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Landscape and Ecological Management Plan & Biodiversity Impact Calculation

Reading Golf Club, Reading

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Issue No	Issue Date	Additions/Alterations	Initials	Notes
1.0	16/09/20	ORIGINAL	OC	
1.1	23/11/20	Additions made following comments from ecology comment submitted on 28/10/2020	OC	
1.2	22/01/21	Updated to reflect latest layout plan		

Report Summary

1. The Ecology Co-operation was commissioned by Fairfax Acquisitions Limited and Reading Golf Club Limited to produce a Landscape and Ecological Management Plan detailing habitat creation, enhancement and management for a proposed residential development (comprising 263 plots) at Reading Golf Club.

2. The Ecology Co-op were also commissioned to undertake a Biodiversity Impact Calculation of the proposal, using the DEFRA Metric 2.0, to quantify net change in biodiversity.

3. During the construction and operation phase of the development the following ecological features will be retained and appropriately protected:

- **priority woodland and wood-pasture and parkland habitat**
- **priority hedgerow habitat**

4. The development will see the provision of the following new habitat:

- **0.5ha of new wet grassland (SuDS) – on-site**
- **0.4ha of new species-rich grassland – on-site**
- **120 new trees – on-site**
- **430m of new species-rich hedgerow – on-site**
- **1.837ha of new species-rich grassland – off-site**

5. Species-specific mitigation and enhancements to be incorporated within the development site include:

- **sensitive timing of vegetation removal to avoid disturbance/destruction of bird nest (including a red kite *Milvus milvus* nest)**
- **sensitive lighting scheme to avoid impacts on foraging/commuting bats**
- **installation of twenty new bat boxes on trees**
- **integration of twenty new bat roosting features within new buildings**
- **installation of twenty new bird boxes on trees**
- **integration of ten swift boxes and ten house sparrow boxes within new buildings**
- **creation of five large log piles within suitable habitat**
- **installation of ten new hedgehog houses within gardens**
- **creation of 'hedgehog highways' throughout the development**

6. Off-site woodland will be taken under management to enhancement its value for biodiversity.

7. The Biodiversity Impact Calculation has demonstrated that in terms of habitat units the proposed scheme results in a likely increase of 3.45 Habitat units totalling a 10.83% net gain. The linear feature calculation for the proposed scheme results in a likely gain of 2.66 Hedgerow units totalling a 106.18% net gain.

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1 INTRODUCTION

1.1 Purpose of the Report

The Ecology Co-op has been commissioned to outline mitigation, habitat creation and management plans for a residential development at Reading Golf Club, Reading. This document has been written to demonstrate how the development of up to 260 new dwellings will minimise its impact upon protected species and provide targeted enhancement measures through habitat creation and the management of these over a 10-year period.

There is a movement in planning policy and legislation towards a requirement for all new developments to demonstrate 'net gains' in biodiversity following the release of an updated National Planning Policy Framework (NPPF 2019)[1] by the Department of Housing, Communities and Local Government.

This document includes a baseline 'Biodiversity Impact Calculation' for the proposed development. The calculation utilises the DEFRA METRIC 2.0 and assigns 'biodiversity units' to the pre-existing habitats contained within a proposed development site and those that are predicted to be lost, restored and/or created once the development has been constructed. This allows an objective comparison to be made between the existing biodiversity value of a given site and the predicted biodiversity value post development, with the net change in biodiversity value subsequently quantified.

In addition to detailing mitigation, habitat creation and management, the purpose of this document is to present the findings of the Biodiversity Impact Calculation based on the most up-to date existing habitat survey information and the most current outline plans for the proposed residential development of the site. Biodiversity Impact Calculations provide an evidence base for discussions between the ecological consultant, developer and the local planning authority regarding on-site avoidance, on-site mitigation and off-site compensation requirements.

It is acknowledged that this report is intended to support an application for Outline Planning Permission. Given the likelihood of proposed changes in the design scheme, some of the recommendations will potentially be subject to change. The LEMP is designed as a dynamic strategy and will be updated accordingly following any changes to, layout, design, timeframes etc. The results of the BIC are deemed accurate for the most recent layout plan.

This report was commissioned and produced at the request of Fairfax (Reading) Limited and Reading Golf Club Limited.

1.2 Background

The application site covers approximately 12ha (the entire course covers approximately 43.5ha) and operates as an active golf course, containing: fairways, greens and tree belts. A clubhouse building and

[1] HM Government (2019). National Planning Policy Framework. Department of Housing, Communities and Local Government. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/810197/NPPF_Feb_2019_revised.pdf

an adjacent dwelling, located at the south-eastern corner of the site, are included within the site and are set within an area of tarmacked hard-standing. The proposed development includes the construction of 263 residential plots and a medical centre within the site, along with associated soft and hard landscaping (Figure 2).

The site was subject to an extensive detailed ecological study in 2019, which included a Phase 1 habitat survey and protected species surveys including those for: bats, breeding birds and reptiles. The results of the surveys, and predicted impacts of the proposed development on designated sites, priority habitats and protected/notable species were set out in the Ecological Impact Assessment (EcIA) report which was produced[2].

Habitats within the site are shown in (Figure 1), these include:

- buildings
- hardstanding
- amenity grassland
- scattered trees
- a small area of lowland mixed deciduous woodland
- scrub – dense/continuous
- hedgerow with trees – species-poor
- intact hedgerow – species poor

The protected species surveys identified:

- buildings with 'negligible' bat roost potential
- trees with 'low-high' bat roost potential
- common species of foraging bat (low –high activity)
- a rarer species of foraging bat (barbastelle *Barbastella barbastellus*) (low activity)
- likely absence of reptiles
- likely absence of active badger setts
- an active red kite nest
- possible breeding by 4 red-list bird species
- presence of glow worms *Lampyris noctiluca* (a priority species within Reading)
- suitable habitat for other notable invertebrates (moths and stag beetles)
- confirmed presence of hedgehogs

[2] The Ecology Co-op (2020) *Reading Golf Club, 17 Kidmore End Road, Reading, RG4 8SQ – Ecological Impact Assessment.*

Figure 1. Phase 1 map and key for the application site, with the boundary is outlined in red. Images prepared using the Phase ONE Habitat Survey Toolkit PRO, Department of Biological and Medical Sciences, Oxford Brookes University Version 1.4.0. Images produced courtesy of Google maps (map data ©2019 Google).

Figure 2. Proposed scheme layout for the development at Reading Golf Club, reproduced from Paul Hewett (Drawing No. 2054/PL.04 Rev. A) (Date: Dec 2020).

1.3 Policy & Legislation

The NPPF 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 regards to the operation of the planning system.

Paragraph 174b, 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*."

Paragraph 175d, states that when determining planning applications, authorities should:

- Refuse permission "*if significant harm to biodiversity resulting from a development cannot be avoided (through locating on an alternative site with less harmful impacts), adequately mitigated, or, as a last resort, compensated for"*
- Encourage *"opportunities to incorporate biodiversity improvements in and around developments, especially where this can secure measurable net gains for biodiversity."*

Circular 06/2005 provides further guidance in respect of statutory obligations for biodiversity and geological conservation and their impact within the planning system[3].

[3] 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.

In accordance with the NPPF, it is important that developments should contribute to local policies that enhance the natural environment by:

- minimising impacts on existing biodiversity and habitats and designated features,
- establishing coherent ecological networks that are more resilient to current and future pressures
- providing net gains in biodiversity and habitats, wherever possible.

