



Preliminary Ecological Appraisal

Four Candles

Chandlers Yard, Marlborough

Survey Date: 25th June 2025

Issued By:

Eco 360 Ltd

Hollinscroft House

Uttoxeter Road

Stoke-on-Trent

ST10 4LJ

Tel: 0330 133 8294

Email: info@eco-360.co.uk

www.eco-360.co.uk

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1. Introduction

1.1. Report Rationale

This report was processed on behalf of Mike Brown, with Habitect Investments Ltd. Eco 360 were commissioned to undertake a Preliminary Ecological Appraisal at Four Candles, Chandlers Yard, Marlborough, SN8 1HT (Grid ref: **SU 18772 69220**). The survey effort involved both a desktop study and field survey. The main purpose of this assessment was to identify the broad habitats (as stated in the JNCC Phase 1 Handbook) and the flora species present within the survey area, with any evidence of protected species usage and/or features of potential ecological interest also included. The field survey was carried out on the 25th June 2025. Both the surveys and the report were completed by Mr. Nathan O'Shea: BSc (Hons), Consultant Ecologist.

1.2. Site Description and Works

The site makes up ~385m² of land located just North of The High Street in the centre of Marlborough, North-East Wiltshire. Surrounding the site are areas of green garden space and scattered trees, with residential dwellings and connecting roadways. Surrounding priority habitats of interest are The Stonebridge Wild River Reserve approximately 500m East, River Kennet (SSSI) 350m South and approximately 1km South-East is the boundary of Savernake Forest (SSSI). As of the most recent survey taken on the site, it consists predominantly of bare, disturbed ground from ongoing works, with also ruderal forb, tree and a small grassland habitat.

The current proposed plans are to re-develop the land into a large residency building, with connected pathways, a privacy hedgerow and amenity grassland surrounding.



Img.1. Site

location.



Img.2. Site

within its larger environment.

2. Survey Methodology

2.1. Desktop survey

A variety of resources were used in assessing the importance of the site in the surrounding environment and local landscape from an ecological perspective. The sources used were Google Maps, Google Earth, OSMaps and National Biodiversity Network Trust (NBN). A search of other relevant nature conservation information was made through the use of the Multi-Agency Geographic Information for the Countryside (MAGIC) database.

2.2. Field survey

A Preliminary Ecological Appraisal (previously referred to as an Extended Phase 1 Habitat Survey) was carried out using the method outlined in the JNCC Handbook for *Phase 1 Habitat Survey: a technique for environmental audit (2010)*. This method aims to map and describe the broad habitat types and notable features present on the surveyed site.

As part of the field survey, the floral species will be identified and noted down. This will consider the dominant, abundant, frequent, occasional and rare (DAFOR) species within each habitat on the survey site. The impacts of the proposed development scheme will be assessed by this report.

Each habitat will be assessed for the presence and/or the potential presence of protected species. The impacts of the proposed scheme of works on all potential protected species on site will be assessed. From this, either remedial action or recommended phase 2 presence/absence surveys will be devised.

Some of the classification codes and colours listed within the JNCC handbook may have been slightly modified for this project.

Habitat Surveys can be carried out at any time of the year, with the optimal time period falling between the months of April through until September. Eco 360 feels confident that the majority of the floral species located on the site were competently identified during the survey effort. In addition to this, Eco 360 feels confident that this report reflects an accurate representation of the sites suitability for protected species to be present.

All sites surveyed by Eco 360 will be run against the relevant Local Wildlife Site Criteria to assess whether or not they meet the required standards.

3. Desktop Survey Results

3.1. Designated Sites

As the work will be kept within the site boundary, there will be no impact on statutory/non-statutory designated sites from the works planned.

3.1. Species Records

3.1.1. Amphibians

There were four species found from the study within the search radius from the site. The most notable were the Great Crested Newt (*Triturus cristatus*) and the Smooth Newt (*Lissotriton vulgaris*). These were recorded near Manton, across Bath Road.

3.1.2. Birds

The desktop study identified that there were 119 different species of bird recorded within the search area.

3.1.3. Crustaceans

There were 8 species identified during this study within the search radius.

3.1.4. Fish

This survey found 9 species of fish recorded along the River Kennet within the study radius.

3.1.5. Flora

741 different plant species have been recorded within the survey area, as identified by NBN.

