

Landscape and Ecology Management Plan

Land to the east of the A48 and Land to the south west of Tycroes

April 2020

A report by

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Report details

Site name: Land to the east of the A48 and Land to the south west of Tycroes
Grid reference: Site 1: SN 599 095
Site 2: SN 592 095
Site 3: SN 574 093
Report date: 29th April 2020
Report author: Colin Hicks BSc (Hons) MCIEEM
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Declaration of compliance

BS 42020:2013

This study has been undertaken in accordance with British Standard 42020:2013 Biodiversity, Code of practice for planning and development.

Code of Professional Conduct

The information which we have prepared is true, and has been prepared and provided in accordance with the Chartered Institute of Ecology and Environmental Management's Code of Professional Conduct. We confirm that the opinions expressed are our true and professional bona fide opinions.

Validity of survey data and report

The findings of this report are valid for 24 months from the date of the surveys that inform it. If work has not commenced within this period, updated surveys by a suitably qualified ecologist may be required.

Revisions

Date	Report no:	Approved by:	Comment
08/01/2020	WOR-1201.1	CDH	Original report
30/03/2020	WOR-1201.2	CDH	Updated report following discussions with Carmarthenshire County Council
29/04/2020	WOR-1201.3	CDH	Final report with new site numbering

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1. Introduction

1.1. Background

This Landscape and Ecology Management Plan (LEMP) has been produced to accompany a planning application for a proposed solar farm near Tycroes, Carmarthenshire in Wales hereafter referred to as the 'Site'.

The LEMP provides details of mitigation and enhancement requirements during the construction and operational phases and a management framework during the operational phase.

It covers the period of the lifetime of the project, although this would be reviewed every five years, after which management would be reviewed against the current site conditions.

1.2. Proposed development

Solar farm

- 1.2.1. The proposed development is a ground mounted Photo Voltaic (PV) solar farm development and includes the proposed cable route (Map 1).
- 1.2.2. Permission would be required for 40 years and the installation would have the design capacity for between 36-40MW of electricity generation.
- 1.2.3. Together with associated infrastructure and housings, the development is comprised of the following main elements:
 - PV panels mounted on fixed metal frames with support posts driven into the ground to a depth of approximately 1.5m, avoiding the use of concrete foundations. The panels are laid out in east-west orientated rows in order to optimise solar gain. The lowest edge of the panels would be approximately 0.8m above ground level with the highest edge being approximately 3.5 m above ground. The rows are spaced approximately 4-5m apart to avoid one row of panels shading the next. The panels are non-reflective (i.e., to prevent glint or glare) and angled at approximately 20- 25° to horizontal. Inverter technology, which converts direct current (DC) into alternating current (AC). These are likely to be string inverter (80 cm by 1m) affixed beneath the PV panels to the PV mounting system.
 - There will be approx. 24 cabinets containing electrical equipment such as switchgear and transformers housed within flat roofed pre-fabricated units no higher than 3m and with a footprint of approximately 5m x 2.5m.
 - An on-site sub-station.
 - Security fencing (most likely deer fencing) to a height of 2.4m along with infra-red security cameras which will feature around the perimeter of the development; directed inward only.
 - There will be no external lighting.
 - Each of the three parcels of land benefits from an established vehicular access directly from both the A48 and the A483 suitable for the delivery vehicles required to deliver the equipment proposed to be installed at the site. Existing gateways and tracks will be used to access the site itself, the surfaces of which would be improved by way of providing additional gravel.

- A buried electrical cable is proposed connecting areas of the proposed solar farm to an electrical substation. It will be laid within a trench approximately 600mm wide before the trench is backfilled.
- Woodland, a river crossing and an area of marshy grassland in the west of the site will be traversed by sub-soil horizontal directional drilling (HDD).

2. Existing features of ecological value

2.1. Habitats

Solar farm

- 2.1.1. Site 1 comprises improved grassland (22.0ha) managed for its agricultural value enclosed by species rich hedgerows (3.65km). Site 2 comprises improved grassland (2.1ha) managed for its agricultural value enclosed by species rich hedgerows (0.41km) and a fence. Site 3 comprises improved grassland (21.8ha) managed for its agricultural value, enclosed by semi-natural broadleaved woodland with internal species rich hedgerow boundaries (2.8km).
- 2.1.2. Both internal and external hedgerows at all three sites would qualify as a Local Biodiversity Action Plan Priority Habitat and a Habitat of Principal Importance, as would Woodland enclosing Site 3.

Cable route

- 2.1.3. The cable route traverses areas of improved grassland, marshy grassland, roadside grassy verges, semi-natural broadleaved woodland, hardstanding, species rich hedgerows and a river.
- 2.1.4. Intact hedge, species rich, Semi-natural broadleaved woodland, Running water and Marshy grassland would qualify as a Local Biodiversity Action Plan Priority Habitat and a Habitat of Principal Importance.

2.2. Species

Species listed here are those that are judged likely to be present within the proposed development and its boundaries.

Badger

- 2.2.1. Evidence of Badgers foraging is present in the north of Site 3, whilst an active sett entrance and well-worn Badger pathways are present in Site 1.
- 2.2.2. Three occasional use entrances are present in a hedgebank between Field F2 and F3 close to the cable route.