1.4 Management Plan Strategic Vision

The aims and objectives for the landscape and biodiversity at this site are as follows:

- retaining and protecting green assets including the boundary hedgerows woodland and mature trees
- creation of new green assets; wildflower meadows, boundary planting, hedgerows, woodland, green roof and wildlife-friendly gardens
- enhancement of the site for bats, birds, invertebrates and hedgehogs.

2 PROTECTION OF EXISTING HABITATS OF ECOLOGICAL VALUE

2.1 Protection of Priority Woodland and Hedgerow Habitat

A 10m buffer zone will be established around the woodland located at the northern edge of the development and a 5m buffer zone will be established from the native hedgerow along the southern site boundary. This will include the establishment of appropriate root protection zones and demarking of the buffer zone with Heras fencing to prevent encroachment. No building works or storage of materials will be permitted within the buffer zones. Landscaping works will be permitted to create new gardens which will then serve as a buffer between the building and hard-landscaping and priority habitats during the operational phase of the development.

Figure 3. The extent of buffer zones (shown in red) to protect priority woodland and hedgerow habitats within the development. These will be established during the construction phase and maintained during the operational phase.

2.2 Protection of Retained Trees

All trees will be protected in accordance with BS 5837:2012 including the establishment of appropriate root protection zones. Heras fencing will be installed around the trees to prevent damage to roots through compaction as a result of vehicle movement. No storage of building materials will occur within fenced off areas around the trees.

3 HABITAT CREATION

The following new habitat; wildflower, hedgerow, trees and tree groups, structure edge planting, are proposed to be created during the construction phase of this project. The methods proposed for the creation of each habitat type are described in detail below.

3.1 On-site

3.1.1 Wet Grassland

Areas of Sustainable Urban Drainage Systems (SuDS) to be created within the site will create wetland habitat through provision of ephemeral waterbodies and wet grassland within the site (see figure 4). These areas of attenuation will be sown with a wet grassland seed mix which will cover 0.5ha. The species included must all be of native British origin (an example seed mixture is EM8 – 'Meadow mixture for wetlands', available from Emorsgate seeds - www.wildseed.co.uk). Seed will be sown between late August and the end of September during mild and wet weather or between mid-March to mid-May, when the ground has sufficient moisture and there is very little risk of frosts, to ensure the best conditions for seedling establishment.

Table 1. Composition of EM8 – Meadow mixture for wetlands' available from Emorsgate seeds (www.wildseed.co.uk).

Wildflowers		
%	**Latin name**	**Common name**
0.5	Achillea millefolium	Yarrow
1	Betonica officinalis - (Stachys officinalis)	Betony
3	Centaurea nigra	Common knapweed
0.4	Filipendula ulmaria	Meadowsweet
3	Galium verum	Lady's bedstraw
0.5	Geranium pratense	Meadow crane's-bill
0.5	Leontodon hispidus	Rough hawkbit
1.8	Leucanthemum vulgare	Oxeye daisy
0.2	Lotus pedunculatus	Greater birdsfoot trefoil
1	Plantago lanceolata	Ribwort plantain
0.5	Primula veris	Cowslip
0.4	Prunella vulgaris	Selfheal
0.8	Ranunculus acris	Meadow buttercup
0.8	Rhinanthus minor	Yellow rattle
1.4	Rumex acetosa	Common sorrel
0.1	Sanguisorba officinalis	Great burnet
0.3	Silaum silaus	Pepper saxifrage
1.7	Silene flos-cuculi - (Lychnis flos-cuculi)	Ragged robin
0.3	Succisa pratensis	Devil's-bit scabious
0.6	Taraxacum officinale	Dandelion
0.8	Vicia cracca	Tufted vetch
Grasses		
0	Agrostis capillaris	Common bent
3	Alopecurus pratensis	Meadow foxtail
3	Anthoxanthum odoratum	Sweet vernal-grass
3	Briza media	Quaking grass
24	Cynosurus cristatus	Crested dogstail
2	Deschampsia cespitosa	Tufted hair-grass
32	Festuca rubra	Slender-creeping red-fescue
3	Hordeum secalinum	Meadow barley

Marginal wetland plants will be planted within the SuDS at an appropriate density (to be confirmed). The species-mix will incorporate but not be limited to:

- purple loosestrife *Lythrum salicaria*
- yellow loosestrife *Lysimachia vulgaris*
- sharp flowering rush *Juncus acutiflorus*
- carnation sedge *Carex panicea*
- water avens *Geun rivale*

The plants listed above are available in early autumn and spring, dependent upon species, and should be planted as soon as possible following the creation of the SuDS.

Figure 4. The extent of new areas of wet grassland habitat (shown in blue) to be created within the development's Sustainable Urban Drainage Systems (SuDS) at Reading golf Club.

3.1.2 Species-Rich Grassland

An approximate area of 0.4ha of species-rich grassland will be created within areas of public open space within the developed site (Figure 5).

Good ground preparation by rotavating the soil is essential to the success of establishing a wildflower meadow habitat, followed by sowing a suitable seed mix between late August and the end of September during mild and wet weather or between mid-March to mid-May, when the ground has sufficient moisture and there is very little risk of frosts, to ensure the best conditions for seedling establishment. The rotavating process is intended to create an area of largely bare ground to allow the wildflower seed mix to establish. A suitable seed mixture for chalk soils, containing not less than 20 wildflower and grass species should be sown across the ground at a density of four grams per square metre. The species included must all be of native British origin (an example seed mixture is EM6 – 'Meadow Mixture for Chalk and Limestone Soils', available from Emorsgate seeds (www.wildseed.co.uk). Table 1 details the composition of this mixture. In addition, to help ensure grasses to not suppress the growth of wildlflowers, the introduction of no less than 100 grams of yellow rattle *Rhinanthus minor* will be included per 0.1ha of new wildflower habitat.

Table 2. Composition of EM6 – Meadow Mixture for Chalk and Limestone Soils available from Emorsgate seeds (www.wildseed.co.uk).

Wildflowers		
%	**Latin name**	**Common name**

0.5	*Achillea millefolium*	Yarrow
0.3	*Agrimonia eupatoria*	Agrimony
1.5	*Centaurea nigra*	Common knapweed
1.5	*Centaurea scabiosa*	Greater knapweed
1	*Daucus carota*	Wild carrot
1.2	*Anthyllis vulneraria*	Kidney vetch
0.3	*Cruciata laevipes*	Crosswort
2	*Galium verum*	Lady's bedstraw
1	*Filipedula vulgaris*	Dropwort
1.2	*Knautia arvensis*	Field scabious
0.5	*Leucanthemum vulgare*	Oxeye Daisy
0.8	*Leontodon hispidus*	Rough hawkbit
1	*Plantago media*	Hoary Plantain
1.8	*Poterium sanguisorba – (Sanguisorba minor)*	Salad Burnet
0.8	*Malva moschata*	Musk mallow
0.1	*Ononis spinosa*	Spiny restharrow
1	*Origanum vulgare*	Wild marjoram
1.6	*Primula veris*	Cowslip
1	*Ranunculus bulbous*	Bulbous buttercup
0.5	*Scabiosa columbaria*	Small scabious
Grasses		
4	*Briza media*	Quaking grass
0.2	*Carex flacca*	Glaucous sedge
24	*Festuca ovina*	Sheep's fescue
20	*Cynosurus cristatus*	Crested dogstail
24	*Festuca rubra*	Slender-creeping Red-fescue
4.6	*Phleum bertolonii*	Smaller cat's-tail
2	*Koeleria macrantha*	Crested hair-grass
1.2	*Trisetum flavescens*	Yellow oat-grass

Figure 5. The extent of new areas of species-rich grassland habitat (shown in orange) to be created within the development at Reading golf Club.

