Llanwern Solar, Whitson, Newport, Wales

Draft Landscape and Ecology Management Plan (LEMP)

August 2017

A report on behalf of Savills

Ref: 0419-LEMP-MWFM

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Site Details

Site Name	Llanwern Solar
Site Location	Whitson, Newport, Wales
Central OS Grid Reference	ST 3780 8445
Client	Savills

Quality Assurance

Report Title	Draft LEMP (Landscape and Ecology Management Plan)
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1 INTRODUCTION

This Draft Landscape and Ecology Management Plan (LEMP) has been produced to accompany a planning application for a proposed solar farm near Whitson, Newport, Wales (central OS grid reference: ST 3780 8445), hereafter referred to as the 'Site'. The LEMP was commissioned by Savills.

The LEMP has been produced by Green Ecology and WYG (landscape architects).

The LEMP provides details of mitigation and enhancement requirements during the construction and operational phases and a management framework during the operational phase. The implementation of the LEMP is central to protecting the landscape and visual and ecological importance of the Site.

It covers a period of five years, after which management will need to be reviewed against the current site conditions. This LEMP may need to be reproduced following consultation and planning.

1.1 Format of the Plan

The LEMP should be read in conjunction with the Environmental Statement (ES)[1] produced as part of the application.

The LEMP is set out as follows:

- Details on implementation and funding of the plan;
- A description of the existing ecological and landscape features;
- Details of ecological avoidance and mitigation strategies required during enabling and construction;
- Details of habitat creation and compensation including landscape and visual mitigation and planting schemes;
- Management and maintenance specification and annual schedule of operations; and,
- Details of mitigation required during decommissioning;
- Review and monitoring of the plan.

Any changes to the LEMP will need to be agreed in writing by the LPA.

[1] Savills (2017), Gwent Farmers' Community Solar Scheme Environmental Impact Assessment Report, Savills, Taunton.

2 MANAGEMENT MECHANISM AND FUNDING

The developer will fund the costs of compliance with the LEMP in full.

The developer will be responsible for implementing the LEMP, or organising a contractor/s to undertake the works in accordance with the LEMP.

3 EXISTING ECOLOGICAL FEATURES & LANDSCAPE CHARACTER

Ecological surveys have been undertaken at the Site since 2014. A summary of the findings are provided below; these features form the **key ecological features** to be protected and enhanced as part of this LEMP. Full details of the surveys and associated figures can be found in the ES and associated appendices submitted as part of the application.

3.1 Site Context and Landscape Character

The Site covers an area of approximately 145 hectares (ha) and lies to the north, west and south-east of the village of Whitson, on the outskirts of Newport. The Site is approximately 0.9 – 3 km from the Severn Estuary and is located on the Caldicot Levels.

The Site comprises predominantly low-lying fields of improved grassland and semi-improved neutral grassland with rush pasture. The fields are bounded by hedgerows with scattered trees and reens (ditches). The Site lies wholly within two Sites of Special Scientific Interest (SSSI): Gwent Levels: Whitson SSSI to the east of Whitson Common Road and Gwent Levels: Nash and Goldcliff SSSI to the west of Whitson Common Road.

The character of the site is typical of the character of LANDMAP aspect area NWPRTVS307, with “primarily pastoral land with limited arable. The pattern of linear rectangular fields to the east is distinctive, some enclosed by cut or outgrown hedges or lined with willows but all bound by ditches... A more sinuous pattern prevails to the west of Whitson Common around Goldcliff... The most distinctive feature is the drainage network including undulating fields, field ditches and reens of various sizes... These have strong reed and other marginal vegetation which contributes to the lowland character of the area”. The degree of impact on the landscape resource of the area would relate to the impacts on this pattern.

3.2 Designated Sites

Several designated sites are located within 10km of the Site boundary. As part of the ES scoping exercise[2] and a desk study exercise, the following designated were considered to fall within the Zone of Influence of the development:

- Gwent Levels SSSI. The Gwent Levels comprises a series of six SSSIs covering a total of 5700ha. The Site is located within the Gwent Levels: Whitson SSSI and Gwent Levels: Nash and Goldcliff SSSI. Each component SSSI is notified for 'reen and ditch habitat', 'insects and other invertebrates'. The Nash and Goldcliff SSSI citation notes that the site is of particular botanical interest as it is the only area in Wales for least duckweed *Wolffia arrhiza* and that there is an interesting community where two species of hornwort *Ceratophyllum submersum* and *C. demersum* grow together. The Whitson SSSI citation states that it is of particular importance for its large number of nationally rare and notable invertebrate species, including shrill carder bee *Bombus sylvarum, Anthomyza bifasciata*, *Coptophlebia volucris* and *Hydrophilus piceus*.
- Severn Estuary Special Protection Area (SPA), Special Area of Conservation (SAC) Ramsar site and component SSSI, located a minimum of 900m south. The SPA is designated for supporting populations of European importance of overwintering Bewick's swan, gadwall, white fronted goose, dunlin, redshank and shelduck and it qualifies as a wetland of international importance by regularly supporting an assemblage of at least 20,000 waterfowl. The SAC is designated for estuarine habitats and fish. The Estuary also meets the criteria for a wetland of international importance under the Ramsar Convention;
- Newport Wetlands National Nature Reserve (NNR)/ SSSI, located approximately 950m west. This reserve is of interest for its breeding and overwintering birds, invertebrates, aquatic and marginal flora, ditch habitats and reedbeds;
- Nedern Brook Wetlands SSSI located 10km to the west designated for wet grassland habitats which support wintering birds including Bewick's swan, redshank and wigeon.

3.3 Habitats

The Site as a whole can be classified as coastal and floodplain grazing marsh, comprising horse, sheep and/or cattle-grazed semi-improved grassland with rush pasture (68.8 ha), and improved grassland (57.2 ha) dominated by perennial rye-grass. Approximately 11 ha of

[2] Savills (2017), Gwent Farmers' Community Solar Scheme Environmental Impact Assessment Report, Savills, Taunton.

rush pasture was present within the improved grassland fields and an additional 5.69 ha was subject to crop rotation and had been sown with white clover.

The fields were bounded by hedgerows and/or water courses. All hedgerows were considered to be Habitats of Principal Importance (HPI) under Section 7 of the Environment (Wales) Act, although double lines of hedgerows alongside some field drains were considered likely to have an adverse effect on adjacent water courses. Standard trees predominantly associated with hedgerows and field boundaries included mature willow, oak, ash and horse chestnut.

The network of reens, ditches and field drains, which link to a much larger network across the wider area, are known to support a wide variety of aquatic plants and invertebrates and are the primary reason for the designation of the Nash and Goldcliff SSSI and Whitson SSSI. The growth of hedgerows on both sides of many of the ditches and reens (particularly the smaller ones) has meant that many of the ditches and reens have not been managed in recent years and have become over-shaded, silted and dry or partially dry in some cases.

Other habitats included small areas of dense bramble scrub and a 1 ha field dominated by tall ruderal vegetation and spoil/ manure piles.

3.4 Species

The Site supports, or has the potential to support the following protected and priority species:

- **Amphibians**: the Site's reens/ ditches may support breeding populations of common amphibian species;
- **Badger**: The Site may support foraging badger, although no setts are within the Site;
- **Bats**: Several mature trees contained features with low or moderate potential to support roosting bats, although no confirmed evidence was found. The Site supported low to moderate levels of commuting and foraging bats, mostly concentrated along linear features including the extensive network of hedgerows and ditches. Although activity was widespread through the Site, H90/D82, H11/ D14 and H37/D33 supported the highest activity. The majority of species recorded were relatively common and widespread, although Nathusius pipistrelle was found to use the Site;
- **Birds**: during wintering and breeding bird surveys, several notable birds were recorded, including teal, mallard and lapwing which are listed in the Severn Estuary SPA waterfowl assemblage, as well as wintering flocks of starling, redwing and fieldfare. The

Site was used at night by feeding/ foraging barn owl, lapwing, common snipe, mute swan, mallard and moorhen. The Site supported breeding gadwall, mallard, tufted duck, lapwing, skylark, cuckoo, whinchat, starling, tree sparrow, song thrush, mistle thrush and linnet. Non-breeding little egret were also present. Sightings of common crane were made during 2015 breeding bird surveys and one pair are now confirmed to be breeding locally (outwith the application area), although birds are using some fields within the application area to forage;

- **Invertebrates**: thirteen notable aquatic and terrestrial invertebrates were recorded during surveys of the Site, including soldier fly which is cited on the SSSI notification. The majority of the Site's habitats were considered sub-optimal to support shrill carder bee, one of the features of the SSSI, the exception being fields 7A, 9E and southern edge of 11A and 11C. A specific shrill carder bee survey is being carried out in August 2017 and an addendum report with be provided at that time, along with any additional mitigation or management requirements;
- **Riparian mammals**: the Site's extensive network of water courses may support foraging otter, especially given the number of records in the local area, although no evidence has been recorded to date. The larger reens were considered suitable for water vole, and confirmed sightings of this species have been made during 2017 surveys;
- **Reptiles**: the Site supports grass snake and potentially other widespread reptile species, particularly in associated with tall ruderal vegetation, hedgerow bases, water courses, manure piles and other suitable habitat;
- **European eel**: records suggest that European eel are present in the local area and given the connectivity of the Site with a large ditch network, it is possible that they are present within the Site's ditches/ reens;
- **Other Notable Species**: The Site contained suitable habitat to support brown hare and hedgehog.

