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Updated Ecological Impact Assessment

Land at Yapton Road, Barnham

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Project No: P2942

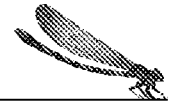
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1.1	13/03/20	Update	SB	



Report Summary

1. The Ecology Co-op has been commissioned by Orchestera (Special Projects 1) Ltd to undertake a updated Preliminary Ecological Appraisal at Yapton Road, Barnham following on from a site visit conducted in 2015. A site walkover survey visit was carried out on the 18th of March 2019 to evaluate the site for changes to habitats and assess their potential to support EU and UK protected/notable species. The purpose of this report is to record the findings of the survey and identify any new potential ecological constraints to a proposed nursing home.
2. This survey was undertaken by Sophie Bradfield BSc.
3. The site consists of sheep-grazed pasture which is situated within a semi-rural context. The site includes species-poor hedgerow, scattered trees, and improved grassland. Adjacent habitats include two ponds and tall grassland habitat.
4. No further surveys have been recommended, as impacts to protected species have been confidently discounted from within the site boundaries. The hedgerow which will be severed for site access has potential to support small numbers of breeding birds, hedgehogs, reptiles and/or great crested newts and therefore mitigation has been outline to ensure there is not a breach of the Wildlife and Countryside Act.
5. The following mitigation and compensation measures must be implemented in full in order for the development to have a positive impact at the site level:
 - Any scattered trees removed to be replaced at a ratio of at least 2:1.
 - A sensitive lighting scheme implemented for bats following Bat Conservation Trust guidance.
 - New species-rich hedgerow planted along the west, north and east boundaries.
 - Vegetation removal should be timed outside of the nesting bird season unless searched by a suitably qualified ecologist and no nests are found.
 - Hand search of the hedge prior to removal for reptiles, great crested newts and hedgehogs.
 - A two phase strim followed by continued mowing to keep the grass short followed by reptile fencing to act as a physical barrier.
 - Any fencing should incorporate hedgehog doors.
6. The landscape plan currently includes a variety of native planting, including the SUDs areas, hedgerows, trees and sedum roofs. Enhancements have been detailed in section 5 and will likely result in a positive impact at the site level including wildflower creation and bat, bird and hedgehog boxes around the site.



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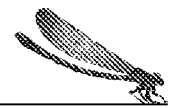


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1 INTRODUCTION

1.1 Purpose of the Report

The Ecology Co-op has been commissioned to undertake an Ecological Appraisal of Yapton Road, Barnham, West Sussex by Orchestra (Special Projects 1) Ltd. This report presents the findings of a walkover survey undertaken by Sophie Bradfield BSc on 18/03/2019. It provides details on the potential for any protected species and/or habitats to be present at the site and an assessment of the potential ecological constraints and opportunities to the proposed development of a new nursing home. Recommendations for further surveys that are likely to be required to inform a planning application and Ecological Impact Assessment (EclA) of the proposal are provided where necessary, and measures to avoid, mitigate and/or compensate for adverse impacts and effects are outlined.

1.2 Background

The site is located land north of Yapton road, Barnham. The central grid reference for the site is SU 96661 04066.

The development area comprises a small one-hectare site of predominantly sheep-grazed pasture with fence-lined boundaries, which include a single south-facing hedgerow, and small area of scattered trees. The site is situated in a semi-rural location with further unmanaged grassland immediately north, residential dwellings south, east and west and the wider landscape includes hedge-lined arable fields and small woodland blocks (see Figure 1)

The proposed project includes development of the site to support a new nursing home with assisted living units. Included in the design is site access via a severance in the hedge which will be approximately 19m wide and the visibility splay either side will take approximately 20-30m (although this will be either replanted or moved backwards away from the road), see Figure 2.



Figure 1. An aerial image showing the location of the site. The approximate site boundary is outlined in red. Images produced courtesy of Google maps (Map data ©2019 Google)



Figure 2. The site plan produced by Richard Clark Chartered Architects. Drawing No. 1693/SP1. July 2019.



1.3 Policy and Legislation

Legal protection applying to relevant bird, mammal, herpetofauna and invertebrate species and current nature conservation planning policy is outlined in Appendix 1 of this report.

Where possible this report has provided guidance on how the proposal can be designed to meet the requirements of both local planning policy and the National Planning Policy Framework (NPPF). Details of the NPPF can be found in Appendix 1 and relevant local planning policy by Arun District Council is provided in Appendix 4.

2 METHODOLOGY

The methodologies used for this survey are in accordance with the Guidelines for Preliminary Ecological Appraisal (CIEEM 2017)¹, but also considers the Guidelines for Ecological Report Writing, Second Edition (CIEEM 2017)² and the Guidelines for Ecological Impact Assessment in the UK and Ireland (CIEEM 2018)³.

2.1 Desk Study

Whilst a full biodiversity record search was not considered appropriate for this update, records for relevant habitats and species have been obtained from an ecological report produced in 2018 by The Ecology Co-op for a property that lies 80 metres west of the survey area. The records are from the Sussex Biodiversity Record Centre (SxBRC) within a radius of 1km of the site. This report is publicly available via the Arun Public Portal⁴.

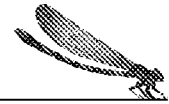
To update previous records, a search of on-line mapping resources was undertaken to identify the location of any features of potential ecological interest including ponds within 500m (relevant to great crested newts *Triturus cristatus*), watercourses (relevant to riparian mammals and crayfish) and connectivity to woodland, scrub, and hedgerow networks (relevant to bats, dormice *Muscardinus avellanarius*) in the wider landscape around the site. The connectivity of the site to these features, buildings, and other semi-natural habitats such as grassland and heathland are also relevant to bats, great crested newts and reptiles.

The MAGIC website resource (www.magic.gov.uk) was used to identify the location of designated sites

¹ CIEEM (2017). *Guidelines for Preliminary Ecological Appraisal, 2nd edition*. Chartered Institute of Ecology and Environmental Management, Winchester.

² CIEEM (2017). *Guidelines for Ecological Report Writing, 2nd edition*. Chartered Institute of Ecology and Environmental Management, Winchester.

³ CIEEM (2018). *Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine*. Chartered Institute of Ecology and Environmental Management, Winchester.



for nature conservation and European Protected Species (EPS) licences granted in relation to the survey site.

2.2 Field Survey

A site walkover survey was undertaken on 13/05/19, during which the habitats contained within the site were described and evaluated, and cross-referenced with findings of previous surveys (2015). All habitat types within the site, together with dominant species and indicator species of important habitat types were recorded.

Site features were evaluated for their potential to support legally protected species and/or species of conservation interest. In addition, observations of any important plant communities, bird assemblages or other potentially valuable ecological features were recorded.

Details of the preliminary survey methods for each legally protected species are given below. Any site specific limitations to the survey, e.g. access constraints or seasonal constraints are set out in section 3.11.

2.3 Badgers

The walkover survey included a comprehensive search for evidence of badger activity, for example setts, footprints, latrines, well-worn paths, and foraging marks. Special attention was paid to boundary features such as hedgerows, woodland edge, earth banks, and fence lines, where signs of badger activity is often concentrated. The methodology follows that of Harris et al 1989⁴.

2.4 Bats

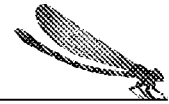
Bats can use a wide range of features for roosting purposes, including loft spaces, cavity walls, loose tiles, mortice joints and cracks/gaps in a variety of built structures. They can also be found in trees with holes, splits, cracks, cavities, ivy, and loose bark.

Trees, buildings, and other structures were broadly assessed for their potential to support roosting bats and further surveys are recommended as appropriate.

The potential for roosting bats for each feature, or group of features was assessed as either negligible, low, moderate, or high, in accordance with the Bat Conservation Trust Survey Guidelines (Collins, J.(ed.) (2016)⁵. Any evidence confirming the presence of bats that was found was clearly recorded including photos and samples (e.g. droppings) where appropriate.

⁴ Harris, S, Cresswell, P. and Jefferies, D. (1989). *Surveying Badgers*. Mammal Society.

⁵ Collins, J.(ed.) (2016). *Bat Surveys for Professional Ecologists: Good Practice Guidelines* (3rd edn). The Bat Conservation Trust, London.



The site was also assessed for its potential to support foraging and/or commuting bats and further surveys recommended where necessary.

2.5 Breeding Birds

Birds can use a wide range of natural and artificial habitats when breeding, including trees, hedgerows, fields, houses and garden sheds. The habitats contained within the site and adjacent areas were broadly assessed for their potential to support important bird species/assemblages, and breeding birds. Any birds identified during the site visit were recorded. Special attention was paid to notable species such as red-listed Birds of Conservation Concern (Eaton *et al.* 2015)⁶ and those species afforded special protection on Schedule 1 of the Wildlife and Countryside Act (1981). Further surveys are recommended as appropriate.

2.6 Dormice

Dormice are found in deciduous woodland and hedgerows, feeding on flowers, pollen, fruits, insects and nuts, favouring hazel *Corylus avellana* and honeysuckle *Lonicera periclymenum* for food and as bedding. The site was broadly assessed for its potential to support dormouse. This included use of on-line mapping resources to assess the surrounding area for connectivity to large blocks of woodland, scrub and extensive hedgerow networks.

Further surveys are recommended as appropriate in accordance with best practice guidance (Bright *et al.* 2006)⁷.

2.7 Great Crested Newt

Great crested newts breed in ponds during the spring and spend the rest of the year feeding on invertebrates in woodland, hedgerows, marshes and tussocky grassland. A desk study was undertaken to identify ponds and wet ditches within 500m of the site that might support breeding great crested newts. Where access permission was granted, or ponds could be viewed from public roads or footpaths, the ponds were assessed for their potential to support great crested newts using the Habitat Suitability Index (HSI) (Oldham *et al.* 2000)⁸. The value of the site for terrestrially foraging great crested newts and any features that might be used by hibernating newts has also been assessed.

