybird		predatory on other insects	+	+	+		+	+	+	+
Thea 22-punctata	22-spot ladybird		feeds on mildews								
Curculionidae	**Weevils**										
Anthonomus pedicularis			larvae develop in hawthorn berries		+				+		+
Barypeithes araneiformis			ubiquitous amongst moss, litter, etc.		+						

Group / species	English name if available	National status	Ecological associations	Where found (see text section 3)							
				1	2	3	4	5	6	7	8
Ceutorhynchus obstrictus			various Cruciferae		+						
Ceutorhynchus pallidactylus			ecology unclear		+						
Ceutorhynchus pollinarius			Nettles		+						
Cionus scrophulariae			Figworts (Scrophularia species)		+						
Curculio glandium		Local	Oak trees	+							+
Curculio pyrrhoceras		Local	oak - causing leaf galls								+
Curculio salicivorus			birch, willow and other trees								+
Dorytomus taeniatus			the larvae feeds inside the female catkins of willow trees		+						
Dorytomus tortrix		Local	in catkins of aspen and sallow		+						
Euophryum confine			dead timber		+						
Gymnetron pascuorum			feeds on flowers of Plantago lanceolata - Ribwort Plantain								+
Hypera nigrirostris			Trifolium pratense - on the foliage								+
Hypera postica			Medicago, Melilotus and Trifolium - on the foliage								+
Hypera rumicis			Rumex species (docks) - on the foliage								+
Nedyus quadrimaculatus			nettles - feeding on the flowers								+
Otiorhynchus singularis			feeds on a variety of plant roots	+							
Phyllobius maculicornis		Local	polyphagous on leaves of deciduous trees and shrubs		+				+	+	
Phyllobius oblongus			polyphagous on broad-leaved trees and bushes								
Phyllobius pomaceus			Nettles		+				+		
Phyllobius roboretanus			nettle - feeding on the leaves and flowers		+						
Phyllobius viridiaeris			typically in hedges and other edge habitats								
Polydrusus cervinus			trees and shrubs - feeding on the leaves								+
Polydrusus pterygomalus			polyphagous on broad-leaved trees, especially oak	+							
Rhamphus oxyacanthae		Local	larva mines in leaves of hawthorn		+						
Rhinoncus castor			Dock plants								
Rhynchaenus querci			larvae mine the leaves of oak trees	+	+				+		+
Sitona lineatus			various legumes	+	+	+	+	+	+	+	+
Trichosirocalus troglodytes			Plantains, usually in grassy places				+				+
Dermestidae											
Anthrenus verbasci			feeds on dead animal and plant matter, including dry carcasses		+						
Elateridae											
Agriotes lineatus			larvae feed on grass roots				+				
Athous (Hemicrepidus) hirtus			grassland, woodland rides, etc. The larvae feed in decaying wood and in soil								

Group / species	English name if available	National status	Ecological associations	Where found (see text section 3)							
				1	2	3	4	5	6	7	8
Athous haemorrhoidalis			the larva feeds on the roots of grasses		+						
Kibunea (Cidnopus) minuta			a species of dry grasslands				+				
Histeridae											
Saprinus semistriatus	a carrion beetle		feeds in carrion	+							
Kateretidae											
Brachypterus glaber			Nettles	+	+		+				+
Brachypterus urticae			Nettles	+	+	+	+				+
Latridiidae											
Aridius bifasciatus			litter, compost, tussocks etc - more or less ubiquitous								+
Aridius nodifer			litter, compost, tussocks etc - more or less ubiquitous								+
Leiodidae											
Catops nigricans			carrion	+							
Melyridae											
Cordylepherus (Malachius) viridis		Local	a common grassland species	+			+				+
Malachius bipustulatus	a malachite beetle		grasslands	+			+				+
Nitidulidae											
Glischrochilus hortensis			unknown association; adults usually in woodland		+						
Meligethes aeneus	a pollen beetle		various flowers	+	+	+	+	+	+	+	+
Scarabaeidae											
Aphodius granarius		Local	dung, rotting vegetation (compost heaps) and carcasses	+							
Scolytidae											
Kisophagus hederae	a bark beetle	NS(Nb)	larva feeds in dead ivy wood		+						
Scolytus scolytus	elm bark beetle		under elm bark			+		+	+		
Scraptiidae											
Anaspis fasciata (= humeralis)			larvae in twigs of oak and other trees; adults at hawthorn blossom		+						
Anaspis frontalis			larvae in twigs of oak and other trees; adults at hawthorn blossom		+						
Anaspis regimbarti			larvae feed in large girth oak branches and decaying oak trunks		+						
Silphidae	**Sexton Beetles**										
Necrodes littoralis			carrion	+							
Nicrophorus humator			carrion	+							
Nicrophorus vespilloides		Local	carrion	+							
Staphylinidae	**Rove beetles**										

Group / species	English name if available	National status	Ecological associations	Where found (see text section 3)							
				1	2	3	4	5	6	7	8
Aleochara curtula			leaf litter, decaying vegetation etc	+							
Aloconota gregaria			plant litter - ubiquitous	+							
Anotylus inustus			leaf litter, carrion, dung and similar	+							
Anotylus rugosus			a detritus-feeding rove beetle	+							
Anotylus sculpturatus			grass tussocks, litter, dung etc	+							
Atheta (Dimetrota) atramentaria			larvae feed in animal dung - very common	+							
Autalia rivularis			associated with herbivore dung	+							
Lathrobium brunnipes			grass tussocks, litter, dung etc	+							
Ocypus (Tasgius) ater			carrion, dung, etc	+							
Philonthus varius			ubiquitous - in moss, litter, carrion, dung etc	+							
Quedius curtipennis			leaf litter, carrion, dung and similar	+							
Quedius levicollis (= tristis)			ecology unclear	+							
Staphylinus brunnipes			leaf litter, carrion, dung and similar	+							
Tachyporus dispar			a detritus-feeding rove beetle	+							
Tachyporus hypnorum			leaf litter, grass tussocks and similar micro-habitats	+							
Tachyporus solutus			leaf litter, carrion, dung and similar	+							
Xantholinus linearis			leaf litter, grass tussocks and similar micro-habitats	+							
CRUSTACEA: ISOPODA	**WOODLICE**										
Oniscidae											
Oniscus asellus			damp, but not wet, habitats everywhere	+	+	+	+	+	+	+	+
Philosciidae											
Philoscia muscorum			under stones etc	+	+	+	+	+	+	+	+
Porcellionidae											
Porcellio scaber			under stones etc								
Trichoniscidae				+	+	+	+	+	+	+	+
Trichoniscus pusillus			under stones, bark, etc		+						
DERMAPTERA											
Forficulidae											
Forficula auricularia	common earwig		generalist species	+	+	+	+	+	+	+	+
DIPTERA											
Agromyzidae											
Agromyza alnibetulae			larva mines the leaves of birch trees	+							
Agromyza dipsaci			larva mines leaves of teasel	+							
Agromyza potentillae			mines leaves of Potentilla reptans and other rosaceous plants		+						+

Group / species	English name if available	National status	Ecological associations	Where found (see text section 3)							
				1	2	3	4	5	6	7	8
Amauromyza labiatarum			mines leaves of Lamium album and other labiates		+						
Liriomyza amoena			mines leaves of elder	+		+		+			+
Phytomyza heracleana			mines leaves of Heracleum spondylium		+						
Asilidae	**Robber flies**										
Dioctria baumhaueri			predatory -mainly in edge habitats	+	+						
Dioctria rufipes			predatory -mainly in edge habitats	+	+						
Leptogaster cylindrica			grassland predator	+	+	+	+	+	+	+	+
Cecidomyiidae				+	+				+		+
Dasineura crataegi			forms galls on hawthorn		+						
Dasineura marginemtorquens			forms rosette gall on sallows and willows		+						
Iteomyia caprea			larva galls the leaves of sallows		+						
Macrodiplosis volvens			larva feeds on oak leaves causing a gall to form a gall	+					+		
Conopidae											
Sicus ferrugineus		Local	parasitic fly on bumble bees			+	+	+			+
Dolichopodidae											
Chrysotus gramineus			very common grassland species	+						+	
Poecilobothrus nobilitatus			aquatic larvae								
Empididae											
Empis (Kritempis) livida			predatory on other flies	+	+	+	+	+	+	+	+
Empis (Xanthempis) trigramma			predatory on other flies	+	+	+	+	+	+	+	+
Lauxaniidae											
Sapromyzosoma 4-punctata			saprophagous species usually in woodland		+						
Tricholauxania praeusta			larvae feed amongst decaying vegetation in damp, shady places		+						
Limoniidae											
Austrolimnophila ochracea			woodland - even small ones- the larvae feeding in dead wood							+	
Cheilotrichia cinerascens			damp places		+					+	
Limonia nubeculosa	a cranefly		woodland - the larvae feeding in leaf litter		+						
Limonia tripunctata			lowland deciduous woodland, the larvae developing in the soil/litter		+						
Molophilus griseus			damp hedgerows, ditches and woodland		+						
Rhipidia (Limonia) duplicata			various habitats, including woodland and grassland, the larvae feeding in animal dung	+							+
Lonchopteridae											
Lonchoptera furcata			a more or less ubiquitous species in edge habitats		+						