4 ECOLOGICAL & LANDSCAPE MITIGATION STRATEGY

The overriding principle of the Mitigation Strategy is to avoid, minimise and compensate for biodiversity loss associated with the proposed solar farm and ensure a net gain for biodiversity. Landscape and visual impacts will also be mitigated for. The objectives are to:

- Minimise biodiversity loss during enabling and construction through avoidance and mitigation techniques (see **Sections 4.1**);
- Compensate for loss of habitats where possible, mitigate for landscape and visual impacts and enhance the Site for biodiversity through habitat creation and enhancements, aiming to provide a net gain in accordance with local and national planning policy (**Section 5**);
- Provide an ecologically coherent, sustainable and connected network for flora and fauna in the context of the Site and surrounding habitats (**Section 5**); and
- Minimise biodiversity loss during decommissioning and return the Site to an equivalent or enhanced ecological state than pre-construction (**Section 8**).

4.1 Enabling & Construction Phase

4.1.1 Aims

To meet the objectives of the Mitigation Strategy, the aims during the enabling and construction phases are:

- Ensure no adverse impacts on the qualifying features of the SSSI, SPA and other designated sites within the Zone of Influence as a result of construction techniques;
- Maintain habitat connectivity by retaining and protecting water courses and hedgerows where identified;
- Ensuring no adverse impacts on bat foraging corridors by restricting lighting;
- Ensuring no adverse impacts on faunal populations which may use the Site for breeding, foraging, shelter and commuting;
- Avoid and minimise disturbance effects on populations of breeding and wintering birds.

4.1.2 Prior to Works Commencing

Table 1 defines the measures to be undertaken prior to works commencing on Site.

Table 1: Pre-construction Prescriptions

No.	Ecological Feature	Avoidance/ Mitigation Requirements	Responsibility
1.1	Habitats/ species – general	A Construction Environmental Management Plan (CEMP) will be produced with input from the project ecologist. This will include details on the location of site compounds, storage and access, work methodologies, control of dust, noise and pollutants, lighting and timings.	Construction Contractor with input from Ecologist
1.2	Hedgerows, trees and water courses	Trees will be protected in accordance with BS5837: 2012 as outlined in the Arboricultural Impact Assessment[3]. Temporary fencing to protect retained hedges and ditches to remain in place until works complete.	Arboriculturalist/ Contractor.
1.3	Double hedgerows	Hedgerows for removal will be identified prior to works commencing and a Hedgerow Reduction Strategy devised (see also **Section 5.1.1** below).	Ecologist and Client
1.4	Bats and trees	Any trees that require felling will be identified and assessed for bat roosts following best practice guidance.	Ecologist and Client
1.5	Water vole	Updated water vole surveys will be undertaken prior to works commencing in areas where water course crossings require reinforcement.	Ecologist
1.6	Ground nesting birds	Prior to works commencing in any areas during the nesting bird season (proposed to be July – August), a check for ground nesting birds will be undertaken.	Ecologist

4.1.3 During Enabling and Construction

The measures to prevent adverse impacts to ecological features during enabling and construction are set out in **Table 2**. An Ecological Clerk of Works (ECoW) will be present for Tasks 2.2, 2.3, 2.4, 2.7, 2.9, 2.13.

[3] Savills (2015), Aboricultural Impact Assessment, Gwent Farmers' Community Solar Scheme, Llanwern, Newport, Savills, Taunton.

Table 2: Enabling and Construction Prescriptions

No.	Predicted Impact	Avoidance/ Mitigation Requirements	Responsibility
2.1	General impacts	The CEMP will be adhered to at all times.	Construction Contractor and Client
2.2	Accidental damage to retained hedgerows, trees and water courses during access.	Existing farm access tracks, watercourse crossings and hedgerow gaps will be used as much as possible to reduce possible adverse impacts. Access routes will be prepared prior to materials and construction traffic being brought onto Site. A minimum 7m buffer or root protection zones in accordance with BS5837: 2012 will be maintained at all times during enabling and construction as detailed in the Arboricultural Impact Assessment Report.[4]	Construction Contractor with advice from Ecologist and Arboriculturist.
2.3	Damage to rush pasture during access	Rush pasture will be protected using aluminium tracks; this will prevent the machinery damaging the soil structure through compaction.	Construction Contractor with advice from Ecologist
2.4	Damage/ pollution to main reens/ ditches	12.5m exclusion zones will be maintained along the main ditches/ reens and 7m exclusion zones along remaining ditches/reens. No construction activities, vehicle movement or storage of materials will take place in this exclusion zone.	Construction Contractor with advice from Ecologist
2.5	Damage to hedgerows during cable routing	Cable crossings to be sited outside of key root protection zones.	Construction Contractor with advice from Ecologist and Landscape consultant/Arboriculturist.
2.6	Damage to soil structure during cable trenching	Store subsoil and top soil on either side of trench to avoid mixing of soil types and back fill accordingly.	Construction Contractor
2.7	Impacts to water voles where reen/ ditch crossings need reinforcing	Water vole surveys will be undertaken (See Table 1). Works to banks will be undertaken following a method statement agreed with NRW. If water vole are present, alternative action will be taken.	Ecologist
2.8	Pollution/ siltation of reens/ ditches	Pollution prevention measures will be adhered to as detailed in the CEMP.	Construction Contractor

[4] Savills (2015), Aboricultural Impact Assessment, Gwent Farmers' Community Solar Scheme, Llanwern, Newport, Savills, Taunton.

No.	Predicted Impact	Avoidance/ Mitigation Requirements	Responsibility
2.9	Disturbance to breeding birds during ground clearance	No enabling or construction works will take place during the core bird breeding season (mid-Feburary to mid-July inclusive). Low impact works such as new crossing points and cabling will commence from mid-July, but not in areas used by cranes or lapwing. Any fields identified as being used by breeding ground-nesting birds will be avoided until all chicks have fledged, under guidance of an ecologist.	Construction Contractor/ Ecologist
2.10	Hedgerow reduction/ removal – impacts on fauna	Hedgerow works will take place between **September and Mid-February inclusive**, which is outside the breeding bird season. If this timing cannot be acheived, a pre-works check for nesting birds will need to be undertaken (**March to August**) although this would apply to small sections only. Active birds nests will be protected with a buffer zone (determined by species), until all chicks have fledged. Areas near to lapwing and crane breeding or nursery areas will not be cut from late-February to August (Inclusive) Hedgerow removal will be undertaken with in accordance with a Hedgerow Reduction Strategy, produced prior to enabling and construction (see also **Section 5.1.1** below). This will involve a heavy coppice down to ground level-30cm to prevent bank damage and silting risks to reens and ditches. Arisings to be used for habitat piles and remainder taken offsite. This hedgerow removal process will continue in phases into operation.	Construction Contractor/ Ecologist
2.11	Entrapment of animals	Trenches or large excavations will be covered overnight to prevent wildlife falling in and failing to escape, or a strategically placed plank will provide a means of escape. Any large bore pipes will be capped at the end of the day to reduce the potential for wildlife to enter and become trapped.	Construction Contractor
2.12	Lighting impacts on nocturnal	No construction or security lighting will be permitted on water courses or hedgerows. Construction will be	Construction Contractor

No.	Predicted Impact	Avoidance/ Mitigation Requirements	Responsibility
	species	restricted to daylight hours, finishing at least 30 minutes before sunset and commencing at least 30 minutes after sunrise during the main bat activity season (**April to October** inclusive).	
2.13	Protection of reptiles/ small mammals	The habitats will be kept in their current state leading up to and during construction, to prevent them becoming more favourable to reptiles and small mammals.	Construction Contractor/ landowner with advice from Ecologist

5 HABITAT CREATION AND ENHANCEMENTS

The following section details the proposed habitat creation associated with the proposed development. These areas are shown on **Figures LM 01.1- 05.1; Landscape Management Plan**. The overarching objectives are to:

- Compensate for habitat loss;
- Mitigate for adverse landscape and visual effects; and
- Enhance the Site to provide a net gain for biodiversity, for both flora and fauna.