3.1.3 Tree Planting

A minimum of 120 new trees will be planted within the development (as set out within the Tree Planting Plan produced by Fabrik Landscape Architects – Drawing number 0103) (see Figure 6). The landscaping plan will incorporate a variety of trees with most species to be UK natives sourced from UK stock. This will create greater habitat for a variety of birds and invertebrates. Given the arrival of ash dieback, it is not recommended that ash *Fraxinus excelsior* saplings are planted anywhere on the site. Tree species to be planted within the site are:

- silver birch *Betula pendula*
- beech *Fagus sylvatica*
- pedunculate oak *Quercus robur*
- wild service tree *Sorbus torminalis*
- field maple *Acer campestre*
- alder *Alnus glutinosa*
- midland hawthorn *Crataegus laevigata*
- crab apple *Malus sylvestris*
- wild cherry *Prunus avium*
- common whitebeam *Sorbus aria*
- rowan *Sorbus aucuparia*

All trees will be planted with tree guards to prevent damaging resulting from browsing by deer.

Figure 6. The Tree Planting Plan for the development at Reading Golf Club produced by Fabrik Landscape Architects – Drawing number 0103 – Dated July 2020).

3.2 Species-rich Hedgerow Planting

A minimum of 430m of new species-rich native hedgerow habitat is to be planted within the development providing increased foraging and commuting habitat for bats plus nesting areas for birds, sheltering/foraging habitat for hedgehogs and an enhancement for a variety of invertebrates. Figure 7 shows the locations of new hedgerow habitat.

These new species-rich hedgerows must use only native species from UK stock and include at least 6 species, with at least 50% of the new hedgerow comprising blackthorn *Prunus spinosa* or hawthorn *Crategous monogyna* to remain consistent with a traditional hedge and provide a good hedge structure. The following species are are recommended in addition to the hawthorn or blackthorn which will make up 50% of the hedging:

- field maple *Acer campestre*
- wild privet *Ligustrum vulgare*
- dogwood *Cornus sanguinea*
- hazel *Corylus avellana*
- guelder rose *Viburnum opulus*
- beech *Fagus sylvatica*
- spindle *Euonymus europaea*

New hedgerows should be planted with 5 plants per linear meter as a minimum and it is best to plant the trees as bare root stock whilst they are dormant between November and March in the absence of heavy frost. Guards to protect these hedge trees from rabbits and deer may be necessary.

Figure 7. The extent of new species-rich hedgerow habitat (shown in green) to be created within the development at Reading golf Club.

Figure 8. The extent of new areas of species-rich grassland habitat (shown in orange) wet grassland habitat (shown in blue to be created within the development at Reading Golf Club.

3.3 Off-site

3.3.1 Species-rich Grassland Creation

A 1.837ha area of species-rich grassland will be created outside of the proposed development site (Figure 9). This will benefit biodiversity by improving foraging habitat for bats, birds and invertebrates (including glow worms). Figure 8 shows the proposed areas for the creation of species-rich grassland.

Good ground preparation via rotavating is essential to the success of establishing a wildflower meadow followed by sowing a suitable seed mix between late August and the end of September during mild and wet weather or during mid-March to mid-May, when the ground has sufficient moisture and there is very little risk of frosts, to ensure the best conditions for seedling establishment. The rotavating process is intended to create an area of largely bare ground to allow the wildflower seed mix to establish. A suitable general-purpose seed mixture, containing not less than 15 wildflower and grass species should be sown across the ground at a density of four grams per square metre. The species included must all be of native British origin (an example seed mixture is EM1 – 'Basic General-Purpose Meadow Mixture', available from Emorsgate seeds (www.wildseed.co.uk). Table 3 details the composition of this mixture.

Table 3. Composition of Basic General-Purpose Meadow Mixture available from Emorsgate seeds (www.wildseed.co.uk).

Wildflowers		
%	**Latin name**	**Common name**
2.5	*Centaurea nigra*	Common Knapweed
3	*Daucus carota*	Wild Carrot
3	*Galium verum*	Lady's Bedstraw
2	*Leucanthemum vulgare*	Oxeye Daisy
2.5	*Malva moschata*	Musk Mallow
1	*Plantago lanceolata*	Ribwort plantain
2.5	*Poterium sanguisorba*	Salad burnet
0.3	*Prunella vulgaris*	Selfheal
1.2	*Rumex acetosa*	Common sorrel
2	*Silene dioica*	Red campion
Grasses		
8	*Agrostis stolonifera*	Common bent
28	*Cynosurus cristatus*	Crested dogstail
24	*Festuca rubra*	Slender-creeping Red-fescue
4	*Phleum bertolonii*	Smaller cat's-tail
16	*Poa pratensis*	Smooth-stalked meadow grass

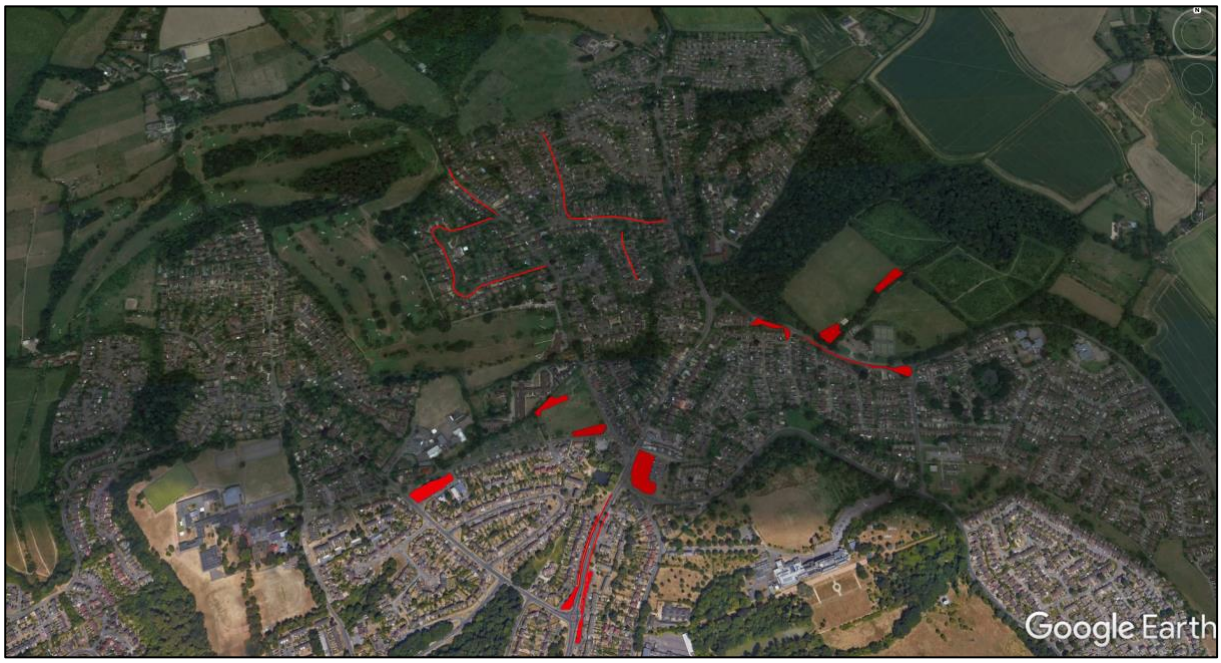

Figure 9. The extent of new species-rich grassland habitat (shown in red) to be created off-site within the local area.