Bats

- 2.2.3. Hedgerows and enclosing woodland are likely to provide good foraging habitat for a range of local bats.

Birds

- 2.2.4. Boundary habitats associated with the solar farm will support widespread and common nesting bird species.
- 2.2.5. Woodland, hedgerows and marshy grassland associated with the cable route may support occasional nesting birds.

Common Dormouse

- 2.2.6. External boundaries at Site 3 are likely to support Dormice, and there is low potential for them to be present in the external boundaries of Site 1.
- 2.2.7. The majority of hedgerows and woodland along the cable route have potential to support Common Dormice.

Otter

2.2.8. It is likely that Otter are feeding along the River Gwili although no holts were found.

Reptiles

2.2.9. Marshy grassland associated with the cable route and boundary habitats have some potential for Grass Snake, Slow Worm and Common Lizard.

Invertebrates

2.2.10. There is potential for marsh fritillary to be present in marshy grassland associated with Field F8 and F13 along the proposed cable route.

2.3. Statutory Nature Conservation Sites

2.3.1. There are 10 Sites of Species Scientific Interest (SSSI) within 4km of this Site (Table 1).

Table 1. SSSIs within 4km

SSSI name	Summary of interest features	Distance
Broad Oak and Thornhill Meadows	Unimproved grasslands containing an abundance of the umbelliferous plants	1.9km to north east of Site 3
Cae Gwynfryn	Unimproved grasslands	1.3km to north east of Site 3
Caeau Afon Gwili	Grassland with colony of Marsh Fritillary	Multiple units, nearest of which is 30m to south east of Site 3
Caeau Blaenau-Mawr	Unimproved species-rich damp grassland. Marsh fritillary and marbled white butterflies have been recorded at the site	2.3km to north of Site 1
Caeau Capel Hendre	Unimproved grassland. The site supports a colony of the marbled white butterfly	1.9km to north of Site 1
Caeau Ffos Fach	Unimproved species-rich grassland with large colony of Marsh Fritillary	2.1km to north of Site 3
Caeau Lotwen	Unimproved grasslands	1.3km to north of Site 3
Felin Fach Meadows, Cwmgwili	Unimproved grasslands with marbled white butterflies	Multiple units, nearest of which is 130m to south east of Site 3
Graig Fawr, Pontardulais	Dry acidic grassland of upland areas	2.1km to south east of Site 1
Gweunydd Glan-Y-Glasnant	Unimproved grasslands	2.5km to north west of Site 3

2.3.2. Broad Oak and Thornhill Meadows SSSI, Caeau Ffos Fach SSSI and Caeau Lotwen SSSI are component sites of Caeau Mynydd Mawr Special Area of Conservation (SAC). This site has been selected for:

Annex II species that are a primary reason for selection of this site:

Marsh fritillaries *Euphydryas aurinia* occur over a wide area of traditionally-managed purple moor-grass *Molinia caerulea* pastures in south-east Carmarthenshire. The extent of suitable habitat, contained within more than 30 enclosures at Caeau Mynydd Mawr, suggests that this is one of the largest metapopulations in Wales.

Annex I habitats present as a qualifying feature, but not a primary reason for selection of this site:

Molinia meadows on calcareous, peaty or clayey-silt-laden soils
(Molinion caeruleae)

2.3.3. This site is of International importance.

Legend

- Site 1, 2 and 3
- Cable route



Title: Map 1. Location of Site 1, Site 2 and Site 3, and cable route

Project: Land to the east of the A48 and Land to the south west of Tvcroes

Checked by: CDH Version: 02
Date: 29/04/2020

3. Ecological mitigation strategy

3.1. Introduction

- 3.1.1. This LEMP should be read in conjunction with the preliminary ecological appraisals of the solar farm (report no: WOR 775.1, May 2019) and the cable route (report no: WOR 1184.2, November 2019).
- 3.1.2. The strategy within this report will focus on existing features of nature conservation value within the site making recommendations on how the value of these features could be retained/protected during the proposed development, and then makes comments on recommendations on overall site enhancement for wildlife and long-term management during the operational phase. Recommendations are made to minimise biodiversity loss during decommissioning.
- 3.1.3. Where there is potential that the proposed development will have a significant¹ effect on a valued ecological feature of nature conservation interest, recommendations for mitigation are made based on the mitigation hierarchy detailed in Paragraph: 018 Reference ID: 8-018-20140306 of National Planning Practice Guidance;
- Avoidance –significant harm to wildlife species and habitats should be avoided through design.
 - Mitigation – where significant harm cannot be wholly or partially avoided, it should be minimised by design, or by the use of effective mitigation measures that can be secured by, for example, conditions or planning obligations.
 - Compensation – where, despite whatever mitigation would be effective, there would still be significant residual harm, as a last resort, this should be properly compensated for by measures to provide for an equivalent value of biodiversity.
- 3.1.4. To align with local and national planning policy, this report will provide detail of the net gain illustrated through Defra Biodiversity Metric 2.0.

