

St. Modwen Properties



ECOLOGYSOLUTIONS

Part of the ES Group

COED DARCY,
LLANDARCY, NEATH

**Landscape and Ecology
Management Plan**

November 2021
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1. INTRODUCTION

- 1.1 This Landscape and Ecology Management Plan (LEMP) has been prepared by Ecology Solutions Limited on behalf of St Modwen Properties (the Applicant) in respect of the proposed development of Coed Darcy, Skewen, Neath; hereafter referred to as 'the Site'.
- 1.2 This document is a draft LEMP for the Site, the intention of which is to set out the guiding mitigation and enhancement principles proposed, such that Neath Port Talbot County Borough Council (NPTCBC), Natural Resources Wales (NRW) and other ecology consultees may be satisfied that the proposed development will not result in any significant adverse ecological impacts on the Site.
- 1.3 This document should be viewed as a 'work in progress', with iterative changes to be made and detail provided, as required, in order to ensure no net losses in ecological value of the Site and, indeed, to realise biodiversity enhancements in the long-term.
- 1.4 The objectives of this LEMP are to secure the delivery of a high quality Green and Blue Infrastructure Network which will both mitigate the development proposals for the Site (both in terms of flora and fauna), and realise long-term biodiversity gains through the provision and retention of high quality habitat in perpetuity.
- 1.5 Noting the outline nature of the proposal, this document outlines the broad governing principles for the creation and retention of the Strategic Green Infrastructure within the development footprint, with detailed prescriptions identified where possible. In addition, consideration is also afforded to opportunities for 'on-plot' Green Infrastructure in due course.
- 1.6 For the purpose of this document, mitigation and enhancement measures are detailed which will benefit those features of ecological value, and which form the existing ecological baseline, as detailed within the Biodiversity Chapter (Chapter 10) of the Environmental Statement.
- 1.7 It is the intention of the Applicant for a final version of this LEMP, with detailed management prescriptions and protected species strategies, to form a condition of any future planning consent.

2. SUMMARY ECOLOGICAL BASELINE

- 2.1 Ecology Solutions undertook a range of ecological surveys at the Site between 2020 and 2021.
- 2.2 Habitat surveys undertaken were based upon an extended Phase 1 survey technique. The habitats and dominant plant species were recorded, together with conspicuous faunal activity, and evidence of the presence, or potential presence, of protected species. Results from the habitat surveys were then plotted onto a base map of the Site (see Figure 10-2 within the ES Chapter).
- 2.3 In addition to general observations of faunal activity, Ecology Solutions undertook specific surveys for:
- Bats;
 - Badgers *Meles meles*;
 - Breeding birds;
 - Otter *Lutrinae* and Water Vole *Arvicola amphibius*;
 - Dormouse *Muscardinus avellanarius*;
 - Reptiles; and
 - Great Crested Newts (GCN) *Triturus cristatus*.
- 2.4 Specific surveys were also undertaken for terrestrial invertebrates by Richard Wilson Ecology.
- 2.5 For details of the survey methodology used for the habitat and protected species surveys, please see the Biodiversity Chapter produced in support of the Planning Application (and documents referenced therein).

Results

Habitats

- 2.6 Habitat features identified within the Site include:
- Compacted clay soils with a mosaic of recolonising vegetation;
 - Wet grassland and mixed scrub;
 - Secondary woodland;
 - Dense and scattered scrub;
 - Waterbodies/ponds;
 - Rush pasture;
 - Exposed rock/cliff;
 - Railway embankment;
 - Tree belts/lines;
 - Amenity grass;
 - Amenity planting;
 - Buildings;
 - Hardstanding.
- 2.7 Where these habitats are of value, either in their own right, as part of a wider habitat mosaic, or due to their importance for faunal species, they are represented within the proposed Green and Blue Infrastructure

Network, including a dedicated ecology area measuring approximately 12ha.

- 2.8 Descriptions and full species lists for each of that habitats/features within the Site are included within the ES Chapter.

Faunal Species

- 2.9 Protected or notable species and assemblages noted within the Site included;

- Badgers;
- Foraging and commuting bats;
- Reptiles;
- Breeding birds;
- Invertebrates; and
- Amphibians (including GCN).

- 2.10 Surveys of the Site found no evidence of Dormouse, Badger, Otter or Water Vole.

- 2.11 Further information on the value and use of the Site by protected and notable species (and assemblages) is included within the ES Chapter.

- 2.12 It is considered that opportunities for all the above protected and notable species will be provided within the Strategic Green and Blue Infrastructure Network (hereafter referred to as the Strategic GI Network) to be delivered within the Site.

3. MANAGEMENT OBJECTIVES

- 3.1 The aims and objectives of the LEMP are to fully safeguard the ecological interest of the Site and ensure long term ecological enhancements are realised through the retention of existing habitats, proposed landscaping and long-term management of the Site's natural and semi-natural habitats.
- 3.2 The management prescriptions, as outlined in this LEMP, will seek to ensure there will be no significant adverse impacts to protected and notable species which utilise the Site. Indeed, following the prescriptions, as set out in this document, it is considered opportunities for protected and notable species will be retained and enhanced in the long-term.
- 3.3 The following objectives have been identified:
- Objective 1: Implement mitigation strategies to maintain and enhance retained and newly created habitats within the Site;
 - Objective 2: Maintain populations of protected and notable species/communities within the Site at a favourable conservation status; and
 - Objective 3: Increase biodiversity by maximising opportunities for flora and fauna.
- 3.4 Appropriate management and monitoring prescriptions for achieving these objectives are set out in the following Sections of this document and will be subject to regular review.
- 3.5 As set out above, the measures detailed in this LEMP primarily relate to the Strategic GI Network to be bought forward in the wider site. However, consideration is also afforded to opportunities for habitat creation and management within development plots, not least in the form of living roof provision.
- 3.6 Habitat creation and management principles for each of the habitats to be delivered within the Site are provided below.
- 3.7 An illustrative Green Infrastructure Masterplan for the Site, detailing areas of semi-natural habitat proposed within the Site, is provided at Appendix 1.

Objective 1: Maintain and Enhance Retained and Newly Created Habitats Within the Site

- 3.8 The development proposals seek to secure a substantial component of the Site as Green and Blue Infrastructure, with in excess of 58.1ha of semi-natural habitats to be delivered or otherwise retained within the Strategic GI Network.
- 3.9 Inclusive within this wider GI Network is a dedicated 'ecology area' measuring approximately 12.1ha, within which no formal public access will be permitted.

- 3.10 The Strategic GI Network will be designed to incorporate the variety of habitats currently present on Site, with new habitat creation proposed to ensure qualitative enhancements over the existing situation. In particular, the design and management of habitats, as well as the control of recreational use, will be targeted to ensure continued and improved opportunities for protected and notable species (and assemblages) in the long-term.
- 3.11 Further opportunities for biodiversity will be delivered through the creation of new areas of semi-natural habitats within the Site, and the integration of biodiversity features within the main development footprint.
- 3.12 The guiding principles for habitat creation, maintenance, and enhancement for these semi-natural habitats are detailed individually below.

Strategic Green Infrastructure Network

- 3.13 The development proposals include the delivery of approximately 58.1ha of Strategic GI Network within the Site. The design and location of this GI has been informed through the existing ecological interest of the Site and, in particular, seeks to retain and enhance the functional connectivity of the Site for faunal species.
- 3.14 The provision of a substantial semi-natural habitat buffer along the Site's western boundary, in addition to a continuous belt of semi-natural habitat linking east to west along the southern boundary of the Site, form key guiding principles in securing and promoting ecological connectivity both within the Site and to the wider area.
- 3.15 Whilst the wider GI Network will be brought forward as a multi-functional resource, a significant area (12.1ha) will be secured as a dedicated 'ecology area', and safeguarded from future recreational use. This ecology area is to be strategically located in the south-east of the Site, adjacent to off-site habitats of interest (not least wetland habitats which form part of the Coed Darcy GCN Site of Importance for Nature Conservation [SINC]), and will provide optimal opportunities for faunal species which are particularly susceptible to anthropogenic disturbance, not least ground nesting bird species such as Lapwing *Vanellinae*.
- 3.16 The Strategic GI Network will support a mosaic of habitat types, including extensive areas of early successional habitats, alongside mature woodland, and significant wetland. In total the Strategic GI Network will include for approximately 19.3ha of woodland, shrub and scrub habitats, 26.9ha of dry grassland and early successional vegetation types, and 7.8ha of varied wetland habitats including for dedicated biodiversity ponds, South Site Reservoir and proposed SuDS. In addition, in excess of 4ha of 'amenity' grassland areas are proposed, significant components of which are envisaged to be managed as meadow grassland in the longer-term.
- 3.17 Due regard will also be given to the protection of retained habitats, as well as protected species, throughout the duration of construction (both of the

Strategic GI Network and the wider site). In this regard, a Construction Environment Management Plan (CEMP) will be prepared and adhered to throughout the course of works. This CEMP will give full regard to the Site's ecological baseline, and ensure retained habitats/features are appropriately safeguarded during construction. Combined with the CEMP, this LEMP will ensure proposals allow for the long-term retention and enhancement of the Site's biodiversity assets.

- 3.18 The phases of habitat removal, particularly areas of early successional habitat which contribute to a wider Open Mosaic Habitat (OMH) resource, will be carefully considered within the CEMP, with the timings of removal considered in tandem with opportunities for habitat creation detailed within the final version of this LEMP. This will ensure a continuation in habitat resource within the Site.
- 3.19 Specific principles for the management and maintenance of semi-natural habitats within the proposed ecology area are detailed below for individual habitats.
- 3.20 As well as ensuring qualitative enhancements for individual habitats within the Site, an overarching objective of habitat management is to ensure the retention of an extensive and varied mosaic of open habitats within the Site.

Dry Grassland

- 3.21 **ES Baseline Habitats of Relevance.** For clarity, this broader post-development habitat category is envisaged to support a mosaic of the following habitat types recorded pre-development:
- Compacted clay soils with a mosaic of recolonising vegetation;
 - Semi-improved grassland;
 - Scattered scrub;
 - Exposed rock/cliff.
- 3.22 Collectively, these habitats contribute towards wider OMH resources within the Site and local area (including the wider Coed Darcy site).
- 3.23 **Summary.** Noting the requirements for large scale land formation, cut and fill and/or ongoing remediation (including works to the Tip which are proceeding outside the planning process) it is envisaged a vast majority of the recolonising mosaic vegetation within the Site is to be lost during construction, albeit on a phased basis.
- 3.24 However, areas of 'dry grassland' will be one of the predominant habitat types to be delivered or retained within the Strategic GI Network with approximately 26.9ha of dry grassland proposed.
- 3.25 These new habitat areas are to be created and managed to promote structural and botanical diversity, reflecting the range of early successional habitats present within the pre-development baseline. Whilst significant areas of dry meadow grassland are sought, a guiding principle of management will seek to promote OMH characteristics within this habitat, as per Table 1 overleaf.

	Criterion
1.	The area of open mosaic habitat is at least 0.25ha in size.
2.	Known history of disturbance at the site or evidence that soil has been removed or severely modified by previous use(s) of the site. Extraneous materials/substrates such as industrial spoil may have been added.
3.	The site contains some vegetation. This will comprise early successional communities consisting mainly of stress-tolerant species (e.g. indicative of low nutrient status or drought). Early successional communities are composed of (a) annuals, or (b) mosses/liverworts, or (c) lichens, or (d) ruderals, or (e) inundation species, or (f) open grassland, or (g) flower-rich grassland, or (h) heathland.
4.	The site contains unvegetated, loose bare substrate and pools may be present.
5.	The site shows spatial variation, forming a mosaic of one or more of the early successional communities (a)–(h) above (criterion 3) plus bare substrate, within 0.25ha.

Table 1. Criteria for OMH classification, as presented by the Joint Nature Conservation Committee (JNCC)

- 3.26 At this stage it is anticipated approximately 60% of the 'dry grassland' will be managed akin to meadow grassland, with the remaining 40% subject to more regular management to sustain early successional communities such as bare and recolonising ground and ruderal vegetation.
- 3.27 Works during the construction phase will include for sequential losses to existing early successional habitats and dry grassland, albeit significant areas will be retained at any one time.
- 3.28 It is proposed for an ecological phasing strategy to be secured as a key component of the site-wide development phasing plan to ensure continuation of OMH within the Site.
- 3.29 Post habitat creation a long-term management regime will be commenced for all dry grassland habitats within the Strategic GI Network.
- 3.30 At this stage it is considered the retention, creation, and management of dry grassland will include for the following activities (as discussed in more detail below):
- Phased losses to existing early successional habitats (recolonising mosaic), with an ecological phasing strategy to be secured as part of the wider development phasing strategy;
 - Phased habitat creation of dry grassland and recolonising mosaic communities within the Site. This to include land forming works allowing creation of topographically varied ground conditions within the GI Network;
 - Selective re-use (translocation) of on Site materials to allow like-for-like habitat creation and the retention of local genetic stock;
 - Instigation of a suitable scrub management regime to maintain scrub at an optimal extent;
 - Instigation of an appropriate cutting regime which seeks to create a diverse vegetation structure and prevent the onset of ecological succession.

- 3.31 **Phasing Strategy.** A detailed ecological phasing strategy will be prepared in tandem with a Site wide development phasing plan. Ecological phasing is anticipated to be detailed within the CEMP, with consideration given to these timeframes within the final version of this LEMP.
- 3.32 Phasing will be designed to achieve an appropriate balance between loss of recolonising mosaic habitats and creation of new dry grassland mosaic during the construction period, ensuring a continuation of early successional habitats within the Site.
- 3.33 At this stage it is anticipated land formation works in the west of the Site will come forward at an early construction phase, thereby providing an opportunity for a significant component of the dry grassland mosaic (and indeed the wider Strategic GI Network) to be delivered prior to wider losses within the Site.
- 3.34 Further details on the phasing proposals are proposed to be provided within a final version of this LEMP.
- 3.35 **Habitat Creation (Ground Works/Preparation).** As above, the creation of dry grassland communities within the Site will seek to secure a mosaic of structurally diverse early successional habitats, albeit with dry grassland communities a dominant component of this mosaic.
- 3.36 A guiding principle of habitat creation will be to secure the re-use and translocation of existing soils and materials from the Site in preference to imported materials or commercially available seed. In addition to ensuring an appropriate growth medium for target habitats, this approach will allow the additional benefit of retaining a desirable seed bank within the Site, allowing for new habitat creation (or re-generation) using local genetic stock. Subject to legislative requirements (i.e. the presence of protected species), 'green hay' collection from habitats in the wider Coed Darcy site may also be utilised for habitat creation.
- 3.37 The use of on Site materials will require the identification of appropriate 'donor locations' within the Site, as well as the appropriate collection and storage of materials prior to their application within 'receptor areas'.
- 3.38 Noting the size, extent and quality of early successional communities are likely to vary in the short to medium term, and whilst the habitat survey findings from the 2020 and 2021 survey work will be a reliable guide, it is proposed for precise donor locations to be identified on Site by an Ecological Clerk of Works (ECoW), prior to relevant construction works commencing. The process of identifying donor sites will be undertaken as required prior to each 'phase' of construction, allowing for the best examples of pre-existing habitat/materials to be identified, collected and stored within the Site prior to habitat losses arising.
- 3.39 The precise collection methodology will vary subject to the nature of the materials or vegetation desired. At this stage, the following methodologies are anticipated to be adopted:
- Green hay/seed collection;

- This will be relevant to areas which support botanically diverse communities, in particular where there are a high proportion of annual species.
 - Vegetation or 'loose' seed will be collected by an appropriately qualified contractor (in accordance with any instructions provided by the overseeing EcoW) during the most appropriate seasonal window (typically late June to August). Seed/plant specimens may be collected by hand or otherwise by suitable machinery such as a brush harvester.
 - Topsoil scrape;
 - Subsequent to any green hay/seed collection, an exercise will be undertaken to remove any undesirable scrub and saplings which have become established within the donor sward. These works shall aim to minimise damage to the soils (i.e. mixing of topsoil and subsoil).
 - Subsequently topsoil from the donor locations will be collected. These works shall be undertaken during the late summer to early autumn months (August to October inclusive) once the majority of flowering plants have set seed. This timing should also ensure works avoid periods in which the land may be waterlogged.
 - The process of topsoil removal will be undertaken methodically to avoid compaction to soils, and will seek to focus on donor locations supporting the most desirable floral communities/substrates. All vegetation and the first 15cm of soil (subject to on Site conditions) will be removed by an excavator and carefully stored, un-compacted and in small discrete mounds, in a suitable location within the Site. These soils will be kept separate from other materials within the Site and will be redistributed at the earliest opportunity following completion of necessary ground works at the receptor locations.
 - The process of soil removal will be managed by an appropriately qualified ecologist who will be able to advise on any Site specific requirements in order to maximise the quality of the materials to be 'translocated' and ensure their optimal storage.
- 3.40 Whilst land forming or 'cut and fill' works will be primarily guided by engineering requirements, due regard will be had to measures to deliver ecological enhancements following the completion of the engineering exercise. Specifically, the exercise will seek to leave a topographically varied 'final level', the design of which will include for the following and will be overseen on Site by an ecologist:
- The creation of bunds and depressions with varying bank gradients; and
 - The provision of south facing, banks or plateaus.
- 3.41 The creation of a varied topography will provide a range of conditions, thereby maximising the likelihood of successful establishment of a botanically varied grassland/recolonising mosaic, and one that is

moreover of optimal suitability to support invertebrate communities recorded in the Site and local area.