Further surveys are recommended as appropriate, in accordance with best practice guidance (English Nature 2001)⁹.

⁶ Eaton, M., Aebischer, N., Brown, A., Hearn, R., Lock, Leigh., Musgrove, A., Noble, D., Stroud, D., Gregory, R. (2015) *Birds of Conservation Concern 4: the population status of birds in the UK, Channel Islands and Isle of Man*. British Birds 108, pp 708-746.

⁷ Bright, P., Morris, P. and Mitchell-Jones, T. (2006). *The dormouse conservation handbook 2nd Ed.* English Nature, Peterborough.

⁸ Oldham, R.S., Keeble, J., Swan, M.J.S. and Jeffcote, M. (2000). Evaluating the suitability of habitat for the great crested newt (*Triturus cristatus*). *Herpetological Journal* 10, 143-155.

⁹ English Nature (2001). *Great Crested Newt Mitigation Guidelines*. English Nature, Peterborough.



2.8 Reptiles

Habitats on the site were broadly assessed for their potential to support reptiles. Particular attention was paid to those features that provide suitable basking areas (e.g. south-facing slopes), hibernation sites (e.g. banks, walls, piles of rotting vegetation) and opportunities for foraging (rough grassland and scrub). The common lizard *Zootoca vivipara*, slow-worm *Anguis fragilis* grass snake *Natrix helvetica* and adder *Vipera berus* are widespread species that can be found in any of these habitats, whereas smooth snake *Coronella austriaca* and sand lizard *Lacerta agilis* have much more restricted and isolated populations on lowland heathland and sand dunes.

2.9 Other Notable Species

The site habitats were broadly assessed for their potential to support species of principal importance for nature conservation (Section 41 NERC Act 2006) and other notable species. This includes mammals such as harvest mouse *Micromys minutus*, hedgehog *Erinaceus europaeus*, brown hare *Lepus europaeus*, and many bird species. The site was broadly assessed for its potential to support important invertebrate assemblages with particular attention paid to features such as standing dead-wood, wet flushes, bare earth banks and botanically rich areas.

3 BASELINE CONDITIONS

3.1 Designated Sites and Granted EPS Licences

There are no designated sites within 1km of the site. A small area of ancient woodland exists at approximately 1km north of the site. There are no granted EPS licences for mitigation projects within 1km of the site boundaries.

3.2 Habitats

The original PEA and Phase 1 Habitat Survey conducted in 2015, mapped three habitat types: poor semi-improved grassland, species-poor intact hedge and coniferous scattered trees, with three hawthorn *Crataegus monogyna* trees and a blackthorn *Prunus spinosa* target noted. The report highlighted the potential for nesting birds and foraging bats to be supported by the site, which was reflected in the mitigation and enhancements outlined in the report⁵.

Table 1 below lists the current Phase 1 Habitat categories found at the site, with target notes on specific features of interest and the general species composition. The Phase 1 Habitat Map for the site and key to the standard mapping symbols used are presented in Figures 3 and 4.

**Table 1.** The Phase 1 habitats contained within the site.

Habitat type	JNCC Code	Area(ha)/ length (m)	Target note including general species composition
Improved grassland	B4	1 ha	Over 50% comprised of agricultural grasses including barren brome <i>Bromis sterilis</i> , perennial ryegrass <i>Lolium perenne</i> , Yorkshire fog <i>Holcus lanatus</i> , meadow sp. <i>Poa</i> , stands of creeping thistle <i>Cirsium arvense</i> and nettle <i>Urtica dioica</i> exist here indicating local improvement. Herbacious species include vetch sp <i>Vicia</i> , forget-me-not <i>Myosotis</i> , cleavers <i>Galium aparine</i> , cranes bill sp <i>Geranium</i> , and common mouse-ear chickweed <i>Cerastium fontanum</i> .
Species-poor intact hedge	J2.1.2	111m	Below 5 no. woody species, categorising it as 'species-poor', these include: hazel <i>Corylus avellana</i> , elder <i>Sambucus nigra</i> , hawthorn, blackthorn and non-woody species include bramble <i>Rubus fruticosus</i> . The understory is dominated by nettle and cleavers.
Coniferous scattered trees	A3.2	21m	South-west edge: several mature conifer trees <i>Pinophyta</i> , one semi-mature elder, with an understory of nettles and bramble.
Broadleaved scattered trees	A3.1	N boundary: 0.5 m E boundary: 15m	Northern edge: a single hawthorn bush. East boundary: hawthorn, hazel coppice, white poplar <i>Populus alba</i> and rose species <i>Rosa</i> , all of which semi-mature.
Fence	J2.4	448m	A wooden fence exists along north, east and southern boundaries. A wire-mesh fence lines the western boundary.



Figure 3. Phase 1 Habitat map of land at Yapton Road.

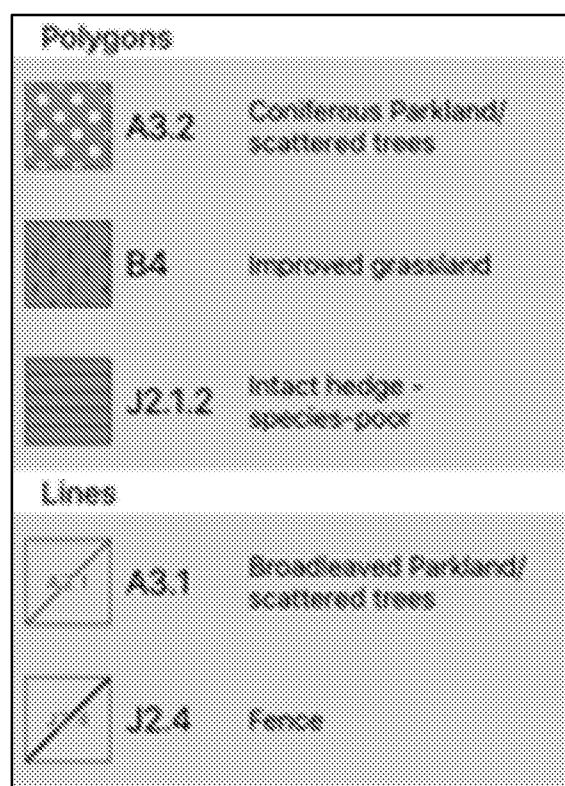


Figure 4. Key for Phase 1 Habitat map



Photographs 1 – 3: Left: improved grassland, middle: species-poor intact hedge, right: coniferous scattered trees.

3.3 Badgers

No signs of any badger activity were identified during the survey assessment, though there are habitats of value for this species within the site and surrounding landscape. It is likely that if any setts were situated within 30m of the site boundary, then some evidence of badger activity would have been observed.

Records of badgers are not provided by the records centre, due to the sensitive nature of this information.

3.4 Bats

Several tree species, which were not identified in the 2015 report, were identified in the updated PEA, suggesting recent planting. None of the trees or hedges identified were considered suitable to support potential roosting features, however, the trees and the hedges which exist on the site provide commuting and foraging habitat for bats.

SxBRC provided 17 bat records in the search area, comprising of 7 identified species. The species include: serotine *Eptesicus serotinus* – one record, common pipistrelle *Pipistrellus pipistrellus* – four records, soprano pipistrelle *Pipistrellus pygmaeus* – one record, brown long-eared bat *Plecotus auritus* – one record, long-eared bat *Plecotus* – two records, Nathusius pipistrelle *Pipistrellus nathusii* – one record, noctule *Nyctalus noctula* – one record, western barbastelle *Barbastella barbastellus* – five records, and one unspecified bat record. The closest record refers to a brown long-eared bat, dated 1/6/2017, located 180m south-west of the site, and a soprano pipistrelle bat dated 3/10/2015. The exact location of the Barbastelle records were not provided by the records centre but were situated within the parish of Barnham⁴.

3.5 Breeding Birds

All of the hedge and trees have potential to support nesting birds. A single pigeon *Columbidae* nest was identified in an elder tree within the hedgerow during the survey.

SxBRC provided numerous bird records for the search area concerning a total of 107 species. The



majority of the records returned were waterfowl and are not relevant to the proposed development site. However, the following S41 species could potentially breed in the hedgerow: dunnoek *Prunella modularis* and song thrush *Turdus philomelo*.

3.6 Dormice

The site contains no woodland, scrub or hedgerows suitable for hazel dormice *Muscardinus avellanarius* and lacks connectivity to other suitable habitats. Therefore, the species is highly unlikely to be present.

3.7 Great Crested Newts and other Amphibians

Although no ponds were identified in the 2015 report, the current assessment identified four ponds within 500m of the site, two of which (Ponds 1 and 2) exist in the garden immediately west of the site and were assessed for their suitability to support great crested newts. The third exists approximately 210m east of the site and a fourth pond was identified 110m south of the site, but neither could be accessed at the time (see Figure 5). The report for land 80m west of the proposed development site includes a Habitat Suitability Index survey for Pond 4 and the information has been reproduced here.