¹ For the purposes of this report, a practical approach has been taken to define the term 'significant'. If an effect is sufficiently important to be given weight in the planning process or to warrant the imposition of a planning condition, it is likely to be 'significant' in the context of the level under consideration (BSI, 2013).

3.2. Construction phase

3.2.1. Table 2 identifies mitigation measures to adopted prior to the start of works and will be detailed in the Construction Environmental Management Plan for the development (CEMP).

Table 2. Mitigation measures prior to the construction phase

Item ID	Feature of nature conservation value	Avoidance/mitigation	Comments
	Habitats		
T2.1	Site 3 - Semi-natural broadleaved woodland and Intact hedge, native species rich	Species rich hedgerows and woodland at the solar farm boundary will be protected by a 10 metre buffer from all construction activities, whilst internal boundaries will be protected by a 7 metre buffer. These buffers will be delineated by a suitable fence.	There will be no access, storage of materials, ground disturbance, burning or contamination within the fenced areas
T2.2	Site 1 and Site 2 - Intact hedge, native species rich	Species rich hedgerows at the solar farm boundary will be protected by a 7 metre buffer from all construction activities, whilst internal boundaries will be protected by a 5 metre buffer. These buffers will be delineated by a suitable fence.	There will be no access, storage of materials, ground disturbance, burning or contamination within the fenced areas
T2.3	Cable route – marshy grassland in F8	The cable route will cross the eastern edge of this field to minimise impact from plant movements.	This will minimise any impact from trenching operations.
	Species		
T2.4	Badgers	A further Badger survey will be completed as near as practicable to the start of site development. This will be completed by a suitably qualified ecologist and identify all active sett entrances, foraging evidence, latrines and well-worn Badger pathways associated with the development. Hedgerow protection and site security fencing along the boundaries will leave an appropriate gap between the fence and hedgebank/hedgerow.	This will ensure the assessment and resultant mitigation to be adopted during construction will be based on the most recent distribution of sett entrances likely to be affected.
T2.5	Cable route – breeding birds	Prior to the start of works within field F8, this habitat will be thoroughly inspected by a suitably qualified person prior to disturbance. If nesting birds are found, all activities likely to damage the immediate area (within 5 metres) will be delayed until chicks have fledged. The 5 metre buffer will be delineated with a suitable temporary fence.	Marshy grassland in Field F8 will be subject to trenching in the bird nesting season to minimise impacts associated with damp ground.
T2.6	Cable route - reptiles	Areas within Field F8 likely to be affected by construction activities will be de-vegetated prior to any site activities under the supervision of a suitably qualified ecologist. Grassland to be removed will initially be strimmed to a height of no more than 20cm, having first used an ecologist to walk and beat the habitat. This will encourage reptiles to disperse naturally into the neighbouring uncut vegetation to the sides. After at least 24hrs a second cut will be made as close to ground/bank level as possible. This de-vegetation cannot proceed until nesting bird checks have been completed.	This will ensure that Grass Snake, if present in Field F8, are displaced from the construction site onto adjacent intact.

T2.7	Cable route – marsh fritillary	Prior to the start of work, the work area will be searched by a suitably qualified ecologist for the presence on the marsh fritillary food plant, Devil's-bit Scabious <i>Succisa pratensis</i> . If this plant is present, micro-siting will avoid larger aggregations.	If works is completed in late summer, the search will also include marsh fritillary larval webs and any required micro-siting will take these into account.
	Statutory nature conservation sites		
T2.8	Cable route - Caeau Mynydd Mawr SAC	Please refer to items T2.3 and T2.7	

3.2.2. Table 3 identifies mitigation measures to adopted during works and will be detailed in the Construction Environmental Management Plan for the development (CEMP).

Table 3. Mitigation measures during the construction phase

Item ID	Feature of nature conservation value	Avoidance/mitigation	Comments
	Habitats		
T3.1	Site 3 - Semi-natural broadleaved woodland and Intact hedge, native species rich	Buffers detailed in T2.1 will be retained during the construction period.	There will be no access, storage of materials, ground disturbance, burning or contamination within the fenced areas
T3.2	Site 1 and Site 2 - Intact hedge, native species rich	Buffers detailed in Table 2.2 will be retained during the construction period.	There will be no access, storage of materials, ground disturbance, burning or contamination within the fenced areas
T3.3.	Site 2 hedgerow at access	Nesting bird checks will be completed before removal of the short section of hedgerow for access into Site 2.	
T3.4	Cable route – Semi-natural broadleaved woodland	Woodland will be traversed by Horizontal Direct Drilling (HDD).	
T3.5	Cable route - Running water	The River Gwili will be traversed by Horizontal Direct Drilling (HDD).	
T3.6	Cable route - Intact hedge, native species rich	The cable trench will be dug under hedgerows and supporting hedgebanks.	This will require hand-digging to avoid the roots of large shrubs and trees.