All planting and seeding, including ground preparation is to be undertaken in accordance with the landscape specification set out in **Appendix 1**. Details of planting schedules are provided in **Appendix 2**.

The on-going management of the various habitats will also help to promote structural and botanic diversity which has the potential to enhance the site for a range of wildlife. The management of habitats and ecological features is detailed in **Section 6**.

5.1 Habitats

5.1.1 Ditches/ Reens

Hedgerow Reduction

As detailed in the ES, hedgerow reduction will take place to enhance the reens and ditches, a key feature of the SSSI. Across the site, hedgerows are often present both sides of the water courses, leading to shading and siltation as well as preventing management. This can cause problems for the invertebrates and plants that require a certain amount of unshaded

water to complete their lifecycles. In addition hedgerows can also reduce water levels in ditches by using the water for their root system.

In agreement with NRW, one hedgerow will be removed in selected places, where double hedgerows exist either side of reens/ ditches and it is assessed that the ecological benefits for removal exceed those of retention of the hedgerow. It is recommended that the south side of any hedge running roughly east to west would be removed to allow more light into the reen, although a selection process by an ecologist on the ground will be undertaken. Double hedgerows on the outer edges of the application site will be retained to provide visual screening.

Removal will be detailed in a Hedgerow Reduction Strategy, produced prior to construction, which will include:

- Details of hedgerows selected for removal. This will be subject to a site walkover by an ecologist, selecting weaker hedgerows for removal, or avoiding those with protected species interest e.g. trees with bat roost potential;
- A method statement to minimise unnecessary adverse impacts to the adjacent water course. This is likely to entail a heavy coppice with all arisings removed. This method will prevent siltation of the adjacent reen that could occur should a method of root removal be employed;
- Timings to avoid direct impacts to protected and notable species;
- Pre-works checks, where required, to search for protected species;
- Phasing of removal across years to reduce impacts on breeding, foraging, sheltering and commuting fauna.

5.1.2 Hedgerows

Compensation

There will be one new section of hedgerow that will be planted within the scheme. This is proposed between existing field boundaries to screen the grid yard and battery storage area as shown in **Figures LM 01.1; Landscape Management Plan**, forming a continuous link around the yard. Planting will consist of native species in keeping with the species present in the existing hedgerow boundaries.

The new native hedge planting will serve to provide screening and also enhance vegetative connectivity.

Enhancements

Where retained hedgerows are established but have significant gaps and do not create a continuous form, these will be gap planted with native species to create a continuous green corridor to maintain ecological links across the development site.

5.1.3 Grassland

Restoration

Once the solar arrays are installed the extent of disturbance to existing vegetation and soil conditions will be assessed and an appropriate restoration method agreed in consultation with the ecologist. In areas with minimal disturbance, the grassland may be allowed to re-colonise naturally. Where more significant disturbance has occurred, bare ground will be restored to permanent grassland using an appropriate meadow seed mix. The solar arrays will be installed with significant clearance between rows and the arrays themselves are partially transparent, which will permit vegetation growth beneath.

Grassland creation/ enhancement for shrill carder bee

Specific areas have been identified to be enhanced for shrill carder bee including 5.9 ha of grassland adjacent to the application area, as shown in **Figures LM 01.1 & 05.1; Landscape Management Plan.** These areas will be seeded with Emorsgate – Meadow Mixture for Wetlands EM8 plus 1g per 100g of the following (all available from Emorsgate) *Trifolium pratense* (Red Clover), *Echium vulgare* (Vipers-Bugloss) and *Lotus corniculatus* (Birds'-foot-trefoil). This mixture will be pre-approved with NRW (see Appendix 2).

Late summer-early autumn sowing of wildflower mix is preferred and depending on the condition of the fields to be seeded, ploughing may not be necessary, rather disc harrowing to create frequent gaps in the sward to allow seeding. After seeding in August/September fields should be rolled to ensure seeds make good contact with the soil.

Grassland creation for winter farmland birds

To enhance winter feeding for farmland bird species e.g. sparrows, buntings and finches and for late-season foraging for shrill carder bee, sunflower crops will be planted in wildflower meadow field corners, as shown in **Figures LM 01.1 & 05.1; Landscape Management Plan.**

Grassland for lapwing

Due to the loss of some fields used by breeding lapwing compensatory measures will be put in place. This comprises provision of 13 fields to the west and southeast of the application area totalling 25 ha which will be managed for lapwing for the lifetime of the scheme **Figures LM 01.3 & 05.1; Landscape Management Plan.** These fields were selected for their suitability and in the ownership of one of the participating landowners who have agreed to the management plan. A lapwing management plan for these areas is given in **Appendix 4.**

5.2 Wildlife Features

Specific features will be created/ installed for wildlife species, as detailed in **Table 3**. Locations are illustrated in **Figures LM 01.1- 05.1; Landscape Management Plan**. New wildlife habitats will help to enhance the site for local species.

Table 3: Wildlife Features

Item	No.	Description and Location
Bird boxes – general purpose.	40	• A variety of boxes with difference sized entrance holes to suit different species of hedgerow birds. To include Schwegler Types 1B (with 26mm & 32mm holes); 2H (open nest box), 3S (starling box). • Positioned at least 2m above ground level. • Entrance out of direct sun, north or east-facing.
Tree sparrow box	20	Wooden boxes with 28mm entrance hole, 2m or more above ground level.
Barn owl box	4	Erected in suitable areas in the south of the Site, to avoid areas close to the proposed M4 bypass. Position at least 3m above ground facing open ground with access hole visible to passing owls.
Bat boxes	50	A variety of bat box types will be used to enhance the site for different species as well as different seasonal use. To comprise • 25no. Schwegler 1FF & 3FF • 5no. Schwegler 1FW hibernation boxes • 20no. Schwegler 2F. Sited on suitable trees with a southerly or westerly aspect in groups of three (with varying aspects to provide different temperature regimes). Hibernation boxes will be mounted on the north side of suitable trees at least 3-4m high.
Habitat piles – to benefit reptiles, invertebrates and amphibians	Up to 50	• Constructed from arisings from hedgerow removal. • Placed in corners of solar array fields, but not so that they impede reen/ hedgerow management machinery.
Bug hotel	4	• 'Bug hotels' will be built within one of the central fields of the each sub-unit site, adjacent to one of the ditches. • Constructed from suitable available materials from the construction of the site infrastructure. Use of wooden

Item	No.	Description and Location
		pallets and reel tubes etc will facilitate a sustainable use of the packaging materials from the installation of the solar farm. Other materials could include logs from any tree works, or vegetation clearance, as well as terracotta plant pots, and bamboo canes.

5.3 Specific Common Crane Mitigation

Survey results suggest that the proposed solar array fields are not used frequently by cranes, which favour fields to the east, south and southeast of application area. No specific crane mitigation is proposed other than timing of construction works to avoid the most sensitive times in the breeding season Mid-February to July (inclusive). This would apply particularly to the subsections to the east and southeast of the site, which are close to areas where they are known to forage and raise their young. The creation of wildflower meadows for shrill carder bee would also benefit this species by offering an enhanced foraging resource and cover for young birds. Control of foxes as part of predator control measures in the lapwing management plan will also benefit breeding cranes.

6 MANAGEMENT PLAN

6.1 Aim and Objectives

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 maintain and enhance the favourable status of the Gwent Levels Whitson SSSI and Nash and Goldcliff SSSI and aid the 'vision' of the SSSI management statements[5]/[6];
- To enhance the Site for shrill carder bee, one of the notified features of the SSSI;
- 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;

[5] https://naturalresources.wales/media/648463/SSSI_0649_SMS_EN001efd9.pdf
[6] https://naturalresources.wales/media/636520/SSSI_0148_SMS_EN0013223.pdf

- Encourage the continued use of the grasslands by waders and wintering birds, including those associated with the SPA and NNR;
- To apply good horticultural and ecological practice to all operations; and,
- To monitor the Site and adjust management prescriptions as necessary.