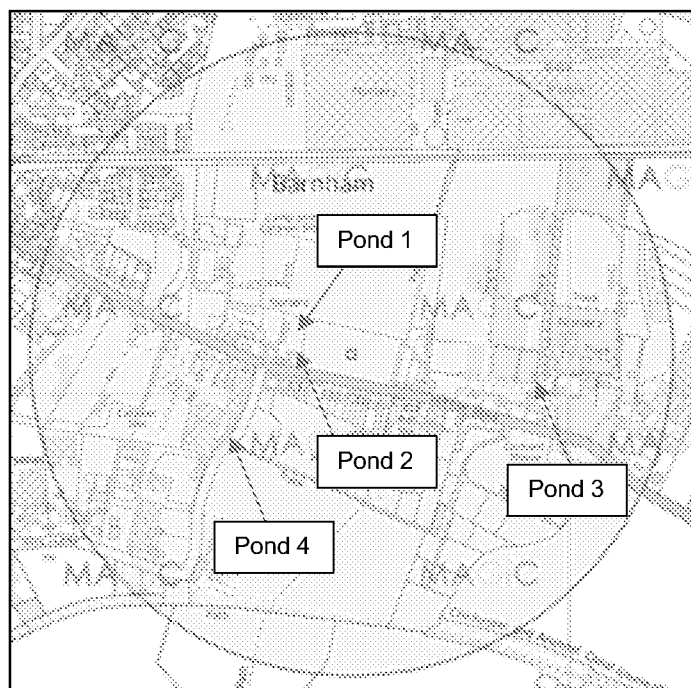


Figure 5. Map of pond locations. The site is represented by the red square.

Overall, Pond 1 had an HSI value of 0.59 and was rated as 'below average' suitability. Pond 2 scored of 0.30 and is considered to have 'poor suitability'. Pond 3 could not be assessed due to access limitations. Pond 4 had a score of 0.55 with below average suitability⁷. (See Appendix 2 for detailed pond descriptions and HSI results.)

SxBRC provided 14 amphibian records in the search area. This included two records for great crested



newt, two records for smooth newt *Lissotriton vulgaris*, six records for common frog *Rana temporaria* and four records for common toad *Bufo bufo*. The closest of these was a record for a great crested newt male 500m north from the boundary of the site, dated 14/05/2012⁷.

It is considered unlikely that great crested newts are present at the survey site due to the short and uneven length of the sward structure and low suitability of the surrounding ponds. However, there is low potential for amphibians to be using the hedgerow.

3.8 Reptiles

The grassland habitat along the edges of the site adjacent to the boundaries, provide suitable habitat for common reptile species, particularly common lizard *Zootoca vivipara* and slow worm *Anguis fragilis*. The hedgerow along the southern boundary provides a hibernaculum and a commuting feature. Despite this, the majority of the site comprises of grazed grassland, with bare areas and a maximum height of 10cm, which is unlikely to support reptiles given the amount of suitable habitat existing north of the site.

The initial PEA and Phase 1 Habitat Survey confirmed suitability for reptiles⁵, therefore a presence/likely absence survey was conducted between April and May 2015. This confirmed a low population of slow worms at the site, with a peak count of one slow worm along the eastern boundary by the public footpath, within the dense grass¹⁰.

Additionally, SxBRC provided 86 reptile records in the search area including records for slow worm, grass snake *Natrix helvetica* and common lizard. The closest of these is 320m north-west from the boundary of the site and includes common lizard, grass snake and slow worm, dated April 2011⁷.

3.9 Invasive Non-native Species

No evidence of invasive non-native species was found during the walkover survey.

3.10 Other Notable Species

3.10.1 Hedgehogs

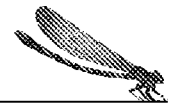
Although no background data exists to support the presence of European hedgehogs *Erinaceus europaeus* on this parcel of land, the hedgerows would provide suitable cover for hedgehogs.

SxBRC provided multiple records of the European hedgehog with one 70m south-west of the site, dated 2003. A more recent record was returned 550m south-west of the site dated June 2017⁷.

3.11 Survey Limitations

An initial site assessment such as this is only able to act like a 'snapshot' to record any flora or fauna

¹⁰ The Ecology Co-op (2015). *Reptile Survey Report High Fields, Yapton Road, Barnham West Sussex*. The Ecology Co-op Lodsworth, West Sussex.



that is present at the time of the survey. It is therefore possible that some species may not have been present during the survey, but may be evident at other times of the year. For this reason, habitats are assessed for their potential to support some species, even where no direct evidence (such as droppings) has been found.

Pond 3 could not be accessed; therefore it is difficult to make an accurate judgement of the presence of great crested newts. Additionally, ponds sometimes manifest themselves (or home owners create new ponds) after online mapping is updated and therefore not all ponds can be accounted for.

4 IMPACT APPRAISAL

4.1 Designated Sites

The site is outside the zone of influence from all designated sites and, based on this and the small scale of the development, there are no identified mechanisms of impact on designated sites as a result of the proposed development. Therefore, in relation to designated sites, the proposed development is considered to be not significant.

4.2 Habitats

The majority of the site is comprised of improved grassland, which is of low ecological value, with low diversity of herbaceous plants, dominated by agricultural species. The intact species-poor hedge and semi mature scattered trees is considered to be of moderate value. This hedge lies close to scattered coniferous trees. Whilst coniferous trees are of little value, they provide connective habitat to the rest of the hedge.

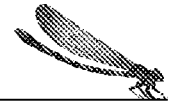
The proposed development will result in the direct loss of improved grassland for construction purposes which will cause a negative impact that is not significant at site level in the absence of mitigation. There will be a loss of a 20m section of hedge for access, resulting in a negative impact at the site level only.

To prevent accidental losses to the hedgerow during the construction phase a 5m buffer zone protected by hedges fencing will be established.

The implementation of new species-rich hedging along all boundaries will more than compensate for the loss and improve connectivity to create a positive impact at the site level for a variety of species in the long-term.

Sedum roofs and a SUDs area will be created to provide new diverse habitats and will be planted up with a native, species-rich and wildlife friendly planting mix that will have a likely positive impact at site level.

The scattered trees should be retained where possible. If a tree cannot be retained, it must be replaced elsewhere within the site with native species at a ratio of at least 2:1.



4.3 Badgers

No signs of badger activity were identified during the assessment and no badger setts are situated on or near of the proposed construction zone. No further mitigation for badgers is advised, however if any signs of digging by large animals is identified on or near to the site prior to construction, then an ecologist should be contacted for advice.

Based on the surveys findings, the proposed development is considered to be not significant for badgers.

4.4 Bats

The hedgerow and semi-mature trees are likely to be of value for foraging and commuting bats. These habitats form part of a wider resource across the landscape.

A section of the species-poor hedge will be removed for access, which in the absence of mitigation will result in a negative impact to foraging bats at the site level only.

As mentioned above, the landscaping plans include the re-planting of most of the existing southern hedgerow further back from the road, with native trees and new species-rich hedgerow planted along the other three boundaries. This, in addition to the SUDs area planted with wildlife friendly plants will likely provide a increase in foraging habitat for bats and result in a positive impact at site level for foraging and commuting bats.

Measures will be taken to avoid harsh lighting which may normally disturb foraging bats, and the low lighting proposed for the development will follow guidance produced by the Bat Conservation Trust, outlined in the initial PEA⁵. Special attention must be paid to the hedgerows at the site boundaries, which must be protected from artificial lighting with no lights shone directly onto any of the hedgerow boundaries creating a 'no-light' zone around the site (see Figure 6).

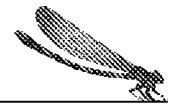
4.5 Breeding Birds

The hedgerow and scattered trees contained in the site have a high potential to support a variety of common nesting and foraging birds.

As a section of hedgerow will be removed to allow for site access, this has potential to cause a direct negative impact at the site level to breeding birds in the absence of mitigation.

It will be essential for any future development to consider the nesting bird season and any vegetation removal and/or building demolition should be timed outside of the nesting bird season (typically avoiding 1st March to 31st October), unless features are first searched by a suitably qualified ecologist 24 hours prior to clearance and no active nests are found.

In addition, the 5m buffer zone as specified in section 4.2 will serve to protect birds nests in the remaining hedge from potential disturbance.



New hedgerow planting along the north, west and east boundaries will provide an increase in nesting bird habitat. In addition, the SUDs, shrubs and sedum planting will create an increase in foraging habitat that will have a positive impact at site level for foraging and nesting birds.

4.6 Great Crested Newts

It is considered unlikely that great crested newts are present within the site given that the short, grazed improved grassland provides unsuitable habitat. However, as pond 3 could not be accessed for assessment, there is a small possibility that the odd individual newt could be present in the local surroundings and could potentially use the hedgerow along the southern boundary as part of a migration route. This would likely have a negative impact that is not significant at the site level in the absence of mitigation given that it is not the only commuting route available with rough grassland present to the north of the site.

Precautionary mitigation is recommended to reduce the potential impacts on individual newts. The improved grassland must be kept short to deter both amphibians and reptiles from using the habitat. This must include a two-phase strim undertaken at temperatures between 9 and 18 degrees, initially to a height of 10cm if necessary and a second strim as low as possible. The grassland must then be maintained at this height until construction. Following the implementation of the strimming, reptile fencing should be installed at the edges of the grassland, providing a barrier to prevent any herpetofauna from entering the site.

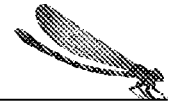
The section of hedgerow to be removed should be hand-searched for amphibians prior to removal. Removal must be in two stages, whereby the above ground vegetation is removed first, and the area below hand-searched before the stumps are excavated or pulled up under the supervision of a qualified ecologist. Hedgerow removal must be done between September and October to avoid the nesting bird season and avoid the hibernation period which runs between November and February.

The new hedgerow to be planted will provide alternative migratory routes for amphibians and reptiles. The SUDs areas including two attenuation basins and a swale will be planted with wildlife friendly plants that are beneficial to breeding amphibians (Figure 6). These additions will create a positive impact at the site level for this species in the long-term by providing hibernacula, and breeding and foraging habitat.

4.7 Reptiles

The proposed development would result in the loss of a very small amount of rough grassland, which exists at the boundaries of the site. The survey findings conducted in 2015 suggest a low population (peak count: 1) existing at the eastern boundary of the site and therefore in the absence of mitigation, the development is likely to have a direct negative impact at site level.