		<p>A 'Broken Trench' hand-dug technique will be used that combines hand dug trench sections with trenchless techniques if excavation is unavoidable. Excavation will be limited to where there is clear access around and below the hedgebanks. Excavation by machine will be used up to the edge of a 2 metre protection zone of the hedges, beyond which the trench will be excavated by hand with precautions taken as follows:</p> <ul style="list-style-type: none"> • The objective is to minimize the disruption as much as possible. Hand digging within the identified protection zones will be undertaken with great care, requiring closer supervision than normal operations. After careful removal of any hard surface material, digging will proceed with hand tools. Under hedgerows, small holes will be tunnelled through for the cable ducts. • Throughout the excavation works great care will be taken to protect the stability of soil under hedgerow. • The cable ducts will be placed at the bottom the trench, away from the roots. • These works will not be carried out without first consulting the onsite ecologist/arboriculturist. • The depth at which the cable will be laid will be between 1000-1500mm, taking into consideration the depth of the lower roots and situate the cable below the all of the hedge root system. • Once the cable has been placed, the backfill into the excavation will be conducted by hand and will use the excavated soil. This will not be compacted but lightly "tamped" and usually left slightly proud of the surrounding surface to allow natural settlement. Other materials will not be incorporated into the backfill. 	
T3.7	Cable route – marshy grassland in F8	<p>The trench will be created using a tracked 5 tonne mini digger.</p> <p>To ensure a habitat suitable for marsh fritillary one of two options will be adopted. If the existing turf supports sufficient Devil's-bit Scabious, turf along the cable route in F8 will be removed using a suitable commercial turf-cutter with as deep a cut as practicable. This may require cutting of the sward prior to removal. Turf will be stored for as short a period as practicable.</p> <p>If the existing turf lacks Devil's-bit Scabious, it will be excavated without turving and Devil's-bit Scabious plugs will be plated at a later date (see T4.3).</p> <p>Topsoil and subsoil will not be mixed and will be returned in sequence, with turf laid back on top if necessary. Works will be limited to the cable route and the footprint of the mini digger. The cable</p>	This will minimise any impact from trenching operations.

		<p>drum will be held on cable drum jack at the mouth of trench in the field to the north or south of F8, and manually pulled into the trench.</p> <p>The trench will be 1.2m deep and 800mm wide and works would take approximately 2-3 days.</p>	
T3.8	Cable route – marshy grassland in F13	F13 will be traversed by Horizontal Direct Drilling (HDD).	
	Species		
T3.9	Badgers	Any deep trenches left open at night (>1m deep) will have some means of escape for Badgers, such as the placement of a scaffolding board at one end.	
T3.10	Bats	If lighting is required during the construction phase, this will be directed into the site and not onto enclosing hedgerows and woodland.	
T3.11	Site 1 and Site 3 – Dormice and nesting birds	Woodland and hedgerow protection buffers will ensure habitats likely to support Dormice and nesting birds are not adversely impacted during the construction phase	
T3.12	Cable route – Dormice and nesting birds	The cable route will be dug under hedgerows and supporting hedgebanks (see T3.5). An area of scrub in the east of the site has potential for Dormice. This will be traversed by Horizontal Directional Drilling (HDD)	This may require hand-digging to avoid the roots of large shrubs and trees.
T3.13	Cable route - Otter	<p>The following will be adopted during HDD under the River Gwili:</p> <ul style="list-style-type: none"> • Daytime working hours will be adopted for any construction works, to commence no sooner than one hour after sunrise and finish no later than one hour before dusk. • At night, a quiet dark corridor will be retained along the watercourse and its bankside vegetation; • Construction materials will be stored well away from the watercourse in way that prevents otters gaining access or using them to rest in (<i>e.g. pipe ends will be capped or covered</i>); • Any trenches that are left open overnight will have planks of wood placed at regular intervals to allow otters a way out; and • All tools, food, litter and construction materials and packaging that may constitute a hazard to otters will be removed daily from the site. 	
	Statutory nature conservation sites		
T3.14	Cable route - Caeau Mynydd Mawr SAC	Please refer to items T3.7 and T3.8	

3.3. Operational phase

3.3.1. Table 4. Details mitigation measures to be adopted during the operational phase.

Table 4. Mitigation measures during the operational phase

Item ID	Feature of nature conservation value	Avoidance/mitigation	Comments
Habitats			
T4.1	Site 3 - Semi-natural broadleaved woodland and Intact hedge, native species rich	Buffers detailed in T2.1 will be retained during the operational phase, although the security fence will cross this buffer at right angles in the north of this site.	
T4.2	Site 1 and Site 2 - Intact hedge, native species rich	Buffers detailed in T2.2 will be retained during the operational phase.	
T4.3	Cable route – marshy grassland in F8	After a settling period of at least 12 months, 200 Devil's-bit Scabious plugs will be planted into the cable route within Field F8.	
T4.4	Site 2 hedgerow at access	On completion of construction, the section of hedgerow removed to provide access into Site 2 will be replanted	
Species			
T4.5	Badgers	<p>Site security fences present during the operational phase will have a suitable gate to allow Badgers to exit the Site should they gain entry. These will align with existing Badger pathways with their locations determined through the preconstruction Badger survey (see T2.4). Indicative locations are shown on Map 2 based on known survey data.</p> <div data-bbox="1167 943 1384 1321" data-label="Image"> </div> <p>Badger gate. Removal of the metal plate will allow the gate to open both ways.</p>	

	Site 1 and Site 3 – Dormice and nesting birds	Buffers detailed in Table 2 will be retained during the operational phase.	
	Statutory nature conservation sites		
T4.6	Cable route - Caeau Mynydd Mawr SAC	Please refer to item T4.3	

4. Management plan

4.1. Aim and objective

4.1.1. The aim of the Management Plan is to ensure the long-term management and maintenance of ecological features during the operational phase of the solar farm. The overarching objectives are:

- To promote wildlife value and species diversity whilst maintaining the existing local landscape character;
- To enhance the Site for marsh fritillary;
- To ensure that other existing ecological features are retained, connected and sensitively managed to maximise their ecological value in the long-term;
- Provide opportunities for a range of faunal species;
- To apply good horticultural and ecological practice to all operations; and, To monitor the Site and adjust management prescriptions as necessary.