- 3.42 Once final earthworks in the receptor locations have been completed, topsoils will be re-distributed. The Site preparation works and distribution of topsoils will be undertaken in a methodical manner, in order to avoid unnecessary handling of the donor soils, damage to the graded subsoils or, indeed, damage to the translocated materials. The re-distribution of soils shall ideally also be undertaken during the summer/autumn months, during suitable weather conditions (e.g. avoiding heavy rainfall).
- 3.43 Finally, hay and seed crop collected at the first stage of the exercise will be strewn in receptor areas, following the re-distribution of the translocated soils, to bolster successful growth of target grassland species. This should be undertaken as soon as possible after harvesting (ideally in early autumn) and as such it is recommended the entire translocation process be completed in as short a time frame as possible.
- 3.44 Sowing will either be undertaken by hand or using low impact farm machinery. Depending on the weather conditions, seeded areas may be lightly watered.
- 3.45 Subject to the success of any green hay or seed collections, and to further maximise the botanical diversity of the re-instated grassland (and ensure a pollen rich habitat for nectar feeding invertebrates), it may be appropriate for localised areas to be overseeded with an additional wildflower rich seed composition. At this stage it is considered approximately 10% of dry grassland habitats will require supplementary seeding. A bespoke seed mixture proposed for living roof habitats (see 'Living Roof' Section below) will be equally suitable for seeding in these areas. The composition of this mix has been selected to include early and late flowering species with a high nectar content.
- 3.46 The composition of this seed mix will be targeted to maximise food sources for notable species recorded during the surveys of the Site, and will include for a high concentration of Horseshoe Vetch *Hippocrepis comosa* and Trefoils; high pollen food sources for a range of nectar feeding invertebrates.
- 3.47 Once the translocation has been completed no further machinery which could cause damage will be permitted to access the area, in order to maximise the likelihood of successful establishment.
- 3.48 As set out above, any soil/hay translocation will be overseen and managed by a suitably qualified ecologist, working in conjunction with all relevant contractors, site managers and engineers, to ensure the process maximises the likelihood of successful establishment, whilst also ensuring it is both viable from a commercial and logistical perspective, and does not cause any unnecessary delays to the construction works at the Site.
- 3.49 **Post-construction Management Overview.** Post-construction, all areas of 'dry grassland' will be brought under a suitable, biodiversity led management regime. This management regime will seek to retain and

enhance the structural and botanical diversity of the grassland within the Strategic Green Infrastructure, ensuring a transition of successional stages and sward heights are retained. As above, it is proposed at this stage for 60% of the 'dry grassland' to be managed akin to meadow, with 40% of the area subject to more regular management to sustain a mosaic of early successional habitats.

- 3.50 Management principles for achieving the desired sward diversity are identified separately below.
- 3.51 **Post-construction Management (Meadow Grassland).** Cutting of grassland will be undertaken in suitable weather conditions in the late summer (typically late September) using a strimmer or brush cutter. Cutting will be undertaken on a rotational basis with a proportion (20%) of the grassland left un-cut each year to allow tussocky areas to establish.
- 3.52 Where cutting is to occur, this should seek to reduce the sward height to no less than 15cm initially, so as to avoid potential impacts on reptiles and amphibians. Subsequent to the initial cut, it is proposed for approximately 60% of the grassland to be subject to a further cut, reducing the sward height to 3 to 4cm, thereby creating basking spots for reptiles, as well as opportunities for solitary insects.
- 3.53 It should also be noted that natural grazing within the Site (such as rabbits *Oryctolagus cuniculus*) may also have the potential to contribute to the retention of a short, open sward within the Strategic Green Infrastructure. This grazing will be encouraged through the retention of scrub pockets (refuge) throughout more open areas.
- 3.54 Selective removal of invasive or overly aggressive grassland and ruderal species will be conducted, as required following annual inspections, in order to retain and enhance the ecological and structural diversity of the habitats present.
- 3.55 Arisings from the above management (excluding invasive/undesirable species) will be retained on Site for a period of 5 days to allow seed to set. Following this timeframe, the majority of arisings will be removed from Site. However, a proportion (10%) will be retained to ensure a source of shelter and food for a range of saprophagous invertebrates.
- 3.56 Patches of bare ground will also be created within the grassland. Whilst of negligible floristic value, this habitat type provides important opportunities for invertebrates and basking reptiles. The rotational creation of bare ground habitat through long-term management will complement the exposed habitats created during the initial cut and fill exercise, ensuring exposed soils at a range of orientations and gradients.
- 3.57 In order to create and maintain these patchworks of bare and disturbed ground on Site, pockets of grassland and ruderal vegetation will be subject to rotational disturbance such that a series of successional microhabitats can develop. Any disturbance should be through the use of hand tools only and with due regard given to the potential presence of protected species such as reptiles (see Faunal Section below).

- 3.58 The provision of bare ground within meadow grassland areas will be through rotavating, with this seeking to retain approximately 10% of the habitat type as bare/disturbed ground. Disturbed habitat should be delivered in a number of distinct pockets ranging 10m² to 100m².
- 3.59 It is recommended this artificial disturbance be undertaken on an annual basis in order to maintain approximately 10% of the grassland mosaic as bare open ground.
- 3.60 Any disturbance of habitat should seek to provide lightly compacted bare ground, within which vegetation is removed (in order to slow natural re-colonisation) and will be undertaken with due regard to the potential presence of protected species. Where these areas of disturbed ground are allowed to re-establish, management will be undertaken as required to prevent growth of undesirable species.
- 3.61 Pockets of scrub will be encouraged, and will vary in size to maximise habitat diversity within areas of grassland. Management will seek to retain scrub cover to no more than 15% of the grassland mosaic, with cutting undertaken on a 4 yearly rotational basis (or as required), in order to retain a varying age structure to this habitat. Where scrub management is required this will be undertaken by hand or through mechanical means. If necessary stumps will be treated with a suitable herbicide to prevent re-growth.
- 3.62 The provision and retention of scrub in a number of individual pockets is an important aspect of the management strategy, allowing for substantial areas of 'edge habitat' to be retained between the grassland and scrub.
- 3.63 Should annual monitoring of the Strategic GI Network identify the encroachment of undesirable or excessive scrub (i.e. ground cover >20%, or high proportions of Bramble *Rubus* or non-native species), a more regular scrub management regime will be adopted, as required.
- 3.64 Where scrub clearance results in the creation of un-vegetated areas, these areas are to be allowed to re-colonise naturally. Where required, selective removal of undesirable or overly dominant species will be undertaken. In particular, consideration will be given to Bramble re-growth. Should significant re-growth be apparent, a further exercise will be undertaken to remove any remaining root systems.
- 3.65 It is envisaged the above management will be informed by annual monitoring of the Strategic GI Network, with iterations to the strategy made where required to ensure the diversity of the habitat is retained and enhanced in the long-term.
- 3.66 In summary, key principles governing long-term management of meadow grassland areas will include:
- Commencement of an annual cutting regime in the late summer (August/September), with a proportion of the grassland (20%) left un-cut each year;
 - Creation and retainment of a structurally diverse grassland of varying sward heights which includes a patchwork of transitional

habitats including scattered scrub (<20%) and bare or early successional vegetation;

- Creation and retainment of areas of bare ground ranging from vertical to horizontal surfaces (~10%);
- Removal of the majority of arisings (first allowing for seed to set).

Post-construction Management (Early Successional Habitats and OMH). As described in the ES Chapter, the Site supports a wide range of early successional habitats which have established on previously developed land. Whilst individually many of these habitats are of low, or even negligible, ecological value, they hold a substantially greater value as a habitat mosaic, not least on account of their value to invertebrate communities' present within the Site.

- 3.67 As set out above, an overarching objective of habitat creation and management within the Strategic GI Network (and indeed the wider development site) is to ensure significant areas of high quality OMH are retained within the Site post-development. This will primarily be achieved through the appropriate re-use and translocation of on Site soils, seed and green hay, alongside the subsequent commencement of a suitable management regime.
- 3.68 For many habitats, particularly those at an early successional stage, there is considerable overlap in management principles, and moreover a need to maintain a management approach which allows for flexibility. With this in mind, broader habitat creation and management proposals for recolonising mosaic (OMH) are provided below. These measures will ensure a range of early successional habitats are retained or recreated on Site.
- 3.69 As set out above in relation to grassland, management of this habitat will include for the provision of bare ground on a rotational basis, thereby enhancing the structural diversity of the habitat. The meadow grassland itself will form a key component of the wider OMH and a principle of habitat management will be to seek a graded transition between this grassland and the early successional habitats within the Strategic GI Network (and indeed the wider site).
- 3.70 Long-term management will be rotational, effectively seeking to sub-compartmentalise early successional habitats within the Strategic GI Network and ensure the habitats present represent a full range of successional habitats, from bare ground to secondary woodland.
- 3.71 The below management principles seek to prevent and/or 'reset' succession for the early successional habitats on Site. The management of more established habitats is detailed separately (see relevant habitat types below).
- 3.72 Management of early successional habitats will be through rotational soil disturbance (rotavating), with this disturbance undertaken on a 2 to 3 year rotation. The location of management will vary between years and will be primarily informed through the vegetation communities present.

- 3.73 The frequency of management will, to a large extent, need to respond to growth rates on Site, with the rates of growth of many early successional habitats being heavily influenced by prevailing weather conditions each year. With this in mind, the management principles below should not be seen as prescriptive, but rather a guide to appropriate management in any one year.
- Larger areas of recolonising mosaic/OMH will be cultivated each autumn (September/October), with one third of the habitat area rotavated each year;
 - Management of footpath/trail margins in the Strategic GI Network will be in the form of an annual harrowing exercise undertaken in the autumn months (September/October). Harrowing will be undertaken on a rotational basis, with approximately 50% of the path margins subject to disturbance each year;
 - Retention of bare ground in meadow grassland through rotational disturbance (rotavating) with 10% of the surface area subject to management each year. Cleared areas to change between years and to vary between 10m² to 100m² in area.
- 3.74 Where necessary, the above management will be preceded by a cut of existing vegetation. Vegetative arisings from these works will be removed.
- 3.75 Where necessary, to bolster the seed bank, long-term management will give consideration to the re-application of a desired seed source (either as a green hay translocation from the wider seed source, or application of a bespoke, commercially available seed mix). Management will also be mindful of retaining topographical diversity, with periodic 're-sculpting' of the ground surface should this be necessary. It is unlikely such re-sculpting would be required more than once in any five year period.
- 3.76 At this stage it is considered chemical use (herbicide and/or fertiliser) within the Strategic GI Network will be avoided. Should chemical use be considered essential at any stage during on-going management, any such application would be discussed and agreed with an ecologist in the first instance.
- 3.77 Appropriately designed recreational use of the Strategic GI Network is an important element of the mitigation strategy, ensuring the day-to-day use of the park complements the above management principles and contributes towards the long-term management objectives.
- 3.78 The types of recreational use proposed for the Site, to include walking/running trails, have been identified with this in mind. The Site wide trail network will include for both open access and managed access routes, as well as path margins of varying widths. Moreover, extensive areas of disturbed ground will be delivered well away from allocated trail routes. This will ensure the frequency/severity of disturbance across the Strategic GI Network will vary, further contributing to habitat diversity.
- 3.79 Controlled access to the proposed ecology area will provide an additional safeguard for a sub-set of the Site, ensuring an area within which

potential disturbance or soil enrichment (such as through dog faeces) is avoided.

- 3.80 It is further noted that areas of exposed cliff will be created or retained as part of the proposals. Whilst the geology of this cliff habitat is considered unsuitable for invertebrate nesting (i.e. would not allow for burrowing or excavation by solitary insects), opportunities exist to artificially create nesting holes such as through localised drilling (see Invertebrate Section below), thus introducing new nesting opportunities within the Site.
- 3.81 At this stage it is not considered any specific management will be required in respect of new and retained cliff habitat itself, albeit occasional removal of invading vegetation may be required to retain an open aspect and prevent overshadowing.
- 3.82 As a slight change in management emphasis (relative to the wider OMH where a diversity of structural variety is the primary objective), management of the dry grassland/OMH within close proximity (approximately 20m) of these 'invertebrate nesting cliffs' will seek primarily to maximise floristic diversity, ensuring a high density of pollen-rich wildflowers. A mosaic of scrub and bare ground will not be targeted in these areas. The management regime will target the removal of coarser grasses or ruderal vegetation, enhancing opportunities for a wider range of wildflowers to establish.
- 3.83 The retention/recreation of areas of pollen rich ruderal vegetation are equally of particular importance, with several key invertebrate species being dependent on the abundant resource available within the Site. Areas of ruderal vegetation are to be proactively sought both as edge habitats, such as adjacent woodland and scrub, as well as within areas of open vegetation and atop mounded habitat. As a guiding principle, 10% of the dry grassland habitat (approximately 2.5 ha) will be targeted for ruderal provision.
- 3.84 Target species groups will include umbellifers, open-flowered yellow crucifers and ragworts, with management seeking to maintain a diversity of species which will ensure continued flowering periods throughout the spring and summer months.
- 3.85 The Strategic GI Network will include for over 4km of recreational trails, including for surfaced and gravel walking routes.
- 3.86 With the exception of where these trails extend through woodland, management will include for the establishment and retention of sparsely vegetated margins. The margins will be designed to have an average width of 2m (on each side of the paths), albeit the precise width will vary where necessary to allow for the retention of other interest features (such as more mature trees).
- 3.87 Management of these margins will be in the form of an annual harrowing exercise undertaken in the autumn months. Harrowing will be undertaken on a rotational basis, with approximately 50% of the path margins subject to disturbance each year. Where necessary, this harrowing exercise will

be preceded by a cut of existing vegetation. Vegetative arisings from these works will be removed.

3.88 In summary, key principles for long-term management of recolonising mosaic/OMH will include:

- Management to retain/restore the topographical diversity within the Site;
- Rotational management to retain a mosaic of transitional habitats from bare ground to secondary woodland; and
- Controlled public access to a subset of the Site as a further safeguard to prevent degradation or damage.

Wet Grassland and Mixed Scrub

Summary. Extensive areas of wet grassland will be retained, enhanced and/or created within the Strategic GI Network, including within dedicated ecology areas. Post-development, these wet grassland and mixed scrub habitats are to be managed in perpetuity for the purposes of nature conservation.

3.89 Collectively, these habitats also contribute towards wider OMH resources within the Site and local area. Indeed, and as for dry grassland habitats above, it is anticipated wet grassland and scrub habitats will form transitional communities with other areas of grassland, as well as wetland habitats.

3.90 In summary, the retention, creation, and management of wet grassland will include for the following activities (as discussed in more detail below):

- Phased losses to existing habitats, with an ecological phasing strategy to be secured as part of the wider development phasing strategy;
- Phased habitat creation of wet grassland communities within the Site. This to include land forming works allowing creation of topographically varied ground conditions within the GI Network;
- Selective re-use (translocation) of on Site materials to allow like-for-like habitat creation and the retention of local genetic stock;
- Instigation of a suitable scrub management regime to maintain scrub at an optimal extent;
- Instigation of an appropriate cutting regime which seeks to create a diverse vegetation structure and prevent the onset of ecological succession.

3.91 **Phasing Strategy.** As for other grassland habitats, works during the construction phase will include for sequential losses to existing habitats and dry grassland, albeit significant areas will be retained at any one time.

3.92 A detailed ecological phasing strategy will be prepared in tandem with a Site wide development phasing plan. Ecological phasing is anticipated to be detailed within the CEMP, with consideration given to these timeframes within the final version of this LEMP.

- 3.93 Post-development, wet grassland is anticipated to be created at the margins of new and retained waterbodies, not least within the dedicated ecology area and around South Site Reservoir, as well as within and surrounding proposed SuDS features (the latter comprising approximately 7.8ha of habitat post-development).
- 3.94 **Habitat Creation (Ground Works/Preparation).** As above, the creation of wet grassland communities within the Site will further complement a mosaic of structurally diverse early successional habitats within the Site.
- 3.95 The preparation and creation of areas of wet grassland will follow the same broad principles as set out above for dry grassland and OMH communities. For clarity, this will include the selective use or translocation of on Site materials (soil/green hay etc) as identified by the ECoW. Localised application of an appropriate seed mix would also be suitable, albeit preference should be given to on Site materials in the first instance.
- 3.96 The surface topography of wet grassland habitats (a significant proportion of which will comprise SuDS features) will be primarily guided by engineering requirements (i.e., to achieve SuDS capacity). However, due regard will be had to measures to deliver ecological enhancements following the completion of the engineering exercise. Specifically, the exercise will again seek to leave a topographically varied 'final level', with a 'pockmarked' surface that allows for depressions, holes, and small basins capable of remaining wet or damp for extended periods.
- 3.97 **Post-construction Management.** Areas of wet grassland are envisaged to be subject to a more irregular mowing regime, with cuts of this habitat undertaken on a three yearly rotation, and a third of this habitat cut per annum (ideally in mid to late summer when water levels are lowest).
- 3.98 This irregular regime will allow the establishment of tussocky grass and sedge habitat, affording improved cover for faunal species. Cutting should be targeted to ensure a range of wet grassland habitats, allowing the retention of the most floristically diverse communities.
- 3.99 Cutting should be to a height of no less than 150mm to avoid potential impacts on reptile and amphibian assemblages which are present within the Site.
- 3.100 It is noted wet grassland habitats are likely to transition into marginal communities, particularly at pond edges. At this stage cutting of marginal vegetation is envisaged to be undertaken less frequently (i.e. on a 4 to 5 year rotation) and is described separately in the 'Ponds' and 'Wetland Habitats' Sections below.
- 3.101 As for dry grassland habitats above, grassland management will seek to retain pockets of mixed scrub as a valuable component of the habitat mosaic. At this stage, it is proposed for scrub management to be as described for dry grassland habitats, with a target ground cover of approximately 15% scrub, and management undertaken on a 4 yearly rotational basis (or as required) in order to retain a varying age structure to this habitat. It is anticipated grassland management elsewhere will be

sufficient to prevent undesirable encroachment of scrub into open grassland areas.

Waterbodies/Ponds/Ditches

- 3.102 **Summary and Overview.** A guiding principle for the landscape proposals is to create an extensive new Blue Infrastructure (SuDS), including a ribbon of ponds and wetland along the western boundary.
- 3.103 As set out in the ES Chapter, the proposals will retain substantial areas of wetland and open water within the Site, not least Coed Darcy Wetlands and South Bay. Moreover, the proposals seek to deliver significant enhancements to South Site Reservoir, converting this from a somewhat artificial reservoir to a significantly more naturalised wetland.
- 3.104 In addition to these larger waterbodies, the proposals will also seek to deliver a large number (a minimum 20) biodiversity pools, some of which will form part of the strategic SuDS network. Networks or swales and ditches are also envisaged to form part of the detailed landscape design.
- 3.105 Habitat creation and management principles for the various wetland habitats are considered in turn below.