3.1.6. Fungi

There were 146 species of fungi on record had been identified within the LNR and other woodland during the search.

3.1.7. Invertebrates

The study identified 562 different species of invertebrates within the search radius.

3.1.8. Mammals

Of the mammal species identified, 6 species of bat were noted within the search radius. These were the Brown Long-Eared (*Plecotus auritus*), Common Pipistrelle (*Pipistrelle pipistrellus*), Soprano Pipistrelle (*Pipistrellus pygmaeus*), Daubenton's (*Myotis Daubentonii*), Natterers (*Myotis Natereri*) and the Serotine (*Eptesicus serotinus*) were bat species showing records in the area. [REDACTED] (*Meles meles*), Otter (*Lutra lutra*), Water Vole (*Arvicola amphibius*) and Hedgehog (*Erinaceus europaeus*) have also been recorded. The majority of records have been along the River Kennet and towards Savernake Forest.

3.1.9. Molluscs

6 mollusc species have records within the search radius from the site.

3.1.10. Reptiles

There were 4 species recorded of reptiles during the study within the search area. These were the Slow-worm (*Anguis fragilis*), Common lizard (*Zootoca vivipara*) and the Grass snake (*Natrix helvetica*), with one viper (*Viperus berus*) record around Savernake Forest.

4. Field Survey

4.1. Habitats

The habitat survey identified six habitat types within the site boundaries. The phase 1 habitat map, habitat codes and target notes for the site are located within Appendix C. The following habitats were recorded on site (in habitat code order):

4.1.1. Individual Trees

One silver birch tree was located towards the North-East corner of the site. This didn't reveal any potential roosting features or nesting sites within it.

4.1.2. Tall Ruderal (C3.1)

Areas where ruderal vegetation had been established around the disturbed land from the ongoing development works. These included species such as spear thistle, ragwort, common sowthistle, nettle and sun spurge.

4.1.3. Other Neutral Grassland (G3c)

Areas of false oat-grass dominated grassland had been left towards the outskirts of the development site. These areas also had occasional nettle, curly dock and common sowthistle.

4.1.4. Modified Grassland (G4)

This was an area of grassland that had been left towards the North-West boundary of the site. It consisted of perennial ryegrass set within an area of potted plants.

4.1.5. Bar Ground (J.4)

Due to the ongoing development works, a lot of the land on-site had been disturbed, leaving behind bare substrate.

4.1.6. Urban, Developed Land; Sealed Surface (U1b)

This area consists of an existing hard-standing concrete, in which a small shed was located. The shed contained no evident PRF's, and exterior windows created an unstable environment for roosting/ nesting opportunities.

4.2. Species

4.2.1. Amphibians

There is lack of connectivity with the surrounding habitats and the site, with fencelines and roadways surrounding the site. There is also lack of suitable habitat on-site, thus the works would be of negligible potential.

4.2.2. Badger

There was no evidence of badger presence within the site or in the immediate periphery of the site. There is also a lack of connectivity due to the fenceline boundary. The works would have no impact on Badger species.

4.2.3. Bats

Neither the individual tree or the small shed possessed roosting features to consider any positive bat potential.

4.2.4. Birds

There was no evidence of any previous/ active nesting sites within the site.

4.2.5. Hazel Dormouse

No impact on Dormouse will result from the works as there was a lack of suitable habitat and connectivity.

4.2.6. Invertebrates

No invertebrate species were identified during the survey and there is a lack of suitable foraging/ breeding habitat for there to be any impact on invertebrate populations within the area.

4.2.7. Reptiles

There is neither connectivity, nor suitable habitat on site for there to be an impact on reptiles within the area.

4.2.8. Water Voles

There is a lack of habitat on site and connectivity with the nearby river Kennet. There would be negligible impact on Water voles from the proposed development.

4.2.9. White-clawed Crayfish

No suitable habitats are present on site. The risk of the proposed works is negligible to White-clawed crayfish is negligible.

4.3. Potential Impacts of the works

Based upon the results from the desktop survey, field survey and using a degree of academic supposition, the uncompensated development impacts have been summarised as follows:

- **Amphibians – Negligible**
- **Badgers – Negligible**
- **Bats – Negligible**
- **Birds – Negligible**
- **Flora – Negligible**
- **Hazel Dormouse – Negligible**
- **Invertebrates – Negligible**
- **Reptiles – Negligible**
- **Water Voles - Negligible**
- **White-clawed crayfish – Negligible**

5. Recommendations

5.1. Designated Sites

There would be no further action needed as no designated sites are within the work boundaries.