Group / species	English name if available	National status	Ecological associations	Where found (see text section 3)							
				1	2	3	4	5	6	7	8
Lonchoptera lutea			ubiquitous species in edge habitats, saprophagous larvae		+					+	+
Platystomatidae											
Platystoma seminationis			larvae develop in decaying vegetable matter	+							
Ptychopteridae											
Ptychoptera albimana			damp habitats, including seepages								
Rhagionidae											
Rhagio lineola			woodland and scrub - especially at the edges							+	
Rhagio scolopaceus			woodland edge and other wooded areas - in clearings and at edges		+						+
Rhagio tringarius			damp habitats							+	
Sepsidae											
Nemopoda nitidula			shade-loving species, larvae in dung and carrion	+							
Sepsis fulgens			the most ubiquitous member of this group, feeding in mammal dung	+							
Stratiomyidae	**Soldier flies**										
Beris chalybata			associated with the scrub/grassland interface	+	+	+	+	+	+	+	+
Beris vallata			larvae require decomposing organic matter	+	+	+	+	+	+	+	+
Chloromyia formosa			ubiquitous	+	+	+	+	+	+	+	+
Chorisops tibialis			larvae require decomposing organic matter		+					+	+
Microchrysa polita			larvae require decomposing organic matter		+						+
Oplodontha viridula		Local	marshes and pond margins							+	
Pachygaster atra			woodland edge & scrubland species - larvae under dead bark of trees		+	+		+	+		
Pachygaster leachii			woodland edge & scrubland species - larvae under dead bark of trees		+						+
Sargus iridatus			larvae feed in rotting vegetation and similar material								
Syrphidae	**Hoverflies**										
Baccha elongata			shaded woodland		+						
Cheilosia albitarsis/ranunculi female				+							
Cheilosia pagana			larvae are thought to feed in the roots of Anthriscus sylvestris		+						
Chrysotoxum bicinctum			grassland species -associated with ants' nests	+			+				+
Dasysyrphus albostriatus			aphid predator at woodland edge habitats		+						
Dasysyrphus tricinctus			aphid predator at woodland edge habitats		+						
Epistrophe eligans			mainly at edge habitats	+	+	+	+	+	+	+	+

Group / species	English name if available	National status	Ecological associations	Where found (see text section 3)							
				1	2	3	4	5	6	7	8
Episyrphus balteatus			ubiquitous species, partly immigrant, and a predator of aphids	+	+	+	+	+	+	+	+
Eristalis arbustorum			Larvae require damp habitats but adults are more or less ubiquitous	+	+	+	+	+	+	+	+
Eristalis nemorum			Larvae require damp habitats but adults are more or less ubiquitous		+						
Eristalis pertinax			Larvae require damp habitats but adults are more or less ubiquitous	+	+	+	+	+		+	+
Eristalis tenax			Larvae require damp habitats but adults are more or less ubiquitous	+	+	+		+	+	+	+
Eupeodes corollae			Grassland	+	+	+	+	+	+	+	+
Eupeodes luniger			Grassland	+	+	+	+	+	+	+	+
Helophilus pendulus			Larvae require damp habitats but adults are more or less ubiquitous	+	+	+	+	+	+	+	+
Melanostoma mellinum			Grassland	+	+	+	+	+	+	+	+
Melanostoma scalare			Grassland	+			+				
Myathropa florea			larvae are semi-aquatic							+	
Neoascia podagrica			edge-habitat species	+	+		+		+	+	+
Pipizella viduata			Larvae feed on root aphids on Umbelliferae								+
Platycheirus albimanus			ubiquitous - larvae prey on aphids	+	+	+	+	+	+	+	+
Platycheirus clypeatus s. str.			Damp habitats							+	
Platycheirus scutatus s. str.			an edge-habitat species		+						
Rhingia campestris			Cow dung	+							
Sphaerophoria scripta			Grassland	+	+	+	+	+	+	+	+
Syritta pipiens			larvae in decaying vegetation; adults at flowers	+	+	+	+	+	+	+	+
Syrphus ribesii			larvae are aphid predators on trees and bushes	+	+	+	+	+	+	+	+
Syrphus vitripennis			larvae are aphid predators on trees and bushes	+	+	+	+	+	+	+	+
Volucella bombylans			inquiline in nests of bumble bees		+						
Volucella pellucens			inquiline in nests of social wasps/hornet		+						
Xylota segnis			Damp, dead wood		+						
Tabanidae											
Haematopota pluvialis			damp habitats - adult females are blood sucking horseflies	+					+	+	
Tachinidae											
Eriothrix rufomaculata			larva parasitises moth larvae	+	+	+	+	+	+	+	+
Tephritidae											
Anomoia purmunda		Local	Larva feeds in the flesh of hawthorn berries	+	+				+		+

Group / species	English name if available	National status	Ecological associations	Where found (see text section 3)							
				1	2	3	4	5	6	7	8
Euleia heraclei			white-flowering Umbelliferae	+							
Terellia ruficauda			larvae gall the flowers of thistles	+							
Urophora cardui			larvae gall the flowers of thistles	+							
Xyphosia miliaria			larvae gall the flowers of thistles - ubiquitous	+							
Tipulidae	**craneflies**										
Savtshenkia pagana			more or less ubiquitous		+						
Tipula oleracea			ubiquitous, larvae feeding on roots of grasses	+	+	+	+	+	+	+	+
Tipula paludosa			ubiquitous, larvae feeding on roots of grasses	+	+	+	+	+	+	+	+
HETEROPTERA											
Acanthosomatidae											
Acanthosoma haemorrhoidale	hawthorn shield bug		hawthorn		+				+		+
Elasmucha grisea			birch, occasionally alder	+							
Anthocoridae											
Anthocoris confusus			trees and shrubs	+	+						
Anthocoris nemoralis			trees and shrubs	+	+	+		+	+	+	+
Anthocoris nemorum			low vegetation	+	+	+	+	+	+	+	+
Cimicidae											
Orius niger			low vegetation on a variety of dry sites				+				
Coreidae											
Coriomeris denticulatus			various legumes	+			+				
Cydnidae											
Legnotus limbosus			Bedstraws		+						
Lygaeidae											
Chilacis typhae			Reedmace - in the flower heads							+	
Drymus brunneus	a plant bug		amongst litter or moss in damp or shaded places		+						
Heterogaster urticae			Nettles	+	+	+	+	+	+	+	+
Kleidocerys resedae			trees and shrubs generally	+	+			+			
Scolopostethus affinis			usually on nettles	+							
Miridae											
Adelphocoris lineolatus			leguminous plants	+							
Blepharidopterus angulatus			a wide range of broad-leaved trees		+						
Capsus ater			Grassland	+			+				
Cyllecoris histrionicus			associated with oak	+					+		
Deraeocoris lutescens			predatory amongst trees and bushes	+	+	+		+	+	+	

