Biodiversity Management Plan

Document prepared in support of the proposed
[name] solar farm, [location]
[planning reference]

Prepared for [developer]
by

[company]

[date]

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Executive Summary

This biodiversity management plan (BMP) has been prepared by [ecological consultants] on behalf of [developer] for the proposed solar farm [name and location]. The overall goal is to achieve a net gain for biodiversity and ecosystem services through avoiding impacts to existing habitats and wildlife, restoring existing habitats and creating new habitats on site. Measures have been designed sensitively to complement existing habitats in the local environment.

This BMP applies the [name] Mitigation Hierarchy, which is designed to minimise impacts and maximise gains by following the successive steps. These are: Avoid; Reduce; Rescue; Repair; Reinstate; Restore; Compensate. Compensation measures for off-site land are described in a separate document [citation].

Potential impacts relating to the construction of this solar farm include: damage to tree roots, hedgerows and their margins; loss of species rich grassland; and disturbance to the resident greatcrested newts.

The site layout incorporates avoidance of areas of value to existing wildlife on site, including breeding birds, bats, great crested newts, intact hedgerows, trees and their respective root protection zones, high quality grassland, scrub and tussocky grassland. Construction will avoid and reduce impacts where possible.

Specific avoidance and reduction measures include:

- ensuring sensitive construction takes place on [name] to retain as much intact grassland as possible;
- providing a buffer of 4.5m along all hedgerows and drainage ditches;
- adhering to tree root protection areas (RPAs) outlined in the 'Tree Survey and Constraints Plan' and using a low impact no-dig surface wherever this is not possible;
- implementing a 50m buffer around a pond containing great crested newts (gcn) and a 10m buffer around two other ponds on site.
- supervising vegetation removal in sensitive areas;
- carrying out construction within 250m of Pond 4 under Reasonable Avoidance Measures (RAMs) for GCN; and
- implementing a 10m buffer next to disused mammal burrows.

To achieve a net gain in biodiversity within the application area, a series of habitat enhancements are proposed including: creating new species-rich grassland in the form of tussocky field margins and a large area of tussocky grassland; wildflower meadow throughout the solar array; restoration of existing hedgerows and creation of new hedgerows; planting of trees, and new areas of scrub; expansion of existing wetland features and the construction of two ponds and one scrape; and the inclusion of additional habitat features including hibernacula, wood piles, bird boxes, bat boxes and beetle banks.

To ensure new and existing habitats meet their full potential it is essential that suitable management is put in place throughout and after the construction process. This plan outlines the stages of supervision, pre- and post-construction survey, and monitoring activities necessary to achieve this, and presents a recommended schedule of monitoring activities.

The expected biodiversity benefits from this management plan are detailed at the end of this report. It is expected that the new and enhanced hedgerows, trees and scrub will increase the abundance and

diversity of breeding and foraging birds and foraging bats, benefitting from new nest sites and foraging resources; the introduction of wildflowers will improve plant diversity, resulting in an increased abundance and variety of invertebrates; and the construction of a pond and scrape will integrate aquatic plants and animals into the ecological composition, whilst serving as a valuable water source for wildlife on site and moving through it.

The enhancements contribute to a biodiversity net gain of [X]% for habitats ([X] habitat units) and [X]% for hedgerows ([X] hedgerow units).

Introduction

[Developer] is committed to achieving a net gain for biodiversity on their solar farms and in the wider environment. This is achievable through protecting existing species and habitats, creating new habitats and implementing long-term management for the life of the solar farm. A series of ecological mitigations and habitat enhancements are presented in this report. It is explained how these will contribute to biodiversity net gain within the application area and the wider environment. The measures contained herein cover the construction process as well as the long-term management of the site.

Full methods, results, discussions and recommendations from ecological surveys can be found in the Full Ecological Assessment [citation], Phase 2 Badger, Bat and Great Crested Newt report [citation] and Breeding Bird Survey report [citation]. A map showing the existing habitats and species is shown in **Appendix A**.

Existing habitats and biodiversity

The site consists of eight arable fields and four sheep-grazed fields, with hedgerows and trees at boundaries, occasional trees within sheep-grazed fields, drainage ditches and occasional small ponds.

A summary of the onsite habitats and biodiversity is as follows:

- Four fields (Fields 9-12) consist of semi-improved grassland with Pignut, an indicator of an old sward,
- Hedgerows are mainly intact and species-rich, with elder, hazel, blackthorn, hawthorn, elm, dogwood, goat willow and field maple the main constituents. Bramble and ivy regularly feature and mature oak, field maple and willow trees are occasionally present.
- The site contained drainage ditches and small areas of standing water,
- Great crested newts (GCN) were found to use Pond 4 in Field 11,
- At least ten bat species were found to use the site, using mostly hedgerows and trees within the grassland areas, for commuting and foraging. Species included barbastelle *Barbastella barbastellus*, serotine *Eptesicus serotinus*, Leisler's *Nyctalus leisleri*, noctule *Nyctalus noctula*, *Myotis* (Daubenton's *M daubentonii*, whiskered *M mystacinus*, Brandt's *M brandtii*), common pipistrelle *Pipistrellus pipistrellus*, soprano pipistrelle *Pipistrellus pygmaeus*, brown long-eared *Plecotus auritus*, and lesser horseshoe *Rhinolophus hipposideros*.
- Thirty-four bird species were found to use the site, 22 breeding in hedgerows and Skylarks using fields for ground-nesting. Lapwings were also observed and have the potential to also nest at this site, as they were observed overhead.
- Mammal burrows (disused) were discovered adjacent to the site.

Biodiversity measures

Biodiversity measures have been designed to increase the value of the site to ensure the avoidance, mitigation and compensation of impacts to existing habitats and contributing to biodiversity net gain. Measures are set out according to the 7-point [name] Mitigation Hierarchy: Avoidance, Reduction, Rescue, Repair, Re-instatement, Restoration, Compensation. Rescue, repair, re-instatement and restoration are grouped as "mitigation" measures.

A map detailing the locations and/or descriptions of measures along with key points for implementation, is shown in **Appendix C**. The programme of habitat creation is summarised in **Table 1** below and the programme of long-term habitat management is summarised in **Table 2**.

AVOIDANCE

Avoidance measures are split into "site layout", "timing of hedgerow gap creation" and "timing of construction". A map displaying these measures is shown in **Appendix B**.

Site Layout

Buffers are included within the agreed site layout to avoid and reduce impacts to existing onsite biodiversity. These include minimum 4.5m hedgerow buffers, a 50m buffer around a GCN pond, a 10m buffer around a disused mammal burrows and root protection areas beside hedgerows and trees, in particular veteran trees.

Buffer zones will be clearly and appropriately marked out prior to construction, under the supervision of an ecologist, using highly visible fencing such as Heras or tape stretched between posts, to ensure they are visible to all contractors. Buffer zones will be adhered to throughout construction and the onsite ecologist will supervise construction adjacent to these areas to ensure they are adhered to.

The temporary compound is positioned within one of the arable fields where it will cause the least impact to biodiversity.

<u>Grassland</u>

Semi-improved grassland in fields 9-12 ([name]) is of biodiversity value and requires protection during construction to retain its structure as far as possible.

- Construction of roads and substation buildings should impact as little of the ground as possible and will avoid existing semi-improved grassland, as well as tree, hedgerow and ditch margins, wherever this is possible.

At the main site entrance, a small amount of ruderal grassland will be removed, to widen the access road. Removal will be carried out during the reptile active season (March to October, inclusive) and supervised by the Ecow who will check for reptiles.

<u>Hedgerows and trees</u>

[Developer] have committed to retaining hedgerows and trees throughout the site and using existing field access routes. Impacts will be avoided as follows:

- All existing hedgerows and drainage ditches will be protected during construction with a standard buffer of 4.5m running along each side and root protection areas (RPAs) set out in the "Tree survey & constraints plan" [citation] are avoided at all points where this is possible. Tree root protection areas (RPAs) have been set out such that all trees deemed worthy of retention will be protected, with construction taking place outside of the designated RPAs of all veteran trees and, where possible, of all other trees on site (shown on **Appendix E**). At points where the access road is required to pass through RPAs, a no-dig method of construction will be used, as shown on the site layout plan. Stony material will be placed on top of the soil in these instances.

- A tree stump is located in the east of field 10 of [name]. Considering that the stump is relatively low to the ground, it should be retained during construction and panels laid over or beside it. Deadwood is a valuable resource for a range of invertebrates, and it is advisable to retain it whenever possible.

Timing of hedgerow gap widening

At nine locations within the site, existing hedgerow gaps will be widened to 4.5m. Gaps are currently around 3m wide so 1.5m of hedgerow will be removed at each gap, totalling around 13.5m of hedgerow removal. This work will be timed so that it is within the active season for GCN and reptiles (**March to October, inclusive**), to ensure that no animals are disturbed or harmed during hibernation. Reptiles are likely to be present in small numbers along the hedgerow bases.

Timing of construction

Construction activities will be timed to avoid potential disturbance to fauna and flora onsite, at all possible points. The sensitivities of relevant protected and vulnerable habitats and species are set out below and summarised in Table 1. Months highlighted in red denote sensitive periods in the natural cycles of each habitat or species, during which they are most likely to be subject to harm or disturbance. Months highlighted in green denote less critical periods, where construction work is less likely to have a negative impact.

Breeding birds

Construction noise and traffic is likely to impact both ground-nesting birds and those nesting in hedgerows across the site.

Construction works should ideally commence outside of the bird nesting season and take place between August and February inclusive, in order to protect the nests of any ground-nesting birds.

If construction is required within the breeding bird season, one breeding bird survey will take place throughout fields 1-8 prior to construction and territories of ground-nesting birds will be noted. If a nest or territory is found, no construction will take place within 50 metres of the nest until any chicks are confirmed to have fledged.

Burrowing mammals

- Works within 30m of the disused burrows will take place during the active season **(March to October, inclusive**) to avoid disturbance to any potential hibernating animals. The site layout has been designed so that construction will take place no closer than 10 metres from the disused burrows.

Grassland

- Works on the existing grassland will not take place when the ground is very wet. Ideally, this would limit works on this grassland to the period **April - October, inclusive**, although ground conditions can be checked at other times by an ecologist and deemed to be suitable or unsuitable for construction. Prior to construction on the grassland, an ecologist will re-assess the area and an ecological clerk of works will be employed to supervise vegetation removal in sensitive areas.

Table 1. Timetable for construction to avoid the disturbance of fauna. Red shaded squares denote months that the habitat or species is more sensitive to disturbance, green denotes less sensitive months.