Coed Darcy Wetlands

- 3.106 **Works During Construction.** The waterbodies associated with Coed Darcy Wetlands are to be fully retained as part of the proposals, with appropriate construction safeguards to be detailed within a CEMP. At this stage it is anticipated works during construction will be limited to appropriate vegetation management, allowing the removal of any non-native or undesirable vegetation, as well as management to allow for a proportion of bankside habitats to remain unshaded.
- 3.107 **Post-construction Management.** Post-development, management of these habitats will be undertaken for sound ecological reasons only. At this stage it is considered management will be largely limited to the removal of invasive or overly dominant species. However, rotational clearance of aquatic vegetation, as well as dredging, may be undertaken to ensure areas of open water are retained at a variety of depths in the long-term. At this stage, given the size of the waterbodies, it is considered unlikely any dredging will be required more regularly than on an 8 to 10 yearly rotation. Aquatic management would be staggered so no more than 25% of habitats are subject to management in any one year.
- 3.108 Ponds will be subject to annual inspections to check for litter and pollutants, with remedial measures undertaken as required.
- 3.109 Management of adjacent habitats, including areas of wet grassland, trees, and shrubs, will again be low key, and will be guided by those measures set out above for these respective habitats. Management will ensure no more than 50% of pond margins are shaded overall, thus ensuring continued opportunities for aquatic/marginal flora to flourish. Rotational clearance of over shading vegetation will be undertaken on an ad-hoc basis where required.

South Site Reservoir

- 3.110 **Works During Construction (Habitat Creation).** It is proposed the existing reservoir be converted to a large area of semi-natural wetland, with extensive exposed banks, marginal vegetation, and shallow open water. In order to achieve this transformation, it is proposed the waterbody be partially infilled during the construction phase. The methodology for infilling the Reservoir will be detailed within a separate document.
- 3.111 The existing banks of the Reservoir are engineered and steep sided, with significant overshadowing scrub and limited emergent or marginal vegetation. As a result of the steep bank gradients emergent vegetation is particularly limited.
- 3.112 The creation of natural banks, including the removal of engineered surfacing and re-grading, alongside the partial infilling of the Reservoir (using appropriate inert materials) will allow for the creation of extensive wider, shallow margins along the edge of the waterbody, as well as within central areas where an island is proposed. This in turn will allow for establishment of a substantially increased extent of marginal/aquatic vegetation, as well as significant exposed earth and drawdown zones.
- 3.113 At this stage, it is anticipated marginal/reed-bed habitat will be created in line with one of the following approaches:
- Excavation of a shelf which sits under a shallow depth of water (10 to 50cm in depth);
 - Deposition of inert materials to create shelves or islands under the water level upon which marginal communities can establish. Water depths between 10 to 50cm to be targeted;
 - Encouragement of natural colonisation within regraded, shallow gradient banks.
- 3.114 Where re-grading is undertaken, the design of the bank slope will be such that it has a shallow bank gradient at the water level, thereby seeking to maximise the draw down zone, in addition to the shallow plateau. The creation of these features will be overseen by a suitably qualified ecologist and/or hydrologist who will be able to advise on the detailed creation of each feature.
- 3.115 Within these shelved areas low key plug-planting will be undertaken. Subject to construction phasing (and protected species licences), it is proposed for this planting to utilise plant stock from elsewhere on Site (i.e. where waterbodies are being lost to built form). Where this is not feasible, plug-planting will be limited to the provision of Common Reed *Phragmites australis*, Yellow-flag Iris *Iris pseudacorus*, Common Club Rush *Schoenoplectus lacustris* and *Typha latifolia* with specimens planted in small, mono-specific clusters to mimic natural recolonization. New planting will comprise donor plants present in the wider Site wherever possible.

- 3.116 To further maximise diversity and promote locally genetic stock, it is anticipated, at this stage, that 50% of the planting shelves will be left for natural colonisation.
- 3.117 **Post-construction Management.** Management of the Reservoir in the early years (Years 1 to 10) will seek to encourage the establishment of the marginal community, with a target to allow for the establishment of 0.4ha of marginal/reedbed habitat within the period. Management in this early period will be limited to the removal of non-target species, should any colonise.
- 3.118 Once the desired extent of marginal vegetation has established, management will revert to maintaining the extent of this habitat through rotational cutting.
- 3.119 Clearance should be small scale, providing structural diversity with more mature vegetation fringing more recently managed areas. No more than 25% of the marginal vegetation would be cleared per year. This same rate of management will apply to existing wetland habitats within the Coed Darcy GCN SINC.
- 3.120 It is anticipated any excavated material will be removed during operational management, and retained elsewhere on Site in the form of habitat piles. Should excessive arisings be gathered, these will be removed from Site.
- 3.121 Whilst the encouragement of marginal vegetation forms a guiding principle of management across the majority of the South Site Reservoir, habitat creation and management within the proposed island will seek to retain generally open, low sward habitats, with areas of wet grassland and exposed soils sought. This will ensure optimal opportunities for a range of ground nesting bird species within this undisturbed section of the Site. Management for these open sward habitats will be undertaken preferably with the use of hand tools, and will be undertaken in the early autumn months (October to November) to avoid disturbance during the main breeding and wintering periods.

Biodiversity (GCN) Ponds

- 3.122 **Summary.** As detailed within the ES Chapter, it is anticipated a minimum of 20 new waterbodies will be created and managed specifically to ensure high quality breeding opportunities for amphibians, including GCN.
- 3.123 The location of these waterbodies has been carefully informed by both current and historic amphibian populations within the Coed Darcy Site. Specifically, the proposals seek to create a dedicated wildlife corridor along the Site's western boundary, with this supporting a necklace of new ponds, with at least one dedicated GCN pond every 250m to maximise dispersal. In addition, clusters of 2 to 3 ponds will be provided within this western corridor to ensure localised breeding hotspots for a range of amphibians.
- 3.124 It is proposed for the detailed locations and design of these dedicated waterbodies to be provided within the final version of this LEMP.

- 3.125 **Works During Construction (Habitat Creation).** The ponds created/proposed will comprise four pond designs (A to D). The design of these ponds is detailed schematically at Appendix 2, and will accord with any measures detailed within a separate GCN licence application (as would be secured for the Site in due course).
- 3.126 The four pond designs will allow for a diversity of aquatic conditions and will buffer the potential for adverse weather conditions to adversely impact all water features. Further diversity of these features will be realised through ongoing pond management.
- 3.127 Whilst the majority of dedicated ponds are proposed to be distinct and stand alone features, it is anticipated a proportion of these dedicated ponds will be located within the basins of strategic SuDS features. In these instances the pond design would be such that the dedicated biodiversity feature supports permanent (or near permanent) standing water, with the wider SuDS basin only infrequently inundated after periods of flooding.
- 3.128 At this stage it is anticipated creation of new ponds will be directly overseen by the appointed ECoW. However, subject to the appointed landscape contractor, such oversight may not be required (for example if the ponds were created by the Amphibian & Reptile Conservation Trust [ARC]).
- 3.129 **Post-construction Management.** New ponds will be subject to monthly checks during the establishment period (Year 1) in order to ensure habitats are healthy and undamaged.
- 3.130 Subsequent to Year 1, all ponds/waterbodies will be inspected on a regular (monthly) basis for the presence of litter, general debris and any other sources which may produce water pollutants. Litter and debris would be removed by hand and taken off Site.
- 3.131 The frequency of vegetation clearance within new and retained ponds will vary to allow for the development of different plant communities. For example, whilst 30% of ponds will be subject to vegetation clearance on a 2 year rotation, 50% of ponds will be subject to vegetation clearance less frequently (e.g. every 4 years), and the final 20% of ponds subject to only irregular management (>4 years) to maintain areas of open water and to remove overly dominant species. The exact quantum of ponds to be managed through the above principles will be informed through ongoing monitoring, although it is unlikely any such management will be needed before the fifth year after planting.
- 3.132 During all intrusive works care will be taken so as not to disturb areas of longer grass deemed to support hibernation sites for GCNs.
- 3.133 Dredging ponds on a rotational basis will provide a range of habitats within the ponds, all of which will be suitable to support breeding GCN. There is no prescribed threshold at which point ponds should be dredged, however, management will ensure all GCN ponds should hold water for a minimum of one year in three. Dredging/desilting works will be

undertaken on a rotational basis and only during the winter months in order to avoid impacting on GCN.

- 3.134 The frequency of dredging will vary across the Site, with some ponds dredged more regularly to maintain larger bodies of open water, and others dredged only rarely, therefore representing shallower features with more extensive marshy margins.
- 3.135 Subject to Site conditions, no more than 30% of ponds should be subject to dredging works in any one year.
- 3.136 Any vegetation or material removed from waterbodies should be deposited at the pond edge for 1 to 2 days, to allow any trapped fauna to disperse, before being appropriately disposed of elsewhere on or off Site as required (e.g. in the form of vegetation piles).
- 3.137 Management of invasive or over-dominant aquatic vegetation will also be undertaken as required. For example, should Typha colonise in any of the on Site ponds this will be managed such that only a proportion (no more than 30%) of the waterbodies support significant levels of this vegetation type at any one time.
- 3.138 All dedicated GCN ponds will be managed such that no one feature is fully overgrown (i.e. when these features are holding water, a proportion of this water will be open at the surface).
- 3.139 For GCN ponds, clearance of bankside vegetation (including scrub) is to be undertaken on a selective basis and to heights no lower than 15cm above ground level to avoid impacting on GCN.
- 3.140 Whilst scrub/tree clearance should be undertaken to avoid excessive overshadowing, it is recommended some ponds are allowed to develop a more shaded margin.
- 3.141 This variation in shading can be managed through rotational clearance, with the banks of some ponds subject to scrub management every other year to remove all overshadowing scrub (30% of ponds), some subject to management every fourth year with the aim of maintaining approximately 30% shaded bank (50% of ponds), and some subject to only infrequent management to ensure no more than 80% of the pond bank is overshadowed. This variation in management frequency will result in a range of microhabitats being present within the Site at any one time. Variation in bankside vegetation and shade will result in different water temperatures, as well as different terrestrial opportunities for GCN.
- 3.142 As above, a series of grassland habitats are proposed within close proximity to GCN ponds, and these habitats will be managed primarily to enhance their suitability to support GCN (i.e. irregular management to 15cm).
- 3.143 It is anticipated the 'sculpting' of wet grassland and SuDS will allow for the creation of seasonally inundated habitats, scrapes or ephemeral pools, each of which are desirable. Where these seasonal wetlands are created (or otherwise establish), management will be limited to

maintaining these in an open condition, with low key works (such as occasional vegetation clearance or dredging for leaf removal) undertaken as required to prevent the features becoming increasingly dry or overly vegetated.

- 3.144 For all waterbodies where management is required, these works will take place in the winter hibernation period, during which any amphibian species (should they colonise the Site in the future) will be in their terrestrial phase.

SuDS

- 3.145 **Summary.** As detailed above, significant areas of SuDS are proposed within the Site, with approximately 7.8ha of SuDS basins proposed.
- 3.146 The detailed design of SuDS basins will need to be informed by further modelling to ensure the delivery of an effective surface water drainage scheme for the Site. The detailed habitat creation for individual SuDS will therefore be determined following this exercise, and will be identified within the final version of this LEMP.
- 3.147 All proposed SuDS will be designed as semi-natural habitats, ranging from areas of open grassland to permanent waterbodies.
- 3.148 **Works During Construction (Habitat Creation).** Detailed habitat creation will be informed by future modelling and engineering (hydrology requirements).
- 3.149 At this stage it is anticipated habitat creation will reflect that identified for other habitats on Site (for example, areas of wet grassland and biodiversity ponds). It is anticipated this will allow for the introduction of topographical variation at strategic locations to maximise biodiversity whilst ensuring appropriate hydrological functionality and maintenance access.
- 3.150 Further prescriptions will be provided in the final version of this LEMP.
- 3.151 **Post-construction Management.** As for construction above, detailed management prescriptions will be informed by future modelling and engineering (hydrology requirements).
- 3.152 Again, it is anticipated habitat management will reflect that identified for other habitats on Site (for example, areas of wet grassland and biodiversity ponds).
- 3.153 Further prescriptions will be provided in the final version of this LEMP

Ditches/Swales

- 3.154 **Summary.** The proposals will allow for the retention of a proportion of the existing ditch network, whilst new linear wetland in the form of ditches/swales are envisaged within the Strategic GI Network. Whilst playing a functional role in the Site wide surface water management

strategy, these features will nonetheless be managed to maximise their ecological value in the long-term.

- 3.155 **Works During Construction (Habitat Retention/Creation).** The protection of retained habitats will be detailed within a CEMP, and will be secured by way of planning condition. The CEMP will clearly outline the measures to be implemented to ensure adverse impacts are avoided on retained habitat, including physical harm or damage, measures for dust suppression, storage of chemicals/contaminants and control of surface water flows.
- 3.156 At this stage it is otherwise anticipated that works to retained habitats during construction will be limited to vegetation management to remove non-native or overly dominant vegetation.
- 3.157 Where new ditches are created, these will be delivered as naturalistic features, with varying bank depths and gradients as well as varying permanence in order to maximise habitat diversity. In preference, it is proposed for new ditch habitats to be allowed to colonise naturally. As for South Site Reservoir above, and subject to phasing, it may be appropriate to use plant stock or materials relocated from elsewhere on Site (such as where aquatic habitats are lost to development or require vegetation management).
- 3.158 Further, detailed prescriptions will be provided in the final version of this LEMP.
- 3.159 **Post-construction Management.** At this stage it is anticipated ditch management will be low key and undertaken on an ad-hoc basis as required in order to ensure they do not become overgrown by scrub, or over silted.
- 3.160 Where wetter ditches are present, these will be managed such that species richness can be enhanced with suitable management to include the selective removal of overly dominant species.
- 3.161 Habitats adjacent to ditches will also be subject to appropriate management in the operational phase in order to ensure they complement aquatic habitats and increase biodiversity overall. It is considered such management will be undertaken on a rotational basis and will include for:
- The selective clearance of over-shading scrub and (3 to 5 year rotation);
 - The sensitive cutting of the grassland and ruderal vegetation habitats adjacent to watercourses (3 year rotation).
- 3.162 As for other aquatic habitats, regular (quarterly) inspections will be made in the operational phase to ensure the stream remains unobstructed, with removal of any significant obstructive material (or encroaching vegetation) completed as required.
- 3.163 Checks will also be made for the presence of invasive and undesirable species. In the event any such species are discovered during the

construction or operational phase of the development then these will be cleared and treated following the most up to date guidance and good practice for the relevant species.

Secondary Woodland

- 3.164 **Summary.** As set out in the ES Chapter, notwithstanding the limited extent of mature trees and the high frequency of undesirable scrub encroachment, the woodlands within the Site would likely qualify as the BAP habitat of *Lowland Mixed Deciduous Woodland*.
- 3.165 The location and extent of existing woodland habitat within the Site has informed the extent and layout of the Strategic GI Network, with the majority of the woodland, including the areas of comparatively greater value, being incorporated into the Strategic GI Network. Moreover, new woodland and scrub planting will allow for an overall net gain in woody vegetation post-development.
- 3.166 Works during the construction phase will include for localised woodland clearance, alongside the instigation of a woodland management scheme to remove non-native, undesirable and overly dominant plant species from the woodland, seeking to create localised areas of more open woodland.
- 3.167 During the operational phase, a long-term management regime will commence and will include for the following key principles:
- New broad-leaved woodland and shrub planting;
 - Rotational tree clearance regime to open up the woodland and encourage growth;
 - Ring barking and retention of standing deadwood;
 - Coppicing (of suitable deciduous stock);
 - Woodland edge management (shrub retention);
 - Small-scale glade and ride creation;
 - Provision of log and brash piles; and
 - Invasive/undesirable species control.
- 3.168 **Works During Construction.** Noting the relatively high prevalence of non-native species within some areas of woodland, it is proposed for an extensive eradication and management regime to commence during the construction phase. This exercise will ensure the removal of undesirable and invasive species from the woodland, in turn allowing for the establishment of a native woodland flora. In particular, this management regime will target the removal of *Buddleia* (dominant), *Cotoneaster* and *Rhododendron* from the Site.
- 3.169 Where feasible, such management should employ mechanical means (for example the grubbing out of *Buddleia* or dense *Bramble*), as opposed to chemical control. In the event chemical controls are required, it is envisaged these will utilise Glyphosate or, in the case of Bracken *Pteridium*, (should control be required), Asulam.
- 3.170 In addition, noting the relatively dense tree growth within some areas of woodland, as well as the dominance of Willows *Salix* and Birch *Betula*, it

is proposed for localised or small scale thinning to be undertaken within the Site during construction, in particular within the Crescent Woodland (W2).

- 3.171 Thinning is essential management of younger woodland to ensure establishing trees have adequate space to grow into natural forms by avoiding overcrowding and forced, spindly upward growth. The increased penetration of light to the field layer is also beneficial in promoting desirable ground flora, and will be of benefit to a range of woodland invertebrates (as considered further in the Invertebrate Section below).
- 3.172 It is proposed for small scale felling or thinning works to be undertaken within W2, with approximately 10% of trees removed. Works should seek to retain a mosaic of larger and smaller specimens (i.e. not seek to only retain the most vigorous stock), and moreover create a patchwork density of woodland in order to create a range of abiotic conditions beneath the canopy. Thinning will seek to ensure the full range of planted species are retained within the Site.
- 3.173 Works within W2 are also proposed to include for the creation of a woodland ride, with this to be created and managed to provide transitional habitats ranging from open grassland and ruderal vegetation, to mixed native shrub and ultimately established woodland. The proposed woodland ride will extend north to south through W2, and will be created to provide a 'scalloped edge' habitat to maximise opportunities for faunal species.
- 3.174 Further, localised 'opening up' of woodland areas will also be sought during the construction period, with detailed locations and extent of these glades to be identified within the final version of this LEMP. At this stage, it is anticipated approximately 0.75ha of open glade habitats will be delivered within W1 and W2, with this comprising a range of smaller clearings.
- 3.175 Where new woodland and shrub planting is proposed within the Site, the following measures are proposed.
- Removal of existing vegetation (including stumps and ruderal vegetation);
 - Re-grading and tilling of soil to create an optimal planting medium;
 - Planting of a bespoke woodland mix with specimens planted naturalistically (i.e. avoiding a strict grid formation and favouring small monospecific groups in some locations);
 - Installation and maintenance of protective fencing to prevent deer grazing, with this forming a perimeter around the woodland compartment;
 - Commencement of a care programme during the establishment period; and
 - Completion of regular health checks of planted stock during adverse weather periods.
- 3.176 Retained woodland will be protected during construction through the establishment of appropriate tree protection measures such as fencing, ground protection, and dust control. These protective measures will be

further secured within a CEMP, as is proposed to be secured as part of this planning application.