Precautionary mitigation involving a two-phase strim of any rough grassland as detailed above for great crested newts must be implemented to reduce the risk of individual reptiles being harmed and the improved grassland kept short until commencement of works. This must be followed by implementation



of reptile fencing, in order to prevent individuals from repopulating the site.

The hedge should be hand-searched for reptiles prior to removal in line with mitigation detailed above for newts.

The new species-rich hedgerow, tree and shrub planting and SUDs planting will result in a positive impact at site level for reptiles by creating an increase in hibernacula and foraging habitats.

4.8 Other Notable Species

4.8.1 Hedgehogs

Removal of a section of the southern hedgerow for access will impact the amount of cover available for hedgehogs. The likely impact of the removal of the small amount of hedgerow will result in a direct negative impact at the site level to hedgehog in the absence of mitigation.

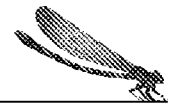
It is recommended that precautionary mitigation involves a hand search of the hedge for individuals by a suitably qualified ecologist prior to removal. Additionally the SUD's should include a small mammal ramp to allow hedgehogs to escape if they fall in.

Once established, hedgerow planting around the boundaries of the site will create an increase in available habitat for hedgehogs and create alternative commuting routes. In addition, any timber fencing erected within the site must incorporate hedgehog doors which are 13cm by 13cm holes cut into the base of a fence to allow continuous movement across the site and across the local landscape. Should all of the above measures be implemented, the development is likely to have a positive impact at site level for hedgehogs.

5 OPPORTUNITIES FOR ENHANCEMENT

The proposed development represents an opportunity for habitat enhancement to benefit a variety of wildlife. Any planting scheme will include native shrub species and flowering species known to encourage insect diversity, with invasive species avoided. Such enhancement measures are in line with the recommendations of the NPPF (See Appendix 1) and as such would be considered favourably when determining the planning application.

It is recommended that the following hedgerow, tree and shrub species are planted for their value to foraging bats and birds: beech *Fagus sylvatica*, spindle *Euonymus europaea*, holly *Ilex aquifolium*, field maple *Acer campestre* and buckthorn *Rhamnus cathartica*. In addition, species identified in the existing hedge should be included in the new planting. The added variety of species used will encourage insect diversity and over time will add ecological value to the hedgerow. It is suggested that all hedgerow is maintained at a height of 2m and 2m in width, and cut in an 'A' frame – by doing so, there will be more opportunities for sunlight to access the ground and encourage natural generation of ground flora. This will maximize opportunities for the species outlined, particularly improving connectivity of ponds and prevention of habitat fragmentation. Hedgerow should be managed outside of the nesting bird season, ideally in February to allow birds to feed on the fruits throughout the winter months.



The implementation of SUDs will include an aquatic planting scheme in and around the waterbodies and the sedum roofs planted with a native species-rich wildflower mix which will provide new diverse habitats in addition to the new hedgerow which will improve foraging opportunities and support insect diversity. A species list for wildflower roofs taken from Emorsgate Seeds¹¹ is provided in Appendix 5.

The following species should be avoided when planting sedum roofs as they are invasive in the UK: Dragons blood *Sedum spurium*, orange stonecrop *Sedum kamtschaticum* and Ice plant *Sedum spectabile* are invasive in the UK and should be avoided.

Planting SUD's helps to filter and purify water run-off and provides habitat for a variety of species. The following native plants are recommended for swales, detention basins and rain gardens: bird cherry *Prunus padus*, dogwood *Cornus florida*, guelder rose *Vernum opulus*, yellow flag *Iris pseudacorus*, cowslip *Primula veris*. Several other plants are also suitable for specific SUD's, a detailed species list can be found in Appendix 6, which were taken from RSPB and WWT guidance on sustainable drainage systems¹²

Wildflowers enhance the ecology of a site by providing a food source to a variety of invertebrates which in turn supports a number of protected species. Additional wildflower planting will be sited at the edges of the attenuation basins and swales such as EM5F – a wildflower mix for loamy soils sourced from Emorsgate Seeds¹³. Alternatively a wildflower mix suitable for damp sites such as EM8 – Meadow mixture for wetlands could be sited along the banks of the SUDs (Figure 6). The species list for Loamy soils and wetlands can be found in Appendix 7.

To greater enhance these areas for reptiles, the wildflower areas will be lightly managed through a single cut in late august, maintaining rough grassland and wildflower patches.

In addition, two hibernacula (log pile features) that provide suitable hibernating and foraging habitat for reptiles and amphibians as well as hedgehogs will be created (Figure 7). These will be placed close to the attenuation basins, one in the shade and one in sunlight (Figure 6). The variation in warmth will attract a variety of different invertebrate species.

The development will also include integral bat roosting opportunities into the new buildings. The 1FR Schwegler bat tubes (Figure 8) are effective for attracting bats which normally inhabit buildings. These tubes provide suitable climatic conditions for bats. a total of eighteen tubes will be incorporated into the south, west and east facing elevations upon each of the new buildings as detailed in Figure 6.

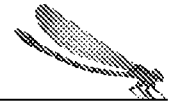
In addition, bird boxes could be installed on each of the buildings on the north and/or east faces (Figure 6). The 1B Schwegler Nest Boxes are known to attract a range of birds and are constructed of woodcrete which is known for its durability. Both the 32mm hole and 28mm hole boxes must be used to attract a variety of birds (Figure 9).

¹¹ Emorsgate Seeds, (n.d) Wild Flowers for green roofs. <https://wildseed.co.uk/mixtures/view/57/wild-flowers-for-green-roofs>

¹² Graham A. et al, (2012) Sustainable drainage systems.

<https://www.rspb.org.uk/globalassets/downloads/documents/positions/planning/sustainable-drainage-systems.pdf>

¹³ Emorsgate seeds, (n.d) Wild Flowers for loamy soils. <https://wildseed.co.uk/mixtures/view/27/wild-flowers-for-loamy-soils>



A minimum of two hedgehog nest boxes as illustrated in Figure 10 must be placed at the base of a hedgerow in shady corners of the site as illustrated in Figure 6.

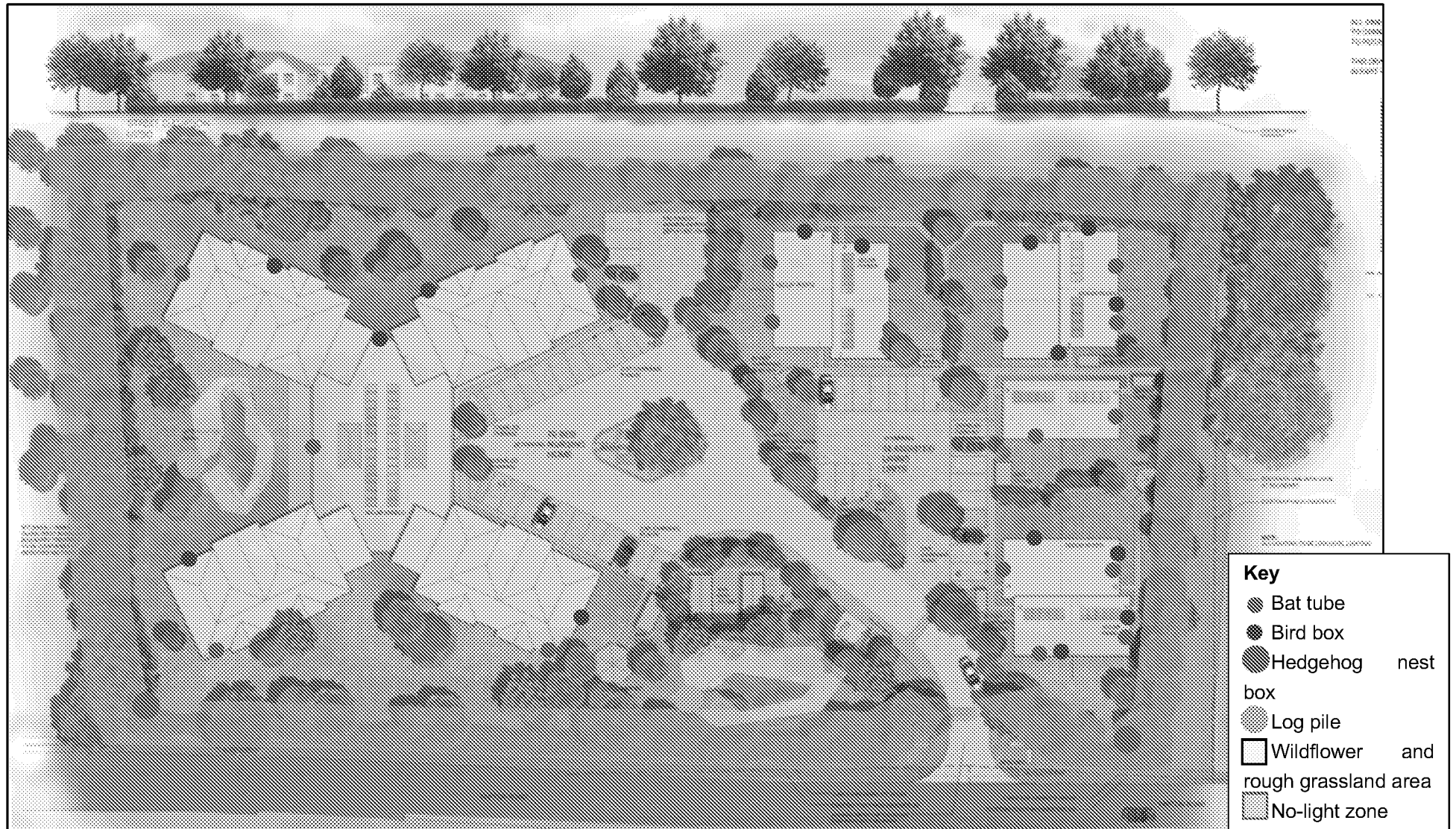


Figure 6. The site plan produced by Richard Clark Chartered Architects. Drawing No. 1693/SP1. July 2019.