Sensitive species	Rationale for avoidance	Construction timings to avoid disturbance											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Amphibians, including great crested newts.	Avoid removing hedgerow and tree understory for hedge gap widening November – February to avoid disturbance during hibernation.												
Breeding birds	Breeding birds and offspring, particularly those that nest on the ground, are at risk of harm or disturbance during the breeding season. If hedgerow gap widening is required during breeding season, an ecologist will first check the sections for nests and ensure no breeding birds are disturbed. If construction is required during breeding season, a focussed survey will be conducted and a 50m buffer instated around nests.												
Burrowing mammals	Mammals such as badgers and foxes are largely inactive during winter months and are at risk of disturbance during this period.												
Grassland	Grassland is more easily damaged when waterlogged. Ecologist can assess at other times and construction can take place if the grassland is not too wet.												
Reptiles	Avoid removing hedgerow and tree understory during this period. Reptiles are inactive during hibernation and are at risk of disturbance during this period.												

REDUCTION

This section presents measures to reduce potential impacts to existing biodiversity.

Pre-construction surveys and ecological clerk of works (Ecow) are designed to identify any protected or notable species within the construction area. Prior to the start of construction, a final site walkover will be conducted by an ecologist to re-assess the site for protected species.

An Ecow will be on site a minimum of one day per week throughout the construction period, and on call at all times. They will be present in particular for works in more sensitive parts of the site.

A Construction Environmental Management Plan (CEMP) will be drawn up by the contractor to:

- Minimise any potential impacts to the existing semi-improved grassland habitats in Fields 9-12, to include the instruction to construct during the dryer period i.e. April – October, unless conditions are deemed to be suitable by the Ecow.
- Protect species that might use hedgerow habitats that are to be removed to widen existing field access gaps.
- Protect bats from the effects of lighting during construction.
- Govern the strict control of potential sediment mobilisation, and the storage and use of hydrocarbons and other hazardous materials on the site during the entire construction period.

Hedgerow gap widening

Immediately prior to removal of any sections of hedgerow an ecologist will assess the hedgerow to be removed for bird nests. The check will cover 5 metres along the hedgerow from the removal zone. If any bird's nests are found, either works will halt until the nest is confirmed to no longer be active, or, if possible, an adjacent section of hedgerow will be removed where no birds are nesting.

The Ecow (GCN-licensed) will supervise hedgerow removal, removal of hedgerow base vegetation and creation of the ditch culverts. They will check for GCN and reptiles. If any GCN are found, works to the hedgerows will immediately stop and the ecologist will contact Natural England. A license will be required before work can recommence. If any reptiles are found, the Ecow will move them to a safe location, considered to be a section of hedgerow around 100m from the section being removed.

Cable Route

Where the cable route runs through the existing grassland, care will be taken to minimise disruption to the sward. In sensitive areas (to be determined by the Ecow) turf will be carefully removed in a thick slab and placed next to the trench. Once a section of trench is infilled, within a timeframe of 2-3 days, the turf will be reinstated on top. In less sensitive areas the disturbed ground along the trench line will be re-seeded with a suitable seed mix within the shortest possible timeframe.

Temporary Compound

Once the temporary compound is no longer in use, the ground will be deep-ploughed prior to reseeding. This will reduce the impact of the compaction that is likely to be caused by extensive use by heavy vehicles.

Pre-construction survey

Pre-construction surveys are designed to identify any protected or notable species within the construction area. Prior to the start of construction, a final site walkover will be conducted by an ecologist to re-assess the site for protected species.

Badgers

Mammal burrows adjacent to the site were found to be disused, during surveys, however there is potential for them to become colonised by badgers in future.

- One check of the burrows will be required prior to construction. If evidence of badger activity is found, an ecologist will be present during initial ground works within 30m of the burrows.

Breeding birds

If works on the arable fields are to take place during the bird nesting season (March to July, inclusive) a pre-construction survey will be conducted. A bird surveyor will assess for skylark territories and will instate buffer zones of 50m around any active nests. The buffer zones will be removed once chicks have fledged and the nests are no longer in use.

Protection during construction

An Ecow will be employed one day per week and on call when required or requested during works, to oversee construction activities and ensure any protected species are suitably dealt with. Relevant licensed or experienced ecologists will also be requested when required.

Bats

Bats were found to use hedgerows as commuting pathways as well as foraging habitats.

- No lighting will be used during construction to avoid impacts on bats using the site.

Great crested newts

A small or ephemeral population of great crested newts was found in Pond 4. With the 50m setback there is a low potential for impact. The following Reasonable Avoidance Measures (RAMs) are in place to ensure a negligible impact:

- No works will take place within 50m of Pond 4. Vehicles and construction activities will remain more than 50m from Pond 4 at all times.
- Works in suitable GCN habitat within 250m of Pond 4 will be supervised by a GCN-licensed ecologist, acting as an Ecow. Suitable habitat exists in hedgerow bases and grassland fields (Fields 10, 11 and 12). The Ecow will carry out spot-checks for vegetation clearance prior to removing hedgerow sections, drilling piles for mounting solar panels.
- The Ecow will provide a “toolbox talk” to all contractors prior to the start of works to inform them of the presence of GCN, their legal protected status and the protocols set out.
- The Ecow will carry out a fingertip search of suitable GCN habitats within 250m of the pond in places where works are to take place. This includes any tussocks of grassland, holes in the soil, underneath stones, wood or other refugia that are to be disturbed.
- If any vegetation is taller than 25-30cm, the Ecow will supervise careful strimming or cutting back of this vegetation to 10-15cm prior to any construction taking place, to minimise its potential value for GCN.

- Vehicles will not travel within 4.5m of hedgerows or the bases of trees unless there is no alternative.
- Any trenches or excavations will be covered overnight or will be provided with methods of escape and will be checked prior to further works.
- In the unlikely event that any GCN are found during construction, works in grassland habitats within 250m of Pond 4 will halt, the Ecow will liaise with Natural England will be contacted and no further works may take place until an appropriate license is put in place.

Grassland

The existing semi-improved grassland at [name] will benefit from the best possible retention of its structure.

- Construction activity will limit vehicle movements. Protective mats will be used in wetter areas / conditions, as advised by the Ecow.
- Prior to construction on the grassland, an ecologist will re-assess the area and will be employed to supervise vegetation removal in sensitive areas.
- Low-pressure vehicles will be used in the wetter parts of the [name] fields and in wetter weather conditions if deemed necessary by the ecologist.

Reptiles

Hedgerow base vegetation at the hedgerow gap widening areas provides potential habitat for reptiles, though of a fairly low quality.

- Vegetation will be removed under a watching brief by the Ecow. In the unlikely event that any reptile is found, they will be removed to hedgerow habitat at least 100m from the area of removal.

MITIGATION (Rescue, Repair, Re-instatement and Restoration) and **ENHANCEMENT**

In this section, measures to restore and compensate any unavoidable impacts to biodiversity are presented and enhancements are set out. In many cases, restoration activities are being applied to habitats that have been degraded by activities undertaken prior to, and separate to, the proposed solar development, including the restoration of species rich grassland on arable fields and infilling defunct hedgerows.

There are five sections relating to different habitats and measures:

Section 1 - Grassland habitats (species-rich meadow and tussock grassland); Section 2 - Woody habitats (hedgerows, scrub, trees and orchard);
Section 3 - Wetland habitats (ponds, scrapes & waterways);
Section 4 - Breeding, roosting and hibernation habitats; and Section
5 - Additional protective measures and enhancements.

Each category is described in terms of plans for enhancement, methods for the creation of new habitat, and long-term management, all using best practice where applicable. All remediative

measures are displayed visually on a site map in **Appendix B**. **Table 2.** summarises the programme of habitat establishment.

This section begins with Habitat Establishment, goes on to prescribe Long-term Management and Survey and Monitoring, and finally discusses Expected Benefits to Biodiversity and Ecosystem Services.

Habitat Establishment

An ecologist will be present to oversee sensitive environmental works including but not limited to harvesting seed; sowing or planting particular areas of wildflower grassland; installing bird and bat boxes and building hibernacula.

Table 2. Programme of habitat establishment

Initial mitigating measures	Timings for installation	Justification
Grassland		
Grassland preparation & seeding	Autumn (preferable) or spring	Preparation of the ground for sowing can take place year-round and must begin at least 1.5 months prior to sowing. Grassland plants naturally produce seeds in the late summer and early autumn. Sowing in this season allows the seeds to germinate and establish a root system ready for spring. If autumn sowing is not possible, spring sowing is possible although carries a lower success rate. Grassland seeding must be coordinated carefully with construction to ensure best possible establishment (best prior to panel cover) and to avoid damage to newly seeded areas. A lag time of 1 year is required for grassland establishment prior to construction. Seeding can otherwise take place post-construction.
Woody habitats		
Hedgerow and tree planting and infilling	November - February	Deciduous woody plants are dormant through the winter and establish best when planted during this period, with November being the best month
Scrub planting	November - February	Deciduous woody plants are dormant through the winter and establish best when planted during this period, with November being the best month
Wetland habitats		
Pond construction	Autumn	Select suitable ground conditions for excavation whilst avoiding the breeding season of ground nesting birds.
Scrape construction	Autumn	Select suitable ground conditions for excavation, whilst avoiding the breeding season of ground nesting birds.
Pond enlargement	Autumn	Select suitable ground conditions for excavation whilst avoiding the breeding season of ground nesting birds.
Breeding, roosting and hibernation habitats		
Beetle bank	Autumn or spring.	As for “grassland seeding and preparation”.
Hibernacula creation	Year round. Time to coincide with availability of materials.	N/A
Wood pile creation	Year round. Time to coincide with availability of materials.	N/A
Secure bird boxes	Year round.	N/A
Secure bat boxes	Year round.	N/A
Install or construct solitary bee hotels	Year round	N/A

Section 1. Grassland habitats - Species-rich meadow and Tussock grassland

Species-rich wildflower meadow

Species-rich meadow and tussock margins will be sown throughout the existing arable fields (fields 18). Any gaps created by construction activities in fields 9-12 will also be re-seeded, with guidance from the Ecow. (measure M1)

The creation of new grassland in the form of species-rich meadow and tussock margins will improve species diversity within the site and in the locality, providing a foraging resource for bats and birds and a suitable habitat for ground nesting birds, small mammals, reptiles and a range of invertebrates. Grassland will also be restored in any small areas that become damaged by construction.

All grassland will be established in the same way but through different management, these habitats will differentiate from one another.

The solar farm will be entirely seeded, or over-sown, where appropriate, with a local green hay or species-rich grassland seed mixture. A combination of green hay and dry seed would be ideal. A map of soil types is sown in **Appendix F** for reference when acquiring seed. General measures are outlined below, followed by specific measures for the different types of existing fields A**:** arable; and B**:** semiimproved).