Group / species	English name if available	National status	Ecological associations	Where found (see text section 3)							
				1	2	3	4	5	6	7	8
Deraeocoris ruber			nettles, brambles as similar rough vegetation	+	+	+		+	+	+	
Dicyphus epilobii			Epilobium hirsutum		+						
Dryophilocoris flavo-4-maculatus			associated with oak	+			+				
Harpocera thoracica			Oaks -solitary and in woods	+			+				
Heterotoma meriopterum			edge habitats - especially in association with nettles	+							
Leptoterna dolabrata			found in a wide range of grassland habitats	+	+		+				+
Liocoris tripustulatus			stinging nettle	+	+		+				
Megalocoleus molliculus			a common plant bug associated with Yarrow	+							
Miris striatus			associated with oak	+				+			
Notostira elongata			grasslands								
Orthotylus marginalis			willow trees, occasionally alder and apple trees		+						
Pantilus tunicatus			alder and birch - on the catkins	+							
Phylus melanocephalus			restricted to oak trees					+			
Phytocoris varipes			dry, open grasslands are preferred. Partly vegetarian and partly a predator				+				
Plagiognathus arbustorum			polyphagous, but usually associated with stinging nettles	+							
Stenodema laevigatum			grasslands	+			+				+
Stenotus binotatus			grasslands	+			+				+
Nabidae											
Himacerus apterus	a damsel bug		a tree-dwelling species		+						
Nabis ferus			dry sites, especially ruderal grassland				+				
Pentatomidae											
Aelia acuminata			Thistles				+				
Dolycoris baccarum			polyphagous species of dry habitats				+				
Eysarcoris fabricii			probably polyphagous		+						
Palomena prasina			trees and shrubs	+	+			+	+	+	+
Pentatoma rufipes	The Forest Bug		tree-dwelling predator that often flies far from woodland	+	+						
Troilus luridus	a plant bug		a predator on broad leaved trees and occasionally on pines		+						
Tingidae											
Physatocheila dumetorum	a lacebug		hawthorn		+				+		+
Tingis ampliata			creeping thistle								+
Tingis cardui			spear thistle - Cirsium vulgare								+
HOMOPTERA: AUCHENORHYNCHA	**FROGHOPPERS**										

Group / species	English name if available	National status	Ecological associations	Where found (see text section 3)							
				1	2	3	4	5	6	7	8
Cercopidae											
Aphrophora alni	a froghopper		larvae feed under froth on a wide range of trees and shrubs		+						
Neophilaenus campestris			dry, open grassland				+				+
Philaenus spumarius	spittle-bug/Cuckoo-spit bug		larvae feed under froth on a wide range of herbaceous plants	+	+	+	+	+	+	+	+
Cicadellidae											
Cicadella viridis			grasses and rushes in marshy places							+	
Iassus lanio			usually on oak, occasionally on other trees	+							
Oncopsis tristis			birch trees	+							
Cixiidae											
Tachycixius pilosus			grasses		+		+				
Delphacidae											
Stenocranus minutus			grasses in a range of habitats							+	
Issidae											
Issus coleoptratus			various tree species		+						
Ledridae											
Ledra aurita	Hippopotamus froghopper	Local	Oak trees					+			
HOMOPTERA: STENORHYNCHA	**HOPPERS AND APHIDS**										
Aphididae											
Dysaphis crataegi agg.			forms galls on hawthorn	+	+				+		
HYMENOPTERA: ACULEATA	**BEES, WASPS AND ANTS**										
Apidae											
Andrena bicolor			open woodland and grassland - nests in the ground								+
Andrena flavipes	a solitary bee	Local	nests colonially, usually tunnelling into in a vertical face, in dry sandy sites								+
Bombus lapidarius	red-tailed bumble bee		ubiquitous	+	+	+	+	+	+	+	+
Bombus lucorum	white-tailed bumble bee		ubiquitous	+	+	+	+	+	+	+	+
Bombus pascuorum	common carder bee		ubiquitous	+	+	+	+	+	+	+	+
Bombus pratorum	a bumble bee		ubiquitous		+						
Bombus terrestris	buff-tailed bumble bee		ubiquitous	+	+	+	+	+	+	+	+
Halictus rubicundus			ground nesting solitary bee		+						
Halictus tumulorum			ground-nesting solitary bee in a range of habitats		+						

Group / species	English name if available	National status	Ecological associations	Where found (see text section 3)							
				1	2	3	4	5	6	7	8
Hylaeus annularis	a yellow-faced bee	Local	nests in hollow plant stems, such as docks, etc		+						
Lasioglossum leucopus		Local	excavates nest burrow in level ground - preferring ruderal sites		+		+				+
Lasioglossum morio			excavates nest burrows in level ground	+	+						
Lasioglossum smeathmanellum			excavates nest burrows in level ground		+						+
Osmia rufa			a red mason bee - nests in holes in trees or hard vertical cliffs	+							
Chrysididae											
Chrysis ignita	Ruby-tailed wasp		cleptoparasitic on eumenid wasps, especially *Ancistrocerus* species		+						
Eumenidae											
Ancistrocerus trifasciatus			nests in dead plant stems	+							
Formicidae											
Lasius niger s. str.	common black ant.		generalist species	+	+		+				+
Myrmica rubra	a red ant		ubiquitous	+	+						+
Sphecidae											
Trypoxylon attenuatum			preys on spiders. Nests in plant stems, beetle tunnel or other cavities		+						
Vespidae											
Vespula germanica	a common social wasp		ubiquitous		+						+
Vespula vulgaris	a common social wasp		ubiquitous							+	+
HYMENOPTERA: PARASITICA	**GALL WASPS**										
Cynipidae											
Andricus curvator			forms a gall on an oak leaf	+					+		
Andricus kollari			forms the oak marble gall	+					+		
Andricus ostreus			forms a gall on an oak leaf	+					+		
Biorhiza pallida			forms the oak apple gall	+					+		
Cynips divisa			forms a gall on oak	+					+		
Neuroterus numismalis			forms the button spangle gall on oak leaves						+		
Neuroterus quercusbaccarum			forms the hairy spangle gall on oak leaves	+					+		
Neuroterus tricolor			causes galls on oak leaves						+		
HYMENOPTERA: SYMPHYTA	**SAWFLIES**										
Argidae											
Arge ochropus			larvae feed on wild rose						+		

Group / species	English name if available	National status	Ecological associations	Where found (see text section 3)							
				1	2	3	4	5	6	7	8
Arge ustulata			sallow, birch and hawthorn are all recorded as foodplants		+						
Cephidae											
Calameuta pallipes			a grassland sawfly	+							
Cephus cultratus			larvae mine the stems of grasses				+				
Cephus pygmaeus			larvae mine the stems of grasses	+			+				
Tenthredinidae											
Aglaostigma aucupariae			larvae feed on bedstraws								
Athalia cordata			ubiquitous sawfly species	+							
Athalia liberta			ubiquitous sawfly species		+						
Dolerus niger			ubiquitous sawfly species		+						
Nematus ribesii			ubiquitous sawfly species		+						
Pontania bridgmannii			larva causes galls on sallow leaves		+						
Profenusa pygmaea			larva mines the leaves of oak trees		+				+		
Tenthredo livida			ubiquitous sawfly species		+						
LEPIDOPTERA:	**BUTTERFLIES**										
Hesperiidae											
Thymelicus sylvestris	Small skipper		grassland	+							
Lycaenidae											
Celastrina argiolus	Holly blue		both holly and ivy are required - as there are two generations per year		+						
Polyommatus icarus	Common blue		various legumes, especially Bird's-foot Trefoil	+							
Quercusia quercus	Purple Hairstreak		oak trees - including isolated examples	+							
Satyrium w-album	White-letter Hairstreak		Elm – feeding on suckers as well as mature trees								+
Nymphalidae											
Aglais urticae	Small tortoiseshell		larvae feed on Stinging Nettle								+
Coenonympha pamphilus	Small Heath	BAP	grassland	+							
Cynthia cardui	Painted lady		immigrant species	+							+
Inachis io	Peacock		nettles		+						
Maniola jurtina	Meadow brown		grassland species		+		+				
Pararge aegeria	Speckled wood		grasses in light woodland or scrub		+						
Polygonia c-album	Comma		nettles	+							
Pieridae											
Pieris napi	Green-veined white		ubiquitous	+							
Pieris rapae	Small white		ubiquitous	+							