5.2. Habitats

No habitats of conservation value will be impacted by the works planned and so no further action is necessary.

5.3. Species

5.3.1. Bats

Due to the lack of potential roost features seen, no further survey effort is necessary. A lighting plan should be followed for the development regarding potential local commuting bats. This is outlined further in **Appendix G**.

5.3.2. Birds

Should any tree habitat be planned to be felled within the bird nesting season (March-September, species dependant), nesting bird checks would have to be conducted at most 24 hours prior to the felling.

5.4. Site Enhancements

For the proposed development works, the following site enhancement measures could be incorporated into the site post-development. These measures are optional but are bespoke to the site surveyed for the enhancement of biodiversity.

5.4.1. Bats

During the works, Eco bat boxes or integrated bat boxes could be installed around the building, or bat access tiling could be incorporated in the roofing of the new building. This would promote suitable roosting opportunities for crevice dwelling bat species within the local area.

5.4.2. Birds

The existing site possesses limited nesting opportunity for local bird species. Bird boxes could be installed around the building to help secure stable nesting opportunity for bird populations within the local environment.

5.4.2. Flora

Introducing native wildflower/ shrub patches to parts of the new site where possible, would promote a positive habitat within the area.

5.4.3. Invertebrates

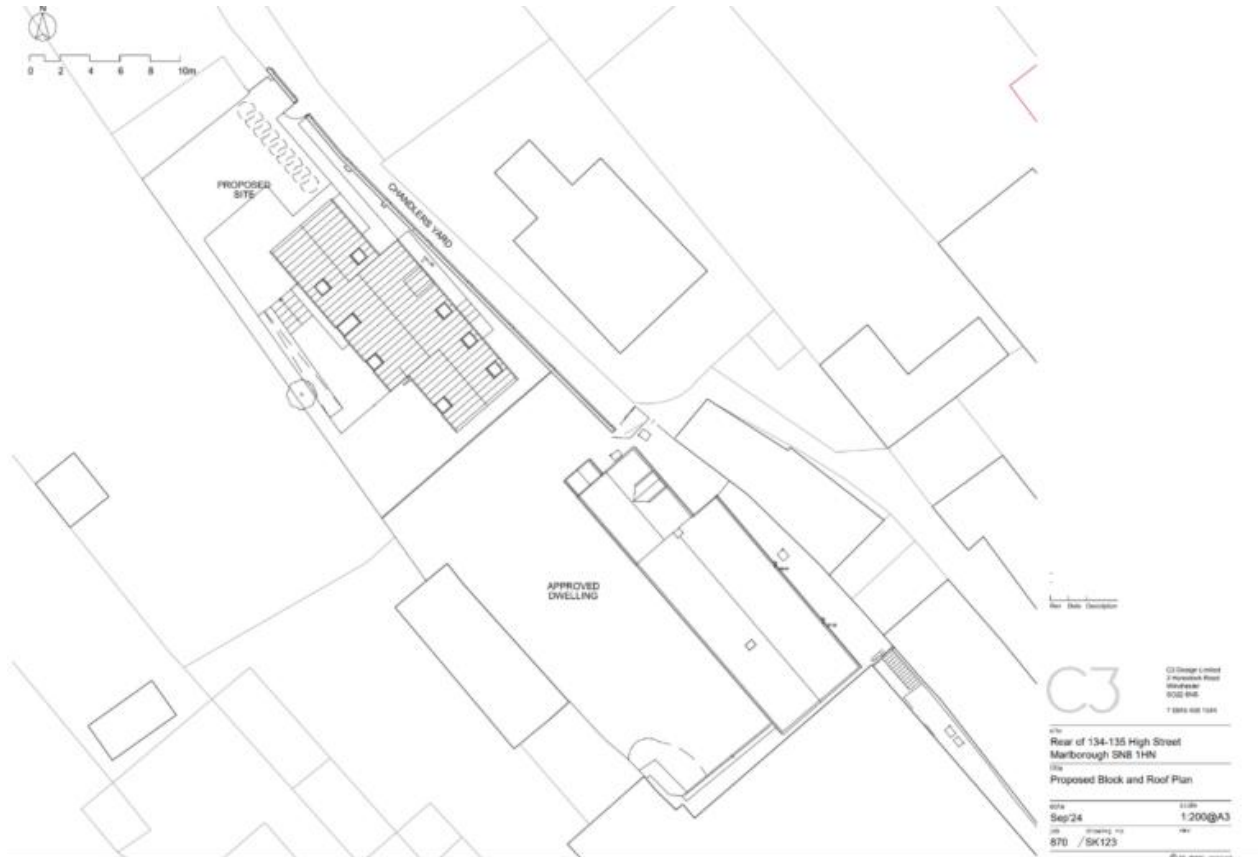
In conjunction with the wildflower planting to preserve invertebrate habitat, it is recommended that one Bumblebee Box are incorporated into the scheme. This will enhance the site for the local invertebrate populations, which will thus attract species further up in the trophic level.