Grassland creation on the arable fields will take place prior to solar panel construction if a sufficient lag time of >1yr is possible to allow the sward to develop prior to construction. If this is not possible, sowing will take place post-construction. Further sowing will also take place after construction in any areas that have been damaged through vehicle movements during construction.

Ground preparation:

A: Existing Arable (Fields 1-8)

To prepare the ground, the fields should be ploughed 3+ times, with at least 2 weeks in between ploughings: this will reduce soil compaction and remove weeds present in the soil. On the final ploughing, the seed bed should be worked to a fine tilth. No herbicide should be required and it will only be used where a significant issue with injurious weeds is anticipated by an ecologist. Selective herbicide will be favoured over non-selective and targeted use favoured over blanket spraying.

Seeding will be undertaken as described below for bare ground.

B: Existing semi-improved grassland (Fields 9-12)

These fields will only be oversown where damage is done during construction. The areas will be harrowed prior to seeding.

Green hay:

A combination of green hay and dry seed is recommended, as green hay tends to result in relatively thin growth.

Spreading of green hay is required to take place in early autumn, immediately after it is cut from the donor site.

Where possible, green hay will be obtained from a species rich donor site. Green hay is composed of wildflowers and grasses that are harvested at the point where they are shedding seed yet still 'green'. If green hay is available from a suitable donor site, it must be cut, baled and strewn within a few hours.

The bales should be broken and strewn evenly across the prepared seed bed, first by a suitable machine, e.g., loader, and then by hand. On bare ground (i.e. Fields 1-8) green hay from 1ha of grassland can be spread over 3ha of ground.

Green hay will be spread alongside yellow rattle and a cover crop of cornfield annuals, to aid grassland establishment. Wildflower seeds:

Sowing of grassland seed is best undertaken in early autumn, whilst soil temperatures remain high and there is moisture in the soil. Sowing can also take place in spring, but seedling development success will be lower if the weather is dry.

Seeds are best sourced from local species-rich sites, from which they can be brush harvested. Seed could be harvested from one of the nearby SSSIs and [name] [website], a Company based in [name], are recommended. Ripened seeds are collected then sieved, dried and stored in a barn until autumn; at this point they are ready to be spread onto the prepared ground.

If it is not possible to source local seeds, a native commercial seed can be used, that is suitable for use on a solar farm (i.e. contains species that tolerate light shade and grow to a suitable height). A different seed mixture can be used in the field margins, which receive more light. Seeds should be sourced as locally as possible, i.e. from [name] or the surrounding counties.

Wildflower seeds will be sown with yellow rattle and ideally with a cover crop of cornfield annuals to aid establishment.

The seed should be sown at the desired rate using a tractor mounted broadcaster or by hand where machines cannot access. The broadcaster should be set to spread seed beneath the panels as well as along the rows. The seed should be rolled in using a Cambridge roller or similar, wherever possible.

On bare ground approximately 40kg of seed is required per hectare. On existing improved grassland approximately 20kg of seed is required per hectare.

The existing semi-improved grassland (fields 9-12) will only be seeded in places where construction activities have created gaps in the sward. The ground will be lightly harrowed prior to sowing seeds. Green hay or seed will be scattered by hand within the semi-improved grasslands.

Tussock margins

Tussock grassland around the site margins will be created through differing management from the main solar array areas, as detailed in the relevant section of this report.

Section 2. Woody habitats - Hedgerows, scrub and trees

New species-rich hedgerows will be created, existing defunct hedgerows will be restored through infilling and new trees and scrub will be planted. These measures will mitigate potential impacts to bats and breeding birds and contribute to an overall net gain in habitats.

Hedgerow

The following hedgerow planting will take place:

1. Along the entire northern [name] boundary of the site (10m south of the fence-line) a new hedgerow of approximately 1,100m in length and a series of trees will be planted alongside

   the existing fence. This hedgerow will be allowed to grow as wide as the development will allow, a minimum of 2 metres in width, to serve as a suitable wildlife corridor for bats, birds and reptiles. Such a hedgerow would reduce noise pollution, which is considered to have adverse effects on the breeding success of numerous bird species, as well as reduce ground and air pollution radiating from the [name]. (measure M2)
2. A new hedgerow will be planted along the east of field 10, parallel with an existing hedgerow. Planting will take place 3 metres from the security fence. (measure M3)
3. A new hedgerow in the northwest of field 1 will be created using hazel hurdles attached to the security fence. These will be put in place immediately after construction of the fence to provide immediate screening. Alder, goat willow and white willow will be planted 3 metres from the hurdles, as shown on the Planting Plan provided by [consultant]. (measure M4)
4. A new hedgerow in the south of field 1 will be created using hazel hurdles put in place prior to construction to provide immediate screening. Alder, goat willow and white willow will be planted 3 metres from the hurdles, as shown on the Planting Plan provided by [consultant]. (measure M5)
5. The hedgerow along the north of field 6 is fragmented limiting its quality as commuting route, breeding habitat and foraging resource. Hedgerow gaps will be infilled with feather whips of multiple species. (measure M6)
6. The hedgerow along the west of field 9 will be infilled with feather whips. (measure M7)

Planting will take place between November and February at the earliest available opportunity, using native species selected to replicate and improve upon hedgerows found locally. Planting in November, or at least before the end of January, is preferable to allow planted stock more time to establish a network of feeder roots before the onset of spring. Planting will be undertaken under frost-free conditions.

Two hedgerow mixtures will be used. Hedgerow mix 1 includes field maple, hazel, hawthorn, spindle, honeysuckle, crab apple, blackthorn, goat willow, white willow and wayfaring tree will be planted in the hedgerow. Hedgerow mix 2 includes alder, goat willow and white willow.

Bare root whips will be 40-60cm / 60-80cm tall and planted in triple staggered rows, 500mm apart at 450mm centres. Whips will be slot planted. Container grown plants will be pit planted.

The bases of new hedge whips and trees will be protected from deer and rabbits using tree guards, which will be removed once the shrubs are deemed sufficiently established through a period of monitoring. Biodegradable tree guards will be used wherever possible as they can be left to degrade naturally. Existing hedgerows that are fragmented will be infilled with feathered whips and trees using the above methods.

Trees will be planted at intervals along the hedgerow, as defined in the Planting Plan. Field maple, crab apple, wild cherry, elder and crack willow will be planted. Trees of 10-12cm girth will secured with stakes and straps.

Weed competition at the base of the new plants will be supressed by a thick layer of wood chip mulch, which will need to be checked and replaced annually, as actively weeded hedgerows establish faster and need less maintenance overall. Chemical treatment of weeds will be avoided, and there will be no application of fertilizers.

Scrub

Planting scrub is of benefit to many species, as a valuable place to take refuge. Nesting and foraging birds particularly value this habitat, as do reptiles and amphibians.

Scrub will be planted:

1. Along the entire northern site boundary, adjacent to the [name] boundary.
2. Around the new pond in the northwest corner of field 1, as per the Planting Plan (see [consultant], 2022). (measure M8)
3. East of the hedge that runs between fields 2 and 3.
4. Adjacent to the bridleway on the east side of field 10.

Planting will take place between November and February at the earliest available opportunity, using native species selected to replicate and improve upon hedgerows found locally. Planting in November, or at least before the end of January, is preferable to allow planted stock more time to establish a network of feeder roots before the onset of spring. Planting will be undertaken under frost-free conditions.

The scrub mixture along the [name] boundary will include: Field maple, hazel, hawthorn, spindle, honeysuckle, elderberry and wayfaring tree.

The scrub mixture in other parts of the site will include: field maple, hazel, hawthorn, spindle, goat willow and crack/white willow.

Bare root whips will be 40-60 or 60-80cm tall and planted in clumps rather than rows, leaving gaps between each cluster to infill naturally. Ensure the openings do not face prevailing winds. Whips will be slot planted. The bases will be protected from deer and rabbits using tree guards, which will be removed once the shrubs are deemed sufficiently established through a period of monitoring. This is likely to be 3-5 years but less is preferable, as guards inhibit outward growth. Biodegradable tree guards will be used wherever possible as they can be left to degrade naturally. Scrub plants will be flagged using coloured tape, either near the tops of whips or on supporting stakes.

Weed competition at the base of the new plants will be supressed by a thick layer of wood chip mulch, which will need to be checked and replaced annually, as actively weeded hedgerows establish faster and need less maintenance overall. Chemical treatment of weeds will be avoided, and there will be no application of fertilizers.

Scrub will be allowed to expand into the field margins where possible throughout the solar farm and low wooden fencing can be used to prevent mowing in wider sections.

Section 3 - Wetland habitats: Ponds and waterways

Wetland enhancement measures will involve the expansion of existing ponds, and the creation of new ponds and scrapes, surrounded by scrub buffers, woodpiles and hibernaculum. These new wetland features will greatly increase the biodiversity value of the site overall, particularly for great crested newts and other amphibians, and contribute to biodiversity net gain. The landscape is inherently wet with a clay-rich soil that holds water easily and so according to ecological principles, these wetlands will be created using natural methods and materials, including puddling clay in appropriate places to

increase the capacity of the features to hold water (e.g. [website]).

Two ponds and one scrape will be created, each with sloped sides at varying depths. An additional two ponds will be enhanced.

Ponds

Ponds holding water year-round support a diverse range of aquatic and semi aquatic plants, invertebrates, amphibians and birds, and provide a valuable water source for wildlife on site and moving through it. Ponds also serve as biodiversity nodes, helping to link different habitats together.

Two new ponds will be created onsite:

1. One pond will be situated near [name] on the northwest corner of field 1. The marginal areas will be planted with wetland herbs such as purple loosestrife and flag iris. (measure M10)
2. One pond will be situated in the southwest corner of the site, in field 1. (measure M11)

Ponds will not be lined, i.e. will be free-draining as the site is naturally quite wet and holds water easily. This will reduce the likelihood of flooding any adjacent properties.

Ponds will be dug using an excavator and will measure approximately 25m^2, with varying shapes and depths (0.25 – 1m).

The marginal areas will be planted with wetland herbs such as purple loosestrife and flag iris.

The spoil from pond construction will be formed into bunds or beetle banks.

Two existing ponds will be enlarged (measure M12):

1. Pond 1 on the southern boundary of field 4
2. Pond 2 on the southern boundary of field 5

These ponds will be enlarged westwards by a minimum of 25m^2 to increase their quality and value for wildlife in the local area. The depth of each of the ponds will be increased by 0.25m and the additional sections will be dug to match this maximum depth, with a range of depths and shelves created and ensuring the sides of the ponds are gently shelved. The spoil from construction will be reconstructed into bunds or beetle banks.