Group / species	English name if available	National status	Ecological associations	Where found (see text section 3)							
				1	2	3	4	5	6	7	8
LEPIDOPTERA:	**MOTHS**										
Agonoxenidae											
Blastodacna hellerella			hawthorn - in the berries						+		
Arctiidae											
Eilema complana	Scarce Footman		lichens - especially on trunks, fences etc		+						
Tyria jacobaeae	Cinnabar	BAP(R)	Ragwort	+							
Bucculatricidae											
Bucculatrix ulmella			oak	+							
Choreutidae											
Anthophila fabriciana	Nettle-tap		nettles		+						
Coleophoridae											
Coleophora flavipennella			oak	+							
Coleophora lutipennella			oak	+							
Drepanidae											
Cilix glaucata	Chinese Character		blackthorn, hawthorn and other rosaceous bushes		+						
Gelechiidae											
Teleiodes luculella			oak	+							
Geometridae											
Biston betularia	Peppered Moth		deciduous trees and herbaceous plants		+						
Cabera exanthemata	Common Wave		Salix species and aspen		+						
Colostygia pectinataria	Green Carpet		bedstraws	+	+			+	+	+	
Cosmorhoe ocellata	Purple Bar		bedstraws	+							
Crocallis elinguaria	Scalloped Oak		deciduous trees		+						
Ecliptopera silaceata	Small Phoenix	BAP(R)	willow herbs, enchanter's nightshade		+						
Epirrhoe alternata	Common Carpet		bedstraws	+	+			+	+	+	
Eupithecia centaureata	Lime-speck Pug		various flowers	+	+			+	+	+	
Eupithecia subumbrata	Shaded Pug	NS(Nb)	herbaceous plants				+				
Eupithecia vulgata	Common Pug		herbaceous plants	+	+				+		
Hydriomena furcata	July Highflier		Salix species	+	+			+	+	+	
Idaea aversata	Riband wave		herbaceous plants - especially bedstraws	+	+			+	+	+	
Idaea biselata	Small Fan-footed Wave		dandelion, plantain, Polygonum etc		+						
Lomaspilis marginata	Clouded Border		sallow, willow, poplar - rarely hazel		+						
Opisthograptis luteolata	Brimstone Moth		deciduous trees		+						
Peribatodes rhomboidaria	Willow Beauty		deciduous trees	+	+					+	

Group / species	English name if available	National status	Ecological associations	Where found (see text section 3)							
				1	2	3	4	5	6	7	8
Xanthorhoe montanata	Silver-ground Carpet		herbaceous plants - especially bedstraws	+	+						
Xanthorhoe spadicearia	Red Twin-spot Carpet		herbaceous plants - especially bedstraws	+							
Gracillariidae											
Acrocercops brongniardella			mines leaves of oak	+					+		
Aspilapteryx tringipennella			Ribwort plantain		+						
Caloptilia robustella			oak	+	+						
Caloptilia stigmatella			sallow and poplar		+						
Caloptilia syringella			caterpillar mines leaves of ash, hawthorn or lilac		+	+		+	+	+	
Cameraria ohridella			larva mines the leaves of Horse Chestnut - a recent colonist in Britain, from Europe								+
Parornix anglicella			mines leaves of hawthorn	+	+			+	+		
Parornix finitimella			Blackthorn	+							
Phyllonorycter acerifoliella	= sylvella		mines leaves of field maple		+				+		
Phyllonorycter blancardella			mines leaves of apple	+							
Phyllonorycter cerasicolella			mines leaves of cherry		+						
Phyllonorycter corylifoliella			mines leaves of hawthorn and other rosaceous shrubs, rarely on birch	+	+				+		+
Phyllonorycter geniculella			mines leaves of sycamore	+							+
Phyllonorycter harrisella			mines leaves of oak	+					+		+
Phyllonorycter maestingella			mines leaves of beech						+		
Phyllonorycter messaniella			mines leaves of oak, beech, hornbeam and sweet chestnut	+					+		
Phyllonorycter oxyacanthae			mines leaves of hawthorn and other rosaceous shrubs		+				+		
Phyllonorycter platanoidella		NS(Nb)	mines leaves of Norway Maple	+							
Phyllonorycter quercifoliella			mines leaves of oak	+					+		
Phyllonorycter salicicolella			mines leaves of willows		+						
Phyllonorycter spinicolella			mines leaves of blackthorn	+							
Phyllonorycter trifasciella			mines leaves of honeysuckle and snowberry		+						
Phyllonorycter tristrigella			mines leaves of elm			+		+	+		
Phyllonorycter ulmifoliella			mines leaves of birch	+							
Hepialidae											
Hepialus humuli	Ghost Moth	BAP(R)	roots of grasses and herbaceous plants	+							
Lyonetiidae											
Lyonetia clerkella			mines leaves of rosaceous bushes and trees, birch etc	+	+						
Momphidae											

Group / species	English name if available	National status	Ecological associations	Where found (see text section 3)							
				1	2	3	4	5	6	7	8
Mompha ochraceella			willow-herbs, mining the leaves		+						
Mompha raschkiella			Rosebay Willow-herb - mining the leaves		+						
Nepticulidae											
Ectoedemia atricollis			rosaceous trees, especially hawthorn, mining the leaves	+	+				+		+
Ectoedemia subbimaculella			larva mines leaves of oak						+		
Stigmella anomalella			mines leaves of rose						+		
Stigmella atricapitella			mines leaves of oak	+					+		
Stigmella aurella agg.			mines leaves of bramble	+	+	+		+	+	+	+
Stigmella basiguttella			mines leaves of oak	+							
Stigmella crataegella			mines leaves of hawthorn	+	+						+
Stigmella hybnerella			mines leaves of hawthorn	+					+		+
Stigmella oxyacanthella			mines leaves of hawthorn	+	+				+		+
Stigmella plagicolella			mines leaves of blackthorn	+							
Stigmella roborella			mines leaves of oak						+		
Stigmella ruficapitella			mines leaves of oak and perhaps Sweet Chestnut	+					+		
Stigmella salicis			mines leaves of willow and sallow		+						
Stigmella samiatella		pRDB3	mines leaves of Sweet Chestnut	+							
Stigmella speciosa			mines leaves of sycamore	+							
Stigmella tityrella			mines leaves of beech						+		
Noctuidae											
Abrostola tripartita	Spectacle		nettles	+	+					+	
Acronicta aceris	Sycamore		Horse Chestnut, Sycamore and other deciduous trees	+							
Agrochola lychnidis	Beaded Chestnut	BAP(R)	deciduous trees and shrubs and herbaceous plants (requires both)	+	+						
Agrotis exclamationis	Heart and Dart		herbaceous plants	+	+			+	+	+	
Agrotis puta	Shuttle-shaped Dart		herbaceous plants	+	+			+			
Allophyes oxyacanthae	Green Brindled Crescent	BAP(R)	rosaceous trees and shrubs		+						
Amphipyra pyramidea	Copper Underwing		deciduous trees and bushes		+						
Apamea lithoxylaea	Light Arches		grasses	+							
Apamea monoglypha	Dark Arches		grasses	+	+			+	+	+	
Atethmia centrago	Centre-barred Sallow	BAP(R)	ash - buds then flowers	+	+			+	+	+	
Autographa gamma	Silver Y		nettles and other herbaceous plants - rarely surviving winter. Immigrants from Europe are regular	+							+
Axylia putris	Flame		herbaceous plants	+							

Group / species	English name if available	National status	Ecological associations	Where found (see text section 3)							
				1	2	3	4	5	6	7	8
Cosmia pyralina	Lunar-spotted Pinion		deciduous trees and bushes			+					
Cosmia trapezina	Dun-bar		deciduous trees	+	+			+			
Diachrysia chrysitis	Burnished Brass		nettles and other herbaceous plants	+	+						
Discestra trifolii	Nutmeg		Atriplex and Chenopodium	+							
Gortyna flavago	Frosted Orange		in the stems of thistle, burdock and similar plants	+							
Hoplodrina alsines	Uncertain		herbaceous plants	+	+			+	+	+	
Hoplodrina ambigua	Vines Rustic		herbaceous plants - especially dandelions	+	+			+	+	+	
Hydraecia micacea	Rosy Rustic	BAP(R)	herbaceous plants, especially docks, feeding in the rootstock	+							
Hypena proboscidalis	Snout		nettles	+							+
Lacanobia oleracea	Bright-line Brown-eye		herbaceous plants					+			
Melanchra persicariae	Dot Moth	BAP(R)	herbaceous plants	+							
Mesapamea didyma	Lesser Common Rustic		grasses						+	+	
Mesapamea secalis	Common Rustic		grasses	+	+				+		
Mesoligia furuncula	Cloaked Minor		grasses	+							
Mythimna impura	Smoky Wainscot		grasses	+							+
Mythimna pallens	Common Wainscot		grasses	+							
Noctua comes	Lesser Yellow Underwing		herbaceous plants	+	+			+	+	+	
Noctua janthe	Lesser Broad-bordered Yellow U		herbaceous plants	+	+			+	+	+	
Noctua pronuba	Large Yellow Underwing		herbaceous plants	+	+			+	+	+	
Nycteola revayana	Oak Nycteoline		oak leaves	+							
Ochropleura plecta	Flame Shoulder		herbaceous plants		+				+		
Oligia latruncula	Tawny Marbled Minor		grasses	+	+						
Omphaloscelis lunosa	Lunar Underwing		grasses	+							
Phlogophora meticulosa	Angle Shades		herbaceous plants	+							
Rivula sericealis	Straw Dot		grasses - especially Brachypodium species	+	+					+	
Xanthia icteritia	Sallow	BAP(R)	sallow/willow catkins - then on herbaceous plants		+						
Xanthia togata	Pink-barred Sallow		catkins of willow and poplar - then on herbaceous plants		+						
Xestia c-nigrum	Setaceous Hebrew Character		herbaceous plants	+	+			+	+	+	
Xestia triangulum	Double Square-spot		deciduous trees and shrubs		+						
Nolidae											
Nola cucullatella	Short-cloaked Moth		blackthorn and hawthorn					+			
Notodontidae											