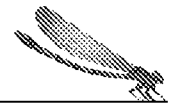


Figure 7. Log pile hibernacula suitable for reptiles and amphibians.

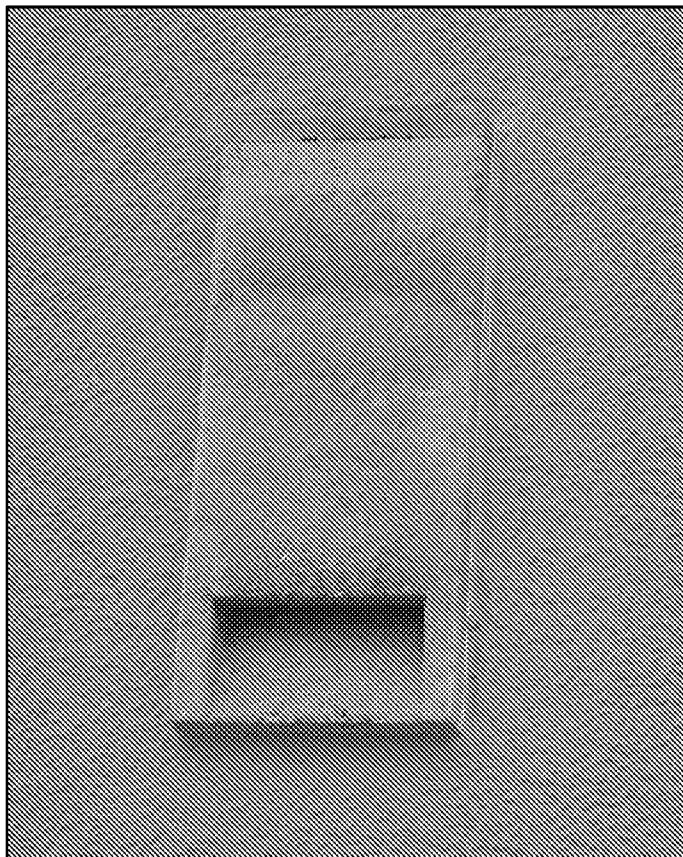


Figure 8. 1FR Schwegler bat tube

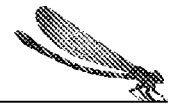
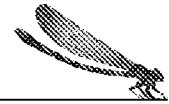


Figure 9. 1B Schwegler Nest Boxes



Figure 10. Hedgehog Nest Box



6 CONCLUSIONS

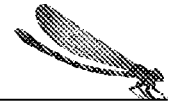
The land north of Yapton Road, Barnham is generally low in ecological value owing to improved grassland that has been grazed short. Despite this, the site contains habitats which have potential to support a variety of species and the development proposal will result in the loss of a section of species-poor continuous hedge, and all of the grazed improved grassland representing a negative impact at the site level. Should all of the above mitigation and enhancement measures be implemented in full, the development will likely have a positive impact at the site level.

Precautionary mitigation for nesting birds, reptiles, great crested newts and hedgehogs is required to ensure there is not a breach of the Wildlife and Countryside Act. Hedgerow planting alongside the management guidance described in the above sections will re-connect the fragmented southern boundary hedgerow and increase the amount of high value hedgerow available within the site. The additional cover is likely to create new features for hibernating reptiles, breeding birds, hedgehogs and commuting great crested newts. With the soft landscaping plans implemented in full including native species there is expected to be an increase in biodiversity at the site and positive impact on ecology at the site level.

The enhancement opportunities identified in Section 5 of this document will result in new opportunities for a variety of species, and a likely increase in biodiversity at the site should they all be implemented in full.

If any protected species are found during the proposed work, work should be stopped immediately and an ecologist must be contacted immediately for advice.

Should you need any further advice on the information provided above, please do not hesitate to contact The Ecology Co-op, info@ecologyco-op.co.uk, www.ecologyco-op.co.uk, Office: 01798 861800.



APPENDIX 1 – Wildlife Legislation and National Planning Policy

Introduction

The following text is intended for general guidance only and does not constitute comprehensive professional legal advice. It provides a summary of the current legal protection afforded to wildlife in general and certain species. It includes current national planning policy relevant to nature conservation.

The ‘Birds Directive’, ‘Habitats Directive’ and ‘Natura 2000 Sites’.

The Council Directive 79/409/EEC on the Conservation of Wild Birds (“the Birds Directive”) sets a framework for the protection of wild birds. Under the directive, several provisions are made including the designation and protection of ‘Special Protection Areas’ (SPAs) – areas which support important bird populations, and the legal protection of rare or vulnerable species.

The Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (the “Habitats Directive”) directs member states of the EU to take measures to maintain favourable conservation status of important habitats and species. This requires the designation of a series of sites which contain important populations of species listed on Annex II of the directive (for example Bechstein’s bat *Myotis bechsteinii*, Barbastelle bat *Barbastella barbastellus* and white-clawed crayfish *Austropotamobius pallipes*. Together with ‘Special Areas of Conservation’ (SPAs), designated under the Birds Directive, SACs form a network across Europe of protected areas known as the ‘Natura 2000 sites’.

Annex IV lists species in need of more strict protection, these are known as “European Protected Species (EPS)”. All bat species, common dormice *Muscardinus avellana*, otter *Lutra lutra* and great crested newts *Triturus cristatus* are examples of EPS that are regularly encountered during development projects.

The ‘Habitats Regulations’

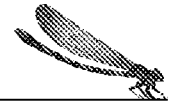
The Conservation of Habitats and Species Regulations 2017 (the “Habitats Regulations”) is the principle means of transposing the Habitats Directive and the Birds Directive, and updates the Conservation (Natural Habitats, &c.) Regulations 1994 (“the 1994 regulations”) in England and Wales.

‘Natura 2000’ sites receive the highest level of protection under this regulation which requires that any activity within the zone of influence of these sites would be subject to a Habitats Regulations Assessment (HRA) by the competent authority (e.g. planning authority), leading to an Appropriate Assessment (AA) in cases where ‘likely significant effects on the integrity of the site are identified.

For European Protected Species, Regulation 41 makes it a criminal offence to;

- Deliberately capture, injure or kill any such animal;
- Deliberately disturb wild animals of such species;
- Deliberately take or destroy their eggs (where relevant);
- Damage or destroy a *breeding or resting place* of such an animal;
- Possess, control, sell or exchange any live or dead animal or plant, of such species;
- Deliberately pick, collect, cut, uproot or destroy a wild plant of such species.

The Habitats Directive and Habitats Regulations provide for the derogation from these prohibitions for



specific reasons provided certain conditions are met. An EPS licensing regime allows operations that would otherwise be unlawful acts to be carried out lawfully. Natural England is the licensing Authority and, in order to grant a license, ensures that three statutory conditions (sometimes referred to as the 'three derogation tests') are met:

- A licence can be granted for the purposes of “preserving public health or safety or for other imperative reasons of overriding public interest including those of a social or economic nature and beneficial consequences of primary importance for the environment” (Regulation 53 (2) (e).
- A licence can be granted if “there are no satisfactory alternatives” to the proposed action.
- A licence shall not be granted unless the action authorised will not be detrimental to the maintenance of the population of the species concerned at a favourable conservation status in their natural range.

Wildlife and Countryside Act (1981) as amended.

This remains one of the most important pieces of wildlife legislation in the UK. There are various schedules to the Act protecting birds (Schedule 1), other animals including insects (Schedule 5), plants (Schedule 8), and control of invasive non-native species (Schedule 9).

Under the Wildlife and Countryside Act (WCA) 1981, all wild birds (with the exception of those listed on Schedule 2), their eggs and nests are protected by law and it is an offence to:

- Take, damage or destroy the nest of any wild bird while it is in use or being built.
- Take or destroy the egg of any wild bird.
- Disturb any bird listed on Schedule 1, while it is nest building, or at a nest with eggs or young, or disturb the dependant young of any such bird.

Schedule 5 lists all non-avian animals receiving protection to a varied degree. At its strongest, the Act makes it an offence to intentionally kill, injure or take any wild animal listed on Schedule 5, and prohibits interference with places used for shelter or protection, or intentionally disturb animals while occupying such places. Examples of species with *full protection* include all EPS, common reptile species, water vole *Arvicola amphibius*, white-clawed crayfish *Austropotamobius pallipes* and Roman snail *Helix pomatia*. Other species are protected from sale, barter or exchange only, such as white letter hairstreak *Satyrion w-album*.

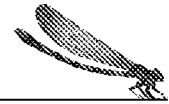
The Act makes it an offence to intentionally pick, uproot or destroy any plant or seed, and sell or possess any plant listed on Schedule 8. It is also an offence to intentionally uproot any wild plant not listed on Schedule 8 unless authorised [by the land owner]. Species on Schedules 5 and 8 are reviewed every 5 years when species can be added or removed.

Measures for the prevention of spreading non-native species which may be detrimental to native wildlife is included in the Act, which prohibits the release of animals or planting of plants into the wild of species listed on Schedule 9 (for example Japanese knotweed *Fallopia japonica*, Himalayan balsam *Impatiens glandifera*, New Zealand Pygmyweed *Crassula helmsii*).