6. References

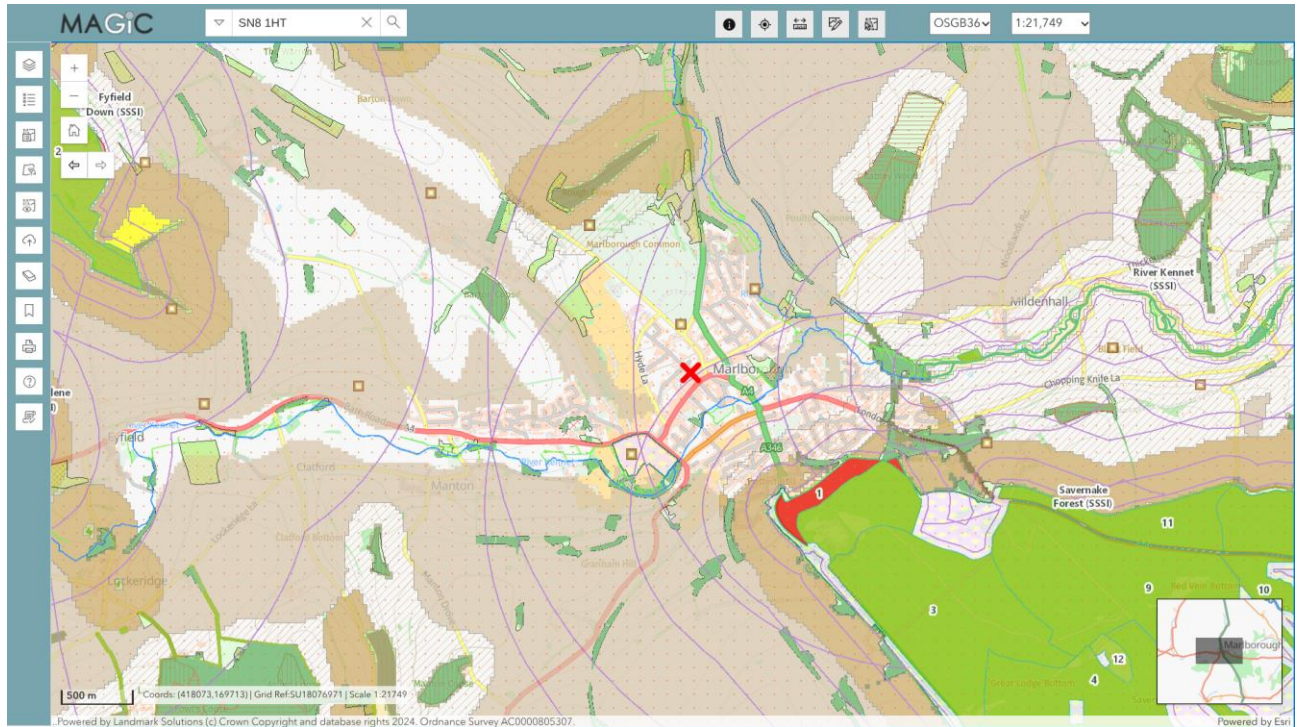
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7. Appendices

Appendix A: Site maps and plans



Appendix B: Ecological Data Search Maps



Appendix C: Phase 1 Habitat Map



Appendix D: Site Photographs



Img.1. Ongoing development and existing site habitats at the time of the most recent survey.



Img.2. Looking from the south of the site.



Img.3. North-East of site.



Img.4. Small area of developed land within the existing plans.



Img.5. Area of grassland and tall ruderal plants.