Group / species	English name if available	National status	Ecological associations	Where found (see text section 3)							
				1	2	3	4	5	6	7	8
Notodonta ziczac	Pebble Prominent		poplars and sallows/willows		+						
Phalera bucephala	Buff-tip		deciduous trees		+						
Ptilodon capucina	Coxcomb Prominent		deciduous trees		+						
Oecophoridae											
Agonopterix heracliana			umbellifers, especially cow parsley, hogweed and Angelica	+							
Batia unitella			under loose dead bark, feeding on fungi	+				+			
Carcina quercana	The Flat Cooper		deciduous trees and bushes		+						
Pyralidae											
Acentria ephemerella			submerged aquatic plants							+	
Agriphila straminella			grasses	+	+			+	+	+	
Agriphila tristella			grasses	+	+			+	+	+	
Catoptria pinella			grasses	+	+			+	+	+	
Chrysoteuchia culmella			grasses	+	+			+	+	+	
Conobathra repandana			oak - usually feeding high in the canopy		+						
Crambus perlella			grasses	+							
Endotricha flammealis			trees and herbaceous plants - then on leaf litter					+	+		
Eudonia mercurella			mosses on trunks, walls etc		+						
Eurrhypara hortulata			nettles		+						
Phlyctaenia coronata			elder, Viburnum, lilac, privet		+						
Phycita roborella			oak					+			
Pleuroptya ruralis			nettles	+	+					+	
Scoparia ambigualis			thought to feed amongst mosses	+							
Sphingidae											
Deilephila elpenor	Elephant Hawk-moth		rosebay willow-herb		+						
Laothoe populi	Poplar Hawk-moth		poplars and sallows/willows	+	+						
Tischeriidae											
Tischeria ekebladella			mines leaves of oak	+					+		
Tortricidae											
Acleris ferrugana			oak						+		
Acleris forsskaleana			maple, sycamore		+				+		
Agapeta hamana			thistles - in the roots	+			+				
Aleimma loeflingiana			oak, occasionally hornbeam and maple/sycamore		+						
Apotomis betuletana			birch	+							
Cydia pomonella			fruits of rosaceous trees, especially apple	+							

Group / species	English name if available	National status	Ecological associations	Where found (see text section 3)							
				1	2	3	4	5	6	7	8
Cydia splendana			oak		+						
Endothenia gentianaeana			teasels - in the seed heads	+							
Epiblema scutulana			thistles - in the root and lower stem								+
Epiblema uddmanniana			Rubus spp., mainly brambles	+	+			+	+	+	+
Epiphyas postvittana			deciduous trees	+	+			+	+	+	
Eucosma cana			thistles and Centaurea nigra - in the flower head	+							
Eudemis profundana			oak	+							
Hedya salicella			Salix alba and other Salix species		+						
Pandemis corylana			deciduous trees and shrubs	+	+			+	+	+	
Pandemis heparana			deciduous trees and shrubs	+	+			+	+	+	
Pseudargyrotoza conwagana			ash and privet in the fruits and seeds	+	+			+	+	+	
Rhopobota naevana			trees and shrubs - especially ivy and blackthorn		+					+	
Spilonota ocellana			trees, shrubs and herbaceous plants	+	+			+	+		
Tortrix viridana	Green Oak Tortrix		oak	+					+		
Zeiraphera isertana			oak						+		
Yponomeutidae											
Acrolepia autumnitella			woody nightshade (bittersweet) and deadly nightshade		+						
Argyresthia bonnetella			caterpillar feeds in the shoots of hawthorn						+		
Argyresthia brockeella			birch and alder	+							
Argyresthia goedartella			birch and alder	+							
Plutella xylostella			primary immigrant from overseas; temporary resident on Cruciferae	+	+	+	+	+	+	+	+
Prays fraxinella			feeds in buds, shoots and leaves of ash trees	+	+	+		+	+	+	+
Scythropia crataegella			hawthorn - sometimes blackthorn						+		
Swammerdamia caesiella			birch	+							
Swammerdamia pyrella			hawthorn, apple and pear are recorded		+						
Ypsolopha parenthesella			oak, hornbeam, birch, hazel and other trees						+		
Ypsolopha scabrella			apple and hawthorn	+							
Ypsolopha sequella			maple and sycamore		+						
MECOPTERA	**SCORPIONFLIES**										
Panorpidae											
Panorpa germanica			edge habitats		+		+				+
MYRIAPODA: CHILOPODA	**CENTIPEDES**										
Cryptopidae											

Group / species	English name if available	National status	Ecological associations	Where found (see text section 3)							
				1	2	3	4	5	6	7	8
Cryptops hortensis			amongst litter - often synanthropic	+							
Lithobiidae											
Lithobius forficatus			many habitats	+							
Lithobius microps			detritivorous	+							
MYRIAPODA: DIPLOPODA	**MILLIPEDES**										
Julidae											
Tachypodoiulus niger	a snake millipede		many habitats and often found climbing trees		+						
NEUROPTERA	**LACEWINGS**										
Chrysopidae	**Green lacewings**										
Chrysopa perla			aphid predator amongst herbage	+	+		+				+
Chrysoperla carnea s.str.			aphid predator of trees and bushes	+	+	+	+	+	+	+	+
Cunctochrysa albolineata			predatory on aphids in tree foliage		+					+	
Nineta flava			thought to be associated with oak, feeding on aphids on the leaves						+		
Coniopterygidae	**Wax flies**										
Conwentzia psociformis			arboreal on deciduous trees		+						
Hemerobiidae	**brown lacewinhs**										
Hemerobius humulinus			trees and bushes, hedges, etc		+						
Hemerobius lutescens			trees and bushes, hedges, etc	+	+						
Hemerobius micans			oak		+				+		
Micromus paganus			ubiquitous, but usually in association with wood or scrub		+						+
Wesmaelius subnebulosus			larvae are aphid predators on trees and bushes		+	+					+
ORTHOPTERA											
Acrididae											
Chorthippus brunneus	Field grasshopper		grassland	+			+				
Tettigoniidae											
Leptophyes punctatissima	Speckled Bush-cricket		rough herbage and scrub		+						
Meconema thalassinum	Oak Bush-cricket		oak trees, especially when at the woodland edge		+						
Metrioptera roeselii	Roesel's Bush-cricket	NS(Nb)	long grassland		+		+				
Pholidoptera griseoaptera	Dark Bush-cricket		scrub and edge habitats		+						
PSOCOPTERA	**BARK LICE**										
Ectopsocidae											
Ectopsocus petersi			associated with trees and bushes		+						
Stenopsocidae											

Group / species	English name if available	National status	Ecological associations	Where found (see text section 3)							
				1	2	3	4	5	6	7	8
Graphopsocus cruciatus			associated with broad-leaved trees		+						

APPENDIX 2: INVERTEBRATE STATUS CODES

Earlier published reviews of scarce and threatened invertebrates employed the Red Data Book criteria used in the British Insect Red Data Book (Shirt 1987) with the addition of the category RDBK (Insufficiently Known) after in 1983. In addition, the status category Nationally Notable (now termed Nationally Scarce) was used from 1991. The original criteria of the International Union for the Conservation of Nature (IUCN – now called the World Conservation Union) for assigning threat status used in these publications had the categories *Endangered, Vulnerable,* and *Rare,* which were defined rather loosely and without quantitative parameters. The application of these categories was largely a matter of subjective judgment, and it was not easy to apply them consistently within a taxonomic group or to make comparisons between groups of different organisms. The deficiencies of the old system were recognised internationally, and in the mid-1980s proposals were made to replace it with a new approach which could be more objectively and consistently applied. In 1989, the lUCN's Species Survival Commission Steering Committee requested that a new set of criteria be developed to provide an objective framework for the classification of species according to their extinction risk. The first, provisional, outline of the new system was published in 1991. This was followed by a series of revisions, and the final version adopted as the global standard by the IUCN Council in December 1994. The guidelines were recommended for use also at the national level. In 1995, the Joint Nature Conservation Committee (JNCC) endorsed their use as the new national standard for Great Britain, and subsequent British Red Data Books have used these revised IUCN criteria. These criteria are used in this present report and are as follows:

EXTINCT (EX) A species is *Extinct* when there is no reasonable doubt that the last individual has died.

