Hopkins Ecology

Site:	**Land North and West of Hethersett**
Work Item:	**Strategic Ecological Assessment**
Client:	**Pigeon Land 2 Ltd and Hethersett Consortium**

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Summary

Hopkins Ecology Ltd was appointed by Pigeon Land 2 Ltd ('Pigeon') and the Hethersett Consortium ('the Landowners') to prepare a strategic ecological assessment of Land North and West of Hethersett, with a view to identifying constraints and opportunities in the context of the proposed allocation of the Site within the Greater Norwich Local Plan.

The Site is on the western and northern fringes of Hethersett and comprises a series of arable fields and associated habitats, with a total area of ~111ha. The entire Site was included within surveys undertaken in 2010 as part of the planning application for 1,196 dwellings and associated uses on land north of Hethersett that was granted outline planning permission in July 2013 (application reference 2011/1804/O).

There are two non-statutory County Wildlife Sites (CWSs) of particular relevance to the Site: Beckhithe Meadow CWS within the Site and Braymeadow CWS adjacent to the north-east boundary. Impacts on surface water flows have the potential to impact both CWSs and will be mitigated via an appropriate surface water management train.

The Site is considered to be typical of an intensive arable landscape, dominated by arable farmland with hedgerows and small areas of improved and semi-improved grass swards.

A key finding from the 2010 surveys was the presence of great crested newts: close to the current west boundary, and within and close to the current east boundary. It is likely that the current distribution is similar, and European Protected Species Mitigation Licensing may be a requirement. It is considered that any impacts can be mitigated via appropriate working methods and scheme design to create suitable areas of green space that are suitable as new habitat.

Mature hedgerow trees are frequent and the presence of bat roosts cannot be discounted. Where possible, masterplanning will avoid impacts by creating and retaining green space around these trees. The mitigation of impacts is considered to be feasible.

A number of other species of conservation concern are likely or potentially present, many of which will be widespread but declining species, and present as components of larger local populations. Further surveys are recommended to provide a robust baseline for the Site, but it is thought likely that any such species found will be in low numbers and the overall assemblages of species will be small.

The main development areas will be on what is currently arable farmland with typically low biodiversity. Ecological mitigation and enhancement will be delivered via appropriate soft landscaping and scheme masterplanning, with other measures such as bird boxes as appropriate. Most species will experience a net gain in habitat area.

Within the Greater Norwich green infrastructure strategy, a green infrastructure corridor is proposed as crossing the Site. Appropriate soft landscaping and semi-natural green space design could make a substantial contribution to the delivery of this corridor.

In conclusion, it is considered likely that ecological impacts can be successfully mitigated and that the scheme can deliver biodiversity gain via ecological enhancements relevant at both the Site-level and within the strategic context of the green infrastructure network.

1. Introduction

BACKGROUND

1.1 Hopkins Ecology Ltd was appointed by Pigeon Land 2 Ltd ('Pigeon') and the Hethersett Consortium ('the Landowners') to prepare a strategic ecological assessment of the Land North and West of Hethersett with a view to identifying constraints and opportunities in the context of the proposed allocation of the Site within the Greater Norwich Local Plan.

Site Context and Status

1.2 The Site forms an arc across the western and northern fringes of Hethersett, with a total area of ~111ha. The entire Site was included within surveys undertaken in 2010 as part of the planning application for 1,196 dwellings and associated uses on land north of Hethersett that was granted outline planning permission in July 2013 (application reference 2011/1804/O) [1].

1.3 The Site is mostly arable farmland with some blocks of other habitat. It is within the *South Norfolk and High Suffolk Claylands Natural Character Area*[2], which is characterised as an agricultural landscape *"incised by numerous small-scale wooded river valleys with complex slopes"*.

LEGISLATION AND PLANNING POLICY

1.4 The following key pieces of nature conservation legislation are relevant to legally protected species (with a more detailed description in Appendix 2):

- The Conservation of Habitats and Species Regulations 2017 (the Habitats Regulations); and
- The Wildlife and Countryside Act, 1981 (as amended).

1.5 Also, the National Planning Policy Framework (DfCLG, 2018[3]) requires local authorities to avoid and minimise impacts on biodiversity and, where possible, to provide net gains in biodiversity when making planning decisions. A substantial number of species are of conservation concern in the UK. A small number of these species are fully protected under the legislation listed above, but others in England are recognised as Species of Principal Importance under the Natural Environment and Rural Communities Act 2006 and reinforced by the National Planning Policy Framework. For these species local planning authorities are required to promote the "*protection and recovery"* via planning and development control. Examples include the widespread reptiles, skylarks and soprano pipistrelle and, brown long-eared bats.

1.6 Although the NPPF has an overarching aim of minimising impacts to biodiversity, the majority of species of conservation concern are not specifically recognised by legislation or planning policy. The level of protection afforded to these is undefined and should be considered within the overall aim of minimising impacts on biodiversity.

[1] 2011/1804 | Land North of Hethersett Village Centre Little Melton Road Including Extension to Thickthorn Park & Ride Hethersett | Residential led mixed use development of 1196 dwellings …

[2] Natural England (2014) *NCA Profile 83: South Norfolk and High Suffolk Claylands.* Available from: http://publications.naturalengland.org.uk/publication/6106120561098752

[3] DCLG (2018) *National Planning Policy Framework*. Department for Communities and Local Government, London.

2. Methods

DESK STUDY

2.1 The desk study comprises a formal data search from the local records centre and review of relevant data and information from other sources (Table 1).

Table 1. Overview of desk study data sources.

Source	Information
Norfolk Biodiversity Information Service	Designated sites, species of conservation concern; 5km search radius.
MAGIC (https://magic.defra.gov.uk/)	Additional information on statutory sites, habitats of principal importance and wider countryside information.
GNDP and South Norfolk DC policy documents	Information regarding local planning policies including a synthesis of related policies.
Local planning applications, manual map-based searching of the South Norfolk DC website	Recent survey data for protected species locally, including negative data. In particular, as referred to above, extensive reference was made to the Land North of Hethersett scheme and the associated surveys in 2010.
Various literature and web-based searches	Information on local projects and initiatives of potential relevance as well as some species-level data.
Historic maps Norfolk (http://www.historic-maps.norfolk.gov.uk/)	Aerial photographs from 1988 and 1946; OS maps from 1880s and earlier.

FIELD SURVEY

2.2 A Site walkover was undertaken on 13 March 2018, and habitats are described according to the methods of JNCC (2010)[4]. Trees were surveyed from ground level for their potential suitability for roosting bats, looking for gaps, cracks and other potential roost features[5]; searches were also made for signs of badgers.