- 3.177 **Post-construction Management.** Long-term management of woodland will be undertaken for sound ecological reasons only (with the exception of where health and safety concerns are present) and as such the precise scope/location of works will be dependent on Site conditions and habitat success.
- 3.178 The frequency and type of broad-leaved woodland management during the operational phase will be informed by both the adopted land managers on-going management of the Site as well as periodic assessments of the Site by a suitably qualified ecologist.
- 3.179 A guide to the management proposals is set out below. The principle of this management will be to deliver a species rich and structurally varied woodland ecosystem in the long-term:
- Rotational tree clearance regime to open up the woodland and encourage growth;
 - Woodland ride/edge management (shrub retention);
 - Ring barking and retention of standing deadwood;
 - Coppicing (of suitable deciduous stock);
 - Encouragement of natural regeneration;
 - Small-scale glade creation;
 - Retention and appropriate management of high value tree specimens;
 - Provision of log and brash piles; and
 - Invasive/undesirable species control.
- 3.180 Detailed management prescriptions are set out below. It is envisaged management of woodland habitats will be via the preferred use of hand tools (such as chainsaws, bow saws or pole saws), and be undertaken with due regard to the potential presence of protected species such as bats and nesting birds (with appropriate methodologies adopted as required – see Faunal Section below).
- 3.181 **Small Scale Felling/Thinning of Woodland.** Management through thinning is primarily proposed in relation to new woodland planting, albeit thinning at reduced rates will likely also be suitable for existing woodland on Site (noting that much of this has established in recent decades).
- 3.182 Thinning of new planting should commence once complete coverage of the ground is achieved, and developing trees are no longer compromised by competition from weed growth. Typically, this condition should be achieved within 10 years of planting.
- 3.183 Small scale felling or thinning works of new planting will then be undertaken on a rotational basis from Year 10. As a guiding principle, thinning should be undertaken at a rate of no more than 10% of trees every tenth year, albeit the initial exercise may be more extensive so as to achieve sufficient spacing between specimens. Works should seek to retain a mosaic of larger and smaller specimens (i.e. not seek to only retain the most vigorous stock), and moreover create a patchwork density

of woodland in order to create a range of abiotic conditions beneath the canopy. Thinning will seek to ensure the full range of planted species are retained within the Site.

- 3.184 When woodland begins to reach significant maturity, thinning will likely cease or otherwise reduce considerably. The intention will be that the woodland retains a predominantly closed canopy (with light levels primarily controlled through additional measures such as coppicing (see below).
- 3.185 **Woodland Edge/Ride Management.** Management of the woodland within W2, as well as woodland edge habitat elsewhere within the Site, will include for the creation of scalloped edges in order to enhance the extent of edge habitat available and increase structural diversity.
- 3.186 Within these areas management will seek to achieve a gradation of habitats from mature woodland to mixed shrub and ultimately meadow grassland.
- 3.187 Management of scrub, shrub, and trees in these scalloped areas will be undertaken on a rotational basis (4 yearly rotation) to provide continued areas of open grassland and ruderal. It is not envisaged management of edge habitat will be required until Year 4 (post creation/planting).
- 3.188 Grassland management will seek to retain rough margins within which grass will be cut on an irregular, rotational basis, with no more than 50% of the edge habitat subject to cutting in any one year. In central areas more regular grassland management will be undertaken, complementing the proposed function of this area as an informal walking route.
- 3.189 **Coppicing.** New deciduous planting will include for species which respond well to coppicing, such as Oak *Quercus*, Field Maple *Acer campestre* and Hazel *Corylus*.
- 3.190 Noting this, it is proposed that from Year 10 rotational coppicing will be introduced. 20% of planted stock will be identified for coppicing. Chosen specimens will include for examples of all planted species. Of the stock earmarked for coppicing a quarter of specimens will be subject to management in Year 10, with a further 20% of (future) stools subject to management every fifth year thereon. Priority should be given to the coppicing of those stools/groups that are the most overgrown/unstable.
- 3.191 Coppice management will primarily seek to manage clusters/groups of trees/shrubs (each of approximately 15 to 20 specimens). Coppicing in groups will allow for a greater change in localised light levels relative to management of individual stools, thereby maximising the variation in abiotic conditions and maximising opportunities for a woodland field layer to establish.
- 3.192 Coppicing of mature Hazel stock will also be undertaken where appropriate, such as where this habitat is locally present within W1. As for new planting above, it is anticipated no more than 20% of stools will be subject to management in a five year period. Priority should be given to the coppicing of those stools which are most overgrown/unstable. Initial

coppicing works will be undertaken during the construction phase, with works at approximately 5 yearly intervals thereon.

- 3.193 **Creation/Retention of Standing and Fallen Deadwood.** Standing deadwood should be retained on Site where possible, with a long-term target of at least five standing deadwood trees per hectare of woodland. Should standing deadwood not occur naturally, management in the form of ring-barking may be undertaken at a rate of no more than 5 trees per annum.
- 3.194 **Encouragement of Natural Sapling Generation/Establishment.** Natural sapling generation will be encouraged as the woodland matures. Indeed, this process forms an integral component of the woodland management approach, contributing towards the establishment of a semi-natural woodland within which planting density, species, age, and structure (maturity) varies.
- 3.195 Management of natural generation will be limited to the removal of non-native or overly dominant species, as well as thinning of stock where required to promote natural growth forms. This management will be determined following annual inspections by the land manager. Management will be through mechanical means (brush cutter or similar) as opposed to chemical means which may otherwise risk drifting onto non-target specimens (including ground flora).
- 3.196 **Small Scale Glade Creation.** In order to further introduce and sustain structural diversity within areas of retained woodland, it is proposed for localised glade creation to be undertaken during the operational phase.
- 3.197 Glade creation/restoration in the long-term should seek to retain approximately 0.75ha of open habitat within areas of woodland, with creation of new glades to compensate for those glades which are allowed to succeed into woodland.
- 3.198 At this stage, following initial glade creation as proposed during the construction phase, glade creation/restoration should again be undertaken on a 20 year rotation (or as required) from Year 10, with the objective of retaining areas of open habitat (grassland/heath) which will offer opportunities for invertebrates and reptiles within more extensive areas of woodland.
- 3.199 At this stage it is anticipated management of the habitats within glades will be low key, with management only undertaken to remove excessive growth or undesirable species. Where appropriate, localised shrub planting or grassland seeding may be appropriate to encourage the establishment of desired habitats within glades.
- 3.200 **Management to Control/Remove Non-native and Overly Dominant Species.** During the operational phase, areas of broad-leaved woodland will be subject to annual monitoring by the adopted land managers, with works undertaken to remove invasive and aggressive flora where required.

- 3.201 Where feasible, such management should employ mechanical means (for example the grubbing out of dense Bramble or the cutting of Bracken), as opposed to chemical control. In the event chemical controls are required, it is envisaged these will utilise Glyphosate or, in the case of Bracken, Asulam.
- 3.202 **Retention and Management of Higher Value Trees.** Where existing, relatively mature Oak *Quercus* trees are present (i.e. locally within W1), these are to be retained as part of the proposals. At this stage it is anticipated these specimens will be managed in such a way as to encourage them to grow into future veteran trees. Pollarding of trees will be undertaken at infrequent intervals (10 to 15 years) in order to encourage veteran characteristics, with advice sought from an arboricultural expert where necessary. Management will be undertaken with regard to advice contained in '*Veteran Trees: A Guide to Good Management*' (2000), specifically Chapter 8 ('*The Next Generation of Veteran Trees*').
- 3.203 **Provision of Log and Brash piles.** A proportion of arisings produced through the above management will be gathered into log piles in adjacent grassland habitats, thereby offering new refugia for reptiles and amphibians, as well as opportunities for saproxylic invertebrates.

Boundary Trees, Tree Lines and Shrub

- 3.204 **Summary.** Extensive linear planting will be retained, both within the Strategic GI Network and, indeed, along the boundaries of the wider Site. Whilst much of this planting will play an important screening function post-development, significant opportunities exist to ensure biodiversity enhancements will be realised in these areas.
- 3.205 **Works During Construction.** Where retained vegetation lies within a proximity of proposed development works protective fencing will be installed prior to the commencement of construction, and retained for the duration of works. Fencing will be undertaken in accordance with the current British Standard (BS 5837:2012) to protect roots from compaction. This will ensure direct impacts and severance/asphyxiation of roots are avoided. Further details on habitat protection will be secured within the proposed CEMP for the Site.
- 3.206 During the construction phase, all areas of retained boundary vegetation will be subject to works to remove non-native and overly dominant or aggressive species. Initial clearance works will again be overseen by a suitably qualified ecologist, where required, to ensure the biodiversity value of these habitats can be maximised.
- 3.207 Where boundary planting borders other semi-natural habitats within the Strategic GI Network, management will seek to provide a transitional sequence of habitats, with areas of rough grassland and ruderal vegetation bordering more mature shrubs and tree belts. Wherever possible, these transitional habitats will also be provided and maintained along the areas of boundary habitat within the wider development Site.

- 3.208 As described for 'Secondary Woodland' above, new tree and shrub planting will be provided in the initial construction phase, and will comprise a wide range of native and wildlife beneficial species, including a number of seed and berry-bearing species (see Appendix 3).
- 3.209 **Post-construction Management.** Once planted, new stock will be watered and covered with 75mm bark mulch to inhibit weed growth. Regular maintenance will ensure these areas are kept weed-free during the establishment period and ensure all shrubs are healthy.
- 3.210 Regular health checks of new planting will also be made during periods of dry weather to ensure they are not affected by drought, and in order to conduct pruning as required. It should be noted that pruning will be undertaken outside of the main bird nesting season wherever possible (or otherwise preceded by a check for nesting birds), and for sound ecological reasons only.
- 3.211 From Year 3 (post completion of new planting), areas of shrub will be subject to rotational management to remove overly dominant species and prevent encroachment of this habitat type into the retained grassland. At this stage it is considered no more than 30% of the boundary will be subject to works in any one year, thereby allowing for a range of successional habitats to develop. Care will be taken to ensure trees planted as standard specimens remain uncut.
- 3.212 Where existing tree belt habitat is retained (for example TB1), management will be limited to that required to ensure good ecological condition, or otherwise for sound arboricultural reasons. At this stage such management is considered to be limited to ad-hoc formative pruning.
- 3.213 However, as for areas of mature Oak trees within W1, opportunities exist for mature trees within the tree belts to be managed in such a way as to encourage them to grow into future veteran trees. Where appropriate, it is proposed pollarding (or appropriate formative management) be undertaken at infrequent intervals (10 to 15 years) in order to encourage veteran characteristics, with advice sought from an arboricultural expert where necessary. Management will be undertaken with regard to advice contained in '*Veteran Trees: A Guide to Good Management*' (2000), specifically Chapter 8 ('*The Next Generation of Veteran Trees*').
- 3.214 Management will be via mechanical means and will be undertaken with due regard to the potential presence of protected species such as reptiles and nesting birds (with appropriate methodologies adopted as required).
- 3.215 Wherever possible, and as for areas of woodland above, management will include for the creation of scalloped edges in order to enhance the extent of edge habitat available and increase structural diversity. Management of vegetation in these scalloped areas will again be undertaken on a rotational basis (3 yearly rotation) to provide areas of open grassland and early successional habitat. There will be a strong management bias for the more open habitats to be created in unshaded areas of the Site with a south-facing aspect. This will ensure these

scalloped edges are of much greater value to the invertebrate communities' present within the Site.

- 3.216 Should hedgerow planting be provided within the Strategic GI Network, long-term management will seek to achieve an optimal structure (objective: to achieve an 'A' shaped structure with a height of >2.5m) through infrequent cutting, with 50% of the hedges per year subject to works. In the long-term occasional management through hedge-laying may be required to restore an optimal structure to the hedgerow. Hedge-laying is considered unlikely to be required more than once every 10 to 15 years.
- 3.217 As for areas of woodland, log and brash piles will be established using timber taken from on-going management of trees and shrub. All dead wood produced in the future will be retained as an ecological feature, offering new habitat for saproxylic invertebrates as well as potential hibernacula for reptile species.

Amenity Grassland (Meadow Planting and areas of POS)

- 3.218 **Summary.** The Strategic GI Network will include for extensive areas of 'amenity grassland' which will be managed primarily for recreational purposes. Nonetheless, significant areas of meadow grassland are anticipated to be subject to relatively informal management, allowing the establishment of areas of more diverse meadow habitat.
- 3.219 **Works During Construction.** Subject to detailed design, and the anticipated use of amenity grassland areas, these will either be seeded with a species-rich seed mixture (such Emorsgate Seeds' Standard General Purpose Meadow Mixture - EM2 or an annual cornfield mix), which comprises a range of native and wildlife beneficial species, or otherwise (in the case of areas subject to the highest levels of amenity use) an amenity grass mix tolerant of heavier wear.
- 3.220 Prior to sowing these seed mixes, a weed free seed bed will be prepared with a medium to fine tilth. Seed mixes will be sown in rows or patches on the surface of these weed free areas, with the surface being subsequently firmed to allow for sufficient seed to soil contact.
- 3.221 **Post-construction Management.** Management of these swards during the first year will vary depending on the adopted seed mix. Where an annual corn mix is applied, a meadow cut regime will commence in Year 1 (see 3.223 below). Where other mixes are applied, cutting in Year 1 will involve regular maintenance to ensure seedling development is successful and the growth of competitive weed species is controlled. Where required, weeding will be undertaken by hand or, if necessary, through the sensitive use of Glyphosate based chemicals. Cuttings should immediately be removed from Site. For the first few years it may be necessary to re-seed the areas of wildflower meadow in order a sufficient, self-sustainable seed-bank can develop.
- 3.222 Subsequent to cutting in Year 1, areas managed more informally as 'meadow' are envisaged to be cut twice a year, once in March/April and again in September/October (after flowering). These cuts should be

completed once the sward has reached a height in excess of 100mm and cutting should be completed to a height of between 40 to 70mm. Cuttings should be left on Site to dry for approximately seven days prior to removal, in order to allow flower seeds to disperse. Cutting should give due regard to the potential presence of reptiles, with a two-stage cut undertaken to encourage dispersal.

- 3.223 Areas with a more formal amenity focus (such as areas for ball sports) are to be provided within the main development footprint, and will generally be subject to an intensive cutting regime. This regime is anticipated to include for regular cuts within the main growing season (March to October), maintaining the sward height below 100mm.
- 3.224 By complying with the management regimes above, the need for additional management to proposed grassland habitats in the form of weed removal or scrub clearance will be largely alleviated. Should additional management be required, this should be in the form of either manual or mechanical vegetation removal. Where this is not possible, Glyphosate based herbicides may be applied to habitats of concern, where necessary.

Invasive Species Management

- 3.225 The adoption of management prescriptions, as set out above, are considered likely to prevent the establishment of non-native species within the Site, without additional targeted measures being required.
- 3.226 Notwithstanding this, ongoing management and monitoring will include for regular inspections for non-native species, with appropriate remedial management identified as required should such species be identified.
- 3.227 The presence of Japanese Knotweed *Reynoutria japonica* within the Site is noted, and a detailed eradication and management strategy is proposed to be secured for this species within the CEMP, as would be secured by planning condition to any successful planning application.

Proposed Habitats Within the Wider Site

- 3.228 Whilst ecological mitigation and enhancement measures are being delivered primarily through the establishment of the proposed Strategic GI Network, extensive opportunities also exist to deliver further enhancements within the main development footprint.
- 3.229 Indeed, the provision of additional Green Infrastructure within the main development area seeks to enhance the permeability of the Site for a range of species, both through creating continuous habitat corridors along the Site boundary, as well as islands of suitable habitat, such as 'living roofs' within the Site.
- 3.230 At this stage, Green Infrastructure creation within the main development footprint is anticipated to include for the following habitats/features:
- Living roofs;
 - Living walls (including vegetated embankment);

- Invertebrate gardens/plateaus;
- Sustainable urban drainage (SuDS);
- Shrub and boundary planting; and
- Meadow planting and areas of Public Open Space (POS).

3.231 It is anticipated detailed proposals for habitat creation within the wider Site will be identified as part of future Reserved Matters applications. It is envisaged habitat creation and management secured as part of those Reserved Matters will remain consistent with the guiding principles detailed in the following section of this LEMP.

Living Roofs/Walls

3.232 **Summary.** The provision of living roofs/living surfaces is a key mitigation principle for the scheme, ensuring substantial OMH is retained, not only within the Strategic GI Network but also across the main development footprint.

3.233 The creation of extensive living roof habitat is proposed within the main development footprint, not least on the proposed school. Opportunities will also be sought to deliver living roof habitat on suitable structures within the Site. Opportunities in this regard may include for on bus stops, cycle shelters, and apartment buildings.

3.234 In addition to living roof habitat, the proposals seek to create living wall habitat and/or sparsely vegetated embankments, particularly in the west of the Site, where substantial level changes offer opportunities to create invertebrate banks, cliff habitat, and nesting walls.

3.235 Further details on the quantum and location of living roof/wall habitat are anticipated to be detailed within a final version of this LEMP.

3.236 **Works During Construction (Habitat Creation).** The proposals for living roof creation have been informed by Buglife's '*Creating Green Roofs for Invertebrates*' guidance document, and are consistent with previous advice provided by them on other schemes. Living roof provision will target the creation of OMH habitats of a comparable nature to those recorded on Site during surveys in 2020/2021.

3.237 Suitable habitat creation measures for areas of living roof are identified below. The detailed design of living roof habitat would be confirmed at a more detailed stage of planning.

3.238 All living roofs will be created with the appropriate engineered foundations/layers to ensure the 'host' buildings can support the material load, remain waterproof, and not be susceptible to root ingress. A drainage board will also be installed to provide a means by which the roof can shed excess water, this being particularly important for the desired creation of heat-stressed OMH (as well as for engineering reasons).

3.239 The substrates to be utilised as the growing medium for the living roofs will be Site won clay soils, as well as inert aggregate (ranging from crushed concrete to gravels and pebbles). It is anticipated these soils will comprise imported materials from the wider Site.

- 3.240 Substrate materials will be distributed to achieve a varied topography, with substrate depths varying from approximately 80mm to 150mm. This will allow for both a variation in growth conditions, with lower substrate depths resulting in a more sparsely vegetated sward, and for the creation of a range of micro-climates, within which abiotic conditions will vary.
- 3.241 Subsequent to the provision of the growing medium and the 'sculpting' of the surface (to ensure a varied topography), the living roofs will be subject to seeding and/or furnishing.
- 3.242 In order to further maximise habitat variety across the areas of living roof, three design variations have been identified, as set out in Table 1 below. At this stage it is proposed for each design type to comprise a third of the living roof provision on Site.