Appendix E: Biodiversity Legislation and Policy

General Legislation and Policy:

The framework of legislation and policy which underpins nature conservation in England.

This is a material consideration in the planning process in England.

Conservation of Habitats and Species Regulations 2017 (Habitats Regulations 2010 as amended)

The Conservation of Habitats and Species Regulations 2017 consolidate and update the Conservation Regulations 1994 and the conservation of habitats and species regulations 2010 (and all their amendments). The Conservation of Habitats and Species Regulations 2017 are the principal means by which the EEC Council Directive 92/43 (The Habitats Directive) as amended is transposed into English and Welsh law.

The Conservation of Habitats and Species Regulations 2017 place duty upon the relevant authority of government to identify sites which are of importance to the habitats and species listed in Annexes I and II of the Habitats Directive. Those sites which meet the criteria are, in conjunction with the European Commission, designated as Sites of Community Importance, which are subsequently identified as Special Areas of Conservation (SAC) by the European Union member states. The regulations also place a duty upon the government to maintain a register of European protected sites designated as a result of EC Directive 79/409/EEC on the Conservation of Wild Birds (The Birds Directive). These sites are termed Special Protection Areas (SPA) and, in conjunction with SACs, form a network of sites known as Natura 2000. The Habitats Directive introduces for the first time for protected areas, the precautionary principle; that is that projects can only be permitted having ascertained no adverse effect on the integrity of the site. Projects may still be permitted if there are no alternatives, and there are imperative reasons of overriding public interest.

The Conservation of Habitats and Species Regulations 2017 also provide for the protection of individual species of fauna and flora of European conservation concern listed in Schedules 2 and 5 respectively. Schedule 2 includes species such as otter and great crested newt for which the UK population represents a significant proportion of the total European population. It is an offence to deliberately kill, injure, disturb or trade these species. Schedule 5 plant species are protected from unlawful destruction, uprooting or trade under the regulations.

The Wildlife and Countryside Act (WCA) 1981 (As amended)

The WCA, as amended, consolidates and amends pre-existing national wildlife legislation in order to implement the Bern Convention and the Birds Directive. It complements the Conservation (Natural Habitats. & c.) Regulations 1994 (as amended), offering protection to a wider range of species. The Act also provides for the designation and protection of national conservation sites of value for their floral, faunal or geological features, termed Sites of Special Scientific Interest (SSSIs).

Schedules of the act provide lists of protected species, both flora and fauna, and detail the possible offences that apply to these species.

The Countryside and Rights of Way (CROW) Act 2000

The CROW Act, introduced in England and Wales in 2000, amends and strengthens existing wildlife legislation detailed in the WCA. It places a duty on government departments and the National Assembly for Wales to have regard for biodiversity, and provides increased powers for the protection and maintenance of SSSIs.

The Act also contains lists of habitats and species (Section 74) for which conservation measures should be promoted, in accordance with the recommendations of the Convention on Biological Diversity (Rio Earth Summit) 1992.

The Natural Environment and Rural Communities (NERC) Act 2006

Section 40 of the NERC Act places a duty upon all local authorities and public bodies in England and Wales to promote and enhance biodiversity in all of their functions. Sections 41 (England) and 42 (Wales) list habitats and species of principal importance to the conservation of biodiversity. These lists supersede Section 74 of the CROW Act 2000. These species and habitats are a material consideration in the planning process.

The Hedgerow Regulations 1997

The Hedgerow Regulations make provision for the identification of important hedgerows which may not be removed without permission from the Local Planning Authority.

UK Biodiversity Action Plan

The United Kingdom Biodiversity Action Plan (UKBAP), first published in 1994 and updated in 2007, is a government initiative designed to implement the requirements of the Convention of Biological Diversity to conserve and enhance species and habitats. The UKBAP contains a list of priority habitats and species of conservation concern in the UK, and outlines biodiversity initiatives designed to enhance their conservation status. Lists of

Broad and Local habitats are also included. The priority habitats and species correlate with those listed on Section 41 and 42 of the NERC Act.

The UKBAP requires that conservation of biodiversity is addressed at a County level through the production of Local BAPs. These are complementary to the UKBAP, however are targeted towards species of conservation concern characteristic of each area. In addition, a number of local authorities and large organisations have produced their own BAPs. UKBAP and Local BAP targets with regard to species and habitats are a material consideration in the planning process.