GUIDANCE

2.3 The ecological assessment has been prepared with reference to best practice guidance published by the Chartered Institute for Ecology and Environmental Management (CIEEM) and as detailed in British Standard 42020:2013 Biodiversity - Code of Practice for Biodiversity and Development.

CONSTRAINTS

2.4 It should be noted that whilst every effort has been made to provide a comprehensive description of the Site, some species may have been overlooked. However, the broad characterisation and assessment of the Site is considered to be robust.

[4] JNCC (2010) *Handbook for Phase 1 Habitat Surveys.* Joint Nature Conservation Committee, Peterborough.

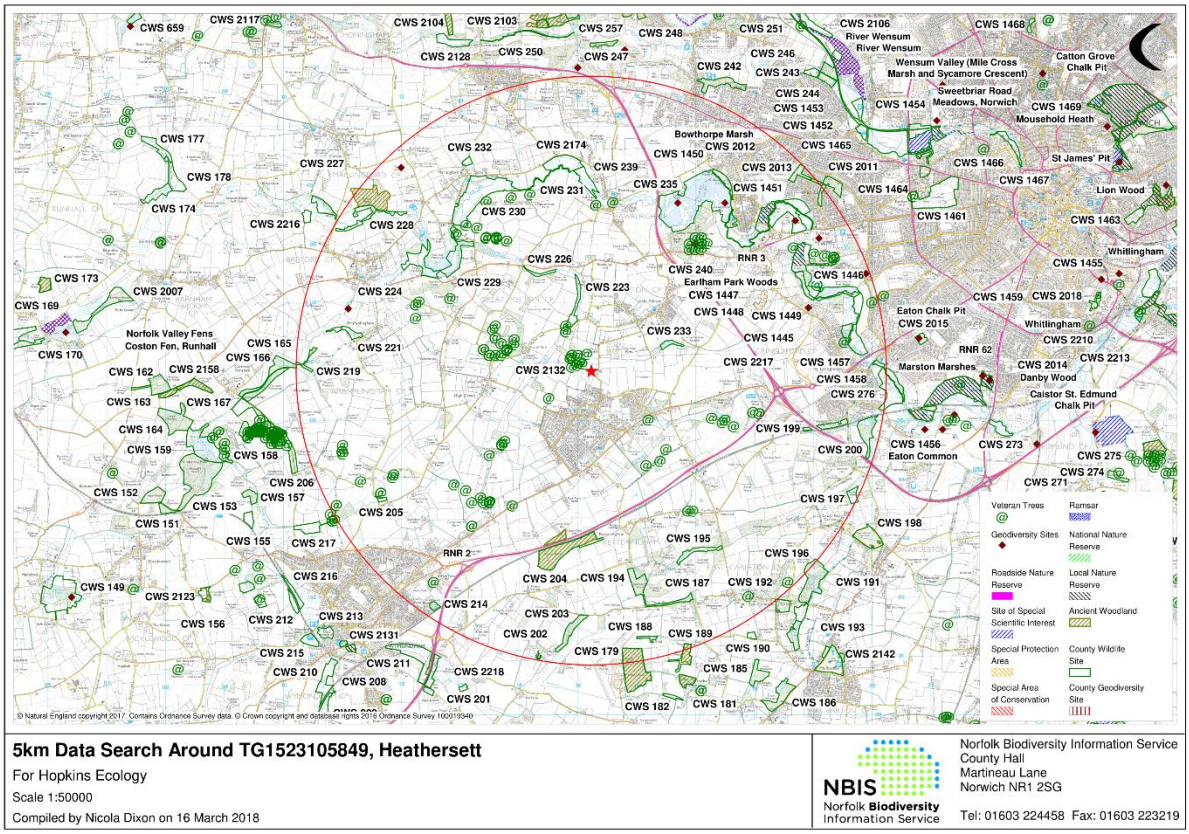
[5] Collins, J. (2016) *Bat Surveys for Professional Ecologists*. Bat Conservation Trust, London.

3. Designated Sites

OVERVIEW

3.1 An overview of the Site in relation to nearby designated sites is shown in Figure 1, showing a concentration of sites along the River Tiffey and River Yare valleys to the west, north and east. Another group of sites is located south of the A11 and Norwich – Cambridge railway, with smaller groups in the urban fringes of Norwich and Wymondham. Most relevant to the Site are two CWSs either within the boundary or adjacent, and another two in the wider countryside to the north.

Figure 1. Data search results for designated sites within a 5km radius.



STATUTORY (INTERNATIONAL AND NATIONAL) SITES

3.2 There are no statutory sites within 5km.

NON-STATUTORY SITES

3.3 Within a 5km radius there is a high number of non-statutory County Wildlife Sites (CWSs), with 48 in total (see Figure 1 and Appendix 2). Two are located within or adjacent to the Site and two are in the wider countryside to the north (Table 2).

Table 2. CWSs within and adjacent to the Site and in the wider countryside to the north.

CWS name (ref)	Location	Description
Beckhithe Meadow (2132)	Within the Site, near north-west boundary.	A small meadow.
Braymeadow (233)	Adjacent to north boundary.	A wet, unimproved neutral grassland.
Low Common (223)	980m north-west, along a stream connected to Beckhithe Meadow.	A mosaic of grassland, fen and woodland.
Melton Beck (226)	2.3km north-west, along a stream connected to Beckhithe Meadow.	Neutral marshy grassland with ponds, wet depressions and a small stream.

3.4 The CWS adjacent to the north boundary (Braymeadow CWS) could not be accessed in 2010-11 and nor could it be viewed in 2018. Beckhithe Meadow CWS is within the Site and in 2018 appeared similar to the condition described by an experienced botanist in June 2011:

> *Beckhithe Meadow is a spring-fed fen meadow supporting high quality damp grassland in the west, and poor-quality rank grassland in the east. The site occupies both banks of the shallowly sloping floodplain of a small tributary of the River Yare which runs north-west through the site. Three shallow drainage ditches cross the site (running north-east to south-west). A large veteran pedunculate oak* Quercus robur *(approximately 2m diameter at breast height) stands at the intersection of the stream and the westernmost drainage ditch. A second large veteran pedunculate oak stands outside the site to the south-east.*
>
> *Hedgerows border the site. They are comprised of hawthorn* Crataegus monogyna*, blackthorn* Prunus spinosa*, coppiced hazel* Corylus avellana *and elder* Sambucus nigra *with occasional mature trees of pedunculate oak and white willow* Salix alba. *Ground flora associated with these hedgerows includes dog's mercury* Mercurialis perennis*, red campion* Silene dioica *and hedge woundwort* Stachys sylvestris*. A similar hedgerow runs alongside the central drainage ditch – dividing the site into distinct eastern and western sections.*
>
> - *The western part of the site is a good example of a spring-fed fen meadow (NVC community M22* Juncus subnodulosus – Cirsium palustre *meadow).*
> - *The eastern part of the site by contrast is rather poor quality; it appears to have been disturbed recently and is almost entirely dominated by a tall rank community of false oat grass* Arrhenatherum elatius *with tall ruderals.*

3.5 The suite of all CWSs are summarised in Table 3, broadly divided into 'zones' for brevity: those associated with the River Tiffey and River Yare Valleys, the Wymondham and Norwich urban fringes, wider countryside south of the A11 and Norwich-Cambridge railway, and those of open countryside to the north and close to the Site as described above. A full listing of the CWSs is given in Appendix 2: Table 5.