The Wildlife and Countryside Act 1981 (as amended) also prohibits certain inhumane methods of traps and devices for the capture or killing of wild animals and certain additional methods such as fixed trap, poisoning with gas or smoke, or spot-lighting with vehicles for killing species listed on Schedule 6 of the Act (this includes all bat species, badger, otter, polecat, dormice, hedgehog and red squirrel).

Natural Environment and Rural Communities (NERC) Act (2006)

The NERC Act (2006) created the statutory nature conservation body Natural England, and places a



statutory duty on all public bodies, including planning authorities, under Section 40, to take, or promote the taking by others, steps to further the conservation of *habitats and species of principal importance for the conservation of biodiversity* in England (commonly referred to as the 'Biodiversity Duty'). This duty extends to all public bodies the biodiversity duty of Section 74 of the Countryside and Rights of Way (CROW) Act 2000, which placed a duty only on Government and Ministers. Section 41 of the NERC Act lists the habitats and species of principle importance. This includes a wide range of species from mosses, vascular plants, invertebrates through to mammals and birds. It originates from the priority species listed under the UK Biodiversity Action Plan (UK BAP) with some omissions and additions.

Protection of Badgers Act (1992)

The Badger *Meles meles* is afforded specific legal protection in Britain under the Protection of Badgers Act (1992), and Schedule 6 of the Wildlife and Countryside Act 1981 (as amended) (see above).

Under this legislation, it is a criminal offence to:

- intentionally kill, injure, take, possess, or cruelly ill-treat, a Badger, or to attempt to do so;
- interfere with a sett, by damaging or destroying it;
- to obstruct access to, or any entrance of, a Badger sett; or
- to disturb a Badger when it is occupying a sett.

A licence may be obtained from Natural England to permit certain prohibited actions for a number of defined reasons including interference of a sett for the purpose of development, provided that a certain number of conditions are met. Note that licenses are not normally granted for works affecting badgers between the end of November and the start of July.

National Planning Policy Framework

The National Planning Policy Framework (NPPF 2019)¹⁴ sets out the Government's view on how planners should balance nature conservation with development and helps ensure that Government meets its biodiversity commitments with regard to the operation of the planning system.

Paragraph 174b, which states that council policies should “*promote the conservation, restoration and enhancement of priority habitats, ecological networks and the protection and recovery of priority species; and identify and pursue opportunities for securing measurable net gains for biodiversity.*” The Office of the Deputy Prime Minister (ODPM) Circular 06/2005, 2005)¹⁵. In accordance with the NPPF, it is important that developments should contribute to and enhance the natural and local environment by:

- Minimising impacts on existing biodiversity and habitats,
- Providing net gains in biodiversity and habitats, wherever possible,

¹⁴ ¹⁴ HM Government (2019). National Planning Policy Framework. Department for Communities and Local Government. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/728643/Revised_NPPF_2018.pdf.

¹⁵ HM Government (2005) ODPM Circular 06/05 Government Circular: *Biodiversity and Geological Conservation – Statutory Obligations and their Impact within the Planning System*. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/7692/147570.pdf.



- establishing coherent ecological networks that are more resilient to current and future pressures.

UK Post-2010 Biodiversity Framework

The UK Biodiversity Action Plan (UK BAP), first published in 1994, was the UK's response to the commitments of the Rio Convention on Biological Diversity (1992) until 2010, when the UK BAP was replaced by the UK Post-2010 Biodiversity Framework. This framework covers the period 2011 to 2020 and forms the UK government's response to the new strategic plan of the United Nations Convention on Biodiversity (CBD) published in 2010. This promotes a focus on individual countries delivering target for protection for biodiversity through their own strategies.

The most recent biodiversity strategy for England, 'Biodiversity 2020: A strategy for England's wildlife and ecosystem services' was published by Defra (2011), and a progress update was provided in July 2013 (Defra 2013).

'Biodiversity 2020' builds on the Natural Environment White Paper for England – 'The Natural Choice', published on 7 June 2011, and sets out the strategic direction for biodiversity policy for the next decade. Biodiversity 2020 deliberately avoids setting specific targets and actions for local areas and species because the Government believes that local people and organisations are best placed to decide how to implement the strategy in the most appropriate way for their local area or situation.

Birds of Conservation Concern (BoCC)

In 1996, the UK's leading non-governmental bird conservation organisations listed the conservation status of all bird species in the UK against a series of criteria relating to their population size, trends and relative importance to global conservation. The lists, known as the 'Red', 'Amber' and 'Green' lists (in order of decreasing concern) are used to inform key conservation policy and decisions. The lists are reviewed every 5 years and are a useful reference for determining the current importance of a particular site for birds. The most recent review was undertaken in 2015 (Eaton et al, 2015), which provides an up to date assessment of the conservation status of birds in the UK.

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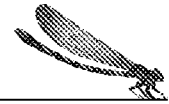
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APPENDIX 2 – Great crested newt ‘Habitat Suitability Index’ values

Table 3. Pond Descriptions

Pond	NGR	Description	HSI value	Interpretation	Survey recommendations
1	SU 96585 04112	Pond 1 exists within tightly mown garden space adjacent to the western boundary of the site. The pond is small, and has isolated areas of good terrestrial habitat, with a hard standing lip around half of the pond. The pond has minimal shading, aquatic vegetation includes variegated grasses, water iris and oxygen weed. The terrestrial value of the vegetation is good, with large stones and bark substrate as well as ferns and rushes providing suitable hibernaculum for amphibians.	0.59.	‘Below average’ suitability	Precautionary mitigation
2	SU 96581 04068	Pond 2 exists close to Pond 1, within tightly mown garden space, adjacent to the western boundary of the site. It is a small, artificial pond lined with plastic, and is stocked with fish. The shading is minimal, with limited aquatic vegetation suitable for egg laying activity, but includes oxygen weed and water lily. Terrestrial vegetation includes variegated grasses and ornamental plants, however these are sparse and do not provide much ground cover.	0.30	‘Poor’ suitability	No further action
3	SU 96949 04026	Pond 3 lies 210m east of the site, but could not be accessed and appears to be within the ownership of Croftway Nurseries. Online mapping suggests this pond lies in close proximity to extensive woodland and therefore should there be potential for great crested newts it is unlikely they will travel from these features of high value to the survey site, however cannot be ruled out.		Could not be assessed	Precautionary mitigation
4	SU 96473 03957	Pond 4 lies 114m south of the site and could not be accessed. The pond appears to be within the ownership of Fleurie Nurseries. A report produced in November 2018 on a site which lies 81m away west of the proposed development outlines the findings and has been reproduced for this assessment. The marginal value of the pond is good, with bramble immediately surrounding the pond, and banks, which are vegetated with rosebay willowherb, nettle, and young ornamental trees. Aquatic vegetation includes mares-tail, the pond also contained rubbish and leaf litter and the water was of poor quality. The terrestrial value comprises suitable	0.55	‘Below average’ suitability	The pond is considered unlikely to represent a constraint to development as it lies at the top of a slope, with two roads and a curb which acts as a significant barrier for great crested newts.



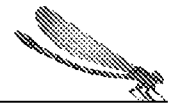
Pond	NGR	Description	HSI value	Interpretation	Survey recommendations
		cover and foraging habitat for newts and includes rough grassland, hedgerow, scattered trees and scrub ⁷ .			

Pond 1

Habitat Suitability Index			SI value
S1. Map location	A/B/C	A	1.00
S2. Surface area	rectangle/ellipse/irregular	ellipse	
	length (m)	3	
	width (m)	3	
	OR estimate (m ²) if irregular		
	area (m ²) =	9	0.02
S3. Dissociation rate	never/rarely/sometimes/frequently	never	0.90
S4. Water quality	good/moderate/poor/bad	moderate	0.67
S5. Shade	% of margin shaded 1m from bank	0	1.00
S6. Waterfowl	absent/minor/major	absent	1.00
S7. Fish population	absent/possible/minor/major	absent	1.00
S8. Pond density	number of ponds within 1km	11	1.00
S9. Terrestrial habitat	good/moderate/poor/isolated	moderate	0.67
S10. Macrophyte cover	%	35	0.66
Note: Guidance in undertaking the HSI is available at www.rdg.gov.uk			HSI score = 0.59
HSI calculation formulae adapted from Rob Clitham			Pond suitability = below average

Pond 2

Habitat Suitability Index			SI value
S1. Map location	A/B/C	A	1.00
S2. Surface area	rectangle/ellipse/irregular	ellipse	
	length (m)	1.5	
	width (m)	1.5	
	OR estimate (m ²) if irregular		
	area (m ²) =	2.25	0.00
S3. Dissociation rate	never/rarely/sometimes/frequently	never	0.90
S4. Water quality	good/moderate/poor/bad	moderate	0.67
S5. Shade	% of margin shaded 1m from bank	0	1.00
S6. Waterfowl	absent/minor/major	absent	1.00
S7. Fish population	absent/possible/minor/major	major	0.01
S8. Pond density	number of ponds within 1km	11	1.00
S9. Terrestrial habitat	good/moderate/poor/isolated	poor	0.33
S10. Macrophyte cover	%	25	0.56
Note: Guidance in undertaking the HSI is available at www.rdg.gov.uk			HSI score = 0.30
HSI calculation formulae adapted from Rob Clitham			Pond suitability = poor



Pond 4

Pond 1		
NGR	SU 96472 83954	
SI attribute	SI value	Notes
Location	1.00	SE England
Pond area	0.10	384m ²
Pond drying	0.50	Rarely
Water quality	0.33	Poor
Shade cover	0.80	100
Water-fowl	1.00	Minor
Fish presence	1.00	Absent
No. ponds	1.00	7
Terrestrial habitat	0.67	Good
Macrophytes	0.31	0%
H.S.I. value	0.55	Below Average suitability



APPENDIX 3 – Reducing Impacts of Artificial Light

Bright external lighting can have a detrimental impact upon foraging and commuting bat flight paths, but more importantly can also cause bats to remain in their roosts for longer. Artificial lighting can also cause significant impacts on other nocturnal species, most notably moths and other nocturnal insects. It can also result in disruption of the circadian rhythms of birds, reducing their fitness. Guidelines issued by the Bat Conservation Trust¹⁶ should be considered while designing the lighting scheme. This includes the following measures:

Do not:

- provide excessive lighting. Use only the minimum amount of light needed for the task.
- directly illuminate bat roosts or important areas for nesting birds

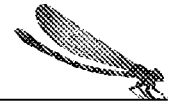
Avoid:

- installing lighting in ecologically sensitive areas such as: near ponds, lakes, rivers, areas of high conservation value; sites supporting particularly light-sensitive species of conservation significance (e.g. glow worms, rare moths, slow-flying bats) and habitat used by protected species.
- using reflective surfaces under lights.