Living Roof Design	Broad Habitats to be Included
Type A	50% clay soils to be seeded/plug-planted with an appropriate seed mix (see text below). 25% clay soils to be left un-seeded to encourage natural colonisation. 10% small aggregate (gravel/crushed concrete). 10% deadwood. 5% larger aggregate (pebbles).
Type B	40% clay soils to be left un-seeded to encourage natural colonisation. 20% clay soils to be seeded/plug-planted with an appropriate seed mix (see text below). 15% sandy soils to be left un-seeded. 10% larger aggregate (pebbles). 10% small aggregate (gravel/crushed concrete). 5% shallow open water.
Type C	30% clay soils to be left un-seeded to encourage natural colonisation. 30% sandy soils to be left un-seeded. 20% small aggregate (gravel/crushed concrete). 10% larger aggregate (pebbles). 5% deadwood. 5% shallow open water.

Table 1. Suitable Options for OMH Creation to be Sought for Living Roof Provision at Coed Darcy.

- 3.243 A bespoke seed mixture will be prepared for the living roof habitats, ensuring it can support a representative range of floral species well suited to nutrient poor soils located in exposed, stressed conditions. Moreover, the composition will seek to include for species that flower at varying times of year, ensuring a continued nectar resource over an extended period. An indicative species mix for seeded areas is detailed in Table 2 below, with a final seed mix proposed to be agreed with ecology consultees and subject to commercial availability.

- 3.244 Where the floral composition is to be introduced, it is proposed for 80% of this to be through seed provision, with 20% of the surface area to be plug-planted. Plug-planted specimens are anticipated to include for Biting Stonecrop *Sedum acre*, Common Knapweed *Centaurea nigra*, Ox-eye Daisy *Leucanthemum vulgare*, Viper's Bugloss *Echium vulgare* and White Campion *Silene latifolia*.

Species	Flowering Period	% Composition of Mixture
Herbs		
Autumn Hawkbit <i>Leontodon autumnalis</i>	June to October	3
Rough Hawkbit <i>Leontodon hispidus</i>		3
Great Mullein <i>Verbascum thapsus</i>	June to August	2
Ox-eye Daisy	July to September	4
Viper's bugloss	June to September	5
White Campion	May to September	3
Night-flowering Catchfly <i>Silene noctiflora</i>	July to September	3
Common Knapweed	June to September	4
Red clover <i>Trifolium pratense</i>	May to September	4
Black Medick <i>Medicago lupulina</i>	May to September	4
Wild Strawberry <i>Fragaria vesca</i>	April to July	4
Wild Carrot <i>Daucus carota</i>	June to August	3
Yarrow <i>Achillea millefolium</i>	June to September	4
Wild Marjoram <i>Origanum vulgare</i>	July to September	2
Yellow-wort <i>Blackstonia perfoliata</i>	June to October	4
Bird's-foot Trefoil <i>Lotus corniculatus</i>	June to September	5
Narrow-leaved Bird's-foot Trefoil <i>Lotus tenuis</i>	June to August	3
Lesser Trefoil <i>Trifolium dubium</i>	May to October	3
Hop Trefoil <i>Trifolium campestre</i>	June to September	3
Horseshoe Vetch <i>Hippocrepis comosa</i>	May to July	5
Kidney Vetch <i>Anthyllis vulneraria</i>	June to September	4
Biting Stonecrop <i>Sedum acre</i>	June to July	5
Grasses		
Creeping Bent <i>Agrostis stolonifera</i>	June to August	5
Sheeps Fescue <i>Festuca ovina</i>	May to June	5

<i>Crested Dog's tail Cynosurus cristatus</i>	May to August	10
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Table 2. Indicative Seed Mix for Living Roofs at Coed Darcy.

- 3.245 Newly created living roofs will be regularly monitored during the establishment phase to ensure desirable establishment, and that planted specimens remain in good health. Dead and diseased specimens will be removed and replaced.
- 3.246 Once established, management of the living roofs will be low key, with ecological succession likely to be largely kept in check by the nutrient poor soils and the exposed, high stress growing conditions of the roofs.
- 3.247 During the operational phase, the roofs will be monitored twice yearly in order to inform any requirements for ongoing management. The principle management goal for these habitats is to retain and enhance the structural and botanical diversity of each roof, allowing each to retain a varied diverse community of species in the long-term. At this stage it is likely management will predominantly focus on the removal of undesirable species such as Buddleia.
- 3.248 The detailed design of the living roof proposed on the school would be agreed at a later stage of planning (i.e. when the detailed design of the school comes forward).
- 3.249 A key design principle for the living roof on the school will be to encourage its use as a learning resource for future school pupils. The design will therefore accommodate the use of the roof for outdoor classes. In line with this ethos, it is envisaged the principles behind the detailed design of this roof (and indeed other areas of OMH within the Site) will be documented in pamphlets (or similar) and made available to the school as a learning tool.
- 3.250 As above, further opportunities will also be sought on other structures within the main development footprint, such as bus stops, cycle shelters and apartment buildings.
- 3.251 Living wall habitats are also proposed within the Site. Whilst the detailed design, location and quantum of living wall habitat will be detailed within a final version of this LEMP, it is considered opportunities will include for the following:
- Retaining walls to comprise vegetated 'criblock' walls, with this in particular favouring pollen-rich species such as Horseshoe Vetch and Trefoils;
 - Retaining walls or suitable built form to include for planters, hanging baskets or ledges within which a range of floral communities will be planted;
 - Provision of habitat walls, nesting walls and 'insect hotels' which will comprise a variety of natural materials ranging from deadwood with drilled holes of varying width to hay, pine cones, or bamboo canes. In particular, opportunities for living walls will be sought immediately beneath living roofs. For example, there are opportunities for the design of cycle stores or bin shelters to be

inspired by designs similar to those created by the *Grass Roof Company*¹;

- The provision of raised planters and habitat panels (again as inspired by the *Grass Roof Company*) which could additionally function as statement pieces, interpretation boards, or waymarkers.

Invertebrate Gardens

- 3.252 As detailed within the ES Chapter, it is proposed for an 'invertebrate garden' to be created within the centre of the Site, with this to comprise a series of raised beds, each supporting a distinct vegetation community reflective of those habitats to be retained or delivered in the wider Site.
- 3.253 Whilst also providing localised habitat diversity, this area will function as an educational resource with interpretation boards and signage to explain the importance of the Site for invertebrates, and identify key species and their ecology.
- 3.254 It should be noted the detailed design and planting proposals for this habitat area will be subject to a Reserved Matters Application within a later phase of development. Nonetheless, the underlying principles and broad design proposals for this area are set out below.
- 3.255 Raised beds will vary in size, height, and orientation, with planters being constructed of various materials, a proportion of which will encourage nesting within the vertical walls of the planters (as inspired by planters created by the *Green Roof Company*²). Planters will each support a unique mosaic of habitats ranging from areas of dry grassland, bare earth and rock/stone aggregate through to areas of floristically rich grassland, wet habitats or scrub/heath.
- 3.256 Whilst the specific planting scheme for this habitat will be agreed at a more detailed stage of planning, suggested habitat provision, based on five types of planters, is provided in Table 3 below.
- 3.257 As for living roof habitats above, preference will be given for each of these planters to be created using Site won soils/substrates, collected from areas which support target habitat types within the Site.
- 3.258 A proportion of the raised planters will also be left bare, with the aim that these features will be allowed to colonise naturally and will support a range of early successional species. These bare plateaus will be filled with validated topsoil from the Site in order to replicate the existing soil conditions, and will be subject to management on a rotational basis (as required) such that an early successional mosaic can be maintained.

Planter Type	Broad Habitats to be Included
Type 1	60% wet grassland (including Sedge <i>Cyperaceae</i> and Rush <i>Juncaceae</i>), 30% open water (hollows/pools),

¹ <https://www.grassroofcompany.co.uk/cycle-bin-shelters>

² <https://www.grassroofcompany.co.uk/habitat-planters>

	10% bare ground (seasonally wet).
Type 2	40% tall/tussock grassland, 40% pollen rich ruderal vegetation, 20% mixed scrub.
Type 3	50% species-rich dry neutral meadow, 30% sparse grassland and ephemeral vegetation, pollen rich ruderal vegetation, 10% bare ground, 10% habitat piles (deadwood).
Type 4	50% sparse dry grassland and ephemeral vegetation, 35% bare ground/disturbed, 15% gravel/aggregate.
Type 5	35% Sparse grassland, 45% sandy bare ground, 20% stone/aggregate.

*Table 3. Options to Achieve Representative Range
of Habitat Communities Within Dedicated Invertebrate Planters*

- 3.259 The preparation of soils/materials will vary depending on the target habitat types, according with suitable measures identified elsewhere within this report. This will include for the appropriate tilling of soils and appropriate application of soils to allow any desired stratification of materials prior to the completion of planting/seeding.
- 3.260 All areas of planting will be regularly monitored during the establishment phase to ensure specimens remain in good health. Dead and diseased specimens will be removed and replaced.
- 3.261 During the operational phase, these plateaus will be monitored twice yearly in order to inform ongoing management. The principle management goal for these habitats is to retain and enhance the structural diversity of each plateau, allowing each to retain a unique community of species in the long-term.

SuDS Features

- 3.262 It is anticipated additional SuDS features will be delivered within the main development footprint, providing a linkage of wetter habitats across the main development footprint park and into the Strategic GI Network. As well as providing a key role in the three stage treatment train for attenuated waters within the Site, these SuDS features will be managed to ensure their value as biodiversity assets is maximised.
- 3.263 Where possible, new SuDS features will be designed to support a varied morphology and ensure some features remain permanently wet (and therefore capable of supporting aquatic vegetation), whilst other features instead only hold water on a seasonal basis or during periods of adverse weather.
- 3.264 Within seasonally dry features, it is proposed for there to be a varied topography, with this allowing for some deeper element which may hold water on an extended basis, enhancing the variety of microhabitats within the Site. Where SuDS features (swales) are designed to be seasonally

wet, these are to be sown with a wildflower seed mixture suitable for seasonally wet soils (for example Emorsgate Seed Mixture for Wetlands - EM8).

- 3.265 Management of these swards during Year 1 will comprise regular cutting to suppress the establishment of undesirable weeds. Management in subsequent years will be in the form of two hay cuts per annum, with these undertaken in March/April and again in August/September, reducing the sward height to 70mm. Where necessary, a third cut may be undertaken in late autumn (late October) to further reduce sward height and prevent the over dominance of coarser grasses. It is recommended a proportion of the grassland (approximately 20% of the surface area) is left uncut during each period.
- 3.266 The permanently wet SuDS pool (alongside any of the seasonally wet swales which are likely to hold water on an extended basis), will be subject to low key marginal planting to provide further floristic diversity. Species such as Ragged Robin *Lychnis flos-cuculi*, Water Plantain, *Alisma plantago-aquatica* and Marsh Marigold *Caltha palustris* will be planted to allow for a significant enhancement of the Site's ecological value, and will ultimately provide novel opportunities for a range of faunal groups such as aquatic invertebrates and amphibians should these faunal group colonise in future.
- 3.267 SuDS ponds will be monitored regularly during the establishment period (6 months) with dead or diseased specimens replaced where required. Following this establishment period, ponds will be monitored on an annual basis to ensure a desirable range of aquatic species are retained.
- 3.268 Dredging/desilting, vegetation clearance, and mowing works will be undertaken on a rotational basis as required to ensure these features continue to function efficiently (both as drainage and biodiversity features). Wherever possible dredging works will be undertaken in late autumn or winter, thereby avoiding the amphibian breeding periods.

Shrub and Boundary Vegetation

- 3.269 As set out for the Strategic GI Network Section above, the proposals are envisaged to include for the retention/provision of boundary vegetation in the form of shrub and tree planting.
- 3.270 The creation and management of these habitats will follow the principles set out for *Boundary Trees, Tree Lines and Shrub* above (see paragraphs 3.204 to 3.217).

Amenity Grassland

- 3.271 The proposals for the wider Site are envisaged to include for the provision of new amenity grassland habitats.
- 3.272 At this stage the creation and management of these habitats are anticipated to follow the principles set out for Amenity Grassland (Meadow Planting and POS) Section above (see paragraphs 3.218 to 3.224).

Objective 2: Maintain Population of Protected and Notable Species/Communities Within the Site at a Favourable Conservation Status.

- 3.273 Within the Site the creation and retention of dedicated ecology habitats, in addition to the introduction of a management regime for these areas, will provide for a wide range of high quality habitats, each of which will be managed in perpetuity for the benefit of biodiversity. This in turn will be of benefit to key species/groups, not least invertebrates, amphibians, bats, birds and reptiles.
- 3.274 The creation of new and enhanced areas of Green Space within the wider development site will deliver additional habitat which will further support and enhance the opportunities available to these protected species groups.
- 3.275 The following Sections of this LEMP serve to identify the mitigation principles which will form the basis of species (and/or assemblage) specific mitigation strategies for the protected and notable species recorded within the Site.
- 3.276 As for habitats above, and noting the proposals are outline in nature, it is proposed for comprehensive mitigation strategies to be provided within a final version of this LEMP.

Badgers

- 3.277 As detailed in the ES Chapter, surveys at the Site have not identified the presence of any Badger setts and, as such, it is not considered this faunal group will represent a constraint to development at the Site.
- 3.278 Nonetheless, and given the mobile nature of Badgers and their ability to rapidly excavate new setts, an updated Badger survey is to be undertaken prior to works on Site commencing. This survey will be sufficient to identify the presence of any new Badger activity within the Application Site and, moreover, to inform the extent of avoidance or mitigation measures required (if any). Should these surveys identify any active sett's which will be impacted by the development proposals, relevant works will need to be agreed with NRW in a detailed licence application.
- 3.279 On a precautionary basis, suitable construction safeguards will also be implemented, with these to be further detailed within a CEMP for the Site. These safeguards will include the following measures:
- Clearance of dense scrub to be preceded by a Badger survey undertaken by the ECoW. Further checks to be undertaken on a staggered basis where large and inaccessible areas of scrub are present;
 - In the event any suspected Badger sett entrances are uncovered, works within that area will cease whilst being surveyed by the ECoW, and will be subject to further monitoring if deemed

appropriate. Works will only re-commence following confirmation from the ECoW that Badgers are absent;

- In the unlikely event an active Badger sett is recorded, works in that area will cease and NRW will be contacted to agree next steps. It is likely further works would then proceed under a NRW Badger licence;
- All Site personnel should attend a tool-box talk, such that they can be made aware of the potential presence of Badgers within the Site, and the implications this will have on their working methodology;
- Wherever possible new excavations (such as trenches) will not be left open overnight. Should excavations be required, they should preferably be covered overnight. If this is not feasible, scaffolding board (or similar) will be left within the feature, or otherwise a graded bank will be retained, in order to provide a means of escape for any animals which may become trapped;
- Where soil bunds (or similar) cannot be avoided, it is recommended these features are subject to regular checks by Site staff (daily where possible), to identify any areas of digging. Any new excavations will be filled in before a full sett is excavated, wherever possible.

3.280 The retention and establishment of an extensive Strategic GI Network (which includes the habitats of greater potential value to Badgers, such as woodland), as well as the provision of extensive areas of Green Infrastructure within the wider development footprint, will ensure substantial foraging and sett building opportunities are retained for Badger, should they colonise the Site in future years.

3.281 Indeed, specific consideration has been given to new shrub planting, with a range of native fruit and nut bearing species proposed, which will provide an optimal foraging resource for Badger populations within the local area.

3.282 The commencement of the long-term habitat management regime for the Site, as set out above, will ensure opportunities for Badgers are further enhanced in the long-term, and will also ensure the favourable conservation status of this faunal group is maintained.

Bats

3.283 Should any trees, which are to be subject to works during the operational phase, be identified as having potential to support roosting bats, further survey effort will first be completed in the form of tree climbing or bat emergence surveys, to confirm the presence or absence of roosting bats. Should a bat roost be identified, works to the feature will be postponed and a European Protected Species Licence be sought from NRW.

3.284 Where trees with bat roosting potential are to be removed, a soft-fell removal methodology will be adopted, as recommended in best practice guidance. This methodology would comprise the following:

- Felling to be undertaken within appropriate weather conditions, i.e. avoiding periods of heavy rain or with temperatures <5C;

- Limbs and trunk to be cut and carefully lowered to the ground under an ecological watching brief;
 - Any features within the limbs/trunks to be inspected upon being lowered to the ground. As a further precaution, these will then be left open (i.e. uncovered) overnight, allowing bats to disperse (in the highly unlikely event they are present but remain undetected).
- 3.285 Substantial areas of the most suitable bat foraging and commuting habitat, including the majority of large wetland habitats (e.g. Coed Darcy Wetlands and South Site Reservoir), and areas of existing woodland are to be retained and/or enhanced as part of the proposals, whilst extensive new semi-natural habitat, primarily in the form of a mosaic of wet and dry grasslands, pools, and localised sparse ground will be delivered. This in turn will ensure significant areas of high quality foraging habitat will be available for foraging and commuting bats post development.
- 3.286 Management of new and retained habitats, as set out above, will give due regard to bats, allowing a gradation of habitats from mature woodland, to mixed scrub, open water, and herb-rich short perennial, and ephemeral habitat, with this providing optimal bat foraging habitat. Elsewhere, such as at the Site boundaries, management will seek to enhance the structure of linear features, maximising their value as commuting corridors.
- 3.287 For clarity, on-going management will include the management and maintenance of the existing bat house within the western boundary of the Site. Management will include for annual external checks to ensure the building remains free from damage, with remedial works undertaken as required. Moreover, management will include for clearance of boundary vegetation as required, to ensure access routes and flight lines to the building remain unobscured in the long-term.
- 3.288 As detailed in the ES Chapter, a sensitive lighting scheme will be secured during construction and will be detailed within the CEMP and/or within an appropriate lighting strategy which may be secured by planning condition.
- 3.289 The lighting scheme for the operational phase of the proposed development, which may also be secured by a suitably worded condition, will serve to minimise impacts on foraging or commuting bats. It is proposed for the design of any lighting to give due regard to the 'Bats and Artificial Lighting in the UK (Guidance Note 08/18)' as issued by the Bat Conservation Trust.
- 3.290 In particular, the proposals will seek to retain dark corridors (<0.5 lux) along the southern, western, and northern boundaries of the Site, in addition to along the railway embankment which extends east to west across the Site. The provision of dark corridors at these locations (which are further identified on the inset of the *Green Infrastructure Masterplan* at Appendix 1) will align with the areas of greatest value to foraging and commuting bats, ensuring continued and uninterrupted dispersal across the Site and in the local area.
- 3.291 For completeness, the entirety of the dedicated ecology area, as well as South Site Reservoir and surrounding woodland (including that associated with the existing mitigation bat house) will remain unlit.