4 PROTECTED SPECIES MITIGATION AND ENHANCEMENTS

The EcIA identified potential for impacts on bats, nesting birds, notable invertebrates and hedgehogs. The following sections outline the mitigation, compensation and enhancement measures proposed to comply with legislation and further the conservation of these species.

4.1 Badgers

All excavations should be covered at night to prevent badgers falling into any pits, failing that an escape mechanism should be provided to allow badgers (and other wildlife) to climb out of an excavation.

Updated badger surveys should be conducted every 6 months in order to confirm the continued absence of active setts or to inform badger mitigation strategy.

Should badgers move on to the site and take up residence within a sett in the construction zone or its immediate zone of influence (within 30m), a badger mitigation strategy will be required which will include consideration of the need for a development licence to close the sett from Natural England.

4.2 Bats

Following the completion of a Potential roost feature (PRF) tree climbing inspection a total of six trees were identified as having bat roosting potential[2]. The locations of these trees are shown in Figure 10. All of these specimens will be retained and protected within the development.

Figure 10. Trees included within the Potential Roost Feature Assessment (tree climbing survey) at Reading Golf Club. Images produced courtesy of Google maps (map data ©2019 Google).

Bright external lighting can have a detrimental impact upon foraging and commuting bats, but importantly can also cause bats to remain in their roosts for longer. At least seven species of bat, including the rare barbastelle *Barbastella barbastellus* were recorded foraging/commuting within the site[2]. As a result, the site boundaries must be protected from artificial lighting with no streetlamps or outside lights to face towards these boundaries. A 'no light zone' must be established along the site's boundaries as shown in Figure 11.

Figure 11. The extent of the proposed no light zones (shown in grey) within the development at Reading Golf Club.

Guidelines issued by the Bat Conservation Trust must be incorporated into the lighting scheme at Cranleigh School and the following measures must be implemented into the site design:

1. No 'upward pointing' or bare bulb lights will be installed anywhere on the development.

2. All external lights upon lampposts will not be more than 3.5 metres in height and will have shields installed to focus light towards footpaths and roads only (See figure 5). No light will be allowed to emit light past horizontal (90 degrees from the ground).

3. No-light zones to protect the boundaries of the site from any artificial light. No lamp posts or other artificial lights should be positioned within 15 metres of these boundaries and no lights should be positioned to face towards these boundaries.

4. Any pedestrian ground lighting will not exceed 3 lux.

5. Narrow spectrum lighting that emit minimal ultra-violet light. Lights should peak higher than 550 nm.

6. No external lights will be installed on new buildings above a height of 2 metres and all external lights will have shields to prevent light splash beyond horizontal.

7. All external lighting should be on motion sensors and timers.

Figure 12. An example of suitable downward shielded street lighting.

To enhance the site for roosting bats, twenty new bat boxes will be installed on retained trees within the development site. It is recommended that a combination of different bat box designs are used (Figure 13).

Figure 13. Left to right – 2F Schwegler bat box, 1 FD Schwegler bat box, 2FN Schwegler bat box, Vivara Pro Woodstone bat box, Eco Kent bat box and Improved Cavity bat box

Figure 14 shows proposed approximate positions for the bat boxes. The boxes would be hung by a suitably qualified ecologist to ensure that this positioning is most suitable, but generally locations above 3.5 metres in the most south easterly facing aspect of a tree is best.

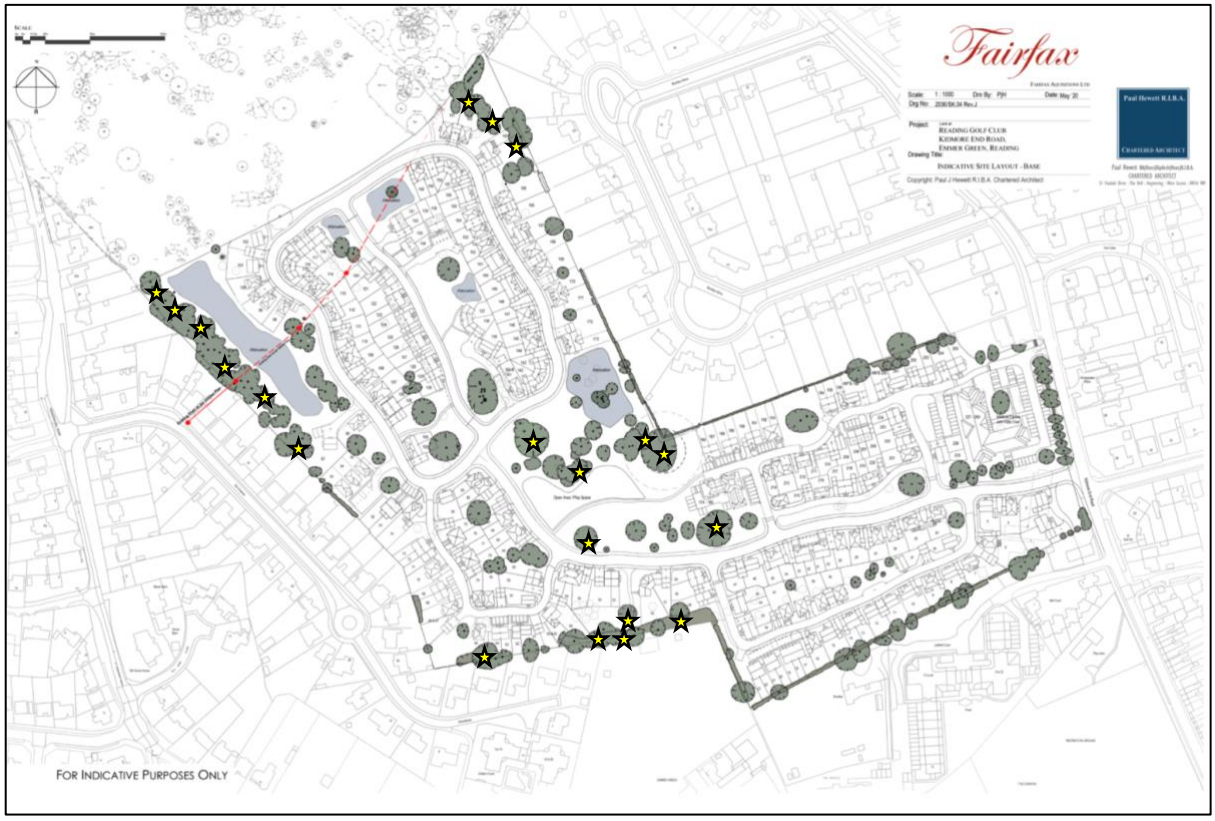

Figure 14. Proposed locations of bat boxes to be installed on retained trees within the development site at Reading Golf Club.

As a measure to further enhance roosting opportunities for bats 'built in' roosting features will be incorporated into the dwelling. Twenty 1FR Schwegler bat tubes (Figure 15) will be integrated into the walls on the south or eastern face approximately 5 meters in height. Figure 16 shows proposed locations of these bat roosting features.

Figure 15. Left – A bat tube integrated into a brick wall. Right – a cross section diagram of a bat tube.