Scrape

Scrapes are shallow depressions with gentle sloping edges. They seasonally hold water, supporting a wide range of invertebrates and providing an important feeding area for wading birds and their offspring. Scrapes can be solely fed by rainwater and winter floodwater, however when excavated beside ditches and drain lines, they can assuage the water overflow from undesirable areas.

One scrape will be created:

1. The scrape will be situated within the large open area situated at the western boundary of the site in field 2 and does not require lining to retain water. (measure M13)

The scrape will be dug using an excavator to varying depths (0.25-0.75m) and will measure approximately 50m^2.

Section 4 - Breeding, roosting and hibernation habitats

In addition to creating and restoring habitats on site, distinct habitat features can be supplementary to the enhancement plan, serving as micro-ecosystems or providing shelter and nesting sanctuaries. This section details the habitat features included in the biodiversity enhancement proposals.

Hibernacula

Six hibernacula will be built next to the ponds and scrapes (measure M14):

1. In the south corner of field 1
2. In the west corner of field 1
3. In the west corner of field 2
4. In the south of field 4
5. In the south of field 5
6. In the middle of field 11

A hibernaculum is built from natural materials and provides a protective and secure holding for animals to hibernate or nest. Hibernacula generally consist of a pile of logs and rubble up to 0.5m high. This structure will be covered with brushwood or topsoil and left to vegetate naturally. Small entrances will be required at ground level by positioning logs or stones to form a permanent opening. The inclusion of hibernacula on site will ultimately encourage small mammals, reptiles and amphibians to use the area.

Woodpiles

Six log piles will be created next to the ponds and scrapes (measure M15)

1. In the south corner of field 1
2. In the west corner of field 1
3. In the west corner of field 2
4. In the south of field 4
5. In the south of field 5
6. In the middle of field 11

Decaying woodpiles provide suitable habitat for invertebrates, fungi and mosses that feed and live on the deadwood. They can also serve as hibernacula, providing shelter for amphibians, reptiles and small mammals. Woodpiles are composed of felled timber and brushwood accumulated during the development process, and routine site management, which is stacked into a range of heights and widths. To bolster colonisation, they should be positioned at the base of hedgerows, within woodland or adjacent to ponds or scrapes.

Bird boxes

Twenty bird boxes will be installed (measure M16)

A range of bird boxes are recommended for [name]; approximate siting locations are included in **Appendix B**. These include open fronted boxes for robins, wrens, thrushes and spotted flycatchers, closed boxes with an entrance hole for tits, and two vertical boxes for treecreepers. Two large boxes will also be installed for kestrels and barn owl. Kestrels require an open fronted box and barn owls prefer closed A-framed boxes with an entrance hole.

Small open fronted nest boxes will be concealed in dense foliage, ensuring there is no vegetation obstructing the entrance and the box is easily accessible to small birds. Robins and wrens favour boxes positioned below 2m from the ground, and those for spotted flycatchers need to be 2-4m from the ground; sheltered with a clear outlook. Tit and treecreeper nest boxes can be fitted to the sides of trees, though it is also best to avoid areas where they are exposed; nestled amongst ivy is preferred. Tit boxes can be positioned between 2-4m high, and treecreeper boxes should be sited 1.5 – 3m high. Barn owl and kestrel nest boxes can also be secured to the sides of large free-standing trees, between 3-5m high, ensuring they face an open vantage point facing the fields.

Bird boxes are best put up in autumn and should be positioned away from the direct line of the sun to avoid inhabitants from overheating during hot spring and summer days. Generally, it should be ensured that there is at least 6m of distance between each box, though tits can nest close together peacefully. It is recommended not to fix additional boxes on trees supporting either barn owl or kestrel next boxes; they should be avoided due to predator-prey proximity.

Bat boxes

Twenty long-lasting bat boxes will be installed on sturdy mature trees at field boundaries. (measure M17)

A range of bat boxes are recommended, to accommodate different bat species that use the habitats. Woodstone and Schwegler boxes from [website] are recommended (as detailed below) but alternative comparable boxes could be used.

- 4 x “Harlech Woodstone Bat Box”
- 4 x “Large Multi Chamber Woodstone Bat Box”
- 4 x “Miramare Woodstone Bat Box”
- 4 x Schwegler “2FN Special Bat Box”
- 2 x Schwegler “Large Colony Bat Box 1FS”
- 2 x Schwegler “Bat Colony Box 2FS”

Bat boxes will be fixed at a height of between 4-5m on the south, east or west facing side of a mature tree, ensuring there is a clear flight path into the box entrance.

Solitary Bee Hotels

Twenty solitary bee hotels will be positioned near wetland, scrub and hibernation features, to provide refuge habitats for bees and other invertebrates. (measure M18)

A range of different sizes is recommended, with at least 2 full-sized “bug hotels” made from stacking a minimum of 5 pallets and inserting materials collected to include bamboo canes, bricks and tiles, old flower stems, pine and fir cones and stones. If wooden features are used, these will degrade and 20 further features will be added every 5 years.

Beetle banks

Beetle banks are grass mounds, about 2 metres wide, and typically run through the middle of fields. When sown with an appropriate seed mix, they can boost the abundance and diversity of invertebrate species and provide a nesting habitat for birds that prefer to breed away from field boundaries, such as corn buntings and skylarks.

Beetle banks will be created using the spoil from digging ponds in fields 1, 5 and 6 and the scrape in field 2. (measure M19)

They will be ideally positioned downhill from these features, to act as additional features to capture water.

Beetle banks can be created using the excess soil from pond and scrape excavation and should be immediately seeded with a high percentage of tussock-forming species such as cocksfoot or timothy grass. The remaining species in the mix can consist of native fescues and bents.

Initial maintenance may involve cutting in the first summer, when the sward reaches 10cm in height. This encourages the grasses to tiller and helps control invasive annual weeds. Once established, cutting will be required once every three years.

Beehives

Beehives will be put onto the site for honeybees. Possible hives include those made from sustainably sourced logs from [website].

Section 5 - Additional protective measures and enhancements

This section covers any additional constraints, mitigations and enhancements not applicable to the main habitat categories.

Signage board

[Name] solar farm has two bridleways and a footpath running through it. There is potential for public engagement regarding wildlife and so a new signage board would be valuable, describing onsite wildlife and management practices. This should be created in conjunction with an ecologist and with use of the ecological reports submitted for this application [citation]. (measure M20)

Habitat Management

Habitats are formed over time by their management, along with ground conditions and weather. The solar farm will be in situ for 40 years and during that time, there will be changes in needs onsite. The management plan set out below should be taken as guidance: management may change according to requirements and advice from ongoing biodiversity survey work.

The basis for habitat management will be ultimately to benefit wildlife, whilst ensuring that the solar farm can run effectively and cater to the needs of people using the site. Wildlife-friendly management practices reduce running costs as management is minimised. Wherever possible, management should be minimal and habitats allowed to re-generate, such as scrub and woodland. Hedgerows should be allowed to grow to full height and width, wherever possible, and grassland should be allowed to grow tall and tussocky, but with recognition that grassland that is cut or grazed at least once a year tends to host greater species diversity. Water should be allowed to find its own way through the landscape and to sit in natural dips in the land. Trees should be allowed to die naturally and deadwood should be left in place where it is safe to do so, and piled up in appropriate locations if it needs removing.

During the lifetime of the solar farm, there may occur opportunities for additional habitat to be created. Suggested further habitats include hedge-laying to increase the values of existing hedgerows, creating further ponds, widening drainage ditches and planting orchard.

The use of herbicide is strongly discouraged, as most problems of invasive plants occur due to management regimes and problem species disappear over time with changes in management. However, in exceptional circumstances, it may be necessary to use herbicide at a small scale. In these circumstances, herbicide will only be used under the guidance of an ecologist, using spot-spaying methods.

A map of proposed habitat management is shown in **Appendix D.** Guidance for the programme of long-term habitat management is shown in **Table 3**.

Table 3. Programme of long-term habitat management.

Long term management	**Frequency**	**Time of year**
Grassland habitats		
Cutting (tussock grassland)	Every 2-3 years	March/April
Cutting (solar array – existing grassland (Fields 9-12)) Remove arisings if possible.	Annually, strip-cut if with necessary.	August/September (with possible strip-cut May/June)
Cutting Remove arisings if possible.	Bi-annually, strip-cut if with necessary.	March/April & July/August (with possible strip-cut May/June)
Conservation livestock grazing (sheep, within security fence – Fields 9-12)	Annually	September - March
Conservation livestock grazing (sheep, within security fence – Fields 1-8)	Annually	Year-round on rotation. 6 months rest period minimum per field.
		Aftermath graze all fields after cuts: sheep remove clippings from grass surface.
Woody habitats		
Cutting and pruning, if necessary.	Annually (half hedgerow only)	October - February
Mulching (new hedgerows and trees)	First 3 years	October - February
Contractor checks	First 5 years	Any time of year
Replacement of dead or diseased trees/shrubs	When required. Check in years 2 and 5.	November - February
Removal of stakes, ties and guards	After 3-5 years or earlier if deemed necessary.	Any time of year
Review of scrub in margins	After 3 years	Any time of year
Watering orchard trees	First 5 years	In dry spells
Pruning and mulching orchard trees	Annually	October - February
Wetland habitats		
Margin management	Every 5 years	September - February

Breeding, roosting and hibernation habitats		
Re-install or replace broken bird and bat boxes	When required	Throughout the year. Removal or adjustment September – February only.
Add material to hibernacula and log piles	When possible	Any time of year
Add 20 new solitary bee hotels, if wooden features	Every 5 years	Any time of year

Section 1. Grassland habitats - Species-rich meadow and tussock grassland

An appropriate cutting or grazing regime is central to the management of a grassland habitat, encouraging the development of species rich grassland with a varied structure. Creating a mosaic of structural variances maximises the value of the grassland as an ecological resource.

To encourage a structured grassland, the site should be cut in a staggered manner, with the site cut in at least three different segments, with periods of at least 2 weeks between segments. This will allow animal species to temporarily transfer to other parts of the site during cutting.

Species-rich meadow

Grassland throughout the solar array (areas between and underneath solar panels) will be cut for hay where possible, and grazed with sheep. The recommended timings should be adhered to but note that in front of static panels, occasionally an additional cut in the growing season may be necessary to avoid overshadowing of the solar panels. If this is necessary, a strip cut only beneath the leading edge of the panels is recommended, leaving all other areas of grassland intact.

After each cut, arisings will be produced. If thick piles of grass cuttings are left in place, they can damage the grassland underneath. Option 1 will be to remove arisings if possible, which promotes diversity throughout the grassland sward. If removal is not possible, there are two further options. Option 2 is to use a mulching mower or mow 2-3 times over the grassland to break up the arisings into smaller pieces. Option 3 is to aftermath graze with sheep, who will eat a large amount of the arisings. If the clippings are especially thick, a combination of these approaches may be necessary.