The key management features for the purpose of this report are:

1. Hedgerows
2. Buffers between the security fence and hedgerows
3. Grassland beneath solar panels
4. Bat and breeding bird boxes

4.1.2. Indicative timings are given in Table 6.

4.2. Hedgerows

4.2.1. A small section (approximately 3 metres) of hedgerow will be removed to allow access into Site 2. This will be replanted once development is complete. Other than this, there will be no reduction in hedgerow area across the Site. The aim of management is to ensure retained hedgerows are maintained with a good structure to provide connectivity for faunal species and support a diverse flora. The main principles of hedgerow management are:

- Manage hedgerows and associated features (ditches) on a regular, rotational basis to promote structural and botanical diversity;
- Improve the connectivity of the Site to facilitate the movement of wildlife through and across the Site through thickening of hedgerows and creating a range of hedgerow heights;
- Provide visual screening where required and deliver good integration of the development into the landscape;
- Enhance gappy hedgerows to increase biodiversity, connectivity and strengthen local landscape character; and,
- Allow and encourage a diverse ground flora to develop along hedgerow bases.

Hedgerow buffer

4.2.2. An undeveloped buffer will be created adjacent to hedgerows to:

- Protect the hedgerows during the construction phase from accidental damage;

- Ensure Dormice, if present, can continue to use hedgerows during the construction and operational phases;
- Provide a boundary buffer managed to create a biodiverse grassland, creating a network of wildlife corridors across the site and linking into the wider landscape.

Additional plantings

4.2.3. Any gaps in hedgerows will be in-filled with native hedgerow species. This will include the short section of hedgerow removed to allow access into Site which will be replanted once development is complete. Plantings will comprise:

- Shrubs and trees of local provenance and the species mix will be Hazel (40%), Hawthorn (30%), Blackthorn (20%) and native Oak (10%).
- Hedging will be planted in two staggered rows at a density of not less than 5 per metre, with approximately 450mm between plants in the same row, and 300-400mm between rows.
- Hedgerows are best planted between November and March, avoiding periods of heavy frost.
- When planting it is important to avoid windy conditions as these can rapidly dry out bare-rooted plants and kill them. Where this is not possible ensure that the roots of the young trees are not exposed to the wind or sun so that they remain moist.
- Watering: Immediately after planting, thoroughly and without damaging or displacing plants or soil.
- Firming: Lightly firm soil around plants and fork and/or rake soil, without damaging roots to a fine tilth with gentle cambers and no hollows.
- The hedge will be 60cm tall when planted. Oak trees will be supplied as whips and will be planted at regular intervals within the hedgerows.

Plant handling

- Bare-rooted planting stock is invariably delivered from the nursery in plastic, light-proof bags and will be stored upright in cool conditions away from direct sunlight. If they are to be stored for long periods (more than a few days), they will be removed from the bags and 'heeled in' to prepared trenches with the roots completely covered in well-cultivated soil until they can be planted.

Hedge planting technique

- Notch planting – insert spade and rock back and forth to form a notch. Insert roots well down into notch. Pull the plant upwards a little to straighten the roots. Firm the soil lightly with heel to exclude air.

Management of additional plantings

- Maintain a weed free area around each tree and shrub, minimum diameter the larger of 1 m or the surface of the original planting pit.
- Tree stakes, if required, will be inspected annually as follows:

- Check stakes for looseness, breaks and decay and replace as necessary to original specification. If a tree with a defective stake has grown sufficiently to become self-supporting, remove stake(s) and fill the hole(s) with lightly compacted soil.
 - Adjust, refix or replace loose or defective ties as necessary, allowing for growth since planting and to prevent chafing. Where chafing has occurred, reposition or replace ties to prevent further chafing.
 - Where stakes are longer than half the height of the clear stem of the tree, cut the stake to this height in spring and retie to tree firmly but not tightly with a single tie.
 - Remove redundant tapes, tags, ties, labels and other encumbrances
 - Remove stakes and ties during spring when no longer required to support tree.
- Plants/shrubs that have failed to thrive will be rectified and replaced with equivalent plants/shrubs. Replacements will match the size of adjacent or nearby plants of the same species. Making good will occur during the next suitable planting season.
 - The new plantings will not be cut in the first growing season. In the second year the previous season's growth will be trimmed back between November and early March by approximately half to encourage bushy growth. In the third year the lateral and lead branches and shoots will be trimmed back to give a more even shape.
 - After any new section of hedgerow has become established (potentially after 3 years), mechanical trimming will be used.