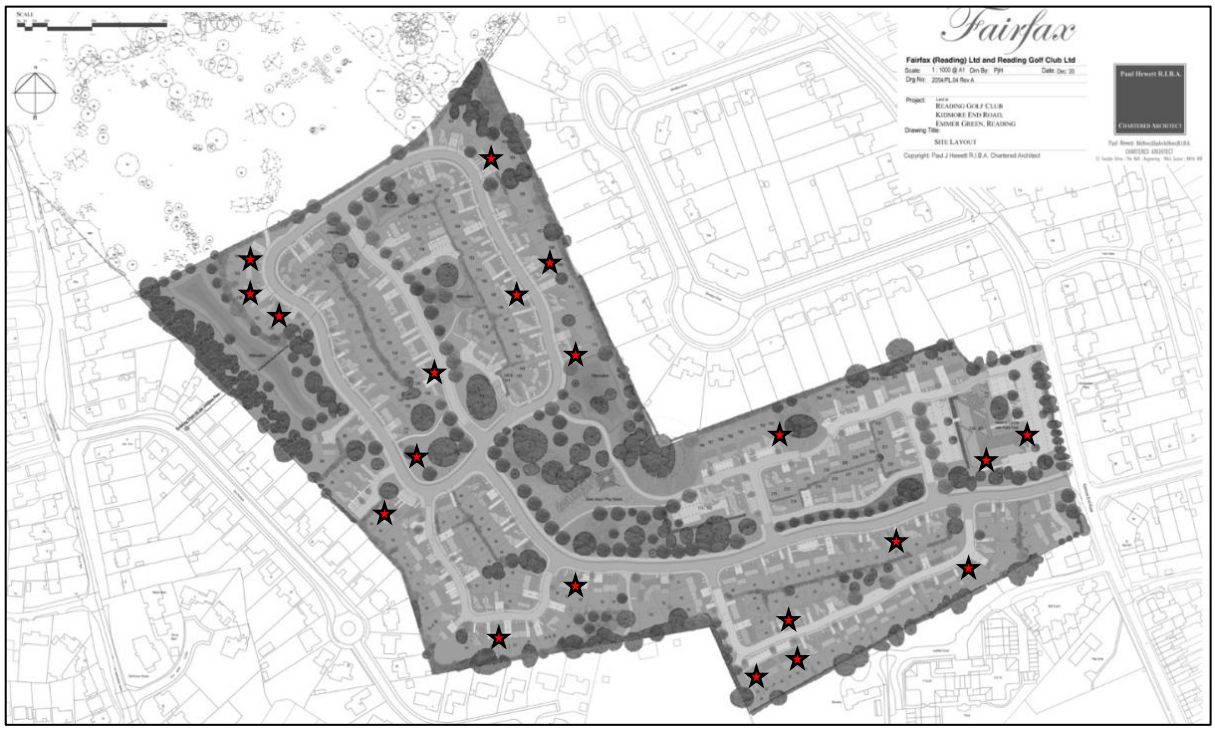

Figure 16. Proposed locations of bat tubes to be integrated into new buildings within the development site at Reading Golf Club.

4.3 Nesting Birds

Any scrub or trees to be cleared must be removed outside of the nesting bird season (1st March to 31st August) unless features are first hand-searched by a suitably qualified ecologist and declared clear of any active bird nests. In the event that any active nests are identified a buffer of at least 5 meters will be to be created and the nest must be left undisturbed until the young have fledged.

The identified red kite nest[2] should be subjected to monitoring prior to the commencement of works. If construction works are to be undertaken within a 50m radius of the nest site during the breeding bird season (March August inclusive) these will only be permitted if a suitably qualified ecologist can confirm that the nest is currently inactive.

In order to enhance the site for nesting birds twenty nesting bird boxes, incorporating a variety of designs (Figure 17), will be installed on retained trees across the site. Proposed locations for the boxes are shown in Figure 18.

Figure 17. Left to right – Vivara Pro Seville 28mm Woodstone Nest Box, Vivara Pro Barcelona Woodstone Open Nest Box, Vivara Pro Tawny Owl Nest Box, FSC Treecreeper Nest Box, 2GR Schwegler Nest Box and a Traditional Wooden Nest Box.

Figure 18. Proposed locations of bat tubes to be integrated into new buildings within the development site at Reading Golf Club.

As a further enhancement to nesting birds, a total of ten swift nest boxes and 10 integrated house sparrow nest boxes (Figure 19) will be integrated into the new buildings within the site. Swift boxes will be installed as high as possible below the eaves, whereas sparrow boxes will be installed at least 3m above ground in close proximity to areas of shrubs within new gardens. Boxes will be integrated into the northern or eastern elevations of buildings; proposed locations of integrated bird boxes are shown in

Figure 19. Left – Woodstone Build-in Swift Box B. Right – Vivara Pro Woodstone House Sparrow Nest Box.

Figure 20. Proposed locations of swift boxes (shown as purple stars) and house sparrow boxes (shown as orange stars) to be integrated into new buildings within the development site at Reading Golf Club.

4.4 Invertebrates

In addition to the creation of new species-rich grassland and new woodland within the wider landholding of Reading Golf Club, new deadwood habitat will be incorporated within these new habitats as well as amongst areas of open space within the development site itself. These areas of deadwood will provide an enhancement for a variety of saproxylic invertebrates including stag beetles *Lucanus cervus*.

A total of five large log piles will be created in shaded areas within the development site. Alternatively, larger logs can be sunk vertically into the ground with holes drilled into the wood to create opportunities for saproxylic invertebrates. A further ten large log piles will be created off-site within the newly created species-rich grassland and existing/newly created woodland.

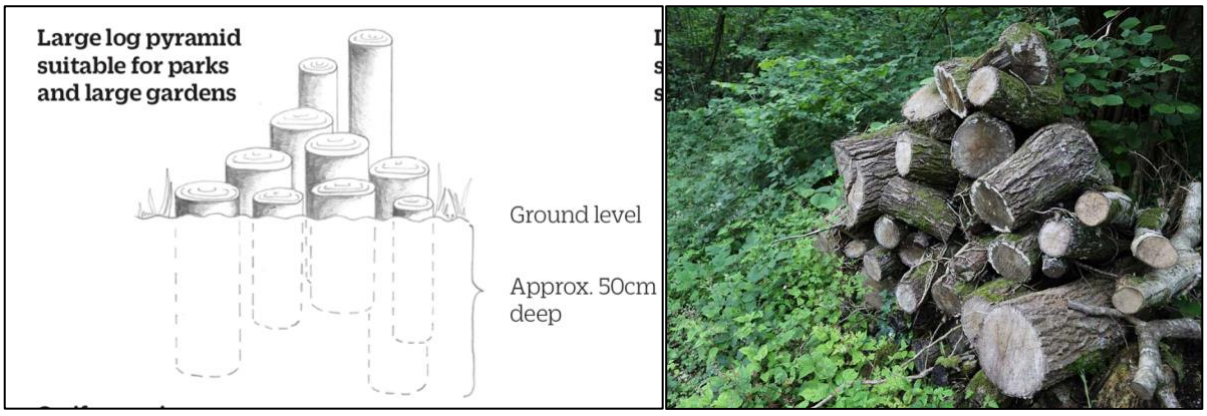

Figure 21. Left – a diagram of a vertical log pile designed specifically for stag beetles (*Source: Peoples Trust for Endangered Species)*. Right – A traditional horizontal laid log pile.