- 3.292 Where artificial lighting is to be delivered within or immediately adjacent to the Green Infrastructure Network, this will only be for essential reasons of public safety and to ensure safe recreational access. It is envisaged such lighting will be limited to features with a downward facing trajectory (an angle of 70 degrees or below wherever possible). Luminaires will comprise warm white LED lighting (<3000K) in order to minimise impacts on bats (and their food source).
- 3.293 Where lighting is proposed elsewhere within the Site during the operational phase, this will again be designed to minimise adverse impacts on light sensitive species. The siting of individual lighting columns (to comprise LED lighting with no UV content) will be considered such that the requirements for areas of built form can be met with minimal spill onto semi-natural habitats. Where necessary, screening vegetation will be provided to minimise spill into wider semi-natural areas. Additionally, accessories (such as baffles, hoods or louvres) will be utilised to further minimise light spillage and direct light below the horizontal plane to where it is required (limiting light to an angle of 70 degrees or below wherever possible).
- 3.294 To realise a significant enhancement for roosting bats, it is proposed 10% of new buildings within the Site will support integrated bat roosting features, as detailed at Appendix 4. The location and orientation of these features will be such that all roosting features will be located close to semi-natural habitats and away from artificial lighting.
- 3.295 The proposed design and locations for integrated features will be secured as part of Reserved Matters Application for relevant development phases. However, as a guide, suitable designs are detailed at Appendix 4.
- 3.296 It is considered the provision of these roosting features at the proposed locations (in close proximity to observed commuting corridors and high quality foraging habitat), will provide a significant net enhancement in roosting opportunities within the Site.
- 3.297 In addition, it is proposed for a total of 100 bat boxes to be installed on suitable retained trees within the Strategic GI Network and/or boundary habitats. Of these, it is proposed at least 10 boxes comprise designs suitable for larger bat roosts (i.e. maternity or hibernation features). It is proposed the locations of these features be detailed within a final version of this LEMP. At this stage the broad locations are considered to be as follows:
- 25 boxes within the dedicated ecology area (including W3);
 - 20 boxes within the Crescent Woodland (W2);
 - 30 boxes within the western boundary woodland (W1, W1A, W1B) and close to South Site Reservoir;
 - 25 boxes along the northern boundary of the Site, including within W4 and TB1.
- 3.298 Suitable designs are provided at Appendix 5. Bat boxes will be situated a minimum of 12ft above the ground, away from areas of significant clutter, and avoiding locations adjacent to branches which may otherwise act as

predator perches. Whilst a range of orientations will be sought, south-east to south-west aspects will be preferred, accounting for at least 60% of placement aspects.

- 3.299 Bat boxes will be subject to annual inspections by a suitably qualified ecologist to ensure they remain in good condition and fit for purpose. Replacement features will be provided where required.
- 3.300 The provision of a high quantity of bat roosting features will further enhance the value of the Site for bats and will provide benefits for Priority Species on the national BAP.

Reptiles

- 3.301 As set out in the ES Chapter, the clearance of suitable habitat will be preceded by the completion of a proportionate level of trapping and/or habitat manipulation. This 'weighted' approach to capture effort will accord with that previously approved for the wider Coed Darcy Site and secured within the package of documents that formed the CEMP. For clarity, this will comprise the following approach:
- High suitability habitats to be subject to full reptile translocation in accordance with best practice methodologies;
 - Moderate to low quality habitats to be subject to a varied approach comprising habitat manipulation and hand searches. Isolated habitats (i.e. where reptiles could not otherwise disperse to safety) would still be subject to translocation.
- 3.302 A decision on the suitability of habitats will be informed by an updated walkover survey undertaken in the current or otherwise most recent active season prior to relevant works commencing. It is proposed for an indicative plan identifying these locations to be provided alongside the final version of this LEMP.
- 3.303 Reptiles will be relocated to the dedicated receptor location(s) to be delivered in respect of GCN (see relevant Section below). The receptor area(s) will be located within the Strategic GI Network where they will be retained in the long-term as a dedicated ecology habitat. They will remain continuous with suitable off-site habitat (including previous herpetofauna receptor areas) and will be safeguarded in the long-term.
- 3.304 Prior to the reptile translocation commencing, any necessary habitat enhancement measures will be undertaken within the receptor location, including the provision of hibernacula and ponds. Works in this regard will be undertaken under ecological supervision and will be sensitive to the potential presence of reptiles (and indeed other protected species). These measures should be undertaken in appropriate weather conditions, with care taken to minimise potential harm to the reptiles present. The completion of necessary habitat enhancement works will both enhance the carrying capacity of the holding area as well as deliver botanical enhancements.
- 3.305 Once these habitat works are complete, the receptor area will be delineated from the wider Site by herpetofauna fencing, such that the

translocation exercise can commence. Any fencing will ensure translocated reptiles can disperse into suitable off-site areas, including the Coed Darcy GCN Area SINC. Where necessary, additional fencing will also be installed to ensure reptiles within the wider area are excluded from active construction areas, as well as to compartmentalise areas of the Site (to improve translocation efficiency). The requirements for fencing will be informed by construction works and phasing, with fencing removed or realigned as required once new habitat creation becomes suitably established.

- 3.306 Following the completion of the translocation, herpetofauna fencing will be retained and/or installed as required to exclude reptiles from active construction areas (including any areas of the Nature Park which will be subject to disruptive works during habitat creation) until such time that relevant works are complete. As an alternative exclusion method, construction zones may be maintained in a manner that removes their potential suitability for reptiles (for example through regular mowing/spraying or maintaining unvegetated buffer areas around construction).
- 3.307 Following the completion of construction, all exclusion fencing will be removed from Site.
- 3.308 The long-term management proposals for new Green Infrastructure, as detailed above, will ensure habitat for reptiles is maintained and enhanced in the long-term. New habitat creation, alongside long-term management, will ensure significant betterment for reptiles in the long-term, securing substantial areas of suitable habitat in perpetuity.
- 3.309 In undertaking management the following guiding principles will be adhered to in order to ensure the conservation of reptile populations within the Site at a favourable status:
- All management of suitable reptile habitat to be undertaken during suitable weather conditions (>10C, dry) during the reptile active season (March to October).
 - Management to include for the adoption of two stage cuts, with these undertaken in a directional manner to encourage reptiles to disperse to undisturbed habitats;
 - Hand tools are to be used wherever possible.
 - Rotational management to ensure the retention of significant areas of suitable habitat at any one time.
 - Management will seek to retain an optimal mosaic of grassland, ephemeral vegetation, and scrub across the Site, providing a varied age structure to these habitats which, in turn, will provide a range of basking habitat (short grassland and bare ground) and refuges (tussocky grassland and scrub) which will provide long-term enhancements for the local reptile population. Elsewhere within the Site the creation of scalloped edges to woodland rides, alongside new glade creation will provide further opportunities for reptiles. The instigation of this management regime will provide significant long-term

enhancement for reptiles through ensuring the retention of suitable foraging and breeding habitat in perpetuity.

- A minimum of two suitable refugia or hibernacula features to be provided per hectare of suitable reptile habitat. At this stage it is anticipated a minimum of 60 such refugia will be provided across the wider GI Network.
- 3.310 In order to further inform the successful conservation of reptiles post-development, it is proposed for post-development monitoring surveys of the Strategic GI Network to be undertaken at set intervals post-creation.
- 3.311 Noting habitat creation and phasing timeframes are to be confirmed at a more detailed stage of planning, it is proposed for suitable 'triggers' to be agreed with consultees and included within the final version of this LEMP. As a guide, at this stage, it is suggested the following would represent a suitable monitoring approach:
- First Monitoring Period – Year 2 following substantial completion of Strategic GI Network;
 - Second Monitoring Period – Year 5 following substantial completion of Strategic GI Network;
 - Third Monitoring Period – Year 10 following substantial completion of Strategic GI Network.
- 3.312 The results of monitoring surveys will be used to inform the long-term management of the wider site, such that opportunities for reptiles may be maximised.
- 3.313 The above measures will allow the reptile populations present on Site to be retained at a favourable conservation status in the long-term.

Wintering and Breeding Birds

- 3.314 The majority of habitats within the Site are assessed as being sub-optimal for over-wintering birds. Where habitats of heightened interest are present, for example the larger waterbodies associated with Coed Darcy GCN SINC, these are to be retained and unimpacted. Moreover, the proposals will include for the naturalisation of South Site Reservoir, including the removal of the concrete/aggregate lined banks, replacing these with gradual natural banks providing a wide draw down zone. An island will be created within the centre of the Reservoir, providing optimal winter and breeding refuge, as well as foraging opportunities
- 3.315 The proposals for South Site Reservoir will allow for a net increase in marginal and reed-bed habitat. As set out in the Habitat Section above, it is targeted for a minimum of 0.4ha of marginal planting (or otherwise established) within the initial 10 year period post construction. This net gain in marginal/reed bed habitat will provide improved refuge for many wintering bird species, as well as a degree of screening from new residents.
- 3.316 In addition, the proposals would include for a dedicated ecology area measuring approximately 12ha, within which no formal public access will be permitted.

- 3.317 For clarity, no footpaths will be located within the ecology area, with those in close proximity to be directed along the far side of substantial vegetative screens (i.e. Woodland W3). At this stage it is further envisaged the ecology area will be demarcated by boundary post and rail fencing, ditches, or otherwise boundary hedgerow (maintained to prevent predator perches) as a further deterrent to unauthorised access. The provision of appropriate signage to identify the ecological importance of the area and to identify the potential ecological harm caused by anthropogenic disturbance is also proposed.
- 3.318 It is proposed for the boundary treatments, as well as proposed signage, to be further detailed in the final version of this LEMP.
- 3.319 The provision and retention of this dedicated ecology area, which adjoins the larger waterbodies within the Coed Darcy GCN SINC (and significant wetland), will ensure optimal wintering opportunities for a range of bird species. The retention of a resource within which disturbance is avoided in the long-term will moreover provide an enhancement relative to a baseline situation where extensive (if not irregular) disturbance has occurred over several years.
- 3.320 The provision of retention/re-instatement of large areas of open grassland, to include for sensitive scrub removal, will provide loafing habitat for Gulls and Waders, as well as foraging opportunities for flocks of Finches, whilst extensive areas of woodland and scrub will be retained for the benefit of Thrushes.
- 3.321 The proposals will therefore allow for the retention of the range of habitats of value to wintering birds, and realise qualitative enhancements to these habitats through the commencement of an appropriate management regime in the long-term.
- 3.322 Breeding birds will also benefit from extensive new habitat creation within the Site, as well as the commencement of an ecologically sensitive management regime in the long-term (as set out in the Habitats Section above). In particular, the creation of extensive areas of open habitat and wetland within the dedicated ecology area will provide optimal opportunities for ground nesting birds including Lapwing and Ringed Plover *Charadrius hiaticula*, more than mitigating for losses during construction. As detailed in the ES Chapter, it is proposed for a subset of the proposed ecology area (1.5ha) to be delivered upfront to ensure some immediate habitat opportunities for ground nesting bird species. The expansion of this ecology area, whilst constrained by a requirement for on-going remediation (proceeding under existing permits), will take place in the early construction phase, in order to maximise the availability of replacement breeding habitat at the earliest opportunity.
- 3.323 As above, specific design consideration has been given to ensuring potential anthropogenic disturbance is avoided during the operational phase of the development.
- 3.324 Where vegetation clearance is required (during either the construction or operational phases) this will be avoided during the main nesting season

(March to August inclusive) unless prior checks of potential nesting areas are undertaken by an ecologist to ensure nesting birds are not present. Should nests be present, they will be protected until it can be confirmed fledglings have left the nest.

- 3.325 It is considered the adoption of best engineering practice during the construction period (i.e. in relation to noise suppression), will mitigate for any potential adverse effects on nesting birds off-site. Moreover, the appropriate phasing and timing of construction works (including ground preparation) will equally ensure potential harm to on Site assemblages is minimised. Further details on appropriate measures are proposed to be provided within the CEMP, with further information on phasing to be provided within the final version of this LEMP.
- 3.326 The establishment of an extensive mosaic of habitats, all of which will be subject to ecologically sensitive management in the long-term, will realise significant enhancements for nesting birds over the existing situation, ensuring the qualitative value of foraging and nesting habitat is retained and enhanced going forward.
- 3.327 Where new woodland and boundary shrub planting is proposed, this will include for a range of native fruiting species, providing an enhanced foraging resource for birds in the autumn and winter periods.
- 3.328 To provide an enhancement for nesting birds, the proposals will deliver a Sand Martin *Riparia riparia* tower or bank within the South Site Reservoir on Site. This feature, which will be situated in an area away from recreational use, will provide new nesting habitat for a species not previously recorded on Site. Should Sand Martin not colonise in the short-term, the design of the tower will be equally suitable for other tunnel nesting birds, such as Kingfisher *Alcedo atthis*.
- 3.329 It is proposed for the detailed design and location of the Sand Martin nesting tower to be provided as part of the final version of this LEMP.
- 3.330 In addition, the proposals for an island within the South Site Reservoir (as detailed above), will provide improved nesting opportunities for a range of Waders, allowing a safe haven within which recreational disturbance will be avoided, and the likelihood of predation (i.e. from terrestrial mammals) minimised. As detailed in the Habitat Section above, management within the proposed island will seek to retain generally open, low sward habitats, with areas of wet grassland and exposed soils sought. This will ensure optimal opportunities for a range of ground nesting bird species and waterfowl.
- 3.331 The value of the South Site Reservoir will be further enhanced through the creation of new marginal and reed-bed habitat for example, ensuring new high quality habitat of value to a range of notable species recorded within the Site or immediate environs, such as Reed Bunting *Emberiza schoeniclus*, Cetti's Warbler *Cettia cetti*, Sedge Warbler *Acrocephalus schoenobaenus*, Reed Warbler *Acrocephalus scirpaceus* and Grasshopper Warbler *Locustella naevia*.

- 3.332 Management of these reed bed and marginal habitats will be undertaken on a rotational basis, with no more than 25% of this habitat being subject to works per annum. This will ensure a diversity of habitat structure and ensure substantial areas of undisturbed habitat are retained each year.
- 3.333 As a further enhancement for nesting birds, it is proposed 10% of new buildings within the Site will support integrated bird nesting features. Suggested designs of these features are detailed at Appendix 4 and will include for features suitable to support Swifts, House Sparrow *Passer domesticus*, and House Martin *Delichon urbicum* (species well suited to more urban environments). Bird boxes will be orientated to have a south-west to south-east facing aspect and will be located close to semi-natural habitats.
- 3.334 As for bats, above, the proposed design and locations for integrated features will be secured as part of Reserved Matters Application for relevant development phases.
- 3.335 Bird nest features will be situated a minimum of 12ft from the ground (with most considerably higher), orientated to have a south-west to south-east facing aspect, and will be located close to semi-natural habitats. Where Swift boxes are installed, these will be situated near the eaves of the buildings, at heights exceeding 20ft.
- 3.336 In addition, it is proposed for a total of 100 bird boxes to be installed on suitable retained trees within new Green Infrastructure and/or boundary habitats. Suggested designs for bird boxes are provided at Appendix 4. Bird boxes will be placed at a minimum height of 12ft above the ground, away from potential predator perches (such as horizontal branches) and situated with north-east to north-west facing aspects in preference.
- 3.337 The range of bird boxes proposed gives due regard to the species recorded on Site, or otherwise considered likely to be present in the local area.
- 3.338 New nesting features will be subject to annual condition checks during the operational phase, with replacement and repair works undertaken as required.
- 3.339 The provision of living roofs within the Site, to include areas of gravel, pebbles, areas of sparse vegetation and grassland, will moreover provide potential nesting opportunities for Black Redstarts *Phoenicurus ochruros*, a RSPB Red List species with less than 100 breeding pairs in the UK.
- 3.340 The provision of a wide range of nesting features and habitats will ensure continued and, indeed, enhanced nesting opportunities for notable bird populations recorded within the Site, ensuring continued opportunities for scrub and woodland nesting species, ground nesting birds, Warblers and waterfowl. Moreover, the proposals will secure new opportunities for species of conservation concern such as House Sparrow, House Martin, and Swifts.
- 3.341 As for reptiles, above, it is proposed for the long-term conservation management of the Site to be informed through a suite of monitoring

surveys for breeding bird assemblages. Monitoring in each year would be in the form of three survey visits, each ideally undertaken on a monthly basis between April and June.

3.342 Again, it is proposed for the precise timings of surveys to be agreed with consultees and be included within the final version of this LEMP. As a guide, at this stage, it is suggested the following would represent a suitable monitoring approach:

- First Monitoring Period – Year 2 following substantial completion of Strategic GI Network;
- Second Monitoring Period – Year 5 following substantial completion of Strategic GI Network;
- Third Monitoring Period – Year 10 following substantial completion of Strategic GI Network;

3.343 The results of monitoring surveys will be used to inform the long-term management of the wider Site, such that opportunities for breeding birds may be maximised, contributing to the favourable conservation status of local populations.

Invertebrates

3.344 As detailed within the ES Chapter, specific surveys during 2020 have confirmed the Site to be of high (regional) value to invertebrates, particularly for communities reliant on areas of OMH. Resultantly the guiding principle of habitat creation is to retain an OMH resource characteristic of that currently present, with extensive areas of dry, floristically diverse grassland, a structurally varied topography, and bare ground. In addition to providing substantial opportunities for invertebrate communities within the Site, a key design consideration is to ensure Green Infrastructure within the Site functions as a valuable stepping-stone habitat within the wider ecological landscape.

3.345 As set out in the Habitats Section above, habitat creation and management has been specifically targeted to ensure high quality opportunities are realised for invertebrates. Extensive areas of species-rich grassland, OMH, and wetland habitat are to be provided within the Strategic GI Network, whilst management will further secure the diversification of retained woodland habitats for the benefit of invertebrate assemblages. Further opportunities for OMH creation will also be sought within the main development footprint in the form of new living roof habitat, invertebrate gardens, and nesting walls.