Planning Policy (England) and National Planning Policy Framework

In early 2012, the National Planning Policy Framework (NPPF) replaced much previous planning policy guidance, including Planning Policy Statement 9: Biological and Geological Conservation. The government circular 06/05: Biodiversity and Geological Conservation - Statutory Obligations and Their Impact within the Planning System, which accompanied PPS9, still remains valid. A presumption towards sustainable development is at the heart of the NPPF. This presumption does not apply however where developments require appropriate assessment under the Birds or Habitats Directives. The latest National Planning Policy Framework was updated in February 2019, with the section in relation to conserving the natural environment being located within section 15.

Section 15, on conserving and enhancing the natural environment, sets out how the planning system should contribute to and enhance the natural and local environment by minimising impacts on biodiversity and, where possible, provide net gains in biodiversity. Opportunities to incorporate biodiversity gains into a development should be encouraged. If a proposed development would result in significant harm to the natural environment which cannot be avoided (through the use of an alternative site with less harmful impacts), mitigated or compensated for (as a last resort) then planning permission should be refused.

Species Specific Legislation

This section contains a summary of legislation with relation to the species present or potentially present in the survey area. The reader should refer to the original legislation for definitive interpretation.

Nesting and Nest Building Birds

Nesting and nest building birds are protected under the Wildlife and Countryside Act WCA 1981 (as amended). Some species (listed in Schedule 1 of the WCA) are protected by special penalties.

Subject to the provisions of the act, if any person intentionally:

- kills, injures or takes any wild bird;
- takes, damages or destroys the nest of any wild bird while that nest is in use or being built; or
- takes or destroys an egg of any wild bird, he shall be guilty of an offence.

‘Reckless’ offences with regard to the disturbance of nesting wild birds included in Schedule 1 of the Wildlife and Countryside Act were added by the Countryside and Rights of Way Act 2000.

The Natural Environment and Rural Communities (NERC) Act 2006 places a duty on Government Departments to have regard for the conservation of biodiversity and maintains lists of species and habitats which are of principal importance for the purposes of conserving biodiversity in England and Wales. These lists include a number of bird species.

The reader is referred to the original legislation for the definitive interpretation.

Badger

The main legislation protecting badgers in England and Wales is the Protection of Badgers Act 1992 (the 1992 Act). Under the 1992 Act it is an offence to:

- wilfully kill, injure, take or attempt to kill, injure or take a badger;
- possess a dead badger or any part of a badger;
- cruelly ill-treat a badger;
- use badger tongs in the course of killing, taking or attempting to kill a badger;
- dig for a badger;
- sell or offer for sale or control any live badger;
- mark, tag or ring a badger; and
- interfere with a badger sett by:
 - damaging a sett or any part thereof;
 - destroying a sett;
 - obstructing access to a sett;
 - causing a dog to enter a sett; and
 - disturbing a badger while occupying a sett.

The 1992 Act defines a badger sett as: "any structure or place which displays signs indicating current use by a badger".

Bats

All species of bat are fully protected under a variety of domestic, European and international legislation and conventions. These include:

- Bern Convention (Appendix II)
- Bonn Convention (Appendix II)
- Conservation Regulations (Northern Ireland) 1995
- Conservation of Habitats and Species Regulations 2010
- Countryside Rights of Way Act 2000
- Eurobats Agreement
- Habitats Directive (Annexes IV and II)
- Habitats Regulations 1994 (as amended) Scotland
- NERC Act 2006
- Wildlife and Countryside Act 1981 (as amended)
- Wild Mammals Protection Act

In addition to this, some species have additional protection by being listed on the UK Biodiversity Action Plan (UKBAP).

The legislation afforded to bats makes it illegal to possess or control any live or dead specimens, to damage, destroy or obstruct access to any structure or place used for shelter, protection or breeding, and to intentionally disturb a bat while it is occupying a structure or place which it uses for that purpose.

All nesting birds are protected under the Wildlife and Countryside Act 1981 (as amended), which protects birds, nests, eggs and nestlings from harm. In addition to this, some rarer species, such as barn owls are afforded extra protection.

National Planning Policy Framework, Section 15:

The published framework in 2018 replaces the previous Planning Policy Statement 9 and National Planning Policy (dated 2012).