Established hedgerows

4.2.4. Management of established hedgerows will aim to create a continuous, moderately high bushy structure with a diversity of fruit and flowers available throughout the year.

- Hedgerows will be managed to maintain a minimum height of 3.5m
- Hedgerows will be managed on rotation (except in areas where safety/visibility dictates otherwise), with each hedgerow cut every 2 – 3 years
- Only one side of each hedgerow will be cut in any given year;
- Trimming must take place during November to February inclusive to avoid the breeding bird season and minimise effects on Dormice, preferably in January - February to allow foraging opportunities for wildlife through the winter.

4.3. Buffers adjacent to hedgerows and woodland

4.3.1. Grassland management within buffer areas between the solar PV array and hedgerows/woodland will aim to create a more diverse sward through natural succession and low impact grazing.

4.3.2. There will no reduction in grassland habitat area across the Site. The aim of management is to:

- Manage the areas of buffer grassland using traditional hay cuts and occasional low intensity grazing to enhance the ecological value of the grassland;
- Maintain the connectivity of the Site to facilitate the movement of wildlife through and across the Site;
- Prevent the build-up of fertility by removing cuttings;
- Monitor and manage, as appropriate, the spread of scrub and invasive species.

Management

- 4.3.3. Buffer grassland will be managed by taking a single hay cut in July onwards. This will be done using a mower set to approximately 50mm. Cut hay will be left to dry and shed seed for 1- 7 days and the resulting hay used as animal fodder.
- 4.3.4. Following the hay cut livestock will be introduced as 'aftermath' grazing to keep the sward short over until late Autumn. Stocking levels will be up to 1.5 Livestock Units per ha and electric fences will be used to prevent damage to hedgerows. The presence of livestock will be regularly re-assessed to ensure it meets the needs of biodiversity, and a changing agricultural environment.
- 4.3.5. Chain/tine harrows will be used in early Spring (prior to the start of the bird nesting season) for the first four years after completion to open up the sward (scarify) on the wider external boundaries allowing recruitment of windblown seed during the spring/early summer.
- 4.3.6. Each year following construction, 1kg of Yellow Rattle *Rhinanthus minor* seed will be sown in selected areas in the buffer grassland, for a maximum of three years, to aid in diversification of the sward. Yellow Rattle seed must be sown in autumn as it needs a prolonged period of chilling through the winter to trigger its germination the following spring. The most suitable sites for Yellow Rattle will be grassland of low to medium fertility and with a balanced sward which is not dominated by coarse vigorous grasses. This is likely to be in Area 1. Prepare for sowing by cutting the grass very short (25mm) or by grazing very hard and open up sites for germination by harrowing, raking or lightly discing, aiming to create up to 50% bare soil. Broadcast the seed on to the prepared surface in line with suppliers' instructions. Exposing bare soil will also provide opportunities for seed within the seed-bank to germinate.
- 4.3.7. Encroaching scrub will be removed by pulling or cutting at the base leaving the soil and surrounding flora undisturbed. This will be undertaken annually outside the bird nesting season.
- 4.3.8. No chemical fertilizer inputs will occur within this habitat.
- 4.3.9. Grassland will be maintained in a healthy vigorous sward, free from disease, fungal growth, discolouration, scorch or wilt.
- 4.3.10. The sward will be monitored as part of the management plan and as the sward changes and the fertility levels change, the management plan of the grassland will adapt in ways to enhance ecology, but also ensure it is practical to continue an extensive grazing programme.

4.4. Grassland beneath solar panels

- 4.4.1. The aim of management beneath solar panel is to;

- Minimise shading of solar panels;
- Provide forage for low numbers of sheep;
- Enhance the ecological value of the grassland

4.4.2. In the first autumn following construction, any bare ground will be seeded with a suitable commercial grazing mix for beneath panel habitats such as those produced by South West Seeds.

Sowing

Seed can be sown by surface broadcasting. Rolling is not usually needed for autumn applications as the weather will settle the seed to the soil.

First year management – to be applied to newly sown areas only

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

- 4.4.3. Areas of retained grassland and sown areas associated with the panels will be managed together after the first year. The area beneath the panels will be grazed by sheep at suitable stocking levels (around 6-8 animals per ha), although this may change during the lifetime of the solar farm depending on changing agricultural practices and management.
- 4.4.4. Weeds and scrub will be controlled by targeted application of a suitable herbicide.
- 4.4.5. No chemical fertilizer inputs will occur within this habitat.

4.5. Bat and breeding bird boxes

- 4.5.1. The aim of the Bat and breeding bird box scheme is to provide additional habitats for roosting bats and breeding birds.
- 4.5.2. Twenty woodcrete bat boxes and 20 woodcrete bird boxes suitable for birds that nest in cavities will be fitted onto trees surrounding Site 3. These are detailed in Table 5 with indicative locations shown on Map 2.