Table 3. Other CWSs within 5km, according to broad location and context.

Zone	Number of CWSs	Summary
Countryside north of Hethersett	4	Four sites as described above.
Norwich fringes	1	A high woodland on the urban fringe.
Wymondham fringes	2	A mixture of grassland and woodland on the urban fringe.
River Tiffey valley bottom	4	Mostly valley bottom habitats adjacent to the River Tiffey.
River Yare valley bottom	23	Mostly valley bottom habitats adjacent to the River Yare.
South of A11 and Norwich - Cambridge railway line	12	A mixture of grassland, woodland and also some wetter sites in the upper River Tiffey area.

4. Green Infrastructure

OVERVIEW

4.1 Green infrastructure is considered to be a key requirement for development in the Greater Norwich Area, with the policy requirements originating in the Joint Core Strategy[6]. The spatial vision for these corridors is informed by a Green Infrastructure Strategy (CBA, 2007[7]) and associated studies (e.g. Green Networks, Norfolk Wildlife Trust, 2007[8]). Such policies are broadly in-line with other countryside restoration schemes, such as the Norfolk Wildlife Trust's *'Claylands Living Landscape'* project[9] within the South Norfolk area:

> *"The Claylands Living Landscape project aims to enhance the management of the area's wildlife habitats and expand its area of grassland and woodland – thereby creating a more joined-up ecological network – as well as to encourage the more sensitive management of farmland. To achieve this aim, (Norfolk Wildlife Trust) will be working closely with community groups and landowners in South Norfolk to raise wildlife awareness, as well as encouraging their active participation in conserving and enjoying the area's historic natural environment."*

GREEN INFRASTRUCTURE AROUND HETHERSETT

4.2 The spatial vision for green infrastructure within the Greater Norwich Area[10] shows a local green infrastructure corridor crossing the Site in a roughly north-east to south-east direction, connecting at the north end to another local green infrastructure corridor running between Wymondham and Norwich (see Figure 2). At its south end this connects to a sub-regional green infrastructure corridor (>1.5km from the Site boundary)[11].

4.3 The Site therefore presents a significant opportunity to support this local green infrastructure network. Specifically, it is proposed that semi-natural green space will be included along the identified route, providing habitat at the northern end of the corridor that crosses Hethersett and providing additional relevant habitat for the Wymondham to Norwich corridor.

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[6] Greater Norwich Development Partnership (2014) *Joint Core Strategy for Broadland, Norwich and South Norfolk.* Available from: http://www.greaternorwichgrowth.org.uk/planning/joint-core-strategy/

[7] CBA (2007) *Greater Norwich Development Partnership. Green Infrastructure Strategy. A Proposed Vision for Connecting People, Places and Nature*. Available from: http://www.greaternorwichgrowth.org.uk/dmsdocument/201

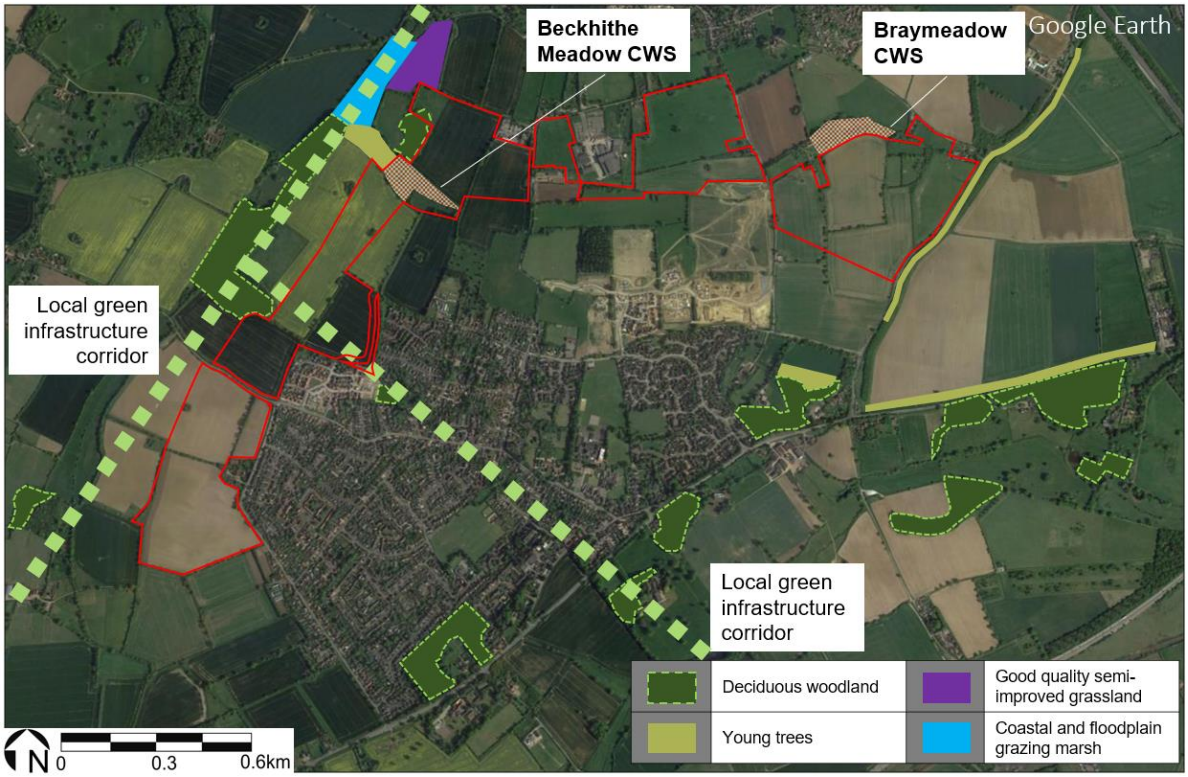
[8] Norfolk Wildlife Trust (2006) *Report of the Ecological Network Mapping Project for Norfolk.* Available from: http://www.norfolkbiodiversity.org/pdf/news/Final_report_of_indicative_map_July%202006.pdf

[9] https://www.norfolkwildlifetrust.org.uk/a-living-landscape/claylands

[10] http://www.greaternorwichgrowth.org.uk/dmsdocument/1590

[11] The sub-regional green infrastructure corridor is: South Norwich - Mulbarton - Diss Corridor

Figure 2. Local green infrastructure corridors and local areas of semi-natural habitats (from MAGIC).