Section 15: Conserving and enhancing the natural environment reaffirms the government's commitment to maintaining green belt protections and preventing urban sprawl, retains the protection of designated sites and preserves wildlife. It also aims to improve the quality of the natural environment and halt declines in species and habitats, protects and enhances biodiversity and promotes wildlife corridors.

Biodiversity 2020:

This sets out to halt overall biodiversity loss and support healthy well-functioning ecosystems by establishing coherent ecological networks, with more and better places for nature, to the benefit of wildlife and people. The government's policy is aimed at individuals, communities, local authorities, charities, business and government, which all have a role to play in delivering Biodiversity 2020.

Freshwater White-clawed Crayfish

The white-clawed crayfish is partially protected under Wildlife and Countryside Act 1981 (as amended). It is listed on schedule 5 and therefore afforded protection under Section 9 (1 and 5). Therefore, it is an offence to take white-clawed crayfish and to sell, or attempt to sell, any part of the species, alive or dead, or intend to buy or sell.

Great Crested Newt

The great crested newt (*Triturus cristatus*) is fully protected under a variety of legislation and conventions. These include:

- Bern Convention (Appendix II)
- Conservation (Natural Habitats, &c.) Regulations 1994 (as amended)
- Conservation of Habitats and Species Regulations 2010
- EU Habitats Directive (Annex II and IV)
- Nature Conservation (Scotland) Act 2004
- NERC Act 2006 (Section 41 England; Section 42 Wales)
- Wildlife and Countryside Act 1981 (as amended)

In addition to this, the great crested newt has been listed as a priority species on the UK Biodiversity Action Plan (UKBAP).

This legislation covers all aspects of newt life stages (eggs, efts and adult newts) and makes it illegal to damage, destroy or obstruct access to any structure or place used for shelter, protection or breeding, and to intentionally disturb a great crested newt while it is occupying a structure or place which it uses for that purpose.

Licenses can be obtained from Natural England (DEFRA) under the Conservation (Natural Habitats etc.) Regulations 1994, to permit activities for the purposes of:

- Regulation 44(2)(e): Preserving public health or public safety or other imperative reasons of overriding public interest including those of a social or economic nature and beneficial consequences of primary importance for the environment, or
- Regulation 44(2)(f): Preventing the spread of disease
- Regulation 44(2)(g): Preventing serious damage to any form of property or fisheries

Or

- If there is no satisfactory alternative.

The above regulations allow people to carry out activities which would otherwise be illegal.

Hazel Dormouse

Hazel Dormouse and their habitats are protected by:

- Wildlife and Countryside Act 1981 (as amended)
- Countryside Rights of Way (CROW) 2000
- The Natural Environment and Rural Communities Act 2006
- Conservation of Habitat and Species Regulations 2010

These make it an offence to:

- Capture, injure or kill a Hazel Dormouse
- Disturb a Hazel Dormouse
- Damage or destroy breeding or nesting sites in use by Hazel Dormice
- Disturb a Dormouse whilst it is occupying a structure or place that they use for shelter or protection
- Obstruct access to any structure or place that the Dormouse uses for shelter and protection.
- To possess or control any live or dead specimens.

Otter

Otters are fully protected by the European Habitats Directive (92/43/EEC) by being incorporated in annex II of the legislation. In addition to this, otters are listed on schedule 5 of the Wildlife and Countryside Act 1981 (as amended). This makes it an offence to:

- To intentionally kill, injure or take an otter.
- To possess or control any live or dead specimens.
- To intentionally or recklessly damage, destroy or obstruct access to any structure, feature or place of shelter in use by otters.
- To intentionally or recklessly disturb an otter whilst it is in occupation of a feature or structure.
- To sell, possess or transport for the purpose of sale or publicly declare the desire to buy or sell otters.

Reptiles

All six native reptiles within Great Britain are legally protected, with the extent of protection varying dependent upon their rarity and conservation importance.

Those that receive full protection under the Wildlife and Countryside Act 1981 (as amended) are the rare sand lizard and smooth snake. These species also receive protection under the Conservation (Natural Habitats &c.) Regulations 1994 (also referred to as the Habitats Directive). This means that they are protected from deliberate disturbance, killing, injury or capture and the habitat in which they live is also fully protected against damage or destruction. Any activity involving disturbance or damage to habitats utilised by sand lizards or smooth snakes would require a licence issued by the Department of the Environment, Food and Rural Affairs (DEFRA) following consultation with the statutory nature conservation organisation (Natural England).