4.5 Hedgehogs

All new garden fencing should contain accessible gaps (10cm x 15cm) at their base to allow movement of hedgehogs between garden plots. A total of ten hedgehog houses will be installed within gardens of the new development. The locations of hedgehog houses and extent of the 'hedgehog highways' created by gaps in garden fencing are shown in Figure 23.

Figure 22. Left – a hole at the base of garden fencing to allow hedgehog movement. Right – an Igloo Hedgehog Home.

Figure 23. The location of hedgehog houses (shown as green stars) and the extent of proposed 'hedgehog highways' (shown in yellow) throughout the development site at Reading Golf Club.

5 POST CONSTRUCTION MANAGEMENT

A compartment plan is included within Appendix 1 of this report.

5.1 On-site

5.1.1 Wet Grassland

Optimal Habitat

To create 0.5ha of species-rich grassland within areas of attenuation. The habitat will contain ephemeral pools with aquatic/hydrophytic plants providing high-value habitat for a variety of terrestrial and aquatic invertebrates.

Year 1

Most sown meadow wildflower and grass species are perennial; they will be slow to germinate and grow and will not usually flower in their first growing season. There will often be a flush of annual weeds from the soil in the first growing season which may grow up and obscure the meadow seedlings beneath. This annual weed growth is easily controlled by topping or mowing.

Mow newly sown meadows 3-4 times throughout the first year of establishment to a height of 40-60mm, removing cuttings if dense. This will control annual weeds and help maintain balance between faster growing grasses and slower developing wildflowers.

Avoid cutting in the spring and early summer if the mixture has been sown with a nurse cover of cornfield annuals, or is autumn sown and contains yellow rattle. These sown annuals should be allowed to flower, then in mid-summer cut back and the cut vegetation removed. It is important to cut back cornfield annuals before they die back, set seed or collapse: this cut will reveal the developing meadow mixture and give it the space it needs to develop.

Carefully dig out or spot treat any residual perennial weeds such as docks.

Yearly management

In the second and subsequent years EM8 sowings can be managed in a number of ways which, in association with soil fertility, will determine the character of the grassland. The best results are usually obtained by traditional meadow management based around a main late summer hay cut in combination with autumn and possibly spring mowing or grazing.

Meadow grassland is not cut or grazed from spring through to late July/August to give the sown species an opportunity to flower. After flowering in July or August take a 'hay cut' : cut back with a scythe, petrol strimmer or tractor mower to c 50mm. Leave the 'hay' to dry and shed seed for 1-7 days then remove to be appropriately composted. Mow or graze the re-growth through to late autumn/winter to c 50mm and again in spring if needed.

Wetland habitats are characteristically quite variable in composition, reflecting local drainage and management. Conditions can vary, for instance, between the highs and lows in ridge and furrow grassland. Localized differences may require a targeted approach. For example, boggy areas which remain waterlogged for much of the year may be best sown with pond edge mixture EP1 (Emorsgate Seeds).

Removal of any litter which has accumulated within attenuation basins may be required between January and March depending on the quanity of leaf-litter present.

5.1.2 Woodland

Optimal Habitat

Retention and protection of existing on-site woodland habitat. Creation/maintenance of rides and glades within the woodland, with significant deadwood. Woodland must be managed to be free from non-native invasive species and young vegetation may need to be protected from browsing deer where evidence of damage is evident.

Year 1

Management of scrub understorey and pruning of canopy to prevent overshading of rides and glades to be undertaken outside of the bird nesting season (avoiding March – August inclusive). Grass arisings, resulting from mowing of glades and rides, will be removed to prevent soil enrichment from excess nutrients.

Creation of new deadwood habitat through the installation of log piles.

Installation of deer guards to protect young trees from damage by browsing animals.

Yearly management

A yearly check for invasive species. In the event that invasive species are identified a suitably qualified ecologist must be contacted for advice regarding the eradication of these.

Annual check of deer guards and repair/replacement as required.

5.1.3 Hedgerows

Optimal Habitat

Retain and sustain the existing hedgerows, along the southern boundary to optimum heights for breeding birds and foraging bats.

Create 450m of new dense hedgerow, maintained at a height of no less than 1.8m throughout the site. These hedges must be native species rich and must be comprised of at least 5 species.

Year 1

Maintain protective fencing in accordance with BS5837:2012 during construction.

Tree guards, to protect the new saplings from rabbits and deer, to be inspected yearly for first 5 years and then removed if planting well established.

Year 2

All planted hedgerows must only be cut outside the bird nesting season (1st March to 31st August) and where possible hedges shouldn't be cut until February, so that valuable winter food associated with fruiting hedge trees is retained for over-wintering birds. Each hedgerow should not be cut shorter than 1.8m (h) and 1.5 m (w) each year.

Yearly management

Check for signs of disease. If disease is identified then advice should be sought from an arboriculturalist regarding the appropriate method of treatment.

5.1.4 Retained Trees

Optimal Habitat

Retain and sustain those trees to be retained within the development.

Plant at least 120 new native trees within the development site (as illustrated in Figure 6)

Yearly management

Check for signs of damage and disease. If disease is identified advice should be sought from an arboriculturalist regarding the appropriate method of treatment.

Any trees which fail within the first two years will be replaced.

5.1.5 Other

Bat and bird boxes on trees are to be inspected to check they have not become detached or damaged each year and any damaged boxes are to be replaced like for like up to at least 5 years from the date of the completion of the development.

Old bird nests are to be cleared out from bird boxes in September to reduce parasitic load build up.

5.2 Off-site

5.2.1 Species-rich Grassland

Optimal Habitat

A diverse species rich sward which should be made up of at least 15 plant species, composed of 20% flowering plant species, from the species listed within Table 3. The wildflower meadow area must support a variety of flowering plant species to provide colour, texture and ecological value.

Year 1

The sward should be cut and gathered to a height of approximately 5cm at least three times in its first year of establishment to control the flush of annual weeds which will grow during the first growing season, and suppress faster growing grass species to encourage establishment of less competitive flowering species.

Year 2 onwards

As part of on-going management, the wildflower meadow should be cut and gathered each year to a height of approximately 5cm after flowering in July and August. This process can be carried out through, strimming or tractor mowing. This is important to ensure that species diversity of the area is maintained and grass species do not become dominant. Where necessary, a second cut could be taken in March each year if the sward is growing too coarsely. The grassland should not be cut between the 1st of April and mid-August so that plants are given the opportunity to flower. Grass cuttings should be collected and composted or used to build hibernacula that will support hibernating amphibians on a patch of ground that will remain dry throughout the year and well away from the pond or watercourses.

5.2.2 Woodland

Optimal habitat
The development will see retention and protection of existing off-site woodland habitat. Creation/maintenance of rides and glades within the woodland, with significant deadwood. Woodlands will remain free from non-native invasive species and young vegetation will be protected from browsing deer.

Year 1
Pruning of canopy to prevent overshading of rides and glades to be undertaken outside of the bird nesting season (avoiding March – August inclusive). Grass arisings, resulting from mowing of glades and rides, will be removed to prevent soil enrichment from excess nutrients.

Creation of new deadwood habitat through the installation of log piles.

Installation of deer guards around young trees in order to prevent damage from browsing animals.

Yearly management
A yearly check for invasive species. In the event that invasive species are identified a suitably qualified ecologist must be contacted for advice regarding their eradication.

Annual check of deer guards and repair/replacement as required.

6 WORK SCHEDULE

Table 4 below provides the timetable for the annual management plan actions for the 10-year management period. The management operations can be continued outside of this proposed 10-year period.