6.2 Key Management Areas

For the purpose of management, the Site has been split into key areas:

1: Reens and Ditches and associated buffers;

2: Hedgerows;

3: Fields containing solar panels.

A management specification in included in **Appendix 1** and a timetable of management operations is provided in **Appendix 3**.

6.3 Reens and Ditches and Associated Buffers

6.3.1 Management Objectives

The aim of the management for ditches is to create a structurally diverse assemblage of vegetation along them. Management will aim to create a range of successional stages of vegetation throughout the ditches on site, through maintenance of small sections at a time following the hedgerow removal programme which will allow access to areas not managed for some time. Dramatic changes to the vegetation structure will be avoided. This will help to provide a varied mosaic of habitat structure across the site with riparian ditch habitat that is of value to a range of wildlife.

The main management objectives during operation of the solar farm are to:

- Enhance the biodiversity of the ditch/ reen system;
- Maintain the favourable status of the notified features of the SSSIs e.g. insects and plants;
- Maintain high water levels in summer;
- Enhance the adjacent buffer areas for flora and fauna;
- Monitor and manage pollution and invasive species.

Hedgerow removal will be undertaken in accordance with **Section 5** above, to allow more light and reduce siltation to selected ditches.

6.3.2 Management Specification

Without regular casting the reens and ditches become silted up and overgrown and lose their special interest, as the insects and plants require a certain amount of open water to complete their lifecycles.

Management of the ditches will be carried out gradually, in stages to avoid affecting the associated marginal vegetation at any one time.

The ditch system on the site will be managed on a rotational basis in any one year, to ensure any notable species that may be present within the marginal habitats are not adversely affected by the management works. Therefore it is proposed that:

- No works will be undertaken within any ditch without consent from Natural Resources Wales (NRW) following best practice guideline;
- Works will be undertaken in late summer/ early autumn; a nesting bird check will be carried out by a suitably qualified ecologist prior to the works;
- Ditches/ reens will be monitored for siltation every five years;
- The reens will be de-weeded every 18 months in accordance with methodologies undertaken by the former Caldicot and Wentlooge Levels Internal Drainage Board (CWIDB), now NRW;
- Reens/ ditches will be cast/ desilted on rotation every 7-10 years;
- This work will be undertaken on rotation, with only 50% of ditches in any one area being managed in any year;
- Resulting silt should be left at the edge of the ditch for at least two days for aquatic species to return to the water;
- All other debris and litter will be removed from ditches/ basins on a regular basis;
- Scrub and dominant aquatic plants will be controlled to maintain open water;
- Buffer strips adjacent to ditches (7 – 12m in width) should be mown/ strimmed as follows, with all cuttings removed:
    - One cut to 40-70mm, late September to provide forage for shrill carder bee. This can be rotated so that some are cut earlier each year (e.g. cut up to 50% in May/ June and again in late September), if required;
    - Mow regrowth to 10cm through autumn and once in spring if needed.

6.4 Hedgerows

6.4.1 Management Objectives

There will be an overall reduction in hedgerow area across the Site and therefore the aim of management is to ensure retained hedgerows are maintained with a good structure, provide connectivity for faunal species and support a diverse flora.

The main management objectives during operation are to:

- Manage hedgerows on a regular, rotational basis to promote structural and botanical diversity;
- Provide on-going management of standard hedgerow trees will aim to promote mature trees, including dead-wood habitat;
- Maintain the connectivity of the Site to facilitate the movement of wildlife through and across the Site;
- Provide visual screening where required and deliver good integration of the development into the landscape;
- Enhance defunct and species-poor hedgerows to increase biodiversity, connectivity and strengthen local landscape character; and,
- Allow and encourage a diverse ground flora to develop along hedgerow bases.

6.4.2 Management Specification - New Hedgerows

New hedgerows will be watered, weeded and mulched as detailed within **Appendix 1** until well established and managed as follows:

- In the first three years, annual light trimming will be undertaken to encourage a dense, bushy growth, as detailed in **Table 4** below;
- Following this, hedgerows will be cut every 2 – 3 years, allowing a small height increase each year (approximately 100mm);
- Bramble, nettle and other competitive weed species should be cut back by hand to allow a more diverse ground flora to develop;
- Dead and diseased plants will be replaced during this establishment phase (likely to be two years);
- Plants should be routinely inspected for pests and diseases and appropriate action taken if required;
- Hedgerows must be cut outside the breeding bird season, which runs from March to August inclusive.

- Cleared woody vegetation should be retained on Site in situ where possible to create deadwood habitats suitable for invertebrates and to provide shelter and potential hibernation habitat for reptiles and amphibians. If it cannot, the wood will be placed in a specific habitat pile(s) in the reen buffers and will be left to degrade naturally.

Table 4: Pruning Schedule - proposed hedgerow planting

Plant name	Pruning requirements	Month to prune
Alnus glutinosa	Selective pruning only (if needed). Prune in January to remove diseased, damaged, congested or crossing shoots. Shoots that are growing in unwanted directions can also be pruned out.	January
Corylus avellana	Pruning group 7 Timing: late winter No routine pruning necessary. Remove diseased, damaged, congested or crossing shoots. Shoots that are growing in unwanted directions can also be pruned out. 7 Note: Tree height to not exceed 5.0m.	February
Crataegus monogyna	Selective pruning only (if needed). Prune in February to remove dead, diseased, damaged, congested, or crossing shoots. Shoots that are growing in unwanted directions can also be pruned out. Prune back to just above a healthy bud. If the buds are positioned on alternating sides of the stem, prune to an outward facing bud as this will avoid future congestion within the plant. If the plant is producing flower buds wait until it has finished flowering. 8 Note: Tree height to not exceed 5.0m.	February
Lonicera perclymenum	No routine pruning necessary. Selective pruning only (if needed). Prune in January to remove diseased, damaged, congested or crossing shoots. Shoots that are growing in unwanted directions can also be pruned out.	January
Prunus spinosa	No routine pruning necessary. Selective pruning only (if needed). Prune in January to remove diseased, damaged, congested or crossing shoots. Shoots that are growing in unwanted directions can also be pruned out.	January
Rubus sp	No routine pruning necessary. Selective pruning only (if needed). Prune in January to remove diseased, damaged, congested or crossing shoots. Shoots that are growing in unwanted directions can also be pruned out.	January

[7] https://www.rhs.org.uk/advice/profile?pid=161#section-2
[8] http://www.shootgardening.co.uk/plant/crataegus-monogyna?referrer=%2Fplant%2Fsearch%3Fq%3DCrataegus+monogyn

6.4.3 *Management Specification - Established Hedgerows*

- Hedgerows will be managed to maintain a height of 2 – 3m minimum;
- 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, suitable mechanical cutters will be used;
- Trimming must only take place during September to February inclusive to avoid the breeding bird season, preferably in January – February to allow foraging opportunities for wildlife through the winter;
- Trim carefully and neatly to regular line and shape with vertical sides;
- Remove current growth rather than old wood;
- Encroaching bramble will be cut back to ground level to allow light to reach hedge bank/ base;
- Tree management will be avoided unless there are overriding safety concerns. Any hedgerow trees will be maintained as standards and managed in accordance with good arboricultural practice. Where tree works are necessary, an assessment of the tree's features to support protected species will be carried out by a suitably qualified ecologist in advance; and,
- Cleared woody vegetation should be retained on Site to create deadwood habitats suitable for invertebrates and to provide shelter and potential hibernation habitat for reptiles and amphibians.

6.4.4 *Management Specification – Removed Hedgerows*

Hedgerows which have been heavily coppiced to aid reen/ ditch management will be managed as follows:

- Hedgerows will be flailed annually between September and February to ground level/ up to 30cm above ground;
- Care will be taken to prevent cut materials from entering the reen/ ditch;
- Trimming must only take place during September to February inclusive to avoid the breeding bird season.

6.5 Grassland Containing Solar Panels

6.5.1 Management Objectives

On-going management of the grassland will aim to maintain and promote the establishment of diverse species associated with less intensive grassland habitats. Management of lapwing fields (outside the site boundary) is provided in **Appendix 4**.

The main management objectives during operation are to:

- Manage the areas of grassland beneath the solar panels using sensitive low intensity sheep grazing to enhance the ecological value of the grassland;
- Manage specific areas specifically to encourage and support shrill carder bee;
- Prevent the build-up of fertility by removing cuttings;
- Monitor and manage, as appropriate, the spread of scrub and invasive species.