Do:

- consider employing a competent lighting designer who will apply the principals of providing the right light, in the right place, at the right time and controlled by the right system.
- minimise the spread of light to at, or near horizontal and 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.
- consider the height of lighting columns. It should be noted that a lower mounting height is not always better. A lower mounting height can create more light-spill or require more columns. Column height should be carefully considered to balance task and mitigation measures.
- consider no lighting solutions where possible such as white lining, good signage, and LED cats eyes. For example, light only high-risk stretches of roads, such as crossings and junctions, allowing headlights to provide any necessary illumination at other times.
- use temporary close-boarded fencing until vegetation matures, to shield sensitive areas from lighting.
- limit the times that lights are on to provide some dark periods. The task being lit often varies, for example roads are less used after 23.00hrs and car parks are empty. A lighting designer can vary the lighting levels as the use of the area changes reducing lighting levels or perhaps even switching installations off after certain times. This use of adaptive lighting can tailor the installation to suit human health and safety as well as wildlife needs.

¹⁶ Bat Conservation Trust (2018) *Artificial Lighting and Wildlife - Interim Guidance: Recommendations to help minimise the impact artificial lighting*. Available at: http://www.bats.org.uk/pages/bats_and_lighting.html



Further reading:

Buglife (2011) *A review of the impact of artificial light on invertebrates*.

Royal Commission on Environmental Pollution (2009) *Artificial light in the environment*. HMSO, London.
Available at: <https://www.gov.uk/government/publications/artificial-light-in-the-environment>

Rich, C., Longcore, T., Eds. (2005) *Ecological Consequences of Artificial Night Lighting*. Island Press.
ISBN 9781559631297.

CPRE (2014) *Shedding Light: A survey of local authority approaches to lighting in England*. Available
at: <http://www.cpre.org.uk/resources/countryside/dark-skies/item/3608-shedding-light>

Planning Practice Guidance guidance (2014) When is light pollution relevant to planning? Available
at: <https://www.gov.uk/guidance/light-pollution>

Institution of Lighting Professionals (2011) *Guidance Notes for the Reduction of Obtrusive Light*
GN01:2011. Available at: <https://www.theilp.org.uk/resources/free-resources/>

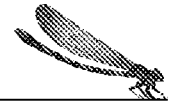


APPENDIX 4 – Arun District Council – Adoption Arun Local Plan 2011–2031 (July 2018)

Policy Number/Title	Policy Summary
Policy C SP1 Countryside	Outside the Built-Up Area Boundaries (as identified on the Policies Maps) land will be defined as countryside and will be recognised for its intrinsic character and beauty. Development will be permitted in the countryside where it is: a. for the operational needs of agriculture, horticulture, forestry, the extraction of minerals or the management of waste as part of a waste site allocation within the West Sussex Waste Local Plan; or b. for quiet, informal recreation; or c. for green infrastructure; or d. for the diversification of the rural economy; or e. for road and/or cycle schemes; or f. in accordance with other policies in the Plan which refer to a specific use or type of development. 7 Settlement Structure & Green Infrastructure The Council will take into account cumulative impact of development in the consideration of planning applications. To ensure better management of the rural-urban fringe in those areas where significant new development is proposed, early consideration will need to be given to landscape and biodiversity enhancement, woodland management, recreation provision and access routes.
ENV SP1 (Natural Environment)	Arun District Council will encourage and promote the preservation, restoration and enhancement of biodiversity and the natural environment through the development process and particularly through policies for the protection of both designated and non-designated sites. Where possible it shall also promote the creation of new areas for habitats and species. In relation to designated sites, development will be permitted where it protects sites listed in Tables 17.1-17.7 that are recognised for the species and habitats contained within them.
Policy ENV DM3 Biodiversity Opportunity Areas	Development shall: a. Retain and sympathetically incorporate locally valued and important habitats, including wildlife corridors and stepping stones b. Be designed in order to minimise disturbance to habitats Development proposals that do not reasonably address opportunities for enhancing these through their design, layout and landscaping or access/management shall not be permitted. Where a development scheme would result in a habitat loss, mitigation measures will be proposed as part of the proposed scheme and such measures agreed with the Local Planning Authority prior to the determination of any planning application. Within Biodiversity Opportunity Areas (BOAs) identified on the Policies Maps or where likely to have an impact on species or habitats within the BOAs, any application for planning permission shall include a properly conducted survey of the presence must be proposed within the planning permission.
ENV DM4 (Protection of trees)	Development will be permitted where it can be demonstrated that trees protected by a Tree Preservation Order(s), (TPO) identified as Ancient Woodland, in a Conservation Area or contributing to local amenity, will not be damaged or destroyed now and as they reach maturity, unless development: a. Would result in the removal of one or more trees in the interests of good arboricultural practice. This shall be demonstrated by the developer following the advice of a suitably qualified person which shall be guided by BS 5837 (2012). Details of any advice received having regard to BS 5837 (2012) shall be submitted, in writing, as part of a planning application; or



Policy Number/Title	Policy Summary
	b. Would enhance the survival and growth prospects of other protected trees; c. The benefits of the proposed development in a particular location outweigh the loss of trees or woodland, especially ancient woodland. Where planning permission is granted in any of the above instances, conditions shall be used to ensure that, for any trees which are removed as part of a development, at least an equivalent number of a similar species and age (where practical) are planted on the proposed development site. Sufficient space for replacement trees to mature without causing future nuisance or damage shall be provided. The planting of new trees shall form an integral part of the design of any development scheme. Proper provision must be made for the protection and management of trees or areas of woodland on-site when undertaking development. A management plan shall be provided as part of a planning application in accordance with BS 5837 (2012) in order to ensure that trees are adequately protected during development and appropriately maintained in the future. Conditions for the continued protection of trees on sites shall be included in any planning permission given. Where there are existing trees on or adjacent to a development site, developers shall be required to provide: d. Land and tree surveys e. A tree constraints plan f. An arboricultural impact assessment to include a tree protection plan and arboricultural method statement These will ensure that development is planned to take a comprehensive view of tree issues at an early stage in the design process and that development works do not have a negative impact on existing trees.
ENV DM5 (Development and biodiversity)	Development schemes shall, in the first instance, seek to achieve a net gain in biodiversity and protect existing habitats on site. They shall also however incorporate elements of biodiversity including green walls, roofs, bat and bird boxes as well as landscape features minimising adverse impacts on existing habitats (whether designated or not). Development schemes shall also be appropriately designed to facilitate the emergence of new habitats through the creation of links between habitat areas and open spaces. Together, these provide a network of green spaces which serve to reconnect isolated sites and facilitate species movement. Where there is evidence of a protected species on a proposed development site, planning applications shall include a detailed survey of the subject species, with details of measures to be incorporated into the development scheme to avoid loss of the species. This involves consideration of any impacts that will affect the species directly or indirectly, whether within the application site or in an area outside of the site, which may be indirectly affected by the proposals. All surveys shall be carried out at an appropriate time of year and shall be undertaken by a qualified and, where appropriate, suitably licensed person. All developments shall have regard to Natural England's standing advice for protected species.
W SP1 (Water)	Arun District Council will encourage water efficiency measures in order to protect the District's water resources and enhance the quality of the water environment which supports a range of habitats and ecosystems. Development will be encouraged to make active use of surface water as a design feature and permitted where it identifies measures to improve and enhance waterbodies, coastal habitats or provides additional flood relief. The Council will also support development that: a. is appropriately located, taking account of flood risk and promotes the incorporation of appropriate mitigation measures into new development, particularly Sustainable Drainage



Policy Number/Title	Policy Summary
	Systems that reduces the creation and flow of surface water and improves water quality; 63 Water stressed areas - final classification (July 2013) b. reduces the risk to homes and places of work from flooding whilst increasing biodiversity; c. delivers a range of community benefits including enhancing the quality of life and providing greater resistance to the impact of climate change.