Sheep will graze in all fields where it is possible. A low stocking density will be used: a maximum of 6 sheep per hectare is the recommended guide for wildflower grassland management. During wetter periods, the density of livestock will be reduced to limit the amount of ground exposed through treading. Exposed ground and sward break-up can lead to the colonisation of unwanted and aggressive weed species. Stock densities should be increased if there is a rise in the amount of uneaten grass, vigorous unpalatable grasses and a reduction in low growing flora.

Treatment of existing grassland in Fields 9-12 will be different to newly created grassland in Fields 18. The different regimes are described in sections below.

On existing grassland in Fields 9-12 cutting will take place once or twice a year leaving a sward height of 150mm. Typically, the cut will be carried out in late July, however on every third year, the cut will be undertaken in August to support the late flowering plants. Cutting late in the season allows sufficient time for the seeds to mature and fall naturally, which regenerates the grassland and provides a key food source for several species of seed eating birds and mammals. Arisings will be removed, if this is possible, otherwise the cuttings will be mulched or twice-mowed. A strip cut earlier in the

season (i.e. May-June) is permitted if deemed necessary for operational reasons. Sheep grazing will continue in these fields but will only take place between September and March.

On newly created grassland in Fields 1-8 cutting will take place twice a year, leaving a sward height of 150mm. Typically, one cut will take place in March and a second in July, however on every third year, the second cut will be undertaken in August to support the late flowering plants. Arisings will be removed for hay, wherever this is possible, otherwise cuttings will be mulched or twice mown. A strip cut earlier in the season (i.e. May-June) is permitted if deemed necessary for operational reasons. Rotational grazing can take place through the year in these fields, with sheep kept in each field for no more than 6 months of the year.

Tussock grassland

The site margins (including all areas outside of the solar array, where possible) will be cut on rotation every 2-3 years in winter or spring, reducing the sward height to 150mm. Cutting should avoid periods of prolonged rain. It is recommended that a maximum of one half of tussock grassland margins be retained intact at any one time.

Arisings can be left in place throughout the margins, although mulching or removal are preferred.

Any tussock grassland within the security fence will be sheep-grazed, along with the solar array, and will form a different structure to grassland outside the security fence.

Section 2. Woody habitats - Hedgerows, scrub trees and orchard

Hedgerow management

Protective guards and stakes used on new hedgerows will be checked after the first year of growth and will be removed unless it is deemed that they are still required. Guards will be checked at least yearly and adjusted or removed as required, with a preference for removal, and will be removed after 3-5 years if still necessary after the first year. Biodegradable guards should be composted, and wooden stakes re-used or piled in suitable locations onsite, to be determined at the time.

Any planting that is diseased should be removed and dealt with appropriately.

Any large areas of dead planting should also be removed and replaced with new planting, with consideration given to planting different species if failure was due to unsuitability of the species previously planted in that location due to microclimate.

Existing and newly planted hedgerows will be allowed to grow to at least 3m and to full height wherever this is possible. They will exhibit a dense bushy structure reaching down to ground level. The main goal is to encourage the sides to thicken, and form an ‘A’ shape, considered to be the optimum shape for benefitting wildlife. To attain this state requires a cutting regime as follows:

- The tops of the existing hedgerows will be cut no lower than 3m, and if possible hedgerows will be allowed to grow to full height. Sides will be cut less intensively. Tall, wide hedgerows are generally more valuable to wildlife.
- Following a three-year cycle, cutting will take place in winter on alternate lengths of hedgerows to ensure there is a consistent supply of winter berries for birds and mammals.

- Cutting alternate sides per year can also be undertaken, ensuring one side is left uncut for fruiting in any year. A maximum of 50% of the hedgerows will be cut in any one year.
- For newly planted hedgerows, light trimming should occur in years 2-5, before the above schedule is applied.

Scrub management

The ground around newly planted whips will require weeding, or mulching using woodchips or straw, this will limit competitive vegetation; a diameter of 1m of mulch around each plant will suppress weeds and retain soil moisture. Brambles should not be removed in established areas as it provides a valuable nesting habitat and food source for several bird species.

Scrub management should be limited to removing protective guards after 1-3 years. No cutting will be necessary as scrub can thrive when left alone. An assessment may be required after the first season's growth to determine whether protective measures, such as deer fencing, will need to be implemented; excessive browsing from deer can destroy young shrubs. To limit the growth of unwanted grasses and encourage bramble growth, areas around scrub can be left uncut. Furthermore, stumps and dead trees are important for fungi and invertebrates and should be retained in woodpiles or left standing where possible.

Additional scrub will be allowed to grow in the solar farm margins next to hedgerows wherever there is a suitable space, by ceasing mowing in those areas and allowing plants to colonise naturally. Possible locations for this measure will be reviewed after the first 3 years of site operation.

Tree management

The newly planted trees will be mulched annually using woodchips or straw, with a diameter of 1-2m around each tree.

Stakes, ties and protective guards will be removed after 3-5 years or earlier if contractor checks consider this necessary. These must not be left for longer than 5 years as they will have a detrimental effect on the trees beyond this timeframe.

Section 3 - Wetland habitats: Ponds and waterways

Ponds

Ponds are relatively low maintenance. Ponds are best when sunlight can reach a portion of them and every 5 years a check will be carried out to see if this remains the case. If trees and scrub start shading large areas of the ponds, vegetation will be thinned to allow sunlight to return. Aquatic vegetation will be managed every 3-5 years as needed to ensure around 50% open water is maintained.

Scrapes

A large proportion of the scrape margins should remain open, with exposed mud to ensure wading birds can find and access food. An overgrown margin inundated with plants such as rush will result in a marked decline of wading bird presence. If possible, low level livestock grazing will be allowed to keep the margins short, though annual mowing once a year may be required during the winter months. It is important to leave a small proportion of the edges ungrazed or uncut to allow the growth of taller marginal vegetation. This will create structural diversity and habitat variety; beneficial to invertebrates and providing cover for chicks.

Section 4 - Breeding, roosting and hibernation habitats

Contractor checks of **breeding, roosting and hibernation habitats** will take place annually. Bird and bat boxes that require maintenance such as re-fixing or replacing will be dealt with accordingly. Log piles and hibernacula can be built up further over time.

Section 5 - Additional protective measures and enhancements

Signage boards

Signage boards will be checked annually and will be replaced once they become damaged, unreadable or out of date.

Survey and Monitoring

In the following section, the requirements for surveys are laid out, including those surveys required pre- and during construction, and those long-term surveys required to monitor the site through its lifetime.

Ecological monitoring in the first five years will oversee the progress of habitat establishment. Monitoring is designed to assess the progress of the site against clear targets, which if not met, will result in adaptive management actions. Intervention should be undertaken if further work is needed to remedy an issue. These issues may include failure of habitat establishment or the presence of invasive animal and plant species, such as Japanese Knotweed.

The process of establishing new habitats and the enhancement of existing habitats will take some time, and it is not possible to forecast the precise rate of change and the subsequent ecological response. For this reason, an ongoing biodiversity monitoring programme will be required; a recommended schedule is presented below (Table 4.). All biodiversity monitoring will be undertaken by qualified ecologists.

Table 4. Example schedule for annual biodiversity monitoring

Biodiversity element	Monitoring activity	Key indicators	Frequency	Time of year
Wildflower margins	Walk full length of each grassland habitat	Check for key herbs flowering, pernicious weeds in high density	Twice during first year of establishment, then annually for the first 5 years, then every 3 years.	1st year: March & June. Annually: in July (as part of botany survey)
Fields 9-12 (existing semiimproved grassland)	Identify all plant species in the main grasslands of fields 9-12, describing abundance using the DAFOR scale. Classify each field in the UKHabs classification system.	All plant species	Once annually	Main flowering period (June to August, approx.)

Bird survey	Walk-through of entire site plus point surveys in early morning	Record all birds, especially priority species	Twice annually during breeding season (March – August) for the first 5 years, then every 3 years.	March - August
Bat survey	1x Activity survey. 2 surveyors. Focus on fields 9-12 and areas of new habitat creation. 1x Static detector survey. 4 detectors for 5 nights at locations of interest – e.g., near	Check for presence of Barbastelle and horseshoe bats in particular. Check for bats using new hedgerows, trees,	First year, then every 3 years.	Activity & static surveys can be carried out together or separately. 1 survey in suitable
	substations/generators, new ponds/grassland/trees/hedgerows	ponds and grasslands. Compare activity levels with predevelopment.		weather June October
Great-crested newt survey	Either: 1x eDNA survey + egg search in May-July Or 4x visits using traditional survey methods mid-March to mid-June, at least 2 visits mid-April to midMay.	Determine presence and breeding activity in Pond 4 and the new and enhanced ponds.	Once in year 2	March to June/July
Badger survey	Examine the disused burrows for signs of activity including footprints, digging and hairs. Note any new setts/ burrows during site walkover.	Presence of badger activity.	Once in year 1	March-October
Botanical survey	20 2x2m Quadrats randomly placed across entire site	Seed mix for each new habitat type; original species list for meadow area	Once annually for the first 5 years, then every 3 years.	July
Invertebrate survey	20 100m Transects randomly placed across entire site, associated with botanical quadrats.	All butterflies and bumblebees. Note other invertebrates of interest.	Once annually for the first 5 years, then every 3 years.	July

Ecosystem services	Assess using SPIES tool	Changes in management approach	Every 5 years	Any time

Contractor Checks

Grassland habitats

The newly established grassland habitats can be checked annually by an ecologist, who will assess whether areas require supplementary seeding or green hay, and whether management requires adjustments to better encourage its establishment. The ecologist will also assess whether the cutting regime is suitable, depending on how vigorous the growth is and which species have established. The cutting regime will be adjusted as required.

It is common for unwanted annual weeds to appear in the grassland habitats during the first 2-3 years of growth; largely due to the high nutrient content in the soil left over from previous years of arable farming. To allow the nutrient content in the soil to revert to a semi-natural state, these annual weeds can be overlooked. Perennials such as creeping thistle can be treated if they become a widespread problem; however, with good grassland management these species will disappear over time.

If the grassland is grazed by livestock, the ecologist will assess whether the stock density is appropriate for the area. Stock densities should be increased if there is a rise in the amount of uneaten grass, vigorous unpalatable grasses and a reduction in low growing flora. During wetter periods, the density of livestock may require reducing, to limit the amount of ground exposed through treading. Exposed ground and sward break-up can lead to the colonisation of unwanted and aggressive weed species.

Woody habitats

Hedgerows, scrub and trees can be checked annually by a tree specialist, who will look for dead or dying specimens, signs of disease and evidence of excessive browsing by herbivores.