6.5.2 Management Specification (Solar Array Fields)

- Grass height to be maintained on rotation;
- Where practicable this will be undertaken with low intensity sheep grazing (5 sheep/acre; 10/hectare), rotated around the various field units;
- Grazing will be stopped or reduced between 15 April and 1 September to encourage flowering, leaving some grassland within field units free to flower and set seed throughout spring – summer. A combination of low stocking density and breaks in grazing in different field units should lead to a high diversity of wild flowers and invertebrates as well as benefiting ground nesting birds and mammals (see also margins below);
- Some of the margins (outside the solar panel fence) can be left ungrazed during spring to create diversity and benefit nesting birds and invertebrates, then cut in late summer followed by aftermath grazing;
- Maintain grass in a healthy vigorous sward, free from disease, fungal growth, discolouration, scorch or wilt;
- Ensure that soil and grass does not become compacted or waterlogged;
- Any scrub or trees invading the grassland or encroaching towards the solar arrays would be removed by pulling or cutting at the base so as to leave the soil and surrounding flora undisturbed. This will be undertaken annually. All tree and shrub removal should be undertaken outside of the bird nesting season (March-September). If

unavoidable, a thorough check of the site for nesting birds should be undertaken prior to any works affecting vegetation.

6.5.3 Management Specification - grassland for shrill carder bee

- No or very low fertilizer inputs.
- Cease summer grazing, or, instead, adopt light rotational grazing throughout the year;
- Ensure that plentiful flower-rich forage habitat is available until late-September. This can also be achieved through a cutting or grazing rotation (low-intensity sheep grazing);
- Height of cut: 50mm;
- Cut traditionally managed hay meadows after mid-July; if possible rotate a late cut to provide forage into September;
- Arisings: Left to dry and shed seed for 1-7 days, resulting hay used for animal fodder;
- Aftermath grazing: following hay cut, livestock reintroduced to keep the sward short over winter until the following spring.

7 MONITORING

Monitoring is fundamental to the success of this management plan and is required to assess biodiversity changes and identify potential issues. It allows assessments of changes to be identified when compared to baseline data. This will not only enable the effectiveness of mitigation or compensation to be identified, but will also inform future mitigation proposals on other sites.

The lifetime of the solar scheme is likely to be at least 20 years. Therefore, 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. A Management Plan related to decommissioning will also be required to ensure that uninstalling the solar panels does not have a negative impact on biodiversity. An adaptive management approach should be adopted whereby the results of monitoring feed back into the appropriate management of the Site.

The following proposals for monitoring works are aimed to identify changes to the ecology of the site and monitor the effectiveness of mitigation. The monitoring programme will be agreed in advance with NRW.

7.1 Habitats

During establishment, monthly visits during the growing season will be required and as necessary to fulfil the requirements of the planting specification.

Once established, monitoring should be undertaken on an annual basis for new habitat creation and every 3 years for assessment of existing habitats.

7.2 Fauna

There is a lack of peer-reviewed scientific studies into the impacts of solar farms on ecological receptors generally; a recent review of existing published data on this subject was published by Natural England in March 2017 (Harrison *et al,* 2017)[9]. In summary it concludes that there is little existing evidence to suggest that birds collide with solar panels although it is not impossible, and that there is no current evidence to suggest collision by bats either. Recommendations given within the Harrison report are as follows:

'…*In the literature, concerns have been raised that solar PV developments have the potential to negatively impact a broad range of taxa including birds, bats, mammals, insects and plants. In light of this, it is highly recommended that research is undertaken into the ecological impacts of solar PV arrays across a broad range of taxa at multiple geographical scales.'*

As an alternative, or in addition, or as part of this, some specific monitoring of birds, bats and invertebrates in particular is proposed:

7.2.1 Birds

General bird monitoring would be undertaken post-development during years 1, 5, 10 and the year prior to decommissioning, which would involve breeding and wintering bird surveys.

In addition monitoring of lapwing mitigation fields and common crane for years 1, 3 and 5. The following methods would be employed:

[9]Harrison C., Lloyd H. & Field C (2017) Evidence review of the impact of solar farms on birds, bats and general ecology (NEER012), Natural England, Peterborough.

- Transect surveys using O'Brian and Smith (1992)[10] – method for censusing lowland breeding wader populations (this method would be adapted to record other bird species of conservation concern e.g. farmland birds);
- Vantage Point Surveys – to monitor cranes based on the standard vantage point survey methodology (SNH, 2014)[11] ;

7.2.2 Bats

Bat monitoring would take place post-development in years 1 and 3. Surveys would be undertaken on the same routes and locations as originally undertaken in the baseline assessment to allow comparisons to be made. The following methods would be employed:

- Transect surveys of solar array fields;
- Automated static bat detector monitoring.

7.2.3 Invertebrates

General terrestrial and aquatic invertebrate surveys would be undertaken in years 2 and 5 following the programme of hedgerow removal to open up reens and ditches. Surveys for shrill carder bee would be undertaken during the month of August in years 2 and 5 once wildflower seeding has established. This would include existing suitable habitat identified in the baseline assessment and areas of flower-rich grassland plantings in the mitigation areas.

7.2.4 Peer Reviewed Scientific Study

Clearly there is an opportunity at this Site to conduct some academic research to further current knowledge on the effects of solar farms on farmland ecology, given the size of the project and its location within the Gwent Levels SSSIs. We are currently discussing this with the University of the West of England (UWE) who have shown a keen interest in getting involved. We are able to offer collaboration, sharing of data and site access to enable studies. Provisional ideas have been based on a review of the recent Natural England

[10] O'Brien M. & Smith K.W. (1992) Changes to the status of waders breeding on wet lowland grassland in England and Wales between 1982 and 1989, *Bird Study* **39**: 165-176.

[5] Scottish Natural Heritage (2014) Recommended bird survey methods to inform impact assessments of onshore wind farms SNH, Inverness.

commissioned literature review on this subject[12]. In addition to proposals already made above some of these ideas are listed below:

- Carbon exchange and soil condition;
- Botanical diversity and composition;
- Pollinator/ plant associations and network indices;
- Use of hedgerows and reens by mammals;
- Habitat avoidance.

This will need to be discussed further with UWE before any commitments are entered in to.

8 DECOMMISSIONING

After 20 – 25 years of operation the site will be restored to its original condition, with the exception of new areas of wildlife habitat and wildlife features which will be retained. It is also proposed that any new crossing points will remain in-situ to avoid damage or disturbance to reens.

Habitats created/ maintained in the 20/25 year period have the potential to be ecologically valuable and support protected species and as such the restoration impacts should be assessed in advance of works commencing. This process will be informed by on-going monitoring of ecological features and pre-decommissioning surveys to establish the value of the site and any suitable mitigation. Prior to restoration the ecological and landscape value will be appraised by a suitably qualified ecologist and landscape architect and a method statement devised.

[12] Harrison C., Lloyd H. & Field C (2017) Evidence review of the impact of solar farms on birds, bats and general ecology (NEER012), Natural England, Peterborough.

Figures - see separate download

Appendix 1: Landscape Maintenance Specification

General

NOTICE:

Give notice before:

- Watering.
- Each site maintenance visit.
- Period of notice: 1 week before site visit.

REINSTATEMENT:

- Damage or disturbance to soil structure, planting, grass: Reinstate to original condition and within a reasonable period of time (according to season).

CONTROL OF MAMMALIAN PESTS:

- Employ only approved firms and methods.

WATERING:

- Supply: Potable mains water.
- Quantity: Ensure the full depth of topsoil is thoroughly wetted.
- Application: Do not damage or loosen plants. Use a fine rose or low pressure hose where appropriate to avoid damaging or loosening plants.
- Compacted soil: Where necessary, loosen soil or form depressions around the stem base of plants to ensure that water reaches the root zone instead of dispersing on the surface.
- Frequency: As necessary for the continued thriving of all planting/grass areas.

WATER RESTRICTIONS:

- If water supply is, or is likely to be, restricted by emergency legislation, submit proposals for an alternative suitable source of water. Obtain instructions before proceeding.

WEED CONTROL GENERALLY:

- Remove and/or prevent plant growth that is not required in the landscape to achieve the following level(s) of weed control: 90% control; no weed species in excess of 150mm high.
- Ensure that the methods used cause the minimum of damage to adjacent plants, trees or grass.
- All tree and shrub planting to be maintained weed free throughout planting area.