5. Habitats and Botany

OVERVIEW

5.1 The Site is largely arable cropland, with limited areas of improved grass swards and also the Beckhithe Meadow CWS, which is classed as semi-improved grass sward (see the earlier description) (Figure 3). There are also numerous ponds, at least 15, but with open water lying extensively after recent rains at the time of survey (see Figure 4). An unnamed tributary of the River Yare runs south to north ~150m from the west boundary. The soil is classed as a 'lightly acid loamy and clayey soil with impeded drainage'.

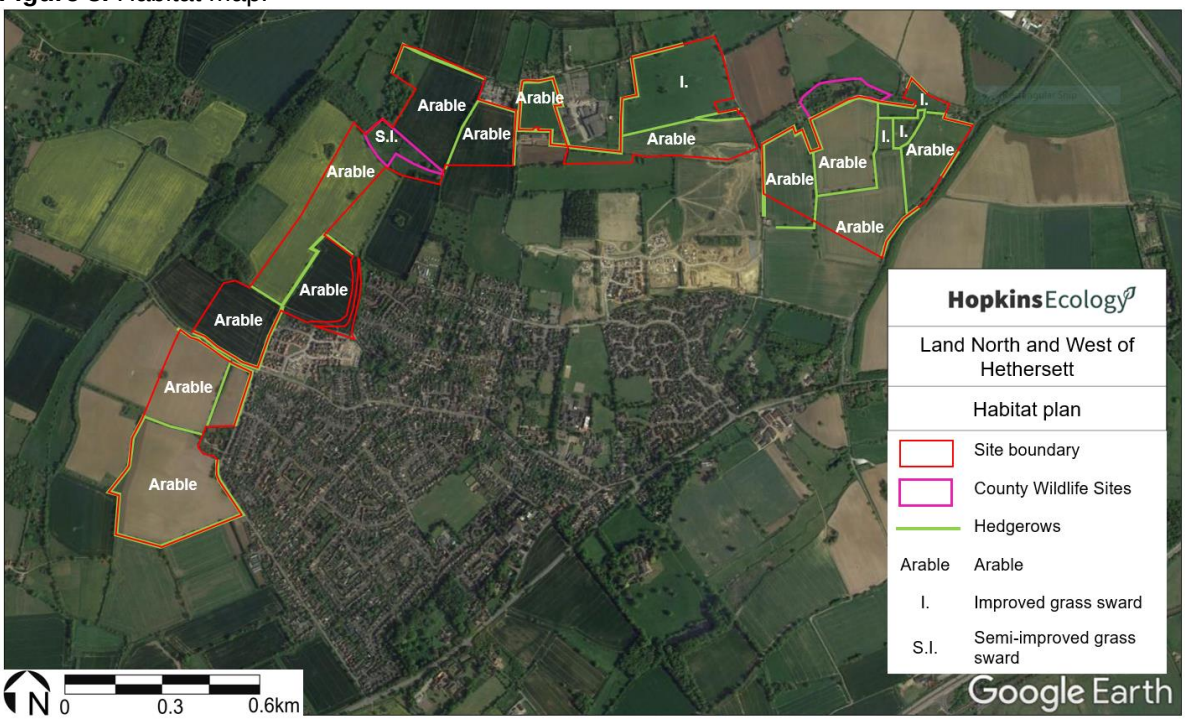
PHASE 1 HABITATS

5.2 The phase 1 habitats are described as follows:

- Arable. The main arable fields were under winter cereals or uncropped, presumably awaiting spring ploughing. The main arable areas were typically weed free, other than common weeds such as sterile brome *Anisantha sterilis* and groundsel *Senecio vulgaris*. The margins are narrow with cropping to the boundary grass verges.
- Semi-improved grass sward. This habitat forms the bulk of the Beckhithe Meadow CWS, interspersed with scrub. The main areas comprised false oat grassland and a *Juncus subnodulosus* sward, similar to that described in 2011. Scrub is frequent, mainly bramble *Rubus fructicosus* agg.
- Improved grass sward. Small fields to the north-east supported improved grass sward, mainly rye grass *Lolium* species with species such as bents *Agrostis* species and are generally intensively managed with few herbs.

- Hedgerows. The fields have boundary hedgerows, mostly intact but also with some gappy and defunct lengths. Standard mature oaks are frequent in some lengths, with the shrub components throughout being mainly hawthorn with the other frequent species being field maple *Acer campestre*, blackthorn, oak, ivy *Hedera helix,* dog and field roses *Rosa canina* and *R. arvensis*. Elm *Ulmus* species, hazel, sycamore *Acer pseudoplatanus*, hornbeam *Carpinus betulus* are occasional components. The associated herb layer was not particularly evident, although several lengths had lords and ladies *Arum maculatum* and also dog's mercury.
- Ponds are described under 'Great Crested Newts' but at least 15 were noted and these were generally lacking in aquatic flora at the time of surveys with partial or heavy shading from surrounding scrub.

Figure 3. Habitat map.



6. Scoping for Species of Conservation Concern

PLANTS

6.1 The data search returned records for few plants of conservation concern, the arable margin species being common cudweed *Filago vulgaris*, tower mustard *Arabis glabra* and basil thyme *Clinopodium acinos*. The broader landscape has a moderate diversity of arable margin species (Walker et al. 2012[12]).

6.2 The extent and quality of habitat for arable species on the Site is, however, likely to be very low, with cropping close to the grassy field margins and only limited areas of 'field corners' with a reduced intensity of cultivation. The assemblage of arable flora is likely to be small.

[12] Walker, H., Cunningham, S., Ellis, B., Neal, S. and Swan, E. (2012) *Important Arable Plant Areas in Norfolk.* Available from: http://www.nbis.org.uk/sites/default/files/documents/Important%20Arable%20Plant%20Areas%20in%20Norfolk_SCREEN.pdf

BATS

6.3 Records for ten species of bat were returned by the data search: barbastelle, serotine, Daubenton's, Natterer's, noctule, Leisler's, Nathusius' pipistrelle, common pipistrelle, soprano pipistrelle, and brown long-eared. The majority of these records were obtained during field surveys for the Norfolk Bat Survey[13]; roost records are all from >1.5km distant, from sites such as UEA and a development site in Costessey.

- Foraging. Much of the Site is open arable farmland with very little foraging habitat for bats. The patches of grassland are low in quality and extent, and wetland areas and ponds small and patchily distributed. High quality foraging habitat, such as extensive wetlands, wet humus-rich soil, herb-rich grassland or extensive woodland are absent. The overall quality of the Site for foraging bats is therefore low and this assessment is consistent with the generally low numbers and moderately-rich assemblage of species reported by the 2010 surveys.

