

HS2

High Speed Rail (London – West Midlands) Act 2017

HS2 Ltd

Buckinghamshire Council

Amersham Vent Shaft – Schedule 17, Paragraph 12: Restoration Proposals

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1 Introduction

1.1 Overview

- 1.1.1 This report supports the Restoration Proposals at the Amersham vent shaft site in Buckinghamshire. The report sets out the details subject to agreement under paragraph 12 of Schedule 17 to the HS2 Act.

2 Consent Context

2.1 Site boundary

- 2.1.1 The area of land subject to this restoration scheme is shown on drawing number 1MC05-ALJ-TP-DGA-CS02_CL04-334150 and includes the land that will be under the permanent control of the Nominated Undertaker (NU) of the High Speed 2 (HS2) railway. The land is also edged blue on the location plan, reference number 1MC05-ALJ-TP-DPL-CS02_CL04-334167.

2.2 Matters subject to other consents

- 2.2.1 The design and external appearance of the buildings, permanent earthworks, fencing and gate locations and external lighting are subject to a separate but concurrent approval under Schedule 17, Paragraphs 2 and 3 to the HS2 Act. They are not subject to agreement under this restoration request. The Proforma (Plans and Specifications) appended to the application makes it clear which plans are subject to approval for each application. See document 1MC05-ALJ-TP-FRM-CS02_CL04-000036.

2.3 Matters subject to this consent

- 2.3.1 Principally, the planting and surfacing detail contained in this submission are subject to agreement, including the proposed use of the land. This includes the details contained in Section 3 of this document.

3 The Restoration Scheme for Agreement

3.1 Vision

- 3.1.1 The restoration scheme is underpinned by a unifying project narrative which conceives of the shaft sites as ‘stepping stones’ – five discrete parcels of land which share common threads around contextually responsive design and biodiversity enhancement.
- 3.1.2 The landscape and habitat creation proposals are tailored to each location and reflect site- specific opportunities and constraints. Whilst each of the vent shaft sites are physically separated, the proposals will be stitched into their immediate setting to promote wider landscape and ecological connectivity; this approach is aligned with HS2s project objective to deliver a ‘green corridor’.
- 3.1.3 A key priority at Amersham is to maximise screening and integration of the buildings alongside habitat creation – the two are not mutually exclusive and the landscape proposals are balanced to achieve both objectives.
- 3.1.4 The restoration proposals will create a small but diverse and functional mosaic of habitats which are connected as far as practicable to the semi-natural habitats which prevail on the edge of the settlement and the rural hinterland. The key habitats which are proposed comprise wildflower and invertebrate rich calcareous grassland, with native broadleaved woodland and shrub planting. Other habitat features to promote biodiversity will be installed and include hibernaculum, basking/invertebrate banks and reptile egg-laying heaps.
- 3.1.5 The landscape will be established and managed to optimise biodiversity value and to contribute to the local character and special qualities of the Chilterns Area of Outstanding Natural Beauty.

3.2 Documents/Drawings for Approval

- 3.2.1 Section 3 of this document describes the restoration scheme and is subject to the overall approval under Paragraph 12 to the HS2 Act.

Landscape drawings

3.2.2 Landscaping and habitat creation proposals for the Site following construction are shown in the following drawings, which are subject to approval:

- Amersham Landscape Planting Plan and Schedules – Drawing no.1MC05-ALJ-TP-DPL-CS02_CL04-334152;
- Amersham Landscape Seeding Plan and Schedules – Drawing no: 1MC05-ALJ-TP-DPL-CS02_CL04-334153 ; and
- Amersham Landscape General Arrangement Drawing – Drawing no: 1MC05-ALJ-TP-DGA-CS02_CL04-334150.
- Amersham Landscape Sections – Drawing No. 1MC05-ALJ-TP-DSE-CS02_CL04-334151 and 1MC05-ALJ-TP-DSE-CS02_CL04-334152.