DISPOSAL OF ARISINGS GENERALLY:

- Unless specified otherwise, dispose of arisings from all specified operations by removing from site.

CHIPPING OR SHREDDING:

- Not permitted on site.

CLEANLINESS:

- Leave the works in a clean, tidy condition at completion and after any maintenance operations.

New Hedgerows

The following measures will be carried out to prepare and plant the hedgerow areas:

- The soil will be ripped to a depth of 500mm where possible and stones of greater than 50mm will be removed;
- Following the Landscape Management Plan, species will be planted between mid-October and April into free-draining and friable rootable soil;
- Hedgerow planting shall be planted in groups of 3-12 no. in a double staggered row at 0.3m centres and 0.25m between each row.

ESTABLISHMENT OF NEW PLANTING

- Duration: 0-5 years.
- 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 AND TIES (IF REQUIRED):

Inspect as scheduled and additionally immediately after strong winds, and carry out the following:

- 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.

REFIRMING:

- Ensure that trees and shrubs remain firmly bedded after strong winds, frost heave and other disturbances. Refirm by treading around the base. 'Collars' at the base of tree stems created by tree movement to be broken up by fork, avoiding damage to roots, backfilled with topsoil as necessary, and refirmed.

TREE SHELTERS:

- Adjust, refix or replace any loose or defective guards to original specification and to prevent chafing. Remove tree shelters and dispose off site once trees / shrubs are fully established.

HAND WEEDING:

- Remove all weeds, including roots, by hand using hoes, trowels or forks, taking care to remove not more than a minimum quantity of soil, causing minimum disturbance to trees, plants, mulched surfaces and leaving the area in a neat, raked, clean condition.

SOIL AERATION:

- Prick up trodden or otherwise compacted soil surfaces using a border fork as specified in BS 7370: Part 4, to aerate the soil of root areas. Do not damage plants and their roots.

MAINTENANCE OF MULCH:

- Top up to thickness of 50mm.
- Sweep up and replace mulch spilling onto adjacent areas and, if not contaminated with weeds or rubbish, return to planted area.
- Remove weeds growing on or in mulch by hand weeding.

NATIVE TREE AND SHRUB PLANTING MAINTENANCE

- Watering: In exceptional circumstances to prevent plants dying.
- Loose plants: Refirm surrounding soil, without compacting.
- Vegetation: Except trees and coppice shoots to be retained, cut down to 5m in edge mix area and 8m in woodland mix area.
- Arisings: Leave between rows.

FORMATIVE PRUNING OF YOUNG TREES:

- Do not prune whips or feathered trees.
- Type and timing of pruning operations to be carried out to suit the plant species.

- Do not prune during the late winter/early spring sap flow period, unless specified otherwise.
- Crown prune young trees up to 4 m high by removing dead branches and reducing selected side branches by one third to preserve a well-balanced head, ensuring the development of a single strong leader and the removal of duplicated branches and potentially weak or tight forks. In each case cut back to live wood.

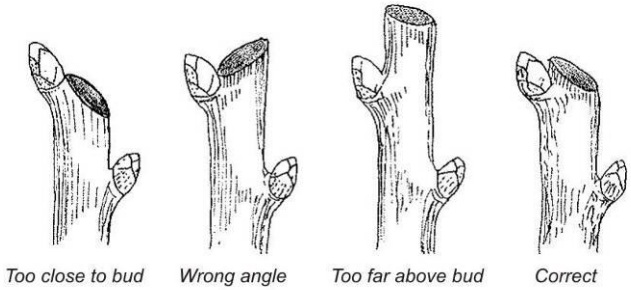
All hedgerows

PRUNING GENERALLY:

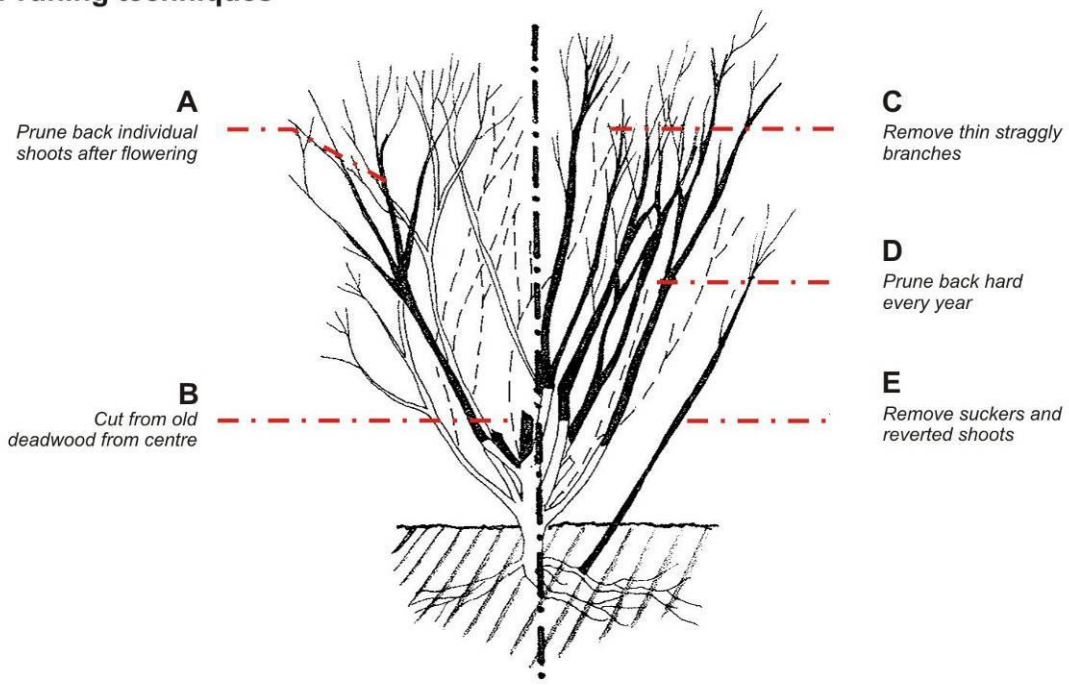
- Prune in accordance with good horticultural practice and BS 7370. Prune larger branches and woody stems in accordance with good arboricultural practice.
- Thin, trim and shape appropriately to each species, location, season, and stage of growth, leaving a well-balanced natural appearance.
- Use clean sharp secateurs, hand saws or other tools to carry out works. Trim off ragged edges of bark or wood with a sharp knife.
- Remove branches without damaging or tearing the stem.
- Keep wounds as small as possible and cut cleanly back to sound wood. Make cuts above and sloping away from an outward facing healthy bud, angled so that water will not collect on cut area.
- Prune larger branches neither flush nor leaving a stub, but using the branch bark ridge or branch collar as a pruning guide.
- Stems shall only be removed so as to retain the natural appearance of the individual plant species
- All damage, diseased or deadwood material shall be removed from trees/shrubs
- Any crossing or rubbing branches are to be removed from trees/shrubs.

PRUNING TECHNIQUES

Pruning cuts



Pruning techniques



taken from Landscape Management & Maintenance Handbook, Jones, Hing P (1990)

PRUNING OF EXCESSIVE OVERHANG:

- Remove annually any growth encroaching onto grassed areas.

REMOVAL OF DEAD PLANT MATERIAL:

At the end of the growing season, check all shrubs and remove all dead foliage, dead wood, and broken or damaged branches and stems.

Tree Work (if required)

TREE WORK GENERALLY

- Identification: Before starting work agree which trees, shrubs and hedges are to be removed or pruned.
- Standards: To BS 3998 and Health & Safety Executive (HSE) 'Forestry and arboriculture safety leaflets'.
- Removing branches: Cut as shown in Arboricultural Association Leaflet No 8 ‘Mature tree maintenance’. Cut vertical branches similarly, with no more slope on the cut surface than is necessary to shed rainwater.
- Appearance: Leave trees with a well balanced natural appearance.
- Chain saw work: Operatives must hold a Certificate of Competence.
- Tree work: To be carried out by an approved member of the Arboricultural Association.

ADDITIONAL WORK

- Defective, diseased, unsafe or weak parts of trees additional to those scheduled for attention: Give notice if detected.

PREVENTION OF WOUND BLEEDING

- Standard: To BS 3998, clause 8.

PREVENTION OF DISEASE TRANSMISSION

- Standard: To BS 3998, clause 9 and Appendix B.