Table 4. Work schedule for the 10-year management period.

Action	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Grassland cutting from year 2								X	X			
Hedge cutting from year 3		X										
Maintenance of glades and rides through scrub management and canopy pruning									X	X		
Mowing of glades and rides									X			

Inspection of woodland for invasive species						X	X					
Inspection of all retained and new trees for damage and any disease						X	X	X				
Inspection of bat and bird boxes									X	X	X	
Clearance of old bird nests from bird boxes									X	X	X	

7 TIME FRAME AND IMPLEMENTATION

A responsible party (to be confirmed) will be responsible for the management actions of the retained and new biodiversity assets over the 10-year time period.

8 MONITORING AND REVIEW

Monitoring of the retained and new biodiversity assets should be undertaken to determine the success or failure of each compartment through a site visit by a suitably qualified ecologist 2 years and 5 years post construction. If necessary, changes to management actions can prescribed along with additional planting of the hedgerows, structural boundary planting and the pond in the event that plants or shrubs fail to establish replanting will be prescribed. Furthermore, in the event that invasive species are identified within any of the compartments suitable control methods would be outlined in detail.

An internal inspection is to be undertaken 10 years post construction to assess the progress of habitat development and determine any changes required for future management as the habitats continue to mature.

9 COMPETENCIES, STANDARD AND SPECIFICATIONS OF WORKS

All tree works are to be undertaken by a suitably qualified horticulturalist.

The instillation of bat and bird boxes is to be undertaken or overseen by a suitably qualified ecologist.

A site inspection of on-site and off-site at 2 years and 5 years post construction must be undertaken by a suitably qualified ecologist.

10 BIODIVERSITY IMPACT CALCULATION

10.1 Methodology

This Biodiversity Impact Calculation uses the Biodiversity Metric 2.0 Calculation Tool Beta Test Final published by Natural England[4]. This uses the Government Biodiversity Metric developed by DEFRA ('the DEFRA Biodiversity Metric')[5] to calculate 'habitat units' and 'hedgerow units' by multiplying the area (ha) or lengths (km), 'distinctiveness' (habitat type), 'condition' (quality), ecological connectivity (location relative to other high value habitat) and strategic significance (location in relation to the authority's local strategy) of each habitat parcel.

The calculation provides a negative value to the biodiversity units where habitat is being directly lost to development. Where habitats are enhanced or created on-site, or off-site, the calculation gives a positive value but adds risk factors that account for uncertainty - difficulty in creating new habitats and time delays while they establish; habitats that are more difficult to restore or that will take a long time to reach a set target condition will score lower and therefore make a smaller positive contribution.

Where on-site gains are equal to or larger than the losses, the project is deemed to have neutral biodiversity impact or biodiversity 'net gain' respectively.

Where on-site gains do not outweigh on-site losses and a biodiversity 'net loss' is calculated, this becomes an 'offset requirement'. Offsets can be provided by further habitat creation or enhancement in-situ or elsewhere and are assessed using the same metric to balance the predicted gains against the losses to ensure no net loss will be achieved. It follows that a biodiversity net gain can still be achieved by providing higher biodiversity gains through the offset than the net loss resulting from the development.

Note that the DEFRA Biodiversity Metric does not allow for 'trading down'; one of the key principles in measuring biodiversity net losses or gains is that habitats of high ecological importance cannot be offset by the creation of larger areas of habitats with lower value. The Biodiversity Metric 2.0 Calculation Tool includes a 'trading down correction' that deducts the number of biodiversity units that are not accounted for through the creation of equivalent high distinctive habitats than that lost. For example, the loss of a small area of unimproved hay meadow priority habitat (high distinctiveness) will not be offset by a larger area of semi-improved grassland (medium distinctiveness) and will only be offset by an equivalent area of habitat of the same distinctiveness or higher.

10.2 Data Sources

This calculation uses the most up to date survey information, using botanical data gathered during the site visit in April 2020[2]. The areas of each habitat category were measured using online mapping tools

[4] Natural England (2019) The Biodiversity Metric 2.0: auditing and accounting for biodiversity value. Available online at: http://publications.naturalengland.org.uk/publication/5850908674228224

[5] Natural England (2019) *Technical paper – metric for the biodiversity offsetting pilot in England*. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/69531/pb13745-bio-technical-paper.pdf

(Google Earth Pro). Condition assessments were made in accordance with the Condition Tables within The Biodiversity Metric 2.0 Technical Supplement[6]. Applying the precautionary principle, a presumption for the higher condition was used where there was any uncertainty in the condition of existing habitats.

To predict biodiversity units supported after the development is constructed, the aerial imagery was overlaid by the current proposed scheme layout (see Figure 2). This allowed direct losses of habitats to be measured where the built environment overlaps with pre-existing habitat, with gardens and amenity areas treated separately. The habitats that are 'created' after development are assumed to achieve the highest level of condition as appropriate.

The DEFRA Metric 2.0 uses a separate calculator spreadsheet for linear features. This works under the same principles as above but replaces areas of habitat with linear length of a feature. It should be noted that because linear features often have higher ecological importance, linear habitats are assigned higher distinctiveness and must be offset with other linear features. The biodiversity units generated for linear features are not equivalent or interchangeable with biodiversity calculations for areas of habitat.

10.3 Results

10.3.1 Existing Habitats Assessment

The following Phase 1 Habitat types were identified across the site (Figure 1):

- buildings
- hardstanding
- amenity grassland
- scattered trees
- a small area of lowland mixed deciduous woodland
- scrub – dense/continuous
- hedgerow with trees – species-poor
- hedgerow – species poor

For input into the Biodiversity Metric, the Phase 1 habitat types were converted into habitat categories appropriate for the metric calculation table as shown in Table 5 using a best-fit approach, aided by the site walkover survey. Table 5 lists the habitat categories used for the calculation and an explanation of the condition assigned to each one.

Overall, the on-site calculated baseline is 31.88 habitat units and 1.58 hedgerow units.

Table 5. Existing habitats: Conversion of Phase 1 habitat categories for input into the Biodiversity Metric 2.0 Calculation Tool.

Habitat types		**Condition assessment**	
Mapped phase 1 Habitat	**UK Habitat Classification System**	**Key features**	**Condition**
On-site habitats			
Amenity Grassland	Urban – Amenity Grassland	Extensive areas of short-sward amenity grassland are present in the site's northern and	Poor

[6] Natural England (2019) The Biodiversity Metric 2.0; Auditing and Accounting for Biodiversity Technical Supplement.

		southern halves. The grassland is regularly mown to <3cm. The grassland is periodically re-sown and is maintained by fertiliser and weed control. The grassland also clearly fails the following assessment criteria: • The appearance and composition of the vegetation on site should very closely match the characteristics for the specific Priority Habitat • Wildflowers, sedges and indicator species for the specific Priority grassland habitat are very clearly and easily visible throughout the sward and occur at high densities in high frequency.	
Broadleaved parkland/Scattered Trees	Woodland and Forest – Wood-pasture and Parkland	Broadleaved tree belts including mature specimens exist along the fairways of the course. Species recorded include oak *Quercus robur*, willow *Salix* sp., hawthorn *Crataegus monogyna* and silver birch. The tree canopy component of the habitat fails the following assessment criteria: • This should be an area of trees with complete canopy cover. • Standing and fallen dead wood of over 20 cm diameter are present including fallen large dead branches/stems and stumps. • The area is protected from damage by agricultural and other adjacent operations. • No signs of significant nutrient enrichment present. The grassland component is periodically re-sown and is maintained by fertiliser and weed control. The grassland also clearly fails the following assessment criteria: • The appearance and composition of the vegetation on site should very closely match the characteristics for the specific Priority Habitat • Wildflowers, sedges and indicator species for the specific Priority grassland habitat are very clearly and easily visible throughout the sward and occur at high densities in high frequency.	Moderate*