APPENDIX 5 – ER1F Wild Flowers for Green Roofs

%	Latin name	Common name
3	<i>Agrimonia eupatoria</i>	Agrimony
5	<i>Achillea vulgaris</i>	Kidney Vetch
1	<i>Calluna vulgaris</i>	Ling. - (Common Heather)
7.5	<i>Centaurea nigra</i>	Common Knapweed
3	<i>Epipendula vulgaris</i>	Dropwort
10	<i>Galium verum</i>	Lady's Bedstraw
1	<i>Helianthemum nummularium</i>	Common Rock-rose
3.5	<i>Hippocrepis comosa</i>	Horseshoe Vetch
5	<i>Hypericum perforatum</i>	Perforate St John's Wort
2.5	<i>Knautia arvensis</i>	Field Scabious
5	<i>Leontodon hispidus</i>	Rough Hawkbit
7.5	<i>Leucanthemum vulgare</i>	Oxeye Daisy - (Moon Daisy)
2.5	<i>Lysimachia arvensis</i> - (<i>Anagallis arvensis</i>)	Scarlet Pimpernel
5	<i>Malva moschata</i>	Musk Mallow
1.5	<i>Ononis spinosa</i>	Spiny Restharrow
6	<i>Origanum vulgare</i>	Wild Marjoram
5	<i>Plantago media</i>	Hoary Plantain
5	<i>Primula veris</i>	Cowslip
2.5	<i>Prunella vulgaris</i>	Selfheal
2.5	<i>Ranunculus bulbosus</i>	Bulbous Buttercup
0.5	<i>Reseda lutea</i>	Wild Mignonette
2.5	<i>Rumex acetosella</i>	Sheep's Sorrel
3.5	<i>Salvia verbenaca</i>	Wild Clary
2.5	<i>Scabiosa columbaria</i>	Small Scabious
2.5	<i>Silene vulgaris</i>	Bladder Campion
1	<i>Teucrium scorodonia</i>	Wood Sage
3.5	<i>Verbascum nigrum</i>	



Appendix 6 - recommended SUDs planting

Plants		SuDS Features											
Trees		Re	Ri	LW	PS	RG Cd	FS St	Br	DB B	RB B	WG	WW	SW
<i>Alnus glutinosa</i>	Alder*								X	X		X	
<i>Betula pubescens</i>	Downy birch*							X	X	X		X	X
<i>Prunus padus</i>	Bird cherry*					X		X	X	X		X	X
<i>Populus tremula</i>	Aspen*								X	X		X	
<i>Sorbus aucuparia</i>	Rowan*							X	X	X		X	X
Shrubs													
<i>Ceanothus</i>	Californian lilac		X										
<i>Corylus avellana</i>	Hazel*					X		X	X	X		X	
<i>Crataegus monogyna</i>	Hawthorn*							X	X	X		X	
<i>Cytisus scoparius</i>	Broom*		X										
<i>Cornus sanguinea</i>	Dogwood*		X			X		X	X	X		X	X
<i>Escallonia rubra</i>	Escallonia		X										
<i>Frangula alnus</i>	Alder buckthorn*								X	X		X	X
<i>Lavendula angustifolia</i>	Lavender		X										
<i>Ribes sanguineum</i>	Flowering currant		X			X		X					
<i>Salix cinerea</i>	Grey willow*					X		X				X	X
<i>Viburnum opulus</i>	Guelder-rose*					X		X	X	X		X	X
Climbers and ramblers													
<i>Hedera helix</i>	Ivy*			X									
<i>Lonicera periclymenum</i>	Honeysuckle*			X									
<i>Rosa canina</i>	Dog rose*			X									

Key: Re = Green roof (extensive); Ri = Green roof (intensive); LW = Living wall; PS = Permeable surfaces; RG = Rain garden; FS = Filter strips; Br = Bioretention; DB = Detention Basin; RB = Retention Basin; WG = Wet Grassland; WW = Wet Woodland; SW = Swale



Plants		SuDS Features											
Herbaceous perennials and grasses cont'd		Re	Ri	LW	PS	RG Gd	FS St	Br	DB B	RB B	WG	WW	SW
<i>Achillea millefolium</i>	Yarrow*	X	X		X		X		X	X	X		X
<i>Agrostis</i> spp.	Bents grasses*	X	X		X		X		X	X	X		X
<i>Ajuga reptans</i>	Bugle*	X	X		X	X		X					
<i>Aquilegia</i> spp.	Columbine					X		X					
<i>Aster</i> spp.	Aster					X		X					
<i>Campanula glomerata</i>	Clustered bellflower*					X		X					
<i>Centaurea nigra</i>	Black knapweed*	X	X		X		X		X	X	X		X
<i>Cynosurus cristatus</i>	Crested dogs tail*	X	X		X		X		X	X	X		X
<i>Echium vulgare</i>	Viper's bugloss*	X											
<i>Eupatorium cannabinum</i>	Hemp agrimony*					X		X					X
<i>Festuca</i> spp.	Fescue grasses*	X	X		X		X		X	X	X		X
<i>Galium verum</i>	Lady's bedstraw*	X	X		X		X		X	X	X		X
<i>Helleborus foetidus</i>	Stinking hellebore*					X		X					
<i>Hypochaeris radicata</i>	Common cat's-ear*	X	X		X		X		X	X	X		X
<i>Iris pseudacorus</i>	Yellow flag*					X		X	X	X			X
<i>Leucanthemum vulgare</i>	Ox-eye daisy*	X	X		X		X		X	X	X		X
<i>Lotus corniculatus</i>	Common birds-foot trefoil*	X	X		X		X		X	X	X		X
<i>Osmunda regalis</i>	Royal fern					X		X					
<i>Plantago lanceolata</i>	Ribwort plantain*	X	X		X		X		X	X	X		X
<i>Primula veris</i>	Cowslip*	X	X		X	X	X	X	X	X	X		X
<i>Prunella vulgaris</i>	Self heal*	X	X		X		X		X	X	X		X
<i>Pulmonaria</i> sp.	Lungwort						X		X				
<i>Rudbeckia hirta</i>	Black-eyed Susan						X		X				
<i>Rumex acetosa</i>	Common sorrel*	X	X		X		X		X	X	X		X
<i>Thymus vulgaris</i>	Thyme*		X		X								

Key: Re = Green roof (extensive); Ri = Green roof (intensive); LW = Living wall; PS = Permeable surfaces; RG = Rain garden; FS = Filter strips; Br = Bioretentions; DB = Detention Basin; RB = Retention Basin; WG = Wet Grassland; WW = Wet Woodland; SW = Swale



Appendix 7 - Wildflowers for loamy soils

%	Latin name	Common name
2.5	<i>Achillea millefolium</i>	Yarrow
1.5	<i>Agrimonia eupatoria</i>	Agrimony
15	<i>Centaurea nigra</i>	Common Knapweed
5	<i>Daucus carota</i>	Wild Carrot
2.5	<i>Galium album</i> - (<i>Galium mollugo</i>)	Hedge Bedstraw
12.5	<i>Galium verum</i>	Lady's Bedstraw
2	<i>Geranium pratense</i>	Meadow Crane's-bill
5	<i>Knautia arvensis</i>	Field Scabious
5	<i>Leontodon hispidus</i>	Rough Hawkbit
9	<i>Leucanthemum vulgare</i>	Oxeye Daisy - (Moon Daisy)
5	<i>Malva moschata</i>	Musk Mallow
4	<i>Plantago lanceolata</i>	Bilwort Plantain
5	<i>Primula veris</i>	Cowslip
2	<i>Prunella vulgaris</i>	Selfheal
6.5	<i>Ranunculus acris</i>	Meadow Buttercup
3.5	<i>Ranunculus bulbosus</i>	Bulbous Buttercup
4	<i>Rhinanthus minor</i>	Yellow Rattle
7	<i>Rumex acetosa</i>	Common Sorrel
1.5	<i>Silene vulgaris</i>	Bladder Campion
1	<i>Taraxacum officinale</i>	Dandelion
0.5	<i>Vicia sativa ssp. segetalis</i>	Common Vetch
100		

Sowing Rates

kg/ha	kg/acre	g/m ²	Order Mixture
15	6	1.5	Order this mixture

Wildflowers for Wetlands

%	Latin name	Common name
0.5	<i>Achillea millefolium</i>	Yarrow
0.4	<i>Achillea ptarmica</i>	Sneezewort
1	<i>Betonica officinalis</i> - (<i>Stachys officinalis</i>)	Betony
3	<i>Centaurea nigra</i>	Common Knapweed
0.4	<i>Filipendula ulmaria</i>	Meadowsweet



%	Latin name	Common name
3	<i>Galium verum</i>	Lady's Bedstraw
0.5	<i>Geranium pratense</i>	Meadow Crane's-bill
0.5	<i>Leontodon hispidus</i>	Rough Hawkbit
1.8	<i>Leucanthemum vulgare</i>	Oxeye Daisy - (Moon Daisy)
0.2	<i>Lotus pedunculatus</i>	Greater Birdsfoot Trefoil
1	<i>Plantago lanceolata</i>	Ribwort Plantain
0.5	<i>Primula veris</i>	Cowslip
0.4	<i>Prunella vulgaris</i>	Selfheal
0.8	<i>Ranunculus acris</i>	Meadow Buttercup
0.8	<i>Rhinanthus minor</i>	Yellow Rattle
1.4	<i>Rumex acetosa</i>	Common Sorrel
0.1	<i>Sanguisorba officinalis</i>	Great Burnet
0.3	<i>Silene silaus</i>	Pepper Saxifrage
1.7	<i>Silene flos-cuculi</i> - (<i>Lychnis flos-cuculi</i>)	Ragged Robin
0.3	<i>Succisa pratensis</i>	Dry's-bit Scabious
0.6	<i>Taraxacum officinale</i>	Dandelion
0.3	<i>Vicia cracca</i>	Tufted Vetch
20		

Grasses

%	Latin name	Common name
10	<i>Agrostis capillaris</i>	Common Bent
3	<i>Alopecurus pratensis</i>	Meadow Foxtail (w)
3	<i>Anthoxanthum odoratum</i>	Sweet Vernal-grass (w)
3	<i>Bruca media</i>	Quaking Grass (w)
24	<i>Cynosurus cristatus</i>	Crested Dogstail
2	<i>Deschampsia cespitosa</i>	Tufted Hair-grass (w)
32	<i>Festuca rubra</i>	Slender-creeping Red-fescue
3	<i>Holcus cernuus</i>	Meadow Ragwort (w)
80		

Sowing Rates

kg/ha	kg/acre	g/m ²	Order Mixture
40	16	4	Under this mixture