CLEANING OUT AND DEADWOODING

Remove:

- Rubbish, wind blown or accumulated in branch forks.
- Wires, clamps, boards and metal objects, if removable without causing further damage and not part of a support structure that is to be retained.
- Other unwanted objects, e.g. tree houses, swings.

CUTTING AND PRUNING GENERALLY

- Tools: Appropriate, well maintained and sharp.

Final pruning cuts:

Chainsaws: Do not use on branches of less than 50 mm diameter.

Hand saws: Cut in one continuous operation to form a smooth cut surface.

Anvil type secateurs: Do not use.

- Removing branches: Do not damage or tear the stem.
- Wounds: Keep as small as possible, cut cleanly back to sound wood leaving a smooth surface, and angled so that water will not collect on the cut area.
- Cutting: Cut at a fork or at the main stem to avoid stumps wherever possible.
- Large branches: Remove in small sections and lower to ground with ropes and slings.
- Dead branches and stubs: When removing, do not cut into live wood.
- Unsafe branches: Remove epicormic shoots and potentially weak forks that could fail in adverse weather conditions.
- Disease or fungus: Give notice if detected. Do not apply fungicide or sealant unless instructed.

CROWN REDUCTION/ SHAPING

- General: Cut back selectively to lateral or sublateral buds or branches to retain flowing branch lines without leaving stumps.

CROWN LIFTING

- Clearances: Remove branch systems to give clearance.
- Removing branches: Remove whole branches back to the stem, or cut lower portions of branches back to lateral or sublateral buds or branches. Do not leave stumps.

CROWN THINNING

- Removing branches: Remove inward growing, crossing, rubbing, dead and damaged branches.
- Thinning: Selectively remove approximately 2.0 metres of secondary and small live branch growth evenly throughout the crown.
- Branches: Cut back to lateral or sublateral buds or branches without leaving stumps.
- Appearance: Leave a uniform and well balanced structure of branches and foliage

CUTTING TREE ROOTS

- Excavating: Use hand tools only.

Protected area:

Do not cut roots within an area which is the larger of:

- The branch spread of the tree.

- An area with a radius of half the tree's height, measured from the trunk.

Outside protected area:

Give notice of roots exceeding 50 mm in diameter. Do not cut without approval.

Cutting:

- Make clean smooth cuts with a hand saw.
- Wounds: Minimize. Avoid ragged edges.
- Finishing: Pare cut surfaces smooth with a sharp knife.

Backfilling:

- Protection: Cover cut roots with clean sharp sand.
- Material: Backfill with original topsoil.

REMOVING TREES

- Standards: To BS 3998, Appendix A and Health & Safety Executive (HSE)/ Arboricultural and Forestry Advisory Group Safety Leaflets.
- Existing services: Check for below and above ground services. Give notice if they may be affected.
- Shrubs and smaller trees: Cut down and grub up roots.

Tree stumps:

- Removal by winching: Give notice. Do not use other trees as supports or anchors.
- Work near retained trees: Where tree canopies overlap and in confined spaces generally, take down trees carefully in small sections to avoid damage to adjacent trees that are to be retained.

Filling holes:

- Material: Use as-dug material and/ or imported soil as required.
- Finishing: Grade to marry in with surrounding ground level

BARK DAMAGE

Wounds:

- Bark: Gently remove ragged edges using a sharp knife.
- Wood: Remove splintered wood from deep wounds.
- Size: Keep wounds as small as possible.

CAVITIES IN TREES

- Investigation: Remove rubbish and rotten wood. Probe the cavity to find the extent of any decay, and give notice. Licensed bat ecologist may need to provide advise.
- Water filled cavities: Do not drain.
- Sound wood inside cavities: Do not remove.
- Protecting / Maintaining / Making Good Defects

New Grassland Areas

ESTABLISHMENT

- Seed will be sown in the autumn or spring.
- To prepare a seed bed weeds will first be removed using repeated cultivation.
- Ploughing is recommended to bury surface vegetation, followed by harrowing to produce a medium tilth, and rolling to produce a firm surface.
- The seed will be surface broadcast and firmed in with a roller once sown.
- The sward will be lighting grazed with sheep in the first spring and autumn.

MAINTENANCE OF GRASS AREAS:

- Grass height: to be maintained with Low-intensity sheep grazing on rotation, leaving some grassland within field units free to flower and set seed throughout spring – summer.
- Condition: Maintain grass in a healthy vigorous sward, free from disease, fungal growth, discolouration, scorch or wilt.
- Water logging and compaction: ensure that soil and grass does not become compacted or waterlogged.

MAINTENANCE OF NEUTRAL LOWLAND MEADOW:

Carry out the following:

- Grass height: to be maintained with Low-intensity sheep grazing, excluded in spring summer to allow plants to flower and set seed.
- Times of year/frequency of cutting: Late July/ August
- Height of cut: 50mm
- Arisings: Left to dry and shed seed for 1-7 days, resulting hay used for animal fodder.

- Aftermath grazing: following hay cut, livestock reintroduced to keep the sward short over winter until the following spring.

FAILURES OF PLANTING:

- Excepting theft or malicious damage after practical completion, any trees/shrubs/plants that have failed to thrive will be regarded as defects due to materials or workmanship not in accordance with the Contract. Unless otherwise instructed they must be replaced by approved equivalent trees/shrubs/plants during the next suitable planting season.
- Replacements must match the size of adjacent or nearby plants of the same species or should match the original specification, whichever is the greater.

Appendix 2: Planting Schedule

Native Hedgerow Mix

Number	Species	%	Specification	Density
158	*Acer campestre*	15	1+1, Transplant, 1-3 breaks, bare root	0.3ctr Double staggered
31	*Clematis vitalba*	3	1+1, Leader with laterals, C	0.3ctr Double staggered
53	*Cornus sanguinea*	5	1+1, 2 breaks, bare root	0.3ctr Double staggered
211	*Corylus avellana*	20	1+1, 2 breaks, bare root	0.3ctr Double staggered
263	*Crataegus*	25	1+1, Transplant, 1-3 breaks, bare root	0.3ctr Double staggered
106	*Ilex Aquifolium*	9	1+1, 3 stems, 3 breaks, 2x transplanted, C	0.3ctr Double staggered
53	*Malus sylvestris*	4.5	1+1, Transplant, 1-3 breaks, bare root	0.3ctr Double staggered
53	*Prunus spinosa*	5	1+1, 2 breaks, bare root	0.3ctr Double staggered
106	*Rosa canina*	9	1+1, Leader with laterals, bare root	0.3ctr Double staggered
53	*Sambucus nigra*	4.5	1+1, 2 breaks, bare root	0.3ctr Double staggered

Grassland Mix for Shrill Carder Bee Areas

Shrill carder bee areas will be seeded with Emorsgate – Meadow Mixture for Wetlands EM8 plus 1g per 100g of the following (all available from Emorsgate) *Trifolium pratense* (Red Clover), *Echium vulgare* (Vipers-Bugloss) and *Lotus corniculatus* (Birds'-foot-trefoil).

%	Scientific name	Common name
0.5	*Achillea millefolium*	Yarrow
0.2	*Achillea ptarmica*	Sneezewort
1	*Betonica officinalis - (Stachys officinalis)*	Betony
2.5	*Centaurea nigra*	Common Knapweed
2	*Filipendula ulmaria*	Meadowsweet
1.5	*Galium verum*	Lady's Bedstraw
0.4	*Geum rivale*	Water Avens
0.6	*Leucanthemum vulgare*	Oxeye Daisy
0.8	*Lotus pedunculatus*	Greater Birdsfoot Trefoil
1	*Plantago lanceolata*	Ribwort Plantain
0.2	*Primula veris*	Cowslip
1.5	*Prunella vulgaris*	Selfheal
2.5	*Ranunculus acris*	Meadow Buttercup
1.5	*Rhinanthus minor*	Yellow Rattle
1.5	*Rumex acetosa*	Common Sorrel
1	*Sanguisorba officinalis*	Great Burnet
0.2	*Silene flos-cuculi - (Lychnis flos-cuculi)*	Ragged Robin
0.6	*Succisa pratensis*	Devil's-bit Scabious
0.5	*Vicia cracca*	Tufted Vetch
10	*Agrostis capillaris*	Common Bent
2	*Alopecurus pratensis*	Meadow Foxtail (w)
2	*Anthoxanthum odoratum*	Sweet Vernal-grass (w)

1	*Briza media*	Quaking Grass (w)
32	*Cynosurus cristatus*	Crested Dogstail
1	*Deschampsia cespitosa*	Tufted Hair-grass (w)
24	*Festuca rubra*	Slender-creeping Red-fescue
1	*Hordeum secalinum*	Meadow Barley (w)
7	*Schedonorus pratensis - (Festuca pratensis)*	Meadow Fescue (w)

Appendix 3: Management Schedule

The annual maintenance programme for the site will be carried out in line with the following programme to ensure that the maintenance works is carried out at the most beneficial time. For all seasons, the following will need to be undertaken:

Inspections;

Watering – may be necessary during the establishment period or through periods of drought to ensure the planting/grass areas continue to thrive; and

Pest and disease control.