- Trees. The standard hedgerow trees within the Site include numerous mature oaks, and these typically have low but not negligible bat roost potential. Small roosts are likely to be present and larger, more significant roosts are possible.

6.4 In summary, extensive tracts of the Site are of very low suitability for foraging with the hedgerows and small areas of wet habitat likely to be used by bats, albeit by low numbers. A number of trees have low but not negligible potential suitability for roosting and the presence of roosts is possible.

GREAT CRESTED NEWTS

6.1 The South Norfolk Claylands area is considered to be a 'stronghold' for the great crested newt[14]. The data search returned numerous records from the wider landscape, such as south Wymondham, Great Melton and north of Little Melton and further afield. The 2010 surveys included an extensive suite of direct surveys, covering all ponds within the previous survey area, and a 500m buffer (with only a few ponds having access refused). The surveyed ponds are shown in Figure 4.

6.2 Great crested newts were recorded from two areas in 2010:

- To the west there was a moderate population, with a cluster of ten ponds likely to form a diffuse population in this area.

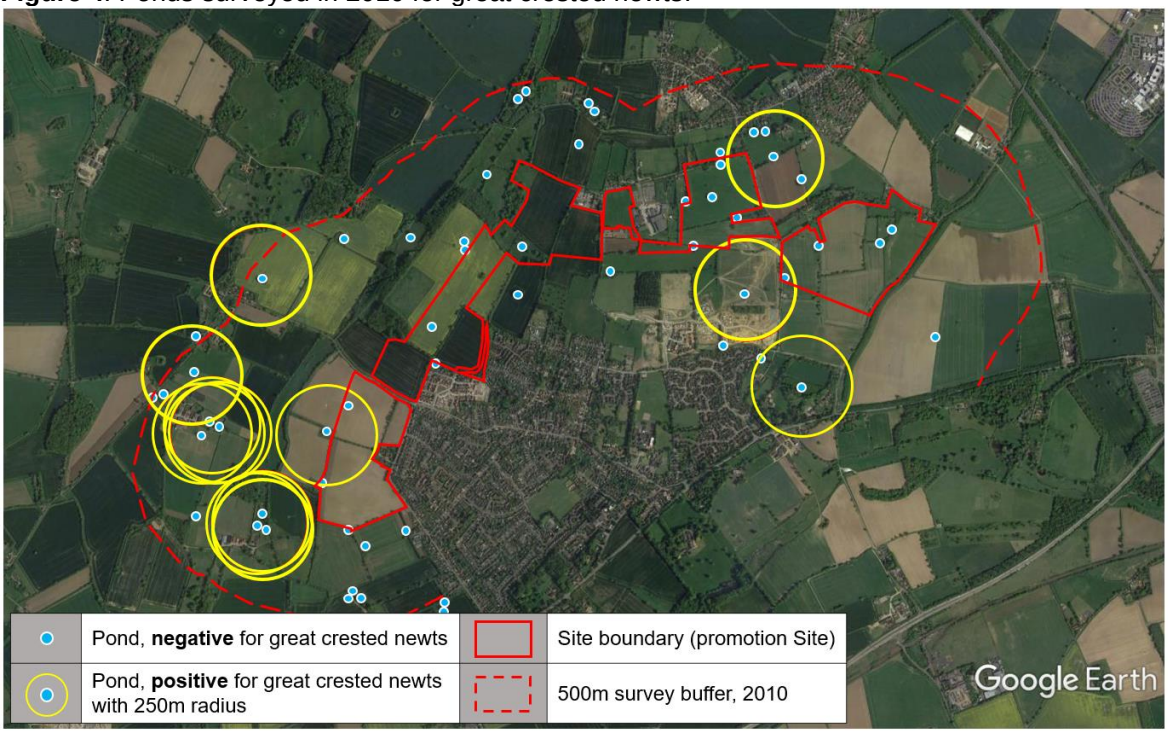
- To the east, within and close to the Site boundary, is a cluster of ponds with typically low numbers of individuals recorded in any individual pond. An isolated off-Site pond close to the south-east boundary supported a 'moderate' population.

6.3 The distribution of great crested newts as recorded in 2010 is likely to be similar to the current distribution, with only minor changes to occupied / unoccupied ponds within these two clusters. It is unlikely that ponds away from these clusters will have been colonised. Mitigation of impacts on great crested newts would be feasible: firstly, via scheme design and creation of green space areas, and second, if required, via appropriate working methods.

[13] http://www.batsurvey.org/

[14] Natural England (2014) loc. cit.

Figure 4. Ponds surveyed in 2010 for great crested newts.



BIRDS

6.4 The data search returned a diverse range of species records, including a number unlikely to be relevant, such as great white egret and species with strong association with wetland areas. Included on the search are species potentially likely to overwinter on arable farmland and utilise open fields and hedgerows / verges for nesting:

- Overwintering species: lapwing, herring gull, lesser black-backed gull and passerines, namely skylark, and yellowhammer;
- Nesting in open fields: skylarks; and
- Nesting in hedgerows and field margins: grey partridge, turtle dove, willow warbler, dunnock, mistle thrush, song thrush, bullfinch, linnet, spotted flycatcher, yellowhammer and reed bunting.

6.5 Species of conservation concern recorded by the 2010 breeding bird surveys on-Site were: dunnock, yellowhammer, skylark, song thrush and bullfinch. The wintering bird surveys generally recorded low numbers of individuals of species of conservation concern, with 16 such species in total. It is likely that the current Site has similarly small assemblages of breeding and wintering species.

6.6 The on-Site habitats appear to be of lower value for many species, lacking winter stubbles, seed-rich margins and particularly dense hedgerows. Thus, the nesting species are likely to comprise common and also declining but widespread species, mainly associated with hedgerows and with low numbers and densities of skylarks on the arable fields.

REPTILES

6.7 The data search returned records for common lizards from development sites around Norwich and Wymondham and numerous records of grass snakes from the river valley areas.

6.8 Arable landscapes typically support few if any reptiles and the 2010 surveys did not record any reptiles. Although reptiles cannot be scoped-out entirely, and vagrant grass snakes are certainly possible, if there is a resident population of reptiles then it is likely to be small and of restricted occurrence. The mitigation of impacts would be feasible for reptiles, via scheme design and working methods if required.

SMALL MAMMALS

6.9 Small mammals are assessed as follows:

- Badgers, numerous records from countryside to the north and also as roadkill on the A11 and A47, but none within 500m. No evidence was found and they are considered to be absent.
- Otters and water voles are known from numerous records along the River Yare and associated areas, but there are no records of water voles. There are no streams or ditches on-Site and both species are considered absent.
- Brown hares are reported widely from open countryside within the 5km data search radius, and low numbers were recorded by the 2010 surveys. It is likely they are present in low numbers.
- Hedgehogs are known widely locally, including from nearby residential areas. The hedgerows and field margins will offer shelter and foraging habitat and they are probably present in low numbers.