Table 5. Bird and bat boxes

Item ID	Type	Number	Comments
T5.1	Bird nest box: Schwegler 1B (32mm entrance)	10	Hung at a height of 1.5 metres or higher. Nest boxes will be angled so that they face away from the prevailing wind (usually south-westerly in the UK). The chances of occupation are higher if there is good tree (particularly oak) or hedge cover nearby as these will provide a good source of insect food for the nestlings when they hatch.
T5.2	Bird nest box: Schwegler 1B (26mm entrance)	10	Hung at a height of 1.5 metres or higher. Nest boxes will be angled so that they face away from the prevailing wind (usually south-westerly in the UK). The chances of occupation are higher if there is good tree (particularly oak) or hedge cover nearby as these will provide a good source of insect food for the nestlings when they hatch.

T5.3	Bat box: 2F Schwegler	20	The 2F bat box can be sited on a tree or building and is best positioned at a height of between 3 to 6 metres in an open sunny position. A group of 3 to 5 boxes facing in different directions will provide a variety of micro-habitats.
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4.6. Additional plantings in Field F8

- 4.6.1. 200 Devil's-bit Scabious plugs will be planted into the cable route within Field F8 (Map 2) following completion of the construction phase. Sunny, damper areas will be selected, and the plugs will be planted in 10 groups in Mid to late Spring as per suppliers' guidelines. Following planting, no further management is required.

Table 6. Indicative timings for habitat creation and management

Item ID	Feature	Planting	Management
T6.1	Additional hedgerow plantings	First winter following construction: Infilling of gaps in existing hedgerows with new plantings	<u>Weeding, check plantings</u> : April, May, July and September for first five years <u>Pest and disease control</u> : as needed <u>Pruning</u> : Between November and March in second and third years. After that manage in common with existing hedgerows
T6.2	Retained hedgerows	NA	<u>Trimming</u> : during January to February on a rotational basis with each hedgerow being trimmed every 2 to 3 years
T6.3	Retained grassland beneath panels	First autumn following construction: any bare ground will be seeded with a suitable commercial grazing mix for beneath panel habitats	<u>Scrub control</u> : Targeted control of scrub and ruderal herbs will take using topping or herbicides applied as per manufacturers recommendations <u>Grazing</u> : Can occur throughout the year
T6.4	Grassland buffers adjacent to hedgerows	NA	<u>Hay cut</u> : July/August. <u>Grazing</u> : After hay cut until late Autumn <u>Harrowing</u> : During spring in the first four years after the completion of construction <u>Scrub and weed control</u> : Trimming or pulling of scrub will take place during November to February <u>Sowing of Yellow Rattle</u> : Each Autumn in the first three years after the completion of construction
T6.5	Bat and breeding bird boxes	Installed in the first year following construction	No management of these features is required
T6.6	Devil's-bit Scabious plugs	Planted in mid to late spring in the first year following construction	No management of these plants is required

5. Monitoring

5.1. Introduction

- 5.1.1. Monitoring is fundamental to the success of this management plan and is required to assess biodiversity changes and identify potential issues. It allows an informed assessment of any changes to be identified, when compared to baseline data. This will enable the effectiveness of mitigation or compensation to be identified.
- 5.1.2. The lifetime of the solar scheme is likely to be 40 years. Every five years during operation, the management activities will need to be reviewed against the condition of the site, and a new five-year Management Plan produced.
- 5.1.3. A Management Plan related to decommissioning will also be required to ensure that solar panel removal does not have a negative impact on biodiversity. An adaptive management approach will be adopted whereby the results of monitoring feed back into the appropriate management of the Site.

5.2. Habitats

- 5.2.1. Monitoring of hedgerows, buffer grassland and grassland beneath the solar panels will occur on an annual basis for the first five years following construction. This will be completed during Spring or Summer months, beginning is the first monitoring period after the completion of the development. It will be completed by a suitably qualified ecologist who will assess the floral species diversity and make recommendations if issues are encountered including encroachment of scrub, overgrazing, ruderal herbs and presence of non-native species.

Hedgerows

Initial baseline and ongoing monitoring methods will be agreed with the relevant authority through planning conditions but are likely to comprise condition assessment as per the methodology within the Hedgerow Survey Handbook² modified inline with condition assessment of hedgerows in The Biodiversity Metric 2.0³.

The management target will include:

- an improvement in hedgerow height, thickness and spread;
- reduced gaps in shrub canopy;
- improved ditch and hedgerow management for biodiversity.

Buffer grassland and grassland beneath solar panels

Initial baseline and ongoing monitoring methods will be agreed with the relevant authority through planning conditions but are likely to comprise assessment as per the methodology within the UK Habitats Classification Manual⁴.

² Hedgerow Survey Handbook (2nd Edition). A standard procedure for local surveys in the UK. Prepared on behalf of the Steering Group for the UK Biodiversity Action Plan for Hedgerows

³ IAN CROSER, SUSANNAH GOLD, MAX HEAVER, MATT HEYDON, LAUREN MOORE, STEPHEN PANKS, SARAH SCOTT, DAVE STONE A & NICK WHITE. 2019. The Biodiversity Metric 2.0: Auditing and accounting for biodiversity value: technical supplement (Beta version, July 2019). Natural England

⁴ UK Habitat Classification Working group (2018). UK Habitat Classification User manual at <http://ecountability.co.uk/ukhabworkjnggrop-ukhab>

The management target within buffer zones will include:

- increased diversity and % cover of herb species;
- a reduction in dominance by agricultural grasses such as Perennial Rye-grass;
- a reduction in ruderal herbs typically associated with agricultural practices such as Creeping Thistle;
- an increase in grasses associated with lightly managed habitats such as False Oat-grass.