3.346 As detailed in the Habitat Section above, it is further proposed for areas of new and retained cliff habitat to be enhanced as large scale nesting walls, with holes of varying sizes to be drilled into the rock face. This will provide a range of opportunities for solitary insects, with this resource further enhanced through the provision of wildflower rich grassland and OMH within close proximity of the cliff edge. Further nesting opportunities will also be sought within the main development footprint through the inclusion of integrated invertebrate nesting bricks within 10% of new built form.

- 3.347 The provision of a series of biodiversity ponds, in addition to the naturalisation of South Site Reservoir, will moreover realise enhanced opportunities for aquatic invertebrate species within the Site, creating extensive areas of shallow margins and wetland habitat.
- 3.348 In addition, enhancements to woodland, including glade and ride creation, thinning of dense vegetation, and the creation of structurally varied scalloped edge habitat will collectively provide a range of enhancements for woodland invertebrates, as will management measures which seek to encourage the 'veteranisation' of mature tree specimens.
- 3.349 Finally, the retention of standing deadwood, as well as the provision of log piles and habitat piles as part of the development proposals, will provide additional opportunities for species reliant on deadwood habitats (of which several have been recorded within the Site). Such opportunities will be replenished through on-going management in the operational phase, with this to include ongoing log-pile creation, as well as localised ring-barking, should standing deadwood not occur naturally.
- 3.350 The establishment of these new habitats and the implementation of sensitive long-term (in-perpetuity) management for the Site will more than mitigate for proposed losses, and ensure a valuable OMH resource is secured in the long-term, safeguarding the entomological interest of the Site and ensuring the Site maintains a valuable function as a component of the wider landscape.
- 3.351 Indeed, the instigation of a suitable management regime for the Site's existing habitats is considered integral to retaining the invertebrate populations within the Site in the medium to long-term, providing a mechanism by which ecological succession can be arrested and/or reversed, and the value of new and retained habitat enhanced going forward.
- 3.352 As a further measure, the proposals will include for a range of signage and interpretation boards, with these to serve as an educational resource for new residents. At this stage it is anticipated interpretation boards will include 'case study' examples of notable species within the Site, as well as examples of target habitats and management practices. The aim of these interpretation boards will be to increase the knowledge and understanding of a range of species or habitats which are often overlooked or underappreciated by non-specialists.
- 3.353 Whilst further detailed case studies would be identified at a more detailed stage of planning, it is anticipated the following species (each of which have been recorded on Site), will be identified as flagship species:
- The beetle ***Paederus fuscipes***. This nationally scarce species is a remarkably colourful beetle, as are all the members of the genus. It has striking metallic blue elytra, the remainder of the beetle being black and red. It is a predator, found in marshes and bogs, on the margins of ponds and dykes, and in permanently wet mires. It is also recorded in saltmarsh habitats. Its distribution is

patchy throughout England and Wales, with most records from the coastal fringes.

- Brown-banded carder bee ***Bombus humilis***. A species of Principle Importance in Wales. It is a species of warm, dry sites with extensive flower-rich calcareous or coastal grasslands. Within Britain it is largely restricted to the coastal south-east, southern and south-west England, and in Wales to the coastal fringes of Gwynedd, Glamorgan and Pembrokeshire.
- The bee-fly, ***Bombylius canescens***. This small bee-fly is restricted to south-west England and southern Wales where it is associated with sparsely vegetated sandy or base-rich substrates in grasslands, woodland edge, or coastal soft-cliffs. It is a parasite of smaller mining bees in the genus *Lasioglossum* which are frequent within the Site.
- The Wolf Spider ***Pardosa tenuipes***. A wolf-spider associated with sparsely vegetated but humid (damp) environments such as dune slacks, floodplain meadows, and riparian vegetation. It is a southern species in Britain with very scattered records within Wales. This species was recorded within damper hollows and at the edge of waterbodies where there are exposed substrates.
- Dingy Skipper ***Erynnis tages*** A declining butterfly and Species of Principle Importance which is generally associated with brownfield sites, colliery spoil heaps and similar places where habitats support short swards and where its food plant, Bird's-foot Trefoil *Lotus corniculatus* occurs. Several individuals were recorded in late May 2020 at various locations within the OMH.
- Grayling ***Hipparchia semele***. Again, a butterfly which is a Species of Principle Importance, supported in patchy grasslands, which has suffered a substantial decline in Britain such that it is now more or less restricted to coastal habitats such as sand dunes and grasslands or, in Wales, colliery spoil heaps. Individuals were observed in late June and mid-July across the 'dunes'.

3.354 The opportunities for both the school and the invertebrate garden to contribute to this education purpose will be further explored, with living roofs/walls and invertebrate gardens representing a valuable resource to introduce new residents to nature.

3.355 In order to further inform the successful conservation of invertebrate assemblages post-development, it is proposed for post-development monitoring surveys to be undertaken at set intervals.

3.356 Noting habitat creation and phasing timeframes are to be confirmed at a more detailed stage of planning, it is proposed for suitable 'triggers' to be agreed with consultees and included within the final version of this LEMP. As a guide, at this stage, it is suggested the following would represent a suitable monitoring approach:

- A new baseline should be undertaken in the above format, in the current or most recent spring and summer relevant to the granting of planning permission;

- First Monitoring Period. A post mitigation baseline is proposed in the first spring and summer after substantive mitigation works (i.e. GI creation) has been completed;
- Second Monitoring Period - Year 2 following substantial completion of Strategic GI Network;
- Third Monitoring Period - Year 4 following substantial completion of Strategic GI Network;
- Final Monitoring Period - Year 10 following substantial completion of Strategic GI Network (this is anticipated to align with completion of Site wide construction and full operational use of the Site).

3.357 The results of monitoring surveys will be used to inform the long-term management of the wider Site, such that opportunities for reptiles may be maximised.

Amphibians (GCN)

3.358 As detailed within the ES Chapter, surveys in 2020 have confirmed the Site supports a 'medium' population class size of GCN, with this population broadly located within two clusters in the north and south of the Site. Known populations of GCN are also noted in the wider Coed Darcy landholding, with approximately 10,000 GCN of all life cycle stages captured and relocated from the Coed Darcy Site to the Coed Darcy GCN SINC which lies adjacent the south-west boundary of the Site. Existing GCN exclusion fencing delineates the previously translocated population from the main development Site.

3.359 Whilst it is proposed for detailed mitigation strategies to be formally agreed as part of any forthcoming NRW licence, an overview of the anticipated conservation strategy is provided below.

3.360 **Works During Construction.** Noting the presence of GCN and common amphibians, a targeted translocation exercise will be undertaken within the Site. This exercise will be completed in accordance with adopted best practice guidance, and any specific measures as may be required through an NRW licence.

3.361 It is anticipated, at this stage, that trapping and translocation will be undertaken selectively, with trapping effort proportionate to the populations recorded locally, in addition to the suitability of habitats present. For clarity, it is anticipated confirmed GCN ponds in the north of the Site (which collectively support a medium population), will be subject to a minimum 60 day translocation, as will habitats within a proximity of PB in the south-west of the Site. Where GCN have only been recorded in low numbers (such as in P20, where a single GCN was recorded in 2020 but not in 2021), it is anticipated a 30 day translocation would apply. In contrast, given an absence of ponds in central areas, as well the presence of predominantly sub-optimal habitats, no capture effort would be proposed.

3.362 An indicative plan, identifying the areas of the Site anticipated to be subject to a GCN translocation is provided at Appendix 6. This plan includes for a tabulated summary of habitats present within the proposed

translocation area. Subject to the date at which any planning permission is granted and works commenced, it may be the extent and duration of any translocation exercise will be informed through updated GCN surveys.

- 3.363 No construction will be permitted within any GCN zones until a sufficient capture effort has been completed. Broadly speaking these GCN zones will comprise suitable GCN habitat within 250m of breeding ponds, as well as high suitability habitats between 250m and 500m (unless separated by dispersal barriers). GCN and common amphibians will be relocated from these zones to dedicated receptor habitat within the wider site.
- 3.364 As detailed within the Reptile Section above, it is proposed for an initial receptor area to be delivered (and sufficiently established) upfront, in the south-west corner of the Site. This receptor area, which is anticipated to measure approximately 1.5ha, will be enhanced to support new ponds and high quality terrestrial habitat, and will be continuous with the existing Coed Darcy GCN SINC, as well as suitable off-site habitats.
- 3.365 Whilst the number, location, and design of ponds will need to be informed through ground investigations (noting a need to avoid disturbance of contaminants), it is anticipated, at this stage, that four ponds (averaging a 250m² surface area) will be delivered within this holding area. Dedicated GCN hibernacula will be delivered at a minimum 1:1 ratio adjacent to new ponds. It is anticipated terrestrial habitats will comprise a mosaic of open communities, as detailed in the Habitat Section above. Rough grassland will form a key component of this terrestrial provision, particularly adjacent to new ponds.
- 3.366 Herpetofauna fencing will be erected to delineate the receptor area from the wider site during construction, whilst ensuring the receptor area is continuous with both the previous receptor site (i.e. the Coed Darcy GCN Area SINC) and suitable off-site habitats, minimising short term population fragmentation.
- 3.367 Herpetofauna translocations, as required within the Site, will commence following the appropriate creation and establishment of receptor site habitats.
- 3.368 As detailed in the ES Chapter, additional Green Infrastructure will be sequentially created during the early construction phase, with this habitat being made available to GCN through sequential removal or realignment of GCN fencing. It is proposed for further detailed information on phasing and habitat delivery to be provided within a final version of this LEMP.
- 3.369 The phasing of subsequent habitat creation will give due regard to the phasing of the herpetofauna translocation(s) and habitat removal, ensuring sufficient habitat is provided to sustain translocated populations in both the short and longer term.
- 3.370 Habitat creation works will be overseen as required by the appointed ECoW who will ensure compliance with any GCN licence. Should an

appropriately qualified and experienced contractor be appointed (such as ARC), the requirement for oversight by the ECoW may be reduced.

3.371 **Post-Construction.** The long-term management proposals for new Green Infrastructure, as detailed above, will ensure habitat for amphibians is maintained and enhanced in the long-term. New habitat creation, alongside long-term management, will ensure significant betterment for amphibians in the long-term, securing substantial areas of suitable habitat in perpetuity and allowing for continued and improved dispersal both within the Site and across the local area. Crucially, the proposals will ensure Green Infrastructure within the Site fully integrates with previous mitigation land bought forward in the wider Coed Darcy Site. This will allow the reconnection of previously translocated populations to those currently present within the Site, and will further safeguard opportunities for further integration with other areas of the Coed Darcy Site (as may come forward through separate planning applications in due course).

3.372 In undertaking management, the following guiding principles will be adhered to in order to ensure the conservation of amphibian populations within the Site at a favourable status:

- All management of suitable terrestrial habitats to be undertaken during suitable weather conditions (>10C, dry) during the amphibian active season (March to October);
 - Hand tools are to be used wherever possible.
- All pond management (including SuDS) will have due regard to the potential presence of GCN. Where management of aquatic habitat is required, these works will take place in the winter hibernation period (November to February) during which GCN will be in their terrestrial phase;
- Rotational management of aquatic and terrestrial habitats to ensure the retention of significant areas of suitable habitat, as well as ponds at varied 'successional stages' at any one time;
- A minimum provision of hibernacula features at 1:1 ratio adjacent to ponds, with additional features to be provided in the wider site (see Reptiles above). The design of hibernacula will accord with the suggested hibernaculum design as detailed within 'The Great Crested Newt Mitigation Guidelines' (Section 8.3.2 of that document).

3.373 **Consideration of Integration with Hard Infrastructure.** As detailed in relation to reptiles, above, the proposed development does not include for any substantive road infrastructure to be delivered within areas of Green Infrastructure, nor any which fragments the Strategic GI Network. However, it is noted that in due course, development in the wider Coed Darcy Site may require the delivery of a new link road. Whilst any such infrastructure would be part of a separate planning application, consideration has nonetheless been given to this potential future scenario. Should road infrastructure be required, and in order to ensure connectivity across the proposed Green Infrastructure Network, this would include for herpetofauna friendly crossings to be provided at intervals along the proposed road. These crossings will comprise ACO Climate Tunnels (KT500) (or similar). The provision of low-height guide

walls will ensure reptiles (and amphibians) are directed towards these tunnels whilst excluding them from the road, thereby preventing mortality in this regard.

- 3.374 As a further safeguard within areas of built form and hard landscaping, careful consideration will be given to the proposed drainage strategy for the Site. In particular, this will include for the inclusion of amphibian friendly drainage features, such that accidental entrapment of amphibians can be avoided. At this stage such features are anticipated to include wildlife kerbs and amphibian ladders. These measures will both minimise the risk of entrapment and, moreover, provide a means of escape in the unlikely scenario amphibians fall into gulley pots.
- 3.375 **Long-term Management and Monitoring.** As above, in-perpetuity habitat management forms a guiding principle for the ecological mitigation and enhancement strategy of the Site.
- 3.376 There is an aspiration for management responsibilities to be adopted by an appropriate conservation body such as ARC (and funded by the proposed development) and, indeed, discussions are on-going with ARC in this respect. It is intended confirmation of the long-term management body, in addition to funding mechanisms, will be detailed within a final version of this LEMP (alongside any necessary legal agreements).
- 3.377 At this stage it is anticipated long-term monitoring of GCN populations and habitats will be undertaken in order to further inform future management. Whilst the detailed prescriptions of any such monitoring will be confirmed as part of the final version of this LEMP (as well as within an NRW licence), it is understood NRW will seek the following:
- Post-construction monitoring and record dissemination for a 25 year period.
 - Annual surveys to allow for abundance counts (torching) over six visits between March and mid June, as well as Habitat Suitability Index (HSI) assessments.
- 3.378 The results of monitoring surveys will be used to inform the long-term management of the wider Site, such that opportunities for amphibians may be maximised, and populations retained at a favourable conservation status in the long-term.

Other Species

- 3.379 The habitat creation and management measures set out within this LEMP will greatly diversify both the range of habitats within the Site and the structural and botanical diversity of these habitats. This will realise opportunities for a range of mammal species known, or likely to be present, in the local area.
- 3.380 For example, the European Hedgehog *Erinaceus europaeus*, a UK BAP Priority Species, will benefit from the proposed woodland creation and enhancements, with this habitat to include for a shrub understorey which will offer improved ground cover and resting habitat for this species. The instigation of long-term shrub and woodland management will retain an

optimal mosaic of shrub within the Site, whilst log and brash piles will provide high quality nesting and hibernation sites for this species.

- 3.381 The provision of access gaps within boundary fencing (including garden plots) will also form a guiding principle of the proposals, and is intended to be secured for all residential plots through subsequent Reserved Matters Applications. Hedgehog tunnels will comprise small (13cm x 13cm) openings in the base of garden fences and boundary walls, providing a means for this species to migrate between gardens and open space in the Site. It is proposed for one Hedgehog tunnel to be provided at each aspect of adjoining residential gardens (i.e. up to 3 in total per garden), as well as within any boundary walls. This will ensure Hedgehogs are able to disperse throughout residential parcels.
- 3.382 These 'Hedgehog Highways' will ensure the Site remains porous for this species in the long-term, allowing uninhibited dispersal for any Hedgehog populations which may be present in the local area.
- 3.383 As identified above, the habitat creation and landscape measures will also offer high quality opportunities for protected species not currently recorded on Site but which could potentially colonise in the future, not least Otter or Water Vole. These species will benefit from the retention and enhancement of significant new areas of wetland, including extensive areas of naturalised bankside habitat and marginal planting which will providing a range of high quality breeding and foraging habitats for amphibious mammals.

Objective 3: Increase Biodiversity by Maximising Opportunities for Flora and Fauna

- 3.384 The instigation of a sensitive management regime which covers the entirety of the Strategic GI Network, as well as areas of Green Infrastructure within the 'main' development footprint, will serve to deliver an extensive mosaic of diverse, high quality habitats across the Site in the long-term. This long-term management will ensure the retention and 'replenishment' of early successional habitats which otherwise will succumb to ecological succession in the short to medium-term. Equally, the proposals will ensure qualitative enhancements can be realised to established habitats such as secondary woodland which currently suffer from dense tree/shrub growth and the presence of non-native species.
- 3.385 The long-term management measures in this regard will, in turn, ensure opportunities for faunal species within the Site are retained and enhanced in the long-term.
- 3.386 As above, a primary management objective is to commence management which secures a diverse range of early successional habitats. This management is essential to prevent the loss of these habitats in the longer-term.
- 3.387 Losses to early successional habitats will be phased during construction. This phasing will ensure the continued representation of OMH on Site during construction, with extensive such habitat also present to the south of the Site (i.e. within the wider Coed Darcy landholding). Together this

will avoid the functional loss of a valuable landscape resource which is of particular importance to invertebrates.

- 3.388 Alongside the retention or creation of substantial OMH within the Strategic GI Network, further opportunities for invertebrates will be ensured through the creation of living roofs, living walls and an invertebrate garden within the main development footprint.
- 3.389 The retention of the Coed Darcy GCN SINC, as well as the conversion of South Site Reservoir to a semi-natural wetland, will ensure significant qualitative enhancements to wetland within the Site, providing enhanced refuge opportunities for wintering birds whilst providing breeding opportunities for a range of wetland bird species in the spring and summer months. These measures will equally be of value to the wetland invertebrate assemblage present in the local area.
- 3.390 The creation of extensive Blue Infrastructure, including a ribbon of waterbodies along the western and northern boundaries of the Site, in addition to extensive high quality terrestrial habitats, will both secure long-term breeding and foraging enhancements for GCN within the Site, whilst importantly establishing a high quality dispersal corridor to enhance landscape level connectivity and improve connectivity between meta-populations within the Site and the local area, which are likely to partially fragmented through the Site's previous use.
- 3.391 The delivery of a dedicated ecology area, measuring approximately 12ha, will ensure high quality and undisturbed habitat for a range of notable faunal populations within the Site, not least ground nesting birds, invertebrates, and amphibians. The creation and management of the GI Network has been carefully considered to prevent formal recreational use of this ecology area, whilst deterring informal use (such as through fencing, hedge and ditch creation).
- 3.392 A wide range of nesting opportunities will be provided for birds through the installation of a nesting Sand Martin tower, integrated nest boxes within built form, and provision of a minimum of 100 bird boxes to be sited on trees within the Strategic GI Network. Alongside the retention of a diverse mosaic of habitats, these nest features will ensure enhanced nesting opportunities for those species recorded during specific surveys of the Site, as well as new opportunities to encourage colonisation by species likely to be present in the local area.
- 3.393 Similarly, the proposals will retain and enhance extensive areas for the benefit of foraging and commuting bats, with key habitats such as areas of open water, woodland and species-rich grassland retained or otherwise created for this faunal group. Further opportunities will be ensured through the provision of new marginal/wetland habitats and strengthened boundary planting within the Site.
- 3.394 The safeguarding and ongoing management of the existing bat house, provision of integrated bat roosting features in 10% of new buildings, and a minimum of 100 bat boxes on retained trees, will ensure a significant net enhancement in roosting opportunities relative to the existing situation.