Dead, dying or diseased shrubs can be left standing, though may need to be removed and replaced. If shrubs are replaced, the ground must first be assessed for soil quality and drainage efficiency, as these factors may underpin why the shrubs are failing to survive. If the soil and drainage is deemed inappropriate for that species of shrub, an alternative more tolerant species may be used as a replacement.

Excessive browsing from deer can kill shrubs, particularly young whips before they are full established. If existing tree guards are deemed insufficient at protecting the young shrubs, temporary deer fencing may be required around the area in question, to allow the shrubs to fully establish and tolerate natural browsing from herbivores.

Wetland habitats

Ponds and scrapes can be checked annually by an ecologist who will assess water quality, the presence of invasive weeds, and whether the surrounding vegetation needs management.

Nitrate run off from adjacent fields can result in an accelerated growth of algae and weeds, which can swamp the water body; ultimately starving it of oxygen. In this instance, sections of pond weed may need to be removed and discarded elsewhere.

It is important to avoid excessive shading over ponds, particularly on the southern shoreline. Therefore, surrounding vegetation may need to be cut back to allow light to reach the water's surface, whilst ensuring a range of vegetation heights and a high diversity of plant species remain.

Expected Benefits to Biodiversity & Ecosystem Services

[Developer] is committed to improving the biodiversity value of its solar farms because it will help stem the decline in UK biodiversity. Improving biodiversity on site will yield a number of wider environmental benefits to society, including increased pollination, reduced erosion and improved carbon sequestration. Together, these benefits improve our resilience to climate change. Furthermore, encouraging biodiversity will improve the aesthetic value of the sites and provides opportunities for the local community to engage with the site. Finally, managing the site for biodiversity should result in reduced management intensity, and therefore reduced costs, over the life of the project.

Ecosystem services are the benefits that nature provides to people which contribute to human health, livelihoods and wellbeing. Ecosystem services are usually grouped into four categories:

- Provisioning: goods people obtain from nature such as food and shelter
- Regulating: benefits obtained from the regulation of ecosystem processes, such as flood defence and climate regulation
- Cultural: benefits such as recreation, spiritual enrichment and 'sense of place'
- Supporting: natural processes that maintain other services such as primary production and nutrient cycling.

The proposal is for a large-scale renewable energy source and the key benefit will be in regulating climate by decreasing the need for carbon-intensive energy production. Aside from this benefit, the activities planned within this BMP will further increase the land's provision of ecosystem services in the following ways:

- Rise in the abundance of crop pest predators; mainly birds but also insects.
- Improved water quality due to permanent grassland vegetation across the site, tussocky margins and removal of agricultural inputs.
- Potential for improved air quality on site due to the restoration and creation of a new hedgerows and scrub between the [name] and the solar farm, and on the northern boundary of the site, benefitting users of the public right of way as well as wildlife using the site.
- Reduced noise pollution from the busy [name] due to the creation of new scrub and hedgerows on the northern boundary.
- Increased abundance of pollinators supported by the new and improved hedgerows. Pollinators play a key role in improving crop yields for agriculture.
- Improved carbon sequestration through the restoration of grassland habitats; assisting climate regulation.
- An overall net gain in biodiversity through the restoration, creation and maintenance of habitats on site.
- A cultural benefit by increasing public access to the countryside through a new permissive footpath as well as providing education through signage boards.

On completion of the BMP activities described in the preceding sections, significant benefits to wildlife are expected to return to [name] over the life of the proposed solar farm. Overall, the calculation shows a habitat net gain of [X]% ([X] habitat units) and a hedgerow net gain of [X]% ([X] hedgerow units) was calculated using the Defra Biodiversity Metric 3.0.

Grassland habitats

Wildflower grassland

Once established, the new areas of wildflower grassland have the capacity to support a diverse range of plants, with the potential to hold up to 45 species per square metre. As observed on existing solar farms, an increase in botanical diversity typically leads to a significant rise in invertebrate abundance, thus providing an excellent foraging resource for birds nesting in the hedgerows. Invertebrates are an important food source for insectivorous birds and fledglings during the breeding season.

Tussocky margins

The tussocky wildflower margins on either side of the hedgerows will enhance the value of the hedgerow as wildlife habitat and as a connective corridor for movement across the site. Further, such wildflower margins will provide a nectar source for a large variety of invertebrates including bumblebees and butterflies. The margins will remain uncut through the summer, providing suitable habitat for the species of moths and butterflies whose larvae feed on common grasses. As the wildflower areas develop, there should be an increase in butterfly diversity, with common blue, brown argus and the migratory clouded yellow being potential visitors, among other common species. Margins composed of tall herbs and grass provide shelter for mammals, nest sites for birds and hunting areas for barn owls and kestrels.

On a larger scale, these new areas of grassland will improve links between existing areas of ecological importance in the wider area, prevent soil erosion and retain water; thus, strengthening the landscape as a whole.

Woody habitats

Hedgerows

The new and restored hedgerows will serve as ecological highways, interlinking the scrub, woodland edge and grassland; providing commuting and foraging routes for bats, and allowing plants to colonise new areas efficiently. With at least 30 British bird species that nest in hedgerows, the new enhancements may encourage currently un-recorded species to breed in the application area such as tree sparrows, and increase the abundance of greater whitethroats, lesser whitethroats and linnets already documented on site. In autumn and winter, migratory redwing and fieldfare flocks may feed on the fruit crop and roost in the hedges, and this increased prey abundance could attract transient birds of prey such as merlin and short-eared owl.

Scrub

Well-managed scrub, varied in age, species and structure can support a range of breeding bird species. Young, scattered scrub is used by buntings, linnets and whitethroats; low growing, closed canopy scrub by dunnock and willow warbler; mature stands of scrub are used by turtle doves and thrushes; and

dense stands of blackthorn and brambles provides an optimal habitat for nightingales. Scrub also provides a valuable food source for wintering bird species that feed on the seeds and fruit.

The margins around scrub are also important habitats; rich in flowering plants providing nectar for insects and seeds that birds will feed on.

Wetland habitats

Ponds

The excavation of a pond will improve overall biodiversity on site and help form a network with other ponds in the locality. Water bodies are an essential breeding habitat for all our native amphibians, and many other species will be attracted by the food provided, such as grass snakes and wetland birds. The shallow water and marginal sections can support a diversity of semi aquatic plants, such as marsh marigold and water crowfoot. Other wetland plants likely to feature are angelica, water-mint and purple loosestrife which are valuable pollinators and will further boost the insect abundance and diversity on site.

Scrapes

The creation of a scrape on the application area will open up the opportunity for wading birds to utilise the land; attracted by the aquatic and terrestrial insects to feed on, and the open vantage areas for security when breeding.

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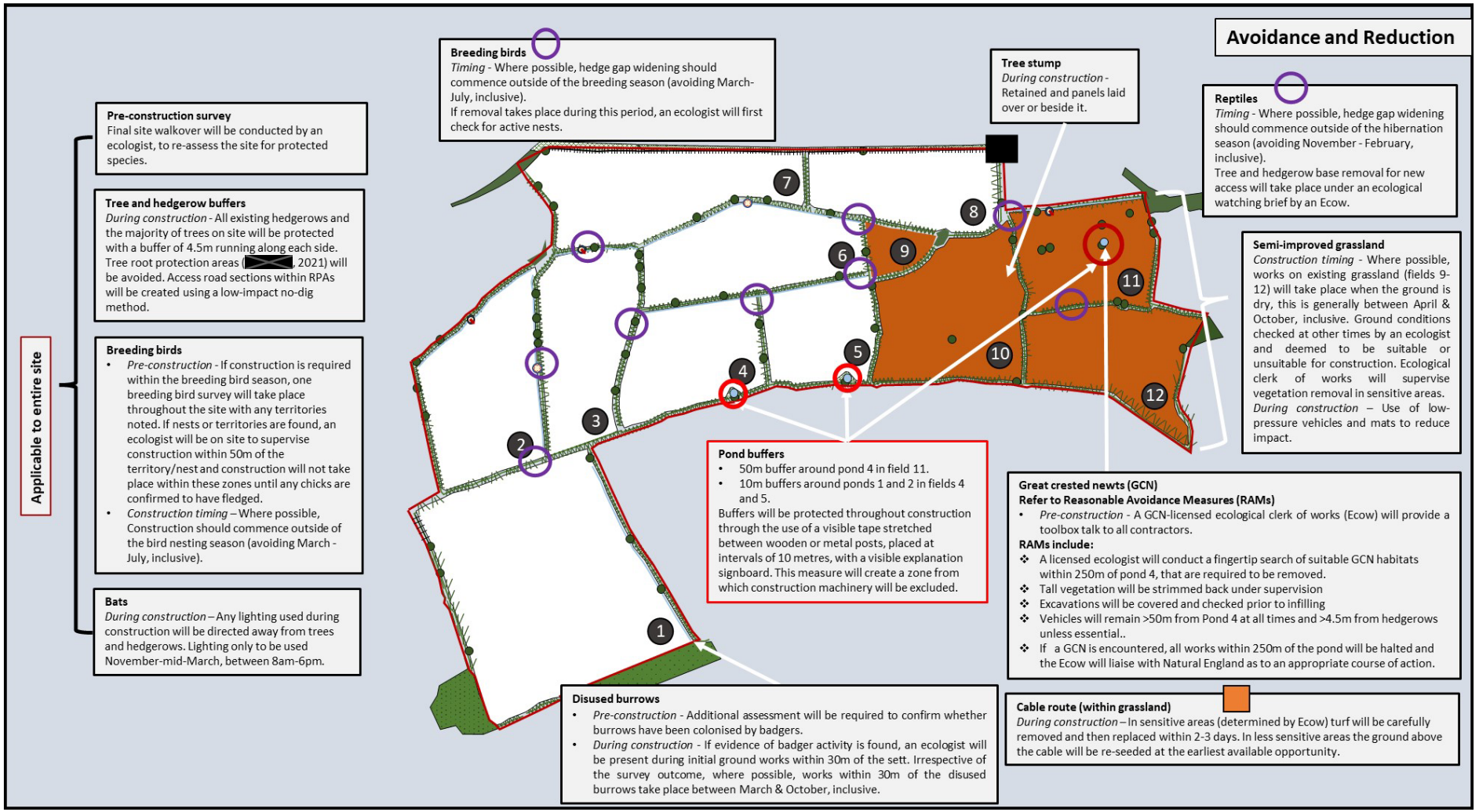
[name], [year]b. Phase 2: Badger, Bat and Great Crested Newt surveys, [name] Solar Farm. [name], [date].