Within the panel areas, scrub and ruderal herbs will be monitored and controlled.

5.2.2. The results of monitoring will be assessed to inform a new Management Plan after an initial five-year period.







5.3. Fauna

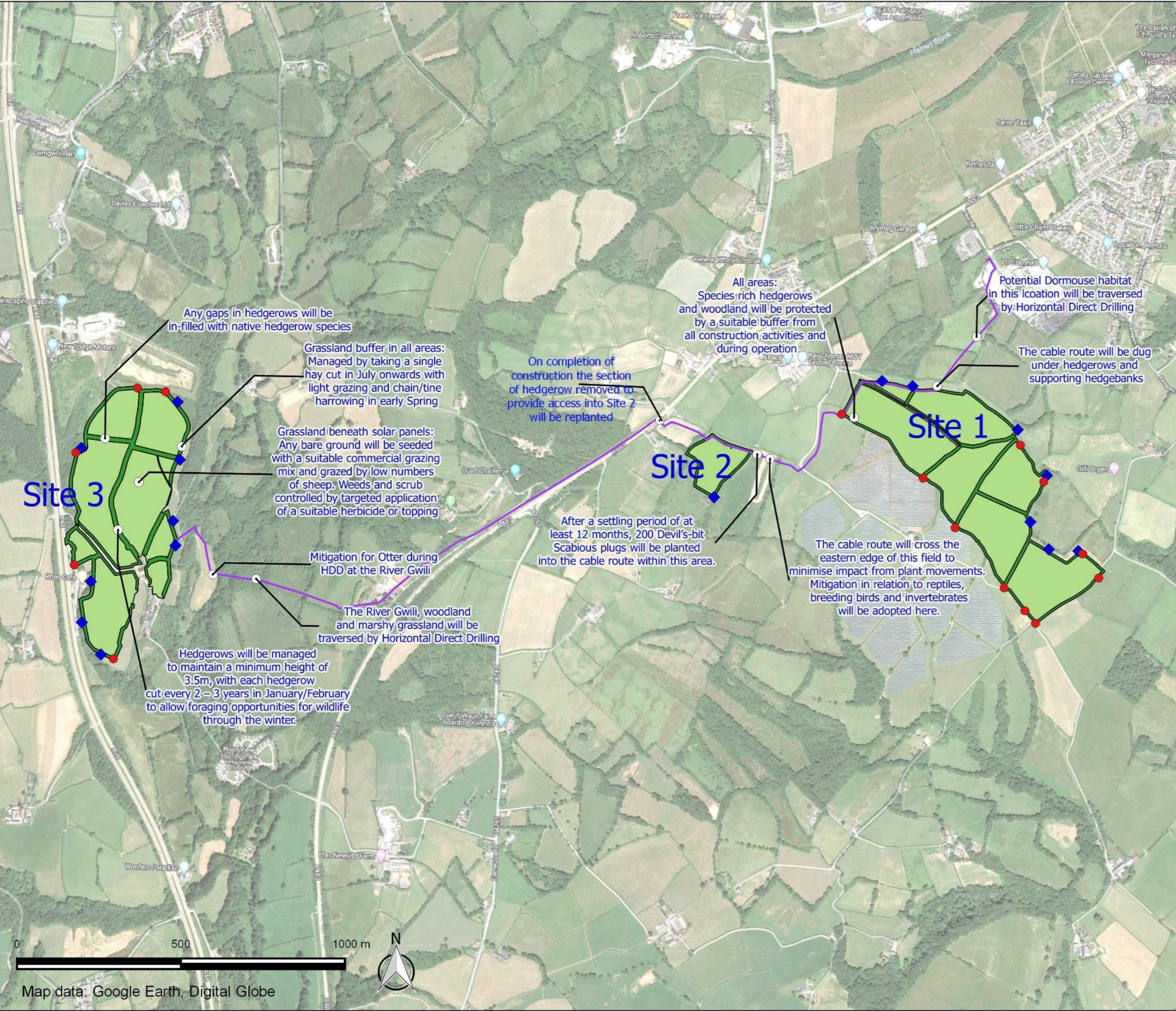
5.3.1. No monitoring for fauna is required.

6. Decommissioning

6.1.1. After 40 years of operation it is likely that the site will be restored to its original condition. Prior to any restoration, habitats will be assessed by a suitably qualified ecologist to determine their value and potential to support species of restricted distribution. These pre-decommissioning surveys will establish the value of the site for biodiversity and form the basis of a formal decommissioning strategy for biodiversity.

Legend

-  Cable Route
-  Grassland habitat under panels
-  Buffer habitat
-  Indicative location for bat and nesting bird boxes
-  Target note
-  Badger gate



Map data: Google Earth, Digital Globe

Title: Map 2. Landscape and ecology management plan

Project: Land to the east of the A48 and Land to the south west of Tvcroes

Checked by: CDH Version: 03
Date: 29/04/2020