Surface Treatments

3.2.3 The restoration scheme for agreement comprises the following surface treatments as shown on the landscape general arrangement (ref: 1MC05-ALJ-TP-DPL-CS02_CL04-334150). These comprise:

- Asphalt for the access road and compound hardstanding and crushed stone material for the agricultural and infiltration blanket access to the east of Whielden Lane.

Habitats

3.2.4 Habitat creation as shown on drawing numbers 1MC05-ALJ-TP-DPL-CS02_CL04-334152 and 1MC05-ALJ-TP-DPL-CS02_CL04-334153 comprising:

- Species-rich calcareous and shade tolerant grassland;
- Native species broadleaf woodland; and
- Native species scrub.

3.2.5 The proposed species mix of each habitat are shown on the above drawings. The tables below summarise these in more detail.

3.3 Landscape and Habitat creation design

3.3.1 The original ES design, setting out landscape and habitat creation proposals was illustrated in the Chalfonts and Amersham MapBook¹ (Fig reference: CT-06-028).

¹ [ES Mapbook - Volume 2: CFA 08 - Chalfonts and Amersham](#)

This established a framework for design and mitigation which has informed the subsequent developed landscape and ecological proposals.

3.3.2 The landscape and ecological components have been designed as an integrated and multi-functional entity to achieve maximum environmental benefits. For the purposes of describing the scheme, the following section considers the landscape components through the lens of integration and visual mitigation of the built form, whilst the ecological elements include the mosaic of natural habitats and features such as hibernacula.

3.3.3 Taken as a whole, the measurable outcomes in terms of ecological enhancement and landscape integration and mitigation are equal to and typically exceed the intentions of the ES design.

Landscape design

3.3.4 The landscape design promotes a positive and contextually driven integration of the buildings and other infrastructure into the receiving landscape, ensuring there is compliance with landscape and visual impact EMRs.

3.3.5 The design adopts the core principle of the recessive architectural approach using complementary materials, sculpted earthworks and planting to minimise views of the building and reduce scale. This is blended with complementary ecological features to optimise biodiversity opportunities.

3.3.6 The screening approach is predicated on retaining as much of the existing mature boundary planting as possible to help settle the building into its setting. This is supplemented by substantial areas of new planting (woodland and woodland edge) which is arranged around much of the site perimeter (equating to a 75% coverage) and follows the geometry of the flint gabion walls, compound wall and earthworks.

3.3.7 Additional woodland and woodland edge planting is proposed to the east of Whielden Lane occupying land used during the construction phase. The planting will add to the existing retained woodland belt in this location, increasing its overall width in places by almost 40m.

Target habitats

3.3.8 Whilst target habitats and species are referred to, they are not targets in the sense of being a binding measure of success. They more broadly refer to what is expected to happen given the conditions that will be created. Inevitably some plant species introduced through planting or seeding will not thrive and some faunal species that

we hope to colonise will not, either because the conditions are not right for them or because these are not found in the surrounding area and do not arrive at the site.

3.3.9 The priority habitats to be established comprise:

- Species-rich calcareous grassland; and
- Creation of approximately 1ha of broadleaved woodland and scrub.

3.3.10 There are many key faunal species associated with calcareous grassland. The high diversity of plants that this habitat supports in turn supports a high diversity of other trophic levels particularly invertebrates, reptiles, amphibians, mammals and birds.

Target species

3.3.11 Targeting specific faunal species on the traffic island site is not an overriding objective of the restoration scheme. However, there will be species that will make good use of habitat features that have been incorporated into the design and ultimately, in the location on west of the field to the east of Whielden Lane, there is merit in providing habitat features to encourage wider biodiversity.

3.3.12 Specific habitat features comprising reptile basking banks, egg laying heaps and hibernaculum have been incorporated into the site design to encourage some of these species to colonise the site or increase their existing populations. These are shown on plan number 1MC05-ALJ-TP-DGA-CS02_CL04-334120 albeit the precise location will be agreed on site under the control of a suitably qualified ecologist.