Broadleaved parkland/Scattered Trees	Woodland and Forest – Other Woodland; Young Trees Planted	Young planted trees within the tree belts which line the course. No condition assessment required.	Poor
Poor Semi-improved Grassland	Grassland – Modified Grassland	Areas of species-poor semi-improved grassland are created by roughs. The grassland clearly fails the following assessment criteria: • The appearance and composition of the vegetation on site should very closely match the characteristics for the specific Priority Habitat • Wildflowers, sedges and indicator species for the specific Priority grassland habitat are very clearly and easily visible throughout the sward and occur at high densities in high frequency.	Poor
Lowland Mixed Deciduous Woodland	Woodland and Forest – Lowland Mixed Deciduous Woodland	A very small section of woodland at the northern boundary of the site, the area forms part of a larger area of woodland which extends beyond the site boundaries. The woodland contains: silver birch, willow, oak, holly *Ilex aquilifolium*, apple *Malus domestica*, ash, hawthorn and hazel. The woodland clearly fails the following assessment criteria: • Free from damage [Bark stripping; Browse line; Damage shoot tips] (in the last five years) from stock or wild mammals with less than 20% of vegetation being browsed. • There should be evidence of successful (i.e. not browsed off before it gets well established) tree regeneration such as seedlings, saplings and young trees. • Standing and fallen dead wood of over 20 cm diameter are present including fallen large dead branches/stems and stumps.	Moderate
Buildings & Hard-standing	Urban – Developed Land; Sealed Surface	A modern clubhouse and dwelling are present at the south-eastern corner of the site. A carpark of concrete hard-standing exists at the south-eastern corner of the site. No condition can be applied to this habitat type.	N/A

Intact Hedge (species-poor)	Native Hedgerow	Native species-poor hedgerows exist along southern boundary. The hedgerows contain. oak, rose *Rosa* sp. blackthorn, bramble *Rubus fruticosus*, willow, beech and fir *Abies* species with sections of dense bramble. The hedgerows clearly fails the following attributes: • Plant species indicative of nutrient enrichment of soils dominate <20% cover of the area of undisturbed ground • >90% of the hedgerow or undisturbed ground is free of damage caused by human activities	Good
Hedge with Trees (species-poor)	Native Hedgerow with Trees	The eastern edge of the site, where the golf club is accessed off the adjacent road, is marked by a beech hedge with a planted row of semi-mature lime *Tilia x europaea*. The hedgerow clearly fails the following attributes, including both attributes in Functional Group A: • >1.5 m height average along length • >1 m width of undisturbed ground with perennial herbaceous vegetation for >90% of length measured from outer edge of hedgerow, and is present on one side of the hedge (at least)	Moderate
Intact Hedge (species-poor)	Ornamental Non-native Hedgerow	Ornamental Non-native hedgerows exist along the northern edge of the site and along the western edge of the site's existing car parking area. The hedgerows fail the following assessment criteria: • 1.5 m height average along length • >1 m width of undisturbed ground with perennial herbaceous vegetation for >90% of length measured from outer edge of hedgerow, and is present on one side of the hedge (at least) • Plant species indicative of nutrient enrichment of soils dominate <20% cover of the area of undisturbed ground • >90%of the hedgerow is free of invasive non-native and neophyte species	Poor
Off-site habitats			
Amenity Grassland	Urban – Amenity Grassland	Extensive areas of short-sward amenity. The grassland is regularly mown to <3cm and	Poor

		maintained as road verges and recreational sports fields. The grassland is periodically re-sown and is maintained by fertiliser and weed control. The grassland also clearly fails the following assessment criteria: • The appearance and composition of the vegetation on site should very closely match the characteristics for the specific Priority Habitat • Wildflowers, sedges and indicator species for the specific Priority grassland habitat are very clearly and easily visible throughout the sward and occur at high densities in high frequency.	
*Condition assessment for Woodland and Forest – Wood-pasture parkland incorporates condition assessments for the tree canopy and grassland components using grassland and woodland assessment criteria[6]			

10.3.2 Habitat Losses and Gains

The proposed development scheme at this site will result in the loss of:

On-site

- 7.55ha of Urban – Amenity Grassland
- 0.14ha of Grassland – Modified Grassland
- 0.8ha of Urban – Developed Land; Sealed Surface
- 0.52ha of Woodland and Forest – Other Woodland; Young Trees Planted

Off-site

- 1.65ha of Urban – Amenity Grassland

The scheme will see retention of:

On-site

- 1.79ha of Woodland and Forest – Other Woodland; Young Trees Planted
- 300m of Native Hedgerow
- 120m of Native Hedgerow with Trees
- 300m of Ornamental Non-native Hedgerow

The scheme will see enhancement of:

On-site

- 0.46ha of Woodland and Forest – Wood-pasture and Parkland improving the conditional assessment from moderate to good.
- 0.12ha of Woodland and Forest – Lowland Mixed Deciduous Woodland improving the conditional assessment from moderate to good.

Post intervention the following habitats will be created:

On-site

- 0.4ha of Grassland – Other Neutral Grassland
- 4.81ha of Urban – Developed Land; Sealed Surface
- 3.3ha of Urban – Vegetated Garden
- 0.5ha of Urban Sustainable Urban Drainage Feature
- 0.86ha of Urban – Street Tree
- 430m of Native Species Rich Hedgerow

Off-site

- 1.837ha of Grassland – Other Neutral Grassland

The overall results of the calculations are presented in Please refer to the Biodiversity Metric 2.0 – Calculation Tool supplied with this document (submitted separately) for full details of the calculation.

Table 6. Headline results of the Biodiversity Impact Calculation for the proposed development at Reading Golf Club.

On-site baseline	Habitat units	31.88
	Hedgerow units	2.51
	River units	0.00
On-site post-intervention (Including habitat retention, creation, enhancement & succession)	Habitat units	27.03
	Hedgerow units	5.17
	River units	0.00
Off-site baseline	Habitat units	3.30
	Hedgerow units	0.00
	River units	0.00
Off-site post-intervention (Including habitat retention, creation, enhancement & succession)	Habitat units	11.60
	Hedgerow units	0.00
	River units	0.00
Total net unit change (including all on-site & off-site habitat retention/creation)	Habitat units	3.45
	Hedgerow units	2.66
	River units	0.00
Total net % change (including all on-site & off-site habitat creation + retained habitats)	Habitat units	10.83%
	Hedgerow units	106.18%
	River units	0.00%

10.4 Conclusions

The Biodiversity Metric 2.0 Calculation has demonstrated that in terms of habitat units the proposed scheme results in a likely increase of **3.45 Habitat units** totalling a **10.83% net gain**.

The linear feature calculation for the proposed scheme results in a likely gain of **2.66 Hedgerow units** totalling a **106.18% net gain**.

The net gain in both habitat and hedgerow units are well above the 10% and no further offsetting will be necessary for the proposed development of Reading Golf Club.

Should you need any further advice on the information provided above, please do not hesitate to contact The Ecology Co-op