Table A3-1 Annual Maintenance Programme

Action	Ditches / reens	Retained hedgerows	Hedge planting	Grass / species rich grass
January				
Inspections	x	x	x	x
Pest and disease control	x	x	x	x
Remove trees or shrubs invading into grass area	x			x
Hedge trimming		x	x	
February				
Weed control			x	x
Prune, commencing in year 5 (see pruning schedule)			x	
Hedge trimming		x	x	
Slubbing out and vegetation cutting	x			
Allow sheep grazing (30-50mm height)				x
March				
Prune, commencing in year 5 (see pruning schedule)			x	
Grass cutting (if ground conditions permit)	x			
Allow sheep grazing (30-50mm height)				x
April				
Weed control (hand weeding)			x	x
Prune, commencing in year 5 (see pruning schedule)			x	
Allow sheep grazing (30-50mm height)				x

Action	Ditches / reens	Retained hedgerows	Hedge planting	Grass / species rich grass
May				
Weed control			x	x
Prune, commencing in year 5 (see pruning schedule)			x	
Allow sheep grazing (30-50mm height)				x
June				
Prune, commencing in year 5 (see pruning schedule)			x	
Allow sheep grazing (30-50mm height)				x
July				
Weed control (hand weeding in grass areas)			x	x
Prune, commencing in year 5 (see pruning schedule)			x	
Stop sheep grazing to encourage wildflowers to grow				x
August				
Prune, commencing in year 5 (see pruning schedule)			x	
Stop sheep grazing to encourage wildflowers to grow				x
September				
Weed control			x	
Prune, commencing in year 5 (see pruning schedule)			x	
Hay cut				x
October				
Prune, commencing in year 5 (see pruning schedule)			x	
Grass cutting (if ground conditions permit)	x			
Allow sheep grazing (30-50mm height)				x
November				

Action	Ditches / reens	Retained hedgerows	Hedge planting	Grass / species rich grass
Prune, commencing in year 5 (see pruning schedule)			x	
Check and replace tree/shrub guards			x	
Allow sheep grazing (30-50mm height)				x

Table A3-2 Annual Maintenance: Native shrub and tree planting

Action	Details	Timing	Standard
Weed control	**Hand weed** a minimum of 4 times per year.	April; May; July; September	Refer to **Appendix 1**: Q35/ 645; 650; 657; 670
Fertiliser	Applications of fertiliser to be carried out early in the growing season.	April	Ensure correct fertiliser application. Refer to **Appendix 1**: Q35/ 695
Pest and disease control	To be carried out if necessary and in accordance with best practice.	When required	To eradicate all pests and disease to a high standard
Pruning	At the appropriate season for the species, pruning to be carried out to remove all damaged diseased or dead wood. To be commenced from year 5.	February – October Where pruning occurs in bird breeding season (Mar – Sept), works must avoid impacting nests	**Shrubs**: Prune to ensure the plant is kept well balanced and in good shape. Refer to **Appendix 2** for pruning techniques and **Appendix 3** for pruning schedule. Refer to **Appendix 1**: Q35/ 170; 540; 545; 570; 580

Table A3-3 Annual maintenance: Lowland neutral meadow

Action	Details	Timing	Standard
Pest and disease control	To be carried out if necessary and in accordance with best practice	When required	To eradicate all pests and disease to a high standard
Mowing	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. Following the hay cut sheep will be reintroduced as 'aftermath' grazing to keep the sward short over winter until the following spring.	October to March	
Scrub removal	Remove by pulling or cutting at the base so as to leave the soil and surrounding flora undisturbed	Annually	

Table A3-4 Annual Maintenance: Retained hedgerows

Action	Details	Timing	Standard
Trimming of hedges	Trim on two to three year rotation to maintain height and shape	January/ February	Refer to **Appendix 1**: Q35/611
Pest and disease control	To be carried out if necessary and in accordance with best practice.	When required	To eradicate all pests and disease to a high standard

Table A3-5 Annual Maintenance: New native hedgerows

Action	Details	Timing	Standard
Trimming of hedges	Cut back hard to encourage bushy growth down to ground level.. Once established, trim and lay 1/3 hedge at an one time, leave some uncut, on two to three year rotation.	October to February	Refer to **Appendix 1**: Q35/605 and Q35/611.

Table A3-6 Annual Maintenance: Ditch / reens

Action	Details	Timing	Standard
Pest and disease control	To be carried out if necessary and in accordance with best practice	January/ February	To eradicate all pests and disease to a high standard
Slubbing out and vegetation cutting	Removal of vegetation and sediment from the sides of the ditches and removal of vegetation from the water body.	From autumn to early spring, half of the reens (and one side of each) will be managed in any one year	As necessary and as directed by the Environment Agency.

Appendix 4: Lapwing Mitigation Plan

Gwent Farmers' Solar Scheme Field Management for Lapwings

The following prescriptions are designed to manage grassland habitats for breeding lapwing. Fields selected for this management should be the least 'improved' as possible. Some of the recommendations below may not be applicable depending on the existing habitat quality e.g. rush cutting or the other management options at the end of the document.

Grazing

- From March 15th to May 30th stocking density must not exceed one beast (cow/heifer/steer/bull) per hectare (ha) or five sheep /ha. Mixed grazing is ok.
- Cattle should not be released directly into breeding wader fields after being over-wintered indoors, as they are excitable and likely to trample nests. Cattle should be outside for at least one week before being put onto breeding lapwing fields.
- The field needs to have a mixed sward height so that in March between 50% and 75% of the field is short (below ankle height) and the rest varied with frequent grass tussocks.
- From July 1st to Feb 28th there are no stocking density restrictions, but cattle must be grazed at some point during this period. Recommend higher density to leave a short sward for following spring.

Rush Management

- Rush cover should comprise 10% to 30% cover and well scattered across the area. Rush control should be undertaken if rush cover exceeds this.
- Rushes should be topped close to the ground using a tractor-based mower. Retain 10% uncut.
- Rush control should not start until August 1st (to account for late breeding snipe) when ground not wet.
- Graze with cattle immediately after cutting to help break up the mat of cut rush.

Manure & Fertilisers

- If farmyard manure is applied, do not apply between 15th March and 30th June.
- Do not apply any organic or inorganic fertiliser or lime between 15th March and 30th June.

Herbicides & Pesticides

- No application of pesticides and diluted sheep dip. Herbicides should only be applied to control noxious weeds such as thistles and ragwort by spot treatment only.

- Do not graze stock that has been recently treated with an Avermectin (especially if this is a bolus treatment). This has a detrimental impact on dung and soil breeding invertebrates on which the birds feed.

Predator Control/Diversion

- Control of foxes by e.g. night shooting using the BASC code of practice.
- Control of carrion crows and magpies by shooting will help reduce lapwing nest predation by these species.
- Remove any isolated trees/tall bushes e.g. hawthorn in middle of fields as these act as avian predator look out posts.

Mechanical Works

- No tractors or other agricultural machines should be used in the lapwing fields between 15th March and 30th June.

Other Management Options

Depending on the quality of the existing habitat the following options can be used to encourage breeding lapwing into a suitable field. In addition to the above, features can be created to make the field appear more suitable to a male lapwing searching for a territory. These features involve increasing the diversity of the grassland and mosaic of the vegetation so that nests and sitting birds are best disguised from predators.

- Simple to create measures include chain harrowing small sections of the field in early-March and/or applying farmyard manure in early-March.
- One or more surface features should be present in grassland fields- molehills/ farmyard manure/hoof prints/bare ground.
- Wet features can be provided from March 15th to June 1st (scrapes, flushes, foot drains, standing surface water). A minimum of 50% of the edge should be exposed as water /mud interface with gently sloping edges with less than 25 % vegetation.

Monitoring

- Fields will be monitored annually by the ecologist to establish breeding and breeding success and identify any need for alteration to the management plan.