EXTINCT IN THE WILD A species is *Extinct* in the wild when it is known to survive only in cultivation, in captivity or as a naturalised population (or populations) well outside the past range.

CRITICALLY ENDANGERED
A species is *Critically Endangered* when it is facing an extremely high risk of extinction in the wild in the immediate future, as defined by any of the following criteria:

A. Population reduction in the form of either of the following:

1. An observed, estimated, inferred or suspected reduction of at least 80% over the last 10 years or three generations, whichever is the longer, based on direct observation, an index of abundance appropriate for the species, a decline in area of occupancy, extent of occurrence and/or quality of habitat, actual or potential levels of exploitation or the effects of introduced species, hybridisation, pathogens, pollutants, competitors or parasites.
2. A reduction of at least 80%, projected or suspected to be met within the 10 years or three generations, whichever is the longer, based any of these parameters.

B. Extent of occurrence estimated to be less than 100 Km^2 or areas of occupancy estimated to be less than 10 Km^2 and estimates indicating any <u>two</u> of the following:

1. Severely fragmented or known to exist at only a single location.
2. Continuing decline, observed, inferred or projected, in any of the following: a. extent of occurrence b. area of occupancy c. area, extent and/or quality of habitat d. number of locations or sub-populations e. number of mature individuals
3. Extreme fluctuations in extent of occurrence, area of occupancy, number of locations or sub-populations or number of mature individuals.

C. Population estimated to number less than 250 mature individuals and either:

1. An estimated continuing decline of at least 25% within 3 years or one generation, whichever is longer or
2. A continuing decline, observed, projected, or inferred, in numbers of mature individuals and population structure in the form of either severely fragmented *(i.e.* no sub-population estimated to contain more than 50 mature individuals) or all individuals are in a single sub-population

D. British population estimated to number less than 50 mature individuals.

E. Quantitative analysis showing the probability of extinction in the wild of at least 50% within 10 years or 3 generations, whichever is the longer.

ENDANGERED (Formerly RDB category 1)

A species is Endangered when it is not *Critically Endangered* but is facing a very high risk of extinction in the wild in the near future, as defined by any of the following criteria:

A. Population reduction in the form of either of the following:

1. An observed, estimated, inferred or suspected reduction of at least 50% over the last 10 years or three generations, whichever is the longer, based on direct observation, an index of abundance appropriate for the species, a decline in area of occupancy, extent of occurrence and/or quality of habitat, actual or potential levels of exploitation or the effects of introduced species, hybridisation, pathogens, pollutants, competitors or parasites.
2. A reduction of at least 50%, projected or suspected to be met within the 10 years or three generations, whichever is the longer, based any of these parameters.

B. Extent of occurrence estimated to be less than 5,000 Km^2 or areas of occupancy estimated to be less than 10 Km^2 and estimates indicating any <u>two</u> of the following:

1. Severely fragmented or known to exist at no more than five locations.
2. Continuing decline, observed, inferred or projected, in extent of occurrence, area of occupancy, area, extent and/or quality of habitat, number of locations or sub-populations or the number of mature individuals.

C. Population estimated to number less than 2500 mature individuals and either:

1. An estimated continuing decline of at least 20% within 5 years or 2 generations, whichever is longer or
2. A continuing decline, observed, projected, or inferred, in numbers of mature individuals and population structure in the form of either severely fragmented *(i.e.* no sub-population estimated to contain more than 250 mature individuals) or all individuals are in a single sub-population

D. British population estimated to number less than 250 mature individuals.

E. Quantitative analysis showing the probability of extinction in the wild of at least 20% within 20 years or 5 generations, whichever is the longer..

VULNERABLE (Formerly RDB category 2)

A species is *Vulnerable* when it is not *Critically Endangered or Endangered but* is facing a high risk of extinction in the wild in the medium-term future, as defined by any of the following criteria (A to E):

A. Population reduction in the form of either of the following:

1. An observed, estimated, inferred or suspected reduction of at least 20% over the last 10 years or three generations, whichever is the longer, based on direct observation, an index of abundance appropriate for the species, a decline in area of occupancy, extent of occurrence and/or quality of habitat, actual or potential levels of exploitation or the effects of introduced species, hybridisation, pathogens, pollutants, competitors or parasites.
2. A reduction of at least 20%, projected or suspected to be met within the 10 years or three generations, whichever is the longer, based any of these parameters.

B. Extent of occurrence estimated to be less than 20,000 Km^2 or areas of occupancy estimated to be less than 20,000 Km^2 and estimates indicating any <u>two</u> of the following:

1. Severely fragmented or known to exist at no more than ten locations. Continuing decline, observed, inferred or projected, in extent of occurrence, area of occupancy, area, extent and/or quality of habitat, number of locations or sub-populations or the number of mature individuals.
2. Extreme fluctuations in extent of occurrence, area of occupancy, number of locations or sub-populations or number of mature individuals.

C. Population estimated to number less than 10,000 mature individuals and either:

1. An estimated continuing decline of at least 10% within 10 years or 3 generations, whichever is longer or
2. A continuing decline, observed, projected, or inferred, in numbers of mature individuals and population structure in the form of either severely fragmented *(i.e.* no sub-population estimated to contain more than 1000 mature individuals) or all individuals are in a single sub-population

D. Population very small or restricted in the form of either of the following:

1. Population estimated to number less than 1,000 mature individuals.
2. Population is characterised by an acute restriction in its area of occupancy (typically less than 100 km) or in the number of locations (typically less than 5). Such a species would thus be prone to the effects of human activities (or stochastic events whose impact is increased by human activities) within a very short period of time in an unforeseeable future, and is thus capable of becoming *Critically Endangered* or even *Extinct* in a very short period.

E. Quantitative analysis showing the probability of extinction in the wild of at least 10% within 100 years.

LOWER RISK (Formerly RDB category 3)
A species is Lower Risk when it has been evaluated but does not satisfy the criteria for any of the categories *Critically Endangered, Endangered* or *Vulnerable.* Species included in the Lower Risk category can be separated into three sub-categories:

• **Conservation Dependent** species which are the focus of a continuing species -specific or habitat-specific conservation program targeted towards the species in question, the cessation of which would result in the species qualifying for one of the threatened categories above within a period of five years.

• **Near Threatened** Species which do not qualify for *Lower Risk (Conservation Dependent),* but which are close to qualifying for *Vulnerable.*

• **Least Concern**
Species which do not qualify for *Lower Risk (Conservation Dependent)* or *Lower Risk (Near Threatened).*

DATA DEFICIENT A species is *Data Deficient* when there is inadequate information to make a direct or indirect assessment of its risk of extinction based on its distribution and/or population status. A species in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution are lacking. *Data Deficient* is therefore not a category of threat or Lower Risk.

LOWER RISK (NATIONALLY SCARCE – FORMERLY NATIONALLY NOTABLE)
Species which are not included within the IUCN threat categories and are estimated to occur less than 100 hectads of the Ordnance Survey national grid in Great Britain. It should be noted that Lower Risk (Nationally Scarce) is not a threat category, but rather an estimate of the extent of distribution of these species. Lower Risk species are subdivided as follows:

Na species estimated to occur within the range of 16 to 30 10-kilometre squares of the National Grid System.

Nb species estimated to occur within the range 31 to 100 10-kilometre squares of the National Grid System.

N Diptera (flies) not separated, falling into either category Na or Nb.

NATIONALLY LOCAL (L)
Species which, whilst fairly common, are evidently less widespread than truly common species, but also not qualifying as Nationally Notable having been recorded from over one hundred, but less than three hundred, ten-kilometre squares of the UK National Grid.

ASSOCIATED DEFINITIONS

Extent of occurrence
Extent of occurrence is defined as the area contained within the shortest continuous imaginary boundary which can be drawn to encompass all the known, inferred or projected sites of present occurrence of a species, excluding cases of vagrancy. This measure may exclude discontinuities or disjunctions within the overall distributions of species (e.g. large areas of obviously unsuitable habitat) (but see 'area of occupancy'). Extent of occurrence can often be measured by a minimum convex polygon (the smallest polygon in which no internal angle exceeds 180 degrees and which contains all the sites of occurrence).