The remaining four reptile species are 'partially protected' under the Wildlife and Countryside Act 1981 (as amended), with these species being slow-worm, common lizard, grass snake and adder. This means that these species are protected against intentional killing, injuring and against sale, but their habitat is not protected. In planning terms this means that the presence of these species is a material consideration and there is a requirement to ensure that any reptile interest is safeguarded. If a proposed development is likely to have an impact on these reptiles, then the statutory nature conservation organisation must be notified, particularly if capture and translocation is being proposed. In some parts of the UK, sites that support common reptile species such as common lizards and slow-worms can qualify as County Wildlife Sites. Sites of this designation may receive protection in planning policy.

Water Voles

Water Voles are fully protected under the Wildlife and Countryside Act 1981 (as amended). This makes it an offence to:

- To intentionally kill, injure or take a water vole.
- To possess or control any live or dead specimens.
- To intentionally or recklessly damage, destroy or obstruct access to any structure, feature or place of shelter in use by water voles.
- To intentionally or recklessly disturb a water vole whilst it is in occupation of a feature or structure.
- To sell, possess or transport for the purpose of sale or publicly declare the desire to buy or sell water voles.

Non-Native Floral Species

It is an offence under schedule 9 of the Wildlife and Countryside Act 1981 (as amended) to plant or otherwise cause non-native flora to grow in the wild. This includes the

transportation of earth that has previously had non-native species growing and includes the spread of the species.

All stands of non-native floral species need to be disposed of safely at a licenced landfill site according to the Environmental Protection Act (Duty of Care) Regulations 1991.

Appendix G: Bats and Artificial Lights

Artificial lighting is known to affect bat's roosting and foraging behaviour, with lighting resulting in a range of impacts that includes roost desertion (BCT, 2009), delayed emergence of roosting bats (Downs et al., 2003), increased activity of some bat species and decreased activity by others (Stone et al., 2012).

An experimental approach using LED units, demonstrated that relatively fast-flying bat species, including the common pipistrelle, showed no significant impacts as a result of new artificial lighting, even when lighting was set at relatively high levels close to 50 lux. In contrast, slow flying bats such as the myotis bats (*Myotis* spp.) showed sharp reductions in presence, even at low light levels of 3.6 lux (Stone et al., 2012).

Current recommendations for all bat species specifies that no bat roost should be directly illuminated.

Due to the impacts of lighting, mitigation and sensitive lighting design schemes are required for projects where bats are present. These should include bat friendly lighting plans that should aim to avoid lighting wherever possible. If this is not possible, then the minimisation of any lighting impacts is required by adopting the following measures:

- To introduce lighting curfews or use of PIR sensors.

Lighting curfews can be an effective way of avoiding impacts on bats. These curfews may involve either turning off lighting or dimming light units at specific times of the night, dimming units at key times of the year, providing the luminaire allows for this option via a control unit. Lighting to be triggered by PIR sensors can be expected to be illuminated only when required and for a low proportion of time.

- To consider no lighting solutions where possible.

Options such as white lining, good signage and LED cat's eyes should be considered as preferable. Reflective fittings may help make use of headlights to provide any necessary illumination in some areas.

- To use only high pressure sodium or warm white LED lamps where possible.

High pressure sodium and warm white LED lamps emit lower proportions of insect attracting UV light than mercury, metal halide lamps and white LED lighting. Generally, lamps should have a lower proportion of white or blue wavelengths, with a colour temperature <4200 kelvin recommended (BCT, 2014).

- To minimise the spread of light.

The light spread should be kept at or near horizontal to ensure that only the task area is lit. Flat cut-off lanterns or accessories should be used to shield or direct light to where it is required. Baffles, hoods, louvres and shields should be used where necessary to reduce light spill.

➤ To consider the height of the lighting column.

While downward facing bollard lighting is often preferable, it should be noted that a lower mounting height does not automatically reduce impacts to bats as bollard lighting can often be designed to provide up-lighting. Where bollard lighting is considered to be the most appropriate system, bollard spacing or unit density should be kept to a minimum and units should be fitted with the appropriate hoods/deflectors to reduce any up-lighting.

➤ To avoid reflective surfaces below lights.

The polarisation of light by shiny surfaces attracts insects increasing bat activity (BCT, 2012). Consequently, surface materials around lighting require consideration.

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