INVERTEBRATES

6.10 Records for 99 species of invertebrate of conservation concern were returned from within 5km, comprising records of species collected from incidental recording and also regular moth trapping stations.

6.11 These data are analysed using Natural England's *Invertebrate Species-habitat Information System*[15] (ISIS) that classifies such inventory data into standardised habitat assemblages. A number of species are scoped-out on the basis that they are dead wood specialists associated with veteran trees on the Norwich fringes such as Earlham Park. Others are scoped-out as they are 'open short sward' species found on the sandy substrates on the River Yare valley sides.

6.12 Species potentially present on-Site are 47 declining but widespread species of moth (Butterfly Conservation, 2007[16]) associated with 'arboreal foliage' and 'grassland and scrub matrix'. These species have caterpillars that are habitat generalists, with a wide range of foodplants, and it is likely that a small assemblage of these species is present.

[15] Drake C.M., Lott, D.A., Alexander, K.N.A. & Webb, J. (2007) Surveying *Terrestrial and Freshwater Invertebrates for Conservation Evaluation.* Natural England, Sheffield.

[16] Butterfly Conservation (2007) *Biodiversity Action Plan – Moths*. Available from: http://butterfly-conservation.org/files/uk-bap-species-moths-research-only.pdf

7. Evaluation

STRATEGIC GREEN INFRASTRUCTURE

7.1 A key policy requirement locally is the provision of green infrastructure to maintain and enhance habitat connectivity across the landscape. The Site is particularly relevant to a proposed local green infrastructure corridor that crosses Hethersett and the Site, to link to a corridor that runs from Wymondham to Norwich.

HABITATS OF PRINCIPAL IMPORTANCE

7.2 In general, the Site is typical of lowland farmland, with large fields of arable cropland with partial boundary hedgerows and smaller patches of other habitats. The following habitat is considered to qualify as a Habitat of Principal Importance (Maddock, 2011[17]):

- Hedgerows, of which the majority will qualify by satisfying the criterion of >80% native woody species. Several lengths are likely to qualify as Important Hedgerows under the Hedgerow Regulations.

7.3 Further assessment would be required to determine the status of:

- Ponds. To qualify they should be of high ecological quality, most likely achieved here by supporting great crested newts.
- The Beckhithe Meadow CWS is not assessed for its habitats. It may variously qualify as grassland or fen habitat.

SCOPING FOR SPECIES OF CONSERVATION CONCERN

7.4 The Site appears to be 'typical' of farmland habitat, with some extensive tracts of open arable fields and limited lengths of boundary hedgerows and other habitats. The assemblages of species of conservation concern are likely to be relatively species-poor and with low numbers. Notwithstanding any legal protection to individual species, it is likely that the Site is of relatively low ecological value and with the species present likely to be in low numbers and as part(s) of larger local population(s). The protected species scoping is summarised below (Table 4).

Table 4. Summary of ecology assessment.

Feature	Description	Assessment
Bats	Foraging habitat largely restricted to hedgerows and smaller wetland areas Hedgerow trees with low roost potential.	Likely to support foraging bats in low numbers and with a moderately-rich assemblage. Roosts possible in hedgerow trees.
Great crested newts	2010 surveys identified two clusters of occupied ponds: one close to the western boundary and within and adjacent to the eastern end of the Site.	Population likely to be similar to that reported previously.
Birds	Hedgerows and verges relatively sparse and not suitable for some species. Arable verge habitat of low quality, lacking weed- and herb-rich margins. Open fields suitable for skylarks.	Nesting likely in hedgerows and also open fields by common and also widespread, declining species. The assemblage is likely to be small and with low densities.
Reptiles	No local records and none found in 2010. Habitat of generally low quality.	Potentially present.

[17] Maddock, A. (2011) *UK BAP Priority Habitat Descriptions*. Available from: http://jncc.defra.gov.uk/PDF/UKBAP_PriorityHabitatDesc-Rev2010.pdf

Feature	Description	Assessment
Badgers	No records from within 1km and no evidence on-Site.	Considered absent.
Otters and water voles	Only otters known within 5km, along the river valleys. No on-Site habitat.	Considered absent.
Brown hare	Numerous local records and small numbers in 2010.	Potentially present.
Hedgehogs	Known to be present locally and hedgerows and verges offer shelter and foraging habitat.	Potentially present.
Invertebrates	Specialist microhabitats generally absent.	Most likely only common and declining but widespread species present.

RECOMMENDATIONS FOR ADDITIONAL SURVEYS

7.5 The work reported here provides a strategic overview of the Site and the main ecological features. It is recommended that surveys are undertaken for: bats (roosting and foraging), great crested newts, breeding and wintering birds, and reptiles.

8. Impacts, Mitigation and Enhancements

IMPACTS

8.1 The main development parcels are on areas that are currently arable and impacts on other habitats such as hedgerows will be minor. As such it is expected that the mitigation of impacts will be achievable in most instances, through scheme design and the provision of green space with appropriate landscaping. The inclusion of semi-natural green space along the route of the green infrastructure corridor will be relevant at a strategic level.

8.2 Other potential pathways of impacts include:

- Surface water management. Potential impacts from surface water management are particularly relevant to: the unnamed tributary of the River Yare running close to the west boundary, and both Beckhithe Meadow CWS and Braymeadow CWS. Mitigation of flows and water quality will require an appropriate surface water management mitigation train (CIRIA, 2015[18]), and is considered to be achievable.
- Recreational impacts on the Beckhithe Meadow CWSs are possible, as it is used for informal recreation. Possible measures to mitigate recreational impacts include: the provision of alternative areas, and possibly visitor infrastructure on the CWS. Other CWSs in the vicinity lack public access.

8.3 It is not expected that there will be impacts on statutory sites, by virtue of distance and location.

MITIGATION

Great Crested Newts and Bats

8.4 If great crested newts are present within 250m (as is likely), then European Protected Species Mitigation Licensing may be required. However, the requirement for any specific mitigation is likely to be low, with only a relatively small part of the Site falling within these distances and mainly comprising arable cropland (and consequently of limited value as terrestrial habitat). It

[18] CIRIA C753 (2015) *The SuDS Manual*. Available from: http://www.ciria.org/Resources/Free_publications/SuDS_manual_C753.aspx

is proposed that the first stage of mitigating impacts will be via scheme design, and then using appropriate working methods as required.