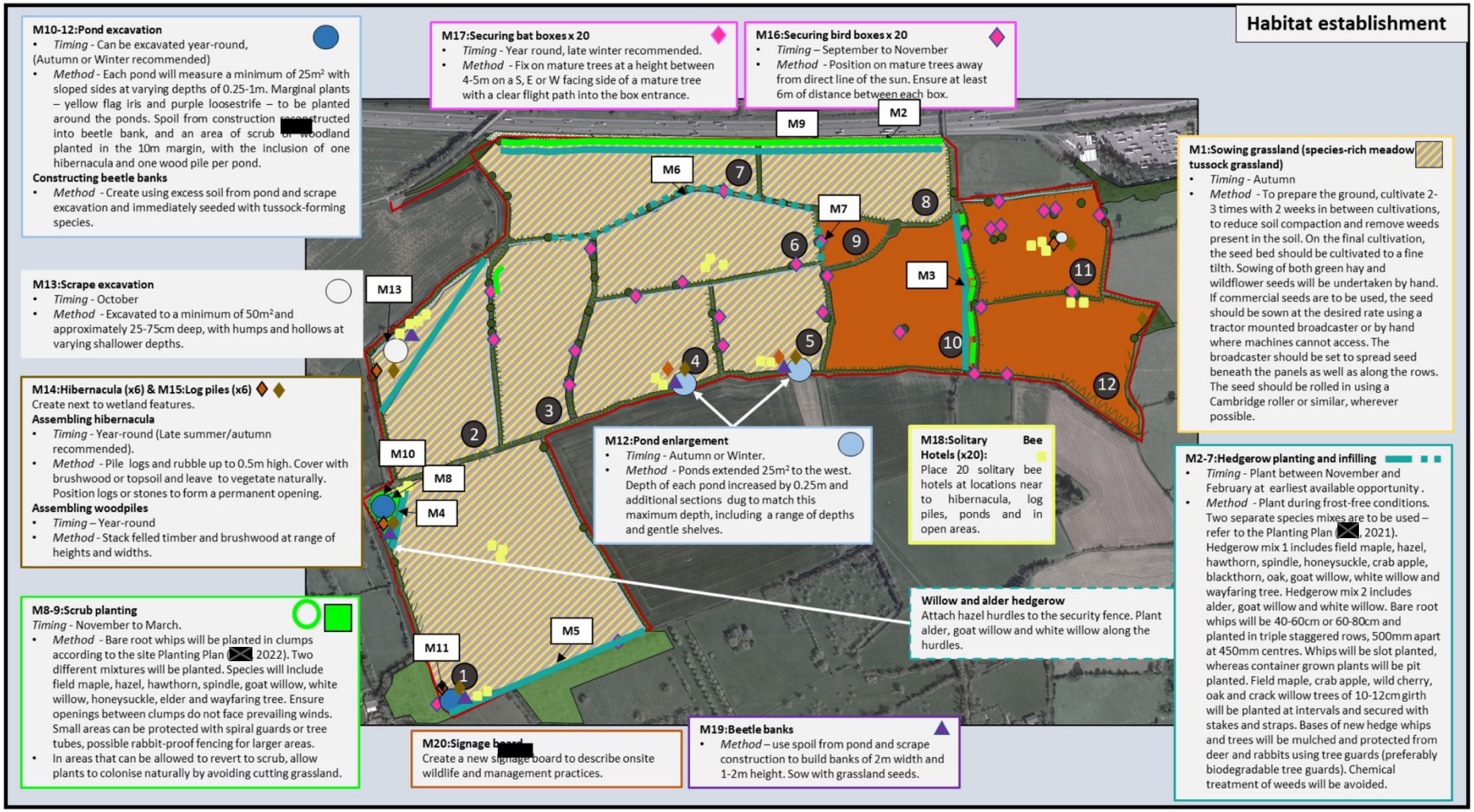
Appendices

Appendix A. Phase 1 Habitats Map of [Name]