- 3.395 The proposals will retain existing habitats of potential value to other faunal species such as Badger, Otter and Water Vole, whilst ensuring the creation or enhancement of significant habitat areas for these faunal groups should they colonise the Site in future years.
- 3.396 The long-term management of the Site will be informed through post-construction monitoring surveys for both habitats and key faunal groups. This monitoring will allow for feedback on the relative successes of varying management techniques, with variations in subsequent management sought to ensure further qualitative enhancements.
- 3.397 A further key objective of the development proposals is to educate new and existing residents in the local area as to the ecological value of both the Application Site and its wider environment. Educational opportunities in this regard will include for the preparation of leaflets to all new residents, as well as the delivery of informative interpretation boards at various intervals within the Strategic GI Network.
- 3.398 Wherever possible, further opportunities for community education and/or engagement will be brought forward as the phased development progresses. Opportunities in this regard may include for the involvement of pupils at the proposed school in 'BioBlitz' style events within the Application Site, or for additional artwork or interpretation to be delivered within the school grounds or in association with community buildings, thus allowing for further educational opportunities.
- 3.399 In addition, opportunities will be sought for the living roof proposed at the school, as well as, potentially, the invertebrate garden, to be designed such that they can be used as a learning resource for future school pupils. The design will therefore seek to accommodate the use of the roof for outdoor classes. In line with this ethos, it is envisaged the principles behind the detailed design of this roof (and indeed the other areas of OMH within the Site) will be documented in pamphlets (or similar) and made available to the school as a learning tool.
- 3.400 By providing educational resources, the development proposals offer a mechanism through which potential new residents can positively interact with the natural environment, both within the Site and the wider area.
- 3.401 Whilst not specifically secured through this LEMP, guiding principles for 'on-plot' biodiversity measures are also identified where appropriate. These measures, as summarised below, will be secured through Reserved Matters Applications as development phases come forward:
- Provision of 'Hedgehog Highways' in boundary treatments, including garden fences, to allow for dispersal of small mammals;
 - 10% of new built form to support integrated bat roosting features;
 - 10% of new built form to support integrated bird nesting features;
 - 10% of new built form to support integrated invertebrate nesting features;
 - Opportunities to be sought for living wall and living roof creation, not least for the proposed school;

- All new residents to receive a 'welcome package' which includes for literature on the ecological value of the Site, the interest features present, and how on-going management (etc) seeks to safeguard this interest.

Management Constraints

- 3.402 Management cannot be undertaken which compromises the survival or success of the species/assemblages listed above. This will ensure conformance with relevant legislation relating to protected species.
- 3.403 In due course a NRW licence will be sought in respect of GCN. Whilst it is intended that any prescriptions in this LEMP are consistent with that NRW licence, the final, detailed mitigation strategy for GCN will be stipulated as part of the licence application. Should any minor variations in management exist between the licence and this LEMP, the licence methodologies will take precedence. It is, however, proposed that future iterations of this LEMP will be revised as required to ensure consistency between documents.
- 3.404 All reptiles are legally protected from injury and killing. As these species hibernate during the winter months (typically from the end October to March), any intrusive works to take place within suitable reptile habitat should be undertaken outside this hibernation period.
- 3.405 All British birds are legally protected from disturbance whilst actively nesting (generally March to August inclusive). Management of scrub and trees should therefore be undertaken outside the bird-breeding season wherever possible.
- 3.406 Should any more mature trees, or those with obvious damage, or thick coverings of Ivy *Hedera* need to be felled as part of future management, these should first be surveyed by an appropriately experienced ecologist, to check for the presence of bats. Should a bat roost be found, either during the initial survey or during felling work, work must stop immediately and cannot continue until appropriate advice has been sought. A licence from NRW may be required. Any future works which may impact bat boxes will be avoided wherever possible. Should essential works be required they will be preceded by a specific bat survey, with a NRW licence sought where roosting bats are found.

4. MONITORING AND MANAGEMENT RESPONSIBILITIES

Personnel Responsible for Implementation of the Plan

- 4.1 Responsibility for implementation of this Management Plan, as well as for its continuation in perpetuity, will be placed with a dedicated management company (to be appointed by the developer) who will ensure management undertaken at the Site complies with the prescriptions set out in this document.
- 4.2 It is desired the appointed management company has specialist knowledge in ecological management and, to this end, discussions are ongoing between the applicant and ARC. It is further noted, some elements of the Green Infrastructure are likely to become adopted by the SAB (Sustainable Drainage Approval Body) Board.
- 4.3 The management company (or companies) will be responsible for the completion of duties set out within the LEMP. The establishment of the management company will be set out in the Section 106 submitted alongside the planning application and will therefore be secured through a legal agreement.
- 4.4 Where required, Ecology Solutions or another suitably qualified ecologist, will be appointed to advise on any specific questions or queries with regards to any issues of ecology or nature conservation which may arise. Suitably qualified ecologists will also be appointed to oversee any required works, as well as undertake post construction monitoring surveys as required.

Five Yearly Project Register

- 4.5 Whilst minor iterations to the management regime will be instigated as required, following annual monitoring of the Site, it is proposed a more formal review of this management plan be commenced every fifth year post substantial completion of the Strategic GI Network.
- 4.6 This review will be preceded by an updated walkover of the Site (following the standard Phase 1 methodology), by a suitably qualified ecologist, and will include consideration of continuing management activities, allowing areas of concern or of significant ecological change to be identified and addressed in order to maximise the biodiversity value of the new and retained habitats within the Site.
- 4.7 Any required amendments set out in forthcoming reviews of the LEMP will be discussed and agreed with the local planning authority (LPA) and NRW (where required) prior to being implemented.
- 4.8 Following each review, a revised management plan will be issued to the adopted land managers and will remain of relevance until the completion of subsequent reviews.

Monitoring and Remedial/Contingency Measures Triggered by Monitoring

- 4.9 It is considered the mitigation and enhancement measures, as set out in this document, will allow for long-term ecological enhancements to be realised to retained habitats within the Site. In order to ensure ongoing management remains appropriate for the Site, and that continued ecological enhancements are realised, a suite of ecological surveys is proposed during the construction and operational phases of the development. These will include for the following specific surveys:
- Phase 1 Habitat Surveys
 - To be undertaken in Years 1, 3 and 5 following substantial completion of the Strategic GI Network, and on a 5 yearly basis thereon.
 - Invertebrate Surveys
 - To comprise a suite of three field visits on a monthly basis between May and July;
 - An initial survey to be undertaken in the above format, in the current or most recent spring and summer relevant to the granting of planning permission;
 - Further surveys to be undertaken in Years 1, 2, 4 and 10 following substantial completion of the Strategic GI Network.
 - Reptile Monitoring Surveys
 - The surveys will comprise presence/absence surveys (sufficient for monitoring population size);
 - To be undertaken in Years 2, 5 and 10 following substantial completion of the Strategic GI Network.
 - Breeding Bird Surveys
 - To comprise a suite of three breeding bird surveys between April and June of each year;
 - To be undertaken in Years 2, 5 and 10 following substantial completion of the Strategic GI Network.
 - GCN Surveys
 - Annual monitoring in the form of abundance counts, with 6 x torching surveys undertaken per annum between March and mid-June;
 - Envisaged monitoring will be undertaken annually for a 25 year period.
- 4.10 These proposed surveys will seek to update the ecological baseline for the Site, with results used to guide future management iterations of this Management Plan.
- 4.11 Annual monitoring checks will be undertaken to highlight any Site specific problems (such as disease or damage to flora), the presence of invasive species), or to identify problems associated with past management regimes. Upon identification of such issues, suitable remedial works will be implemented.
- 4.12 It is considered these checks need not be undertaken by a qualified ecologist but could instead be undertaken by the management body employed to undertake the duties prescribed elsewhere in the LEMP.

- 4.13 In addition to the surveys outlined above, opportunities for third party and community involvement will be encouraged within the Strategic GI Network, with local charities (such as local bat groups, amphibian and reptile groups, and bird organisations) encouraged to undertake regular surveys of the Site. Consideration will also be given to the potential for annual recording events such as a 'BioBlitz', to be held within the Strategic GI Network, with involvement from students of the new school within the wider Site encouraged.
- 4.14 It is noted there may be occasions when felling or remedial measures (e.g. from a health and safety perspective) will be required in respect of trees. Where any features which could be used by roosting bats are to be subject to work (i.e. those trees which have been provisioned with bat boxes), pre-commencement checks should be made by an appropriately qualified ecologist.
- 4.15 Checks for nesting birds will also be necessary for any works undertaken within the main bird breeding season (March to August inclusive).

5. SCHEDULE OF WORKS (POST - ESTABLISHMENT)

Objective	Receptor	Management Prescription	Commencement, Timing, Frequency and Duration of Works	Extent of Works/Objective
1. MAINTAIN AND ENHANCE RETAINED AND CREATED HABITATS	<u>Nature Park</u>			
	<u>Dry Grassland</u>	Rotational scrub clearance.	Commence Year 1 (anticipated 2020) and annually thereafter. Conduct outside the main bird breeding season (March to August) wherever possible.	Target of 20% scrub cover to be sought through rotational management (4 year rotation with no more than 25% of habitat managed annually).
		Rotational cutting of grassland.	Commence Year 1 (anticipated 2020) and annually thereafter. Annually between August and September. 20% grassland to remain uncut, 20% cut to 15cm, 60% cut to 7cm. Majority of arisings to be removed after 5 days.	Create a structurally varied sward to ensure continued opportunities for a range of fauna.
		Small scale rotovation.	Commence Year 1 (anticipated 2020) and annually thereafter. To be undertaken in August/September.	10% of habitat to be retained as bare ground (location to vary between years).
		Selective removal of aggressive and non-native specimens.	Commence Year 1. As required thereon.	-

	<u>Secondary Woodland</u>	Selective removal of aggressive and non-native specimens.	Commence Year 1 (anticipated 2020) and annually thereafter (as required).	-
		Management of mature Oak trees to target veteran features.	From Year 10, pollarding of trees to be undertaken at infrequent intervals (10 to 15 years).	From Year 10 and on a 10 to 15 year cycle thereafter.
		Management of edge habitat.	Commence Year 4. Works undertaken on a 4 yearly rotational basis between September and February.	No more than 25% of rides managed in any one year.
		Hazel coppicing.	Commence Year 5 with works undertaken on a 5 yearly basis thereon. Works to be undertaken between September and February wherever possible.	25% of stools to be coppiced every 5 th year.
		Deadwood habitat creation (ring barking/log pile creation).	Commence Year 10 and on an annual basis thereon.	Minimum of 5 standing and 5 fallen deadwood features to be retained per hectare of woodland. No more than 1 or 2 trees to be subject to ring-barking per annum.
	<u>Early Successional Habitats (OMH)</u>	Rotovation of OMH field.	From Year 2. One third of habitat to be rotovated per annum (3 year rotation).	Maintain a varied OMH (not least for Broad-leaved Cudweed) and prevent ecological succession.

		Retention of cliff habitat.	From Year 1. Works undertaken as required.	To retain nesting habitat in optimal condition and check overshading vegetation.
		Footpath edge management.	From Year 1. Annual harrowing with 50% of habitat disturbed per annum.	Maintain a mosaic of early successional habitats and bare ground.
		Management of OMH adjacent to cliffs.	Annually as required with cuts undertaken in late summer (August/September). Re-seeding undertaken on an ad-hoc basis as required.	Maintain a floristically diverse sward within a 20m radius of cliff habitat (wildflower composition >80%).
		Footpath edge management.	From Year 1. Annual harrowing with 50% of habitat disturbed per annum.	Maintain a mosaic of early successional habitats and bare ground.
	<u>Lakes and Pools</u>	Reedbed management (rotational cutting).	Unlikely to be required before Year 10. Cutting to be undertaken on 4 yearly rotation with 25% of reed bed cut per annum.	Retain a desirable extent of reed bed (minimum 0.3ha) and with a range of ages/structures.
		Pond monitoring and remedial measures.	Annual monitoring from Year 1 with remedial works (i.e. litter picking and removal of pollutants) undertaken as required.	-

		Pond management (biodiversity ponds).	Rotational management from Year 2 and as follows: • 30% of ponds managed on a 2 year rotation • 50% of ponds managed on 4 year rotation • 20% of ponds subject to only irregular management (>4 years)	Retain a gradation of wetland habitats ranging from extensive open water to heavily vegetated.
	<u>Boundary Shrub, Trees and Hedge</u>	Rotational shrub management.	From Year 3, with 30% of habitat subject to management per annum.	Encourage a varied age/structure of shrub habitat.
		Scalloped edge management.	From Year 3, with a third of habitat subject to management per annum.	Retain open habitat areas in sunny aspects. These open habitats to support a range of OMH habitats.
		Long-term hedge management.	From Year 1. 50% of hedge cut per annum.	Target to retain an 'A' shaped hedge with a 3m height.
		Hedge-laying	As required to restore structure	-
	<u>Wider Site Green Infrastructure</u>			
	<u>Living Roofs</u>	Monitoring and remedial works (removal of undesirable species).	Bi-annually (twice yearly) from Year 1. Removal of undesirable species as required.	Maintain a varied OMH and manage non-native colonisation (i.e. <i>Buddleja</i>).

	<u>Living Wall</u>	Monitoring and remedial works as required.	Annually from Year 1. Replacement of material as required.	To maintain nesting walls in optimal condition for a range of solitary invertebrates.
	<u>Ecology Car Park</u>	Monitoring and remedial works (removal of undesirable species).	Annually from Year 1. Habitat management (in line with that proposed for OMH above) undertaken where required to check ecological succession.	Maintain a varied OMH with areas of established floristic diversity alongside bare ground.
	<u>SuDS</u>	Dredging/de-silting.	As required	-
		Mowing of meadow grassland.	Bi-annual (twice yearly) hay cut from Year 2 during spring (March/April) and autumn (August/September). Sward to be reduced to 70mm. Third cut if required in late October. 20% of grassland to be uncut each year.	Maintain a species rich sward.
	<u>Shrub and Boundary Planting</u>	As per comparable habitat in Nature Park (see above).	-	-
	<u>Woodland Planting</u>	Small scale thinning.	Unlikely to be required before Year 10. Thinning to be undertaken as required.	-
		Meadow management.	Year 1 onwards. Twice annual cuts of grassland in spring and summer.	
	<u>Meadow/POS</u>	Mowing of meadow grassland.	Bi-annually (twice yearly) from Year 1. Cut to reduce sward height to <70mm.	
		Mowing of amenity grassland.	As required from Year 1 to maintain desired sward height.	-

2. MAINTAIN POPULATIONS OF PROTECTED SPECIES AT A FAVOURABLE CONSERVATION STATUS	<u>Reptiles</u>	Retention of temporary reptile fencing to delineate population from intrusive works.	As required following completion of Nature Park works and prior to completion of relevant development in the wider site. Monthly checks of fencing to be undertaken in the reptile active season (typically March to October)	
		Provision of additional reptile hibernacula.	As applicable following tree/shrub works. Minimum 5 hibernacula to be retained within the Site.	
		Manage suitable breeding and foraging habitat to retain this habitat type in the long-term.	Annual management from Year 1 (see relevant habitat sections above).	Maintain an optimal mosaic of habitats such that the FCS of common reptiles can be retained in the long-term.
	<u>Bats</u>	Maintenance of bat roosting features.	- Free hanging bat boxes - Annual condition checks from Year 1. Replacement as necessary during the winter period. Advice sought from suitably qualified ecologist where necessary. - Bat loft to be subject to annual condition checks with remedial works undertaken as required. - Integrated bat roost features will not require annual management.	Maintain and enhance the value of the Site to roosting, foraging and commuting bats.
		Provision and maintenance of suitable foraging and commuting habitat.	Annual management (see relevant habitats above).	-

	<u>Birds</u>	Long-term habitat management to retain and enhance opportunities for wintering and breeding birds.	From Year 1. See relevant Habitat Sections above.	
		Maintenance of bird nesting features.	• Free hanging bird boxes - Annual condition checks from Year 1. Replacement as necessary during the winter period. Advice sought from suitably qualified ecologist where necessary. • Tern raft and Sand Martin tower to be subject to annual condition checks with remedial works undertaken as required. • Integrated nest features will not require annual management.	
		Any management work to trees to be sympathetic to breeding birds.	See habitats above. Avoid undertaking management work during main bird breeding season 1 March to 31 August.	
	<u>Invertebrates</u>	Provision and maintenance of optimal invertebrate habitats (as identified through specific surveys).	Annual management from Year 1 (see relevant Habitats Sections above).	Annually following completion (see above).

	<u>Badgers</u>	Long-term habitat management to retain and enhance opportunities for Badgers within the Site.	From Year 1. See relevant Habitat Sections above.	
3. INCREASE BIODIVERSITY BY MAXIMISING OPPORTUNITIES FOR FLORA AND FAUNA	-	Instigation of a scrub management regime.	Annually from Year 1, see Habitats Sections above. To be undertaken outside breeding bird season where possible, with specific surveys undertaken if conflicts are likely.	Prevent adverse ecological succession.
		Maintenance and enhancement of extensive invertebrate nesting and foraging habitat	Extensive areas of OMH, to include cliff habitat, species-rich grassland, wetland, woodland, living roofs, nesting walls and ecology car parks. Above habitats to as required (see Habitats Sections above).	Retain optimal OMH to ensure the assemblage of invertebrates present on Site can be retained in the long-term.
		Provision and maintenance of extensive new bird nesting and bat roosting habitats.	Annually or as required, see Species Section above.	

		Ongoing management of the Nature Park and wider Green Infrastructure to maintain a diverse habitat mosaic and ensure optimal opportunities to a wide range of faunal species.	See Habitats Section above.	
		Provision of leaflets to new residents.	Operation phase (as required after occupation).	
		Provision and maintenance of interpretation boards and signage.	Twice annual checks of signage from Year 1, and repair as required.	

APPENDICES

APPENDIX 1

Illustrative Green Infrastructure Masterplan