8.5 Bat roosts are possibly present in hedgerow trees. As far as possible, trees with roost potential will be located within areas of green space, to limit incidental disturbance, light spill and to provide continued access to open countryside. Where impacts are anticipated on trees direct surveys for roosts should be undertaken, with possible requirements for European Protected Species Mitigation Licensing.

8.6 It is considered that the mitigation of impacts on both great crested newts and bats is feasible and realistic.

Other Species

8.7 Green space and soft landscaping are proposed as mitigation for most species, providing habitat and resources relevant to species present locally.

Construction Impacts

8.8 Direct measures to avoid impacts during construction may depend on the results of follow-up surveys, e.g. for reptiles. Generic guidance at this stage includes:

- General site clearance works should avoid the nesting bird season; and
- Measures to prevent soil and other run-off into local watercourses should be avoided, by following appropriate guidance (SEPA, 2017[19]).

ENHANCEMENTS

8.9 It is expected that there will be a net biodiversity gain as a result of the scheme. The creation of new green space areas with appropriate landscaping will be relevant both on-Site and in the context of the local green infrastructure corridors and network.

Green Infrastructure Corridors

8.10 As described, there are local green infrastructure corridors within and near the Site. These are required to enhance connectivity across the landscape by offering movement corridors for species and also habitat in their own right. Key principles for such corridors are:

- As far as possible, the corridors should offer near-continuous belts of structural planting along which species that tend not to stray from cover will fly along. This includes many bats and also birds.
- Conversely, structural planting should not form overly dense belts of trees through which many species will struggle to fly. The options are to create paths through the planting, akin to double hedgerows or by spacing trees such that gaps will be retained between individual tree canopies. Planting should also aim to provide a diversity of local conditions, from open grassland to longer grassland forming a matrix with scrub, ultimately grading into denser scrub and tree cover.
- The corridors should be as dark as possible, through a combination of reduced lighting and also structural planting to screen from light spill (Gunnell and Grant, 2012[20]).

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[19] *Guidance for Pollution Prevention Works and maintenance in or near water: GPP 5 January 2017.* Available from: http://www.netregs.org.uk/media/1418/gpp-5-works-and-maintenance-in-or-near-water.pdf

[20] Gunnell, K. and Grant, G. (2012) *Landscape and Urban Design for Biodiversity and Bats*. Bat Conservation Trust, London.

- The corridors should offer resources for a range of species, increasing the value of the corridors as stepping stones across the landscape. Examples include the provision of blossom over an extended period as required by many pollinating insects, fruit and berries in autumn for many birds, and insect food plants.

Generic Soft Landscaping

8.11 Soft landscaping is the most appropriate Site-wide enhancement, using appropriate native species and species of known wildlife value. Key points for many species groups is the need for insect prey, for bats and also for the chicks and many fledgling birds. Thus, a range of native plant types should be planted to provide a range of resources across the seasons from spring to autumn (insects and their predators), and also fruit and berry producing species in autumn and winter (birds). Such planting would also directly benefit species such as the declining but widespread moths.

8.12 For woody species appropriate for structural planting, those typical of local hedgerows (Norfolk County Council, undated[21]) are:

- Hawthorn, blackthorn, ash, maple, dogwood *Cornus sanguinea*, elm and hazel, with lesser amounts of crab apple *Malus sylvestris*, hornbeam and holly, and scattered examples of privet *Ligustrum vulgare*, oak, spindle *Euonymus europaeus*, wild cherry *Prunus avium* and guelder rose *Viburnum opulus*.

8.13 Shrubs suitable for planting within the scheme include most of the species listed for hedgerows. Small trees with smaller minimum distances to buildings include silver birch *Betula pendula*, rowan *Sorbus aucuparia*, whitebeams *Sorbus* species, and fastigiate forms of hornbeam. Within green space trees allowed to develop open growth forms typical of parkland trees would be of particular value in the medium- and long-term, with oak and beech *Fagus sylvatica* of very high value in such locations.

8.14 Within areas of grassland and SUDS features there are a number of relevant wildflower seed mixes available from commercial suppliers, including wetland and pond planting (e.g. Emorsgate EM8 meadow mixture for wetlands), wildflower swards on heavy soils (e.g. EM4 meadow mixture for clay soils and EM10 tussock mixture) and flowering lawns for areas with more intensive use and management (e.g. EL1 flowering lawn mixture).

8.15 Additional measures could include:

- Bat boxes to be erected on buildings, either as integral ‘bat tubes’ embedded within walls or as external boxes. A wide range of types are suitable[22].
- Bird boxes for locally relevant species, including swifts and house sparrows.
- Using woody material created by Site clearance to provide habitat piles in conjunction with soft landscaping and also species-specific mitigation.

[21] Norfolk County Council (undated) *Planting Hedges in Norfolk – Maintaining Regional Character*. Available from: http://www.norfolkbiodiversity.org/pdf/reportsandpublications/HedgeBookletPROOF4.pdf

[22] http://www.wildlifeservices.co.uk/batboxes.html

9. Conclusion

9.1 The Site is considered to be typical of an intensive arable landscape, mainly comprising arable farmland with hedgerows and small areas of other habitats.

9.2 Surveys in 2010 covered the current Site. Among the key findings was that great crested newts were then present close to the current western boundary and within and close to the eastern boundary. It is likely that the current distribution of great crested newts is similar, and that European Protected Species Mitigation Licensing may be a requirement. Impacts can be mitigated via scheme design to create areas of new habitat and habitat buffers, and also with the use of appropriate working methods if required.

9.3 Mature hedgerow trees are frequent and bat roosts cannot be discounted. Where possible, masterplanning should aim to avoid impacts by creating and retaining green space around these trees, but direct surveys and possible licensing may be required if there are direct or significant impacts. The mitigation of impacts is considered to be feasible.

9.4 A number of other species of conservation concern are likely or potentially present, many of which will be widespread but declining species, and present as components of larger local populations. Further surveys are recommended to provide a robust baseline for the Site, but it is thought likely that any such species will be in low numbers and the overall assemblages of species will be small.

9.5 New areas of open green space will mitigate impacts on-Site and also support the local network of green infrastructure corridors. This local network includes a green infrastructure corridor running across the Site, and it is proposed that landscaping and semi-natural green space within the western part of the Site will represent a substantial contribution to this corridor. It is expected that there will be a net ecological gain as a result of the scheme.

9.6 In conclusion, it is considered likely that ecological impacts can be successfully mitigated and that the scheme can deliver biodiversity gain via ecological enhancements relevant at both the Site-level and within the strategic context of the green infrastructure network.

10. Appendix 1: Photographs

Figure 5.
Arable field, hedgerow.

Figure 6.
Roadside hedgerow.

11. Appendix 2: Additional Data

Table 5. Details of County Wildlife Sites within 5km.