Appendix B. Map of avoidance and reduction measures

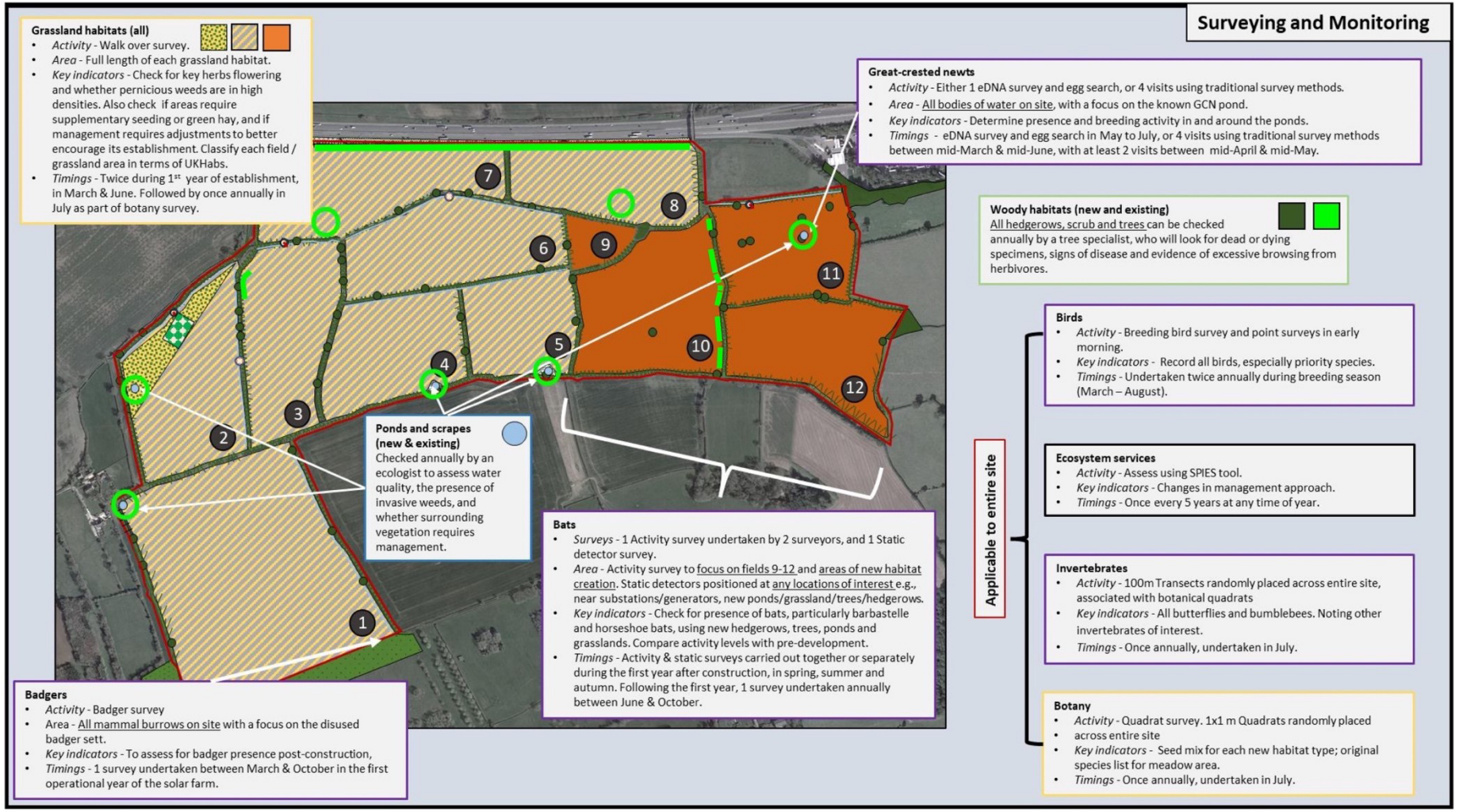


Appendix C. Map of habitat establishment

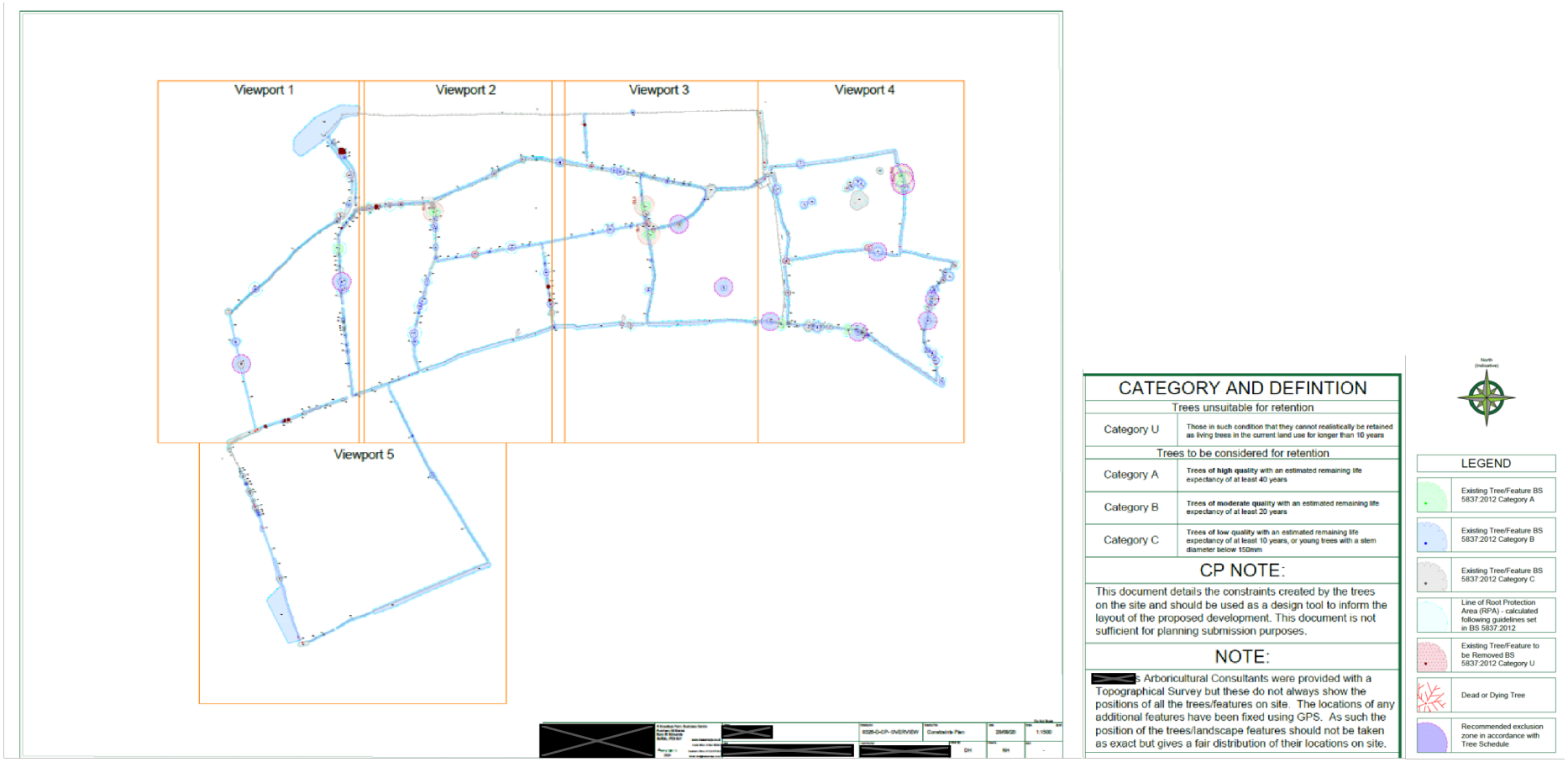


Appendix D. Map of habitat management

Appendix E. Map of surveying and monitoring requirements

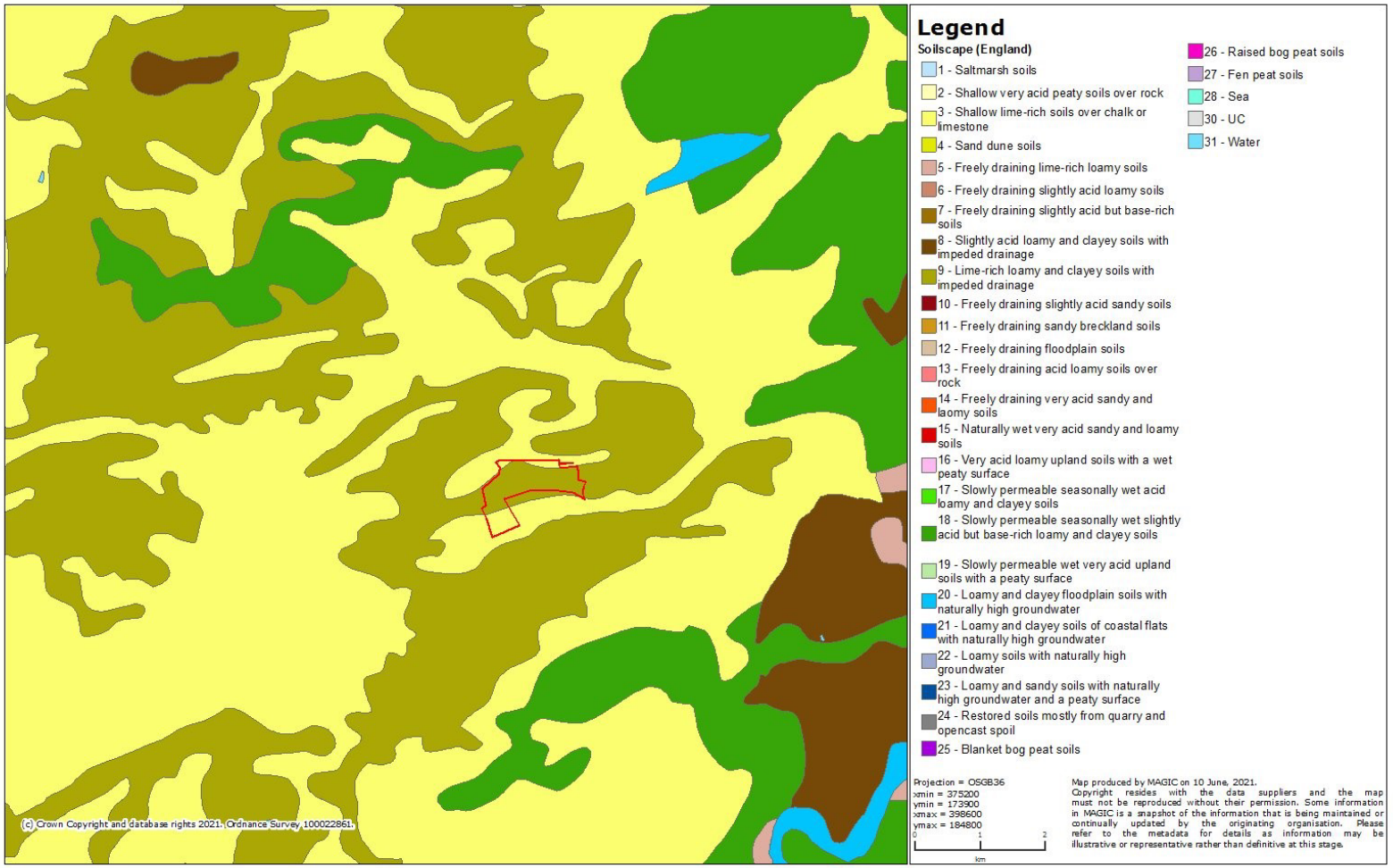


Appendix F. Map of trees on site (from arboriculture report ([citation]))



Appendix G. Soil types

MAGIC



Appendix H. Legislative Framework

This report has been developed in alignment with planning guidance and with special consideration for legally protected species and habitats.

A number of plants and animals receive legal protection under the Wildlife and Countryside Act 1981 (as amended). For these species with legal protection, any type of development that would injure, kill, ill-treat, intentionally damage or destroy any protected species or place of shelter would be considered a criminal act. The Act was further strengthened in 2000 by the introduction of the Countryside and Rights of Way (CRoW) Act 2000.

Species of European Importance receive additional protection under the Conservation of Habitats and Species Regulations 2010 (The 'Habitats Regulations') as amended by the Conservation of Habitats and Species (amendment) Regulations 2012. Other species receive protection through species-specific legislation (e.g., the Protection of Badgers Act, 1992).

Any development which may have an impact upon the integrity of a statutory designated site for nature conservation purposes is also subject to the provisions of the Wildlife and Countryside Act 1981 (as amended) and the Habitats and Species Regulations 2010 (as amended). Under the latter, an Appropriate Assessment may be required in order for a Competent Authority to determine the significance of this impact, both from the proposed scheme and in combination with any other schemes.

Councils also have a statutory obligation under the Natural Environment and Rural Communities (NERC) Act 2006 to take into account biodiversity conservation as a material consideration in the determination of all types of planning applications. Local planning authorities therefore require relevant information from wildlife surveys in order to assess the effects on biodiversity of a proposed development.

In 2007, the UK list of conservation priority species and habitats was fully revised taking into account emerging priorities, conservation successes, and information gathered in the past decade. The list now contains 1150 species and 65 habitats that have been listed as priorities for conservation action under the UK Biodiversity Action Plan (UKBAP). The framework for conserving biodiversity is currently laid out in 'Biodiversity 2020: A Strategy for England's Wildlife and Ecosystem Services'[i].

Local Biodiversity Action Plans (LBAPs) have been produced for every county in the UK. These LBAPs highlight local biodiversity issues, with specific action plans being implemented for priority habitats and species where they occur.

It is essential that any ecological assessment of a proposed development site addresses the possibility of protected species being present within or around the site, along with any potential impacts of the proposed scheme on statutory designated sites. Such an assessment would enable a developer to demonstrate due diligence in its responsibilities to protect legally protected species and habitats.

It would, however, be unreasonable for an ecological assessment to survey for every protected species. Any such assessment should therefore be based upon the results of a habitat survey and the associated possibility or likelihood of protected species being present.

Legal implications for species considered pertinent to the proposed development are discussed below.

Amphibians and Reptiles

All native amphibian and reptile species within the UK receive some legal protection through the Wildlife and Countryside Act 1981 (as amended). Certain species are also protected under the Habitats Regulations; these species are often referred to as European Protected Species (EPS) and receive further stringent protection. There are effectively three levels of protection for native amphibians and reptiles in the UK:

Full Protection – The great crested newt *Triturus cristatus,* natterjack toad *Epidalea calamita,* sand lizard *Lacerta agilis* and smooth snake *Coronella austriaca* are 'fully protected', all elements of Section 9 of the Wildlife and Countryside Act apply, as does Regulation 39 of the Habitats Regulations 2010. The Act and Regulations include provisions making it an offence to:

- Deliberately or intentionally kill, injure or take;
- Intentionally or recklessly damage or destroy and breeding site or place used for shelter or protection;
- Intentionally or recklessly obstruct access to a place used for shelter or protection;
- Deliberately or recklessly disturb an animal while occupying a structure or place which it uses for that purpose;
- Deliberately take or destroy eggs; and
- Keep, transport, sell or exchange. It is an offence to possess or control any live or dead specimen or anything derived from such an animal.

Protection against killing, injuring and sale – This applies to common lizard *Zootoca vivipara,* slow worm *Anguis fragilis,* grass snake *Natrix natrix* and adder *Viper berus.* These species are afforded protection under the Wildlife and Countryside Act 1981 (as amended). Part of sub-section 9(1) and all of sub-section 9(5) apply; these prohibit the intentional killing and injuring as well as trade. There is no protection afforded to the resting places of these species.

Protection against sale only – This applies to smooth newt *Lissotriton vulgaris,* palmate newt *Lissotriton helveticus,* common frog *Rana temporaria* and common toad *Bufo bufo.* These species are only afforded protection under Section 9(5) of the Wildlife and Countryside Act 1981 (as amended), prohibiting the sale, barter, exchange, transporting for sale or advertising to sell or buy.

The provisions of both the Wildlife and Countryside Act 1981 and the Habitat Regulations apply to all life stages of the protected species; eggs, juveniles and adults.

Bats

2.3.13 All species of British bat are listed under Schedule 5 of the Wildlife and Countryside Act 1981 (as amended), and are therefore afforded special protection. It is an offence to:

- Intentionally kill, injure or take any wild bat;
- Intentionally damage, destroy or obstruct access to any place that a wild bat uses for shelter or protection; and
- Intentionally or recklessly disturb any wild bat while it is occupying a structure or place that it uses for shelter or protection.

Bats are further protected under the Habitats Regulations which make it an offence to:

- Capture or kill a bat;
- Significantly disturb a bat (in any location); and

- Damage or destroy a breeding site or resting place of any bat.

Badger

The badger *Meles meles* is widespread and common in many parts of the UK and as such is not considered a conservation priority in the UK, but animals are fully protected under animal cruelty legislation (the Protection of Badgers Act 1992), under which it is illegal to wilfully kill, injure or take a badger. Their setts are also protected against obstruction, destruction or damage and the animals inside cannot be disturbed without a licence from Natural England.

Birds

All wild birds, their nests and eggs are, with few exceptions, protected under the Wildlife and Countryside Act 1981 (as amended). Over eighty species or groups of species are listed under Schedule 1 of the Act, which confers special protection with increased penalties for offences committed. Additional protection is provided to species listed under Directive 2009/147/EC on the conservation of wild bird (the 'Birds Directive') codified version. Following recent revisions, fifty-nine species are now listed on the UKBAP.