Area of occupancy
Area of occupancy is defined as the area within its 'extent of occurrence' (see definition) which is occupied by a species, excluding cases of vagrancy. The measure reflects the fact that a species will not usually occur throughout the area of its extent of occurrence, which may, for example, contain unsuitable habitats. The area of occupancy is the smallest area essential at any stage to the survival of existing populations of a species *(e.g.* colonial nesting sites, feeding sites for migratory species). The size of the area of occupancy will be a function of the scale at which it is measured, and should be at a scale appropriate to relevant biological aspects of the species. The criteria include values in km^2, and thus to avoid errors in classification, the area of occupancy should be measured on grid squares (or equivalents) which are sufficiently small.

APPENDIX 3: AQUATIC INVERTEBRATE SPECIES RECORDED

Group / species	English name	Ecological associations and comments	In aquatic area					
			1	2	3	4	5	6
ANNELIDA	**LEECHES**							
Erpobdellidae								
Erpobdella testacea		eutrophic water bodies where it feeds on insect larvae		+				
COLEOPTERA	**WATER BEETLES**							
Dytiscidae								
Agabus bipustulatus		freshwater ponds etc		+				
Hydroporus palustris		freshwater ponds etc		+				
Hydroporus planus		most water bodies will support this common species		+			+	
Hydroporus pubescens		freshwater ponds etc		+				
Elmidae								
Limnius volkmari		aquatic species	+				+	
Haliplidae								
Haliplus ruficollis s. str.		ponds ditches and similar static water bodies		+			+	
Hydrophilidae								
Helophorus minutus				+				
CRUSTACEA: AMPHIPODA								
Gammaridae								
Gammarus pulex		most freshwater habitats		+	+	+	+	
CRUSTACEA: ISOPODA								
Asellidae								
Asellus aquaticus	freshwater hog louse	most freshwater habitats		+	+	+	+	
DIPTERA	**TRUE FLIES**							
Chironomidae	**midges**							
unidentified larvae				+	+	+	+	
Culicidae	**mosquitoes**							
unidentified larvae				+				
Tipulidae	**craneflies**							
unidentified larvae						+	+	
EPHEMEROPTERA	**MAYFLIES**							
Baetidae								
Baetis rhodani		Usually in running water - especially riffles	+					
HETEROPTERA	**WATER BUGS**							
Corixidae								
Callicorixa praeusta		Aquatic species. Most still or slow-flowing water bodies.		+			+	
Sigara lateralis		freshwater ponds etc thriving in those polluted by animal dung		+				
Sigara stagnalis		Aquatic species.		+				
Gerridae								
Gerris lacustris		Aquatic species. Ponds, lakes and canals with abundant submerged vegetation.		+				
Naucoridae								
Ilyocoris cimicoides		Aquatic species - weedy ponds, canals etc		+		+		
Notonectidae								
Notonecta glauca		Aquatic species - weedy ponds, canals etc		+				
MOLLUSCA	**WATER SNAILS**							
Lymnaeidae								
Lymnaea peregra	the wandering snail	ponds, streams and marshes		+	+	+	+	
Planorbis planorbis		freshwater habitat with pondweeds		+				
ODONATA								
Coenagriidae								
Enallagma cyathigerum	Common blue	static, open water bodies with emergent vegetation,		+				

	damselfly	flying mid May to early October						
Ischnura elegans	Blue-tailed damselfly	found in most permanent water bodies, the adults flying from May to August		+				
PLECOPTERA	**STONEFLIES**							
Nemouridae								
Nemoura cinerea		aquatic larvae are associated with still and very slow water		+				
TRICHOPTERA	**CADDIS FLIES**							
Limnephilidae								
Limnephilus auricula		common species of grassy pools and ditches including temporary waters	+					

Appendix 6G Great Crested Newts

Pond Number	Description	HSI	Presence of great crested newts confirmed
1	Field waterbody immediately north of Bainton Road in Bucknell. The waterbody had almost entirely dried out by the end of the survey. To the south an intact hedgerow to the north an arable field. Waterbody covered by grass with no areas of open water. This waterbody is sub-optimal for great crested newts.	0.6 (average)	No, smooth newt (*Lissotriton vulgaris*) present.
2	A large, old landscaped waterbody lined by limestone walls mostly collapsed or covered by vegetation. The northern banks were natural with marginal and emergent vegetation. The eastern and western banks were shaded by woodland. A small causeway provided access to a man-made island.	0.69 (average)	Yes, smooth newt also present.
3	On line pond linked to the winterbourne. Shallow waterbody dry by late June. A relict hedgerow on the southern boundary. Waterbody supports Water Mint (*Mentha aquatica*) and Fool's Water-cress (*Apium nodiflorum*). Sub-optimal for great created newts since dries out too early in the year.	0.47 (poor)	No, common frog (*Rana temporaria*) present.
4	On line pond linked to the winterbourne. Shallow waterbody dry by late June. Hedgerows on two sides. Waterbody covered by Bittersweet (*Solanum dulcamara*), Brookline (*Veronica beccabunga*) and Great Willowherb (*Epilobium hirsutum*). Sub-optimal for great created newts since dries out too early in the year.	0.53 (below average)	No; no other amphibians recorded.
5	Large waterbody in the village green. Set in an area of mown grass. To the west was a band of mature trees and scrub; to the east the Bicester Road. This waterbody has large areas suitable for display and marginal vegetation suitable for egg-laying. This waterbody dries out in early summer.	0.54 (below average)	Yes, smooth newt and common frog also present.
6	Crowmarsh pond spring fed and stream fed. It supported a diverse wetland flora (see Ponds in the main body of the report). This waterbody has large areas suitable for display and marginal vegetation suitable for egg-laying. This pond supports large numbers of three-spined stickleback (*Gastreosteus aculeatus*) and it therefore sub-optimal for use by great crested newts.	0.43 (poor)	No, smooth newt present.
7	Waterbody heavily poached by cattle with a diverse marginal flora that included Pink Water-speedwell (*Veronica catenata*) and Common Water-crowfoot (*Ranunculus aquatilis*). This waterbody has areas suitable for display and marginal vegetation suitable for egg-laying.	0.75 (good)	Yes, smooth newt and common frog also present.

Pond Number	Description	HSI	Presence of great crested newts confirmed
8	Very shallow spring-fed waterbody, water levels barely 10mm deep. Ephemeral waterbody considered sub-optimal for great crested newts.	0.49 (poor)	No; no other amphibians recorded.
9	Disused swimming pool with Ivy (*Hedera helix*) covered walls and Duckweed (*Lemna* spp.) covered water surface.	0.64 (average)	Yes, smooth newt also present.
10	Pond NW of Hawkwell Farm. Water surface covered by water-crowfoot (*Ranunculus* sp.). Waterbody suitable for use by great crested newts but not close to any ponds where their presence has been confirmed.	0.45 (poor)	No, smooth newt present.
11	Waterbody between an access track and hedgerow, it supported a diverse marginal flora with few aquatic plants. It appeared to dry out on a regular basis making it sub-optimal for use by great crested newts.	Unsuitable dry by late May	No; no other amphibians recorded.
12	Large man-made waterbody grazed by Canada geese (*Brenta canadenis*). Bogbean (*Menyanthes trifoliata*) and Water Mint were recorded on the water edge. Fish were also recorded within this feature (identification obscured by the turbidity of the water) making it sub-optimal for use by great crested newts.	0.37 (poor)	No; no other amphibians recorded.
13	Pond online with a winterbourne. This pond was used by domestic ducks and devoid of wetland vegetation. It was sub-optimal for use by great crested newts.	0.39 (poor)	No, smooth newt present.
14	Pond located within an arable field and was approximately 20m long and 15m wide. It was almost completely covered in the aquatic plant Common Water-crowfoot (*Ranunculus aquatilis*). Marginal vegetation comprised Branched Bur-reed (*Sparganium erectum*), Water Mint (*Mentha aquatica*) and Redshank (*Persicaria maculosa*), grading into False Oat-grass (*Arrhenatherum elatius*) and Common Nettle (*Urtica dioica*) in the drier areas around the pond. Whilst not connected to the hedgerow network directly, the pond was located approximately 60m from hedgerows that bound the arable field. Tall ruderal habitat and wood piles were located close to the farm building approximately 150m away, connected to the hedgerows that bound the arable field. These features comprise suitable terrestrial habitat for great crested newts.	0.79 (good)	Yes, smooth newt also present.