Location	Reference	Name	Description
Countryside north of Hethersett	223	Low Common	A small mosaic of grassland, fen and woodland around a stream
	226	Melton Beck	Neutral marshy grassland with a number of ponds, wet depressions and a small stream
	233	Braymeadow	A wet, unimproved neutral grassland
	2132	Beckhithe Meadow	A small meadow
Norwich fringes	2013	Twenty Acre & Bunkers Wood	High forest broadleaf plantation
River Tiffey valley bottom	165	Tiffey River Corridor	An area of woodland situated adjacent to the River Tiffey
	219	Spring Plantation	Old plantation on sloping land alongside the River Tiffey
	221	Tiffey Woods	Woodland either side of the River Tiffey
	224	Turnpike Farm Pond	A sizeable fenced-off pond surrounded by species-poor grassland
River Yare valley bottom	240	River Yare (west and east), Bowthorpe	2.9km length of the River Yare
	196	The Carrs Woodland	A large semi-natural woodland containing several ponds, fen areas and grassland
	200	Intwood Carr	A moderately large area of predominantly damp broad-leaved semi-natural carr woodland
	228	Yare Valley (Colton Wood)	Low-lying marshy grassland and tall fen
	229	Yare Valley (Marlingford Hall)	Woodland, marshy grassland and fen
	230	Yare Valley (Marlingford)	A diversity of habitats situated on flat land either side of the River Yare
	231	River Yare at Marlingford	A length of the River Yare
	232	Old Hall Meadow	A series of small semi-improved fields with associated ponds and small blocks of scrub and trees.
	235	Bawburgh/Colney Gravel Pits	A large area of flooded sand and gravel pits surrounded by unimproved neutral to acid grassland, scrub and woodland
	239	Yare Valley (Bawburgh)	A series of fields of tall vegetation with associated scrub
	276	Riding School Meadow	This site is a large area of diverse marshy grassland
	1445	Bluebell Marsh	Two areas of the floodplain
	1446	The Heronry & Violet Grove	Dense tall marsh, unimproved and semi-improved neutral grassland
	1447	UEA Marsh	Marsh within the floodplain of the R.Yare
	1448	UEA Butterfly Meadow	Scattered neutral scrub underlain by grassland

Location	Reference	Name	Description
	1449	UEA Broad	A large mesotrophic lake with limited aquatic vegetation but which has a moderately species-rich marginal vegetation.
	1450	Bowthorpe Riverside	Unmanaged floodplain marshy grassland and a small area of woodland
	1451	Earlham and Colney Marshes	An area of grazed meadowland on both sides of the R.Yare
	1457	Eaton Street Meadow	A small semi-improved meadow s
	1458	Eaton Island	An island situated between two arms of the R.Yare
	2012	Bowthorpe Marsh	A low-lying, undulating area of tall-herb fen and unimproved grassland
	2174	Pasture at Easton College	A large area of watermeadows
	2217	Softley Drive Meadow	This is a large area of wet woodland situated adjacent to the River Yare
South of A11 and Norwich - Cambridge railway line	179	Hethel Wood	Alarge area of semi-natural woodland
	187	St. Thomas' Belt	Woodland and parkland surrounding Ketteringham Hall
	188	Hethel Hall Moat	A small, shaded and partially dry U-shaped moat surrounded by grassland and woodland
	189	East Wood	A coppice woodland over damp soils
	192	Carleton Lodge Woodland	An area of neglected woodland
	194	Bean & Outer Park Woods	A large area of mixed plantation
	195	Ketteringham Hall Lake	A linear site running along a small valley bottom
	197	Foxburrow Meadow	A small L-shaped area of marshy grassland, patches of tall herb fen, scrub and scattered trees
	199	Meadow Farm Meadow	A diverse area of marshy grassland
	202	Stanfield Hall Moat	Mesotrophic water surrounding Stanfield Hall
	203	North Drive	An area of semi-natural woodland
	204	Smeeth Wood	A large area of mixed plantation wood
Wymondham fringes	205	Melton Road Meadow	A grassland site with invading scrub
	214	Moot Hill	A raised mound of semi-natural woodland

Table 6. Non-technical account of relevant national legislation and policies.

Species	Legislation	Offence	Licensing
Bats: European protected species	Conservation of Habitats and Species Regulations 2010 (as amended) Reg 41	Deliberately capture, injure or kill a bat; deliberate disturbance of bats; or damage or destroy a breeding site or resting place used by a bat. [The protection of bat roosts is considered to apply regardless of whether bats are present.]	A Natural England (NE) licence in respect of development is required.

Species	Legislation	Offence	Licensing
Bats: National protection	Wildlife and Countryside Act 1981 (as amended) S.9	Intentionally or recklessly obstruct access to any structure or place used for shelter or protection or disturb a bat in such a place.	Licence from NE is required for surveys (scientific purposes) that would involve disturbance of bats or entering a known or suspected roost site.
Birds	Wildlife and Countryside Act 1981 (as amended) S.1	Intentionally kill, injure or take any wild bird; intentionally take, damage or destroy the nest of any wild bird while that nest is in use or being built. Intentionally or recklessly disturb a Schedule 1 species while it is building a nest or is in, on or near a nest containing eggs or young; intentionally or recklessly disturb dependent young of such a species [e.g. kingfisher].	No licences are available to disturb any birds in regard to development.
Great crested newt: European protected species	Conservation of Habitats and Species Regulations 2010 (as amended) Reg 41	Deliberately capture, injure or kill a great crested newt; deliberate disturbance of a great crested newt; deliberately take or destroy its eggs; or damage or destroy a breeding site or resting place used by a great crested newt.	Licences issued for development by Natural England.
Great crested newt: National protection	Wildlife and Countryside Act 1981 (as amended) S.9	Intentionally or recklessly obstruct access to any structure or place used for shelter or protection or disturb it in such a place.	A licence is required from Natural England for surveying and handling.
Adder, common lizard, grass snake slow worm	Wildlife and Countryside Act 1981 S.9(1) and S.9(5)	Intentionally kill or injure any common reptile species.	No licence is required. However, an assessment for the potential of a site to support reptiles should be undertaken.
Scientific Interest (SSSI) It is an offence	Wildlife and Countryside Act 1981 (as amended)	To carry out or permit to be carried out any potentially damaging operation. SSSIs are given protection through policies in the Local Development Plan.	Owners, occupiers, public bodies and statutory undertakers must give notice and obtain the appropriate consent under S.28 before undertaking operations likely to damage a SSSI. All public bodies to further the conservation and enhancement of SSSIs.
County Wildlife Sites	There is no statutory designation for local sites.	Local sites are given protection through policies in the Local Development Plan.	Development proposals that would potentially affect a local site would need to provide a detailed justification for the work, an assessment of likely impacts, together with proposals for mitigation and restoration of habitats lost or damaged.