Pond Number	Description	HSI	Presence of great crested newts confirmed
15	Pond located on the boundary of a grazed field, bounded on its southern side by a steep bank vegetated with tall ruderal herbs and grass, which links to the hedgerow bounding the southern edge of the field. The pond was approximately 40m long and 20m wide with a small island in the centre. Aquatic and marginal vegetation comprised Water Mint, Soft-rush (*Juncus effusus*), Bulrush (*Typha latifolia*), Toad Rush (*Juncus bufonius* sens. str.) and Hard Rush (*Juncus inflexus*). Patches of willow (Salix sp.) and Bramble (*Rubus fruticosus* agg.) scrub bordered the pond, becoming dense in the south western corner.	0.76 (good)	Yes, smooth newt also present.

The maximum adult great crested newt count gained for Pond 14 was 15 on the 17th May. The maximum adult great crested newt count gained for Pond 15 was 2 on the 13th and 26th May. These results indicate the presence of a population at the lower end of the medium size class at Pond 14 and a small population size class at Pond 15. In addition, small numbers of smooth newts were found in both ponds.

Appendix 6H Breeding Birds

Birds recorded during the breeding bird surveys in 2010 and/or 2011. Not all species that were recorded were breeding within the Masterplan site. For the complete BOCC Red and Amber lists see Easton et al (Ref 6-23).

Species		**Conservation Value**	**Year**
Sparrowhawk	Accipter nisus	-	2010
Long-tailed tit	Aegithalos caudatus	-	2011
Skylark	Alauda arvensis	BOCC Red list Section 41 NERC Act	2010, 2011
Red-legged partridge	Alectoris rufa	-	2010
Mallard	Anas platyrhynchos	BOCC Amber list	2011
Little owl	Athene noctua	-	2010
Canada goose	Branta canadensis	-	2010, 2011
Buzzard	Buteo buteo	-	2010, 2011
Linnet	Carduelis cannabina	BOCC Red list Section 41 NERC Act	2010, 2011
Goldfinch	Carduelis carduelis	-	2010, 2011
Greenfinch	Carduelis chloris	-	2010, 2011
Stock dove	Columba oenas	BOCC Amber list	2010, 2011
Wood pigeon	Columba palumbus	-	2010, 2011
Carrion crow	Corvus corone	-	2010, 2011
Rook	Corvus frugilegus	-	2011
Jackdaw	Corvus monedula	-	2010, 2011
Cuckoo	Cuculus canorus	BOCC Red list Section 41 NERC Act	2010
Blue tit	Cyanistes caeruleus	-	2010, 2011
Greater spotted woodpecker	Dendrocopos major	-	2010
Yellowhammer	Emberiza citrinella	BOCC Red list Section 41 NERC Act	2010, 2011
Reed bunting	Emberiza schoeniclus	BOCC Amber list Section 41 NERC Act	2010
Robin	Erithacus rubecula	-	2010,

Species		Conservation Value	Year
			2011
Kestrel	Falco tinnunculus	BOCC Amber list	2010
Chaffinch	Fringilla coelebs	-	2010, 2011
Coot	Fulica atra	-	2010
Moorhen	Gallinula chloropus	-	2010, 2011
Jay	Garrulus glandarius	-	2010, 2011
Swallow	Hirundo rustica	BOCC Amber list	2010, 2011
Herring gull	Larus argentatus	BOCC Red list Section 41 NERC Act	2011
Pied wagtail	Motacilla alba	-	2010, 2011
Yellow wagtail	Motacilla flava flavissima	BOCC Red list Section 41 NERC Act	2010
Spotted flycatcher	Muscicapa striata	BOCC Red list Section 41 NERC Act	2010
Wheatear	Oenanthe oenanthe	BOCC Amber list	2011
Great tit	Parus major	-	2010, 2011
Marsh tit	Poecile palustris subsp. palustris/dresseri	BOCC Red list Section 41 NERC Act	2010
House sparrow	Passer domesticus	BOCC Red list Section 41 NERC Act	2010
Pheasant	Phasianus colchicus	-	2010, 2011
Chiffchaff	Phylloscopus collybita	-	2010, 2011
Willow warbler	Phylloscopus trochilus	BOCC Amber list	2010, 2011
Magpie	Pica pica	-	2010, 2011
Green woodpecker	Picus viridis	BOCC Amber list	2010, 2011
Dunnock	Prunella modularis	BOCC Amber list Section 41 NERC Act	2010, 2011
Bullfinch	Pyrrhula pyrrhula	BOCC Amber list Section 41 NERC Act	2010, 2011
Goldcrest	Regulus regulus	-	2010, 2011
Collard dove	Streptopelia decaocto	-	2010
Tawny owl	Strix aluco	-	2010

Species		Conservation Value	Year
Starling	Sturnus vulgaris	BOCC Red list Section 41 NERC Act	2010, 2011
Blackcap	Sylvia atricapilla	-	2011
Garden warbler	Sylvia borin	-	2011
Whitethroat	Sylvia communis	BOCC Amber list	2010, 2011
Lesser whitethroat	Sylvia curruca	-	2010
Wren	Troglodytes troglodytes	-	2010, 2011
Blackbird	Turdus merula	-	2010, 2011
Song thrush	Turdus philomelos	BOCC Red list Section 41 NERC Act	2010, 2011
Mistle thrush	Turdus viscivorus	BOCC Amber list	2010
Barn owl	Tyto alba	BOCC Amber list Schedule 1 Wildlife and Countryside Act	2010
Lapwing	Vanellus vanellus	BOCC Red list Section 41 NERC Act	2010

Appendix 6I Wintering Birds

Birds recorded during the wintering bird surveys in 2010 and 2011. For the complete BOCC Red and Amber lists see Easton et al (Ref 6-23).

Species		**Conservation Value**
Long-tailed tit	Aegithalos caudatus	-
Skylark	Alauda arvensis	BOCC Red list Section 41 NERC Act
Red-legged partridge	Alectoris rufa	-
Teal	Anas crecca	-
Mallard	Anas platyrhynchos	BOCC Amber list
Grey heron	Ardea cinerea	-
Little owl	Athene noctua	-
Buzzard	Buteo buteo	-
Linnet	Carduelis cannabina	BOCC Red list Section 41 NERC Act
Goldfinch	Carduelis carduelis	-
Greenfinch	Carduelis chloris	-
Feral pigeon	Columba livia	-
Wood pigeon	Columba palumbus	-
Carrion crow	Corvus corone	-
Rook	Corvus frugilegus	-
Jackdaw	Corvus monedula	-
Blue tit	Cyanistes caeruleus	-
Greater spotted woodpecker	Dendrocopos major	-
Yellowhammer	Emberiza citrinella	BOCC Red list Section 41 NERC Act
Reed bunting	Emberiza schoeniclus	BOCC Amber list Section 41 NERC Act
Robin	Erithacus rubecula	-
Kestrel	Falco tinnunculus	BOCC Amber list
Chaffinch	Fringilla coelebs	-
Moorhen	Gallinula chloropus	-
Jay	Garrulus glandarius	-
Herring gull	Larus argentatus	BOCC Red list Section 41 NERC Act
Lesser black-backed gull	Larus fuscus	-
Great black-backed gull	Larus marinus	-
Red kite	Milvus milvus	Schedule 1 Wildlife and Countryside Act
Pied wagtail	Motacilla alba	-
Blue tit	Parus caeruleus	-
Great tit	Parus major	-
Marsh tit	Poecile palustris subsp. palustris/dresseri	BOCC Red list Section 41 NERC Act
House sparrow	Passer domesticus	BOCC Red list Section 41 NERC Act
Grey partridge	Perdix perdix	BOCC Red list Section 41 NERC Act
Pheasant	Phasianus colchicus	-
Magpie	Pica pica	-
Green woodpecker	Picus viridis	BOCC Amber list
Dunnock	Prunella modularis	BOCC Amber list Section 41 NERC Act
Bullfinch	Pyrrhula pyrrhula	BOCC Amber list

Species		Conservation Value
		Section 41 NERC Act
Goldcrest	Regulus regulus	-
Woodcock	Scolopax rusticola	-
Collard dove	Streptopelia decaocto	-
Starling	Sturnus vulgaris	BOCC Red list Section 41 NERC
Wren	Troglodytes troglodytes	-
Redwing	Turdus iliacus	BOCC Red list Schedule 1 Wildlife and Countryside Act
Blackbird	Turdus merula	-
Fieldfare	Turdus pilaris	BOCC Red list Schedule 1 Wildlife and Countryside Act
Song thrush	Turdus philomelos	BOCC Red list Section 41 NERC Act
Mistle thrush	Turdus viscivorus	BOCC Amber list
Lapwing	Vanellus vanellus	BOCC Red list Section 41 NERC Act