3.4 Seeding and Planting

Grassland

3.4.1 Species-rich grassland will be created through reinstatement of suitable substrates and soils once the construction of the shaft site is complete. The existing subsoils and topsoil will be recovered and reused to create the appropriate profiles for each of the habitat/ planting types. Species mixes are tailored to the location which includes consideration of degree of shading.

3.4.2 Where practicable, all seeded areas which front on to the public footpaths (principally along Whielden Lane) will be established using pre-grown wildflower turf. The extent and location of this will be confirmed as part of the detailed design stage of the project and through agreement with suitably qualified soil specialists and ecologists. Elsewhere, all seeding will be established using traditional sowing

and/ or hydro seeding techniques. This approach will also be deployed if the use of wildflower turf is not deemed appropriate.

3.4.3 A detailed seeding schedule is provided on drawing 1MC05-ALJ-TP-DPL-CS02_CL04-334153 and summarised in **Table 1** below:

Table 1: Species composition for grassland seed mixes.

Scientific name	Common name	Calcareous grassland	Shady grassland
<i>Achillea millefolium</i>	Yarrow	✓	✓
<i>Agrimonia eupatoria</i>	Agrimony		✓
<i>Agrostis capillaris</i>	Common Bent		✓
<i>Alliaria petiolata</i>	Garlic mustard		✓
<i>Anthoxanthum odoratum</i>	Sweet vernal-grass		✓
<i>Anthyllis vulneraria</i>	Kidney vetch	✓	
<i>Betonica officinalis</i>	Betony		✓
<i>Brachypodium sylvaticum</i>	Wood false-brome		✓
<i>Briza media</i>	Quaking grass	✓	
<i>Carex flacca</i>	Glaucous sedge	✓	
<i>Centaurea nigra</i>	Common knapweed	✓	✓
<i>Centaurea scabiosa</i>	Greater knapweed	✓	
<i>Clinopodium vulgare</i>	Wild basil	✓	✓
<i>Cynosurus cristatus</i>	Crested dog's-tail	✓	✓
<i>Daucus carota</i>	Wild carrot	✓	
<i>Deschampsia cespitosa</i>	Tufted hair-grass		✓
<i>Digitalis purpurea</i>	Foxglove		✓
<i>Festuca ovina</i>	Sheep's fescue	✓	
<i>Festuca rubra</i>	Red-fescue	✓	✓
<i>Galium album</i>	Hedge bedstraw		✓
<i>Galium verum</i>	Lady's bedstraw	✓	
<i>Geum urbanum</i>	Wood avens		✓
<i>Hypericum perforatum</i>	Perforate St John's wort		✓
<i>Knautia arvensis</i>	Field scabious	✓	
<i>Koeleria macrantha</i>	Crested hair-grass	✓	
<i>Leontodon hispidus</i>	Rough hawkbit	✓	
<i>Leucanthemum vulgare</i>	Oxeye daisy	✓	✓
<i>Lotus corniculatus</i>	Common bird's-foot trefoil	✓	

Scientific name	Common name	Calcareous grassland	Shady grassland
<i>Onobrychis viciifolia</i>	Sainfoin	✓	
<i>Origanum vulgare</i>	Wild marjoram	✓	
<i>Phleum bertolonii</i>	Smaller cat's-tail	✓	
<i>Plantago lanceolata</i>	Ribwort plantain		✓
<i>Plantago media</i>	Hoary plantain	✓	
<i>Poa nemoralis</i>	Wood meadow-grass		✓
<i>Poterium sanguisorba</i>	Salad burnet	✓	
<i>Primula veris</i>	Cowslip	✓	✓
<i>Primula vulgaris</i>	Primrose	✓	✓
<i>Prunella vulgaris</i>	Selfheal	✓	✓
<i>Ranunculus acris</i>	Meadow buttercup	✓	
<i>Ranunculus bulbosus</i>	Bulbous buttercup	✓	
<i>Scabiosa columbaria</i>	Small scabious	✓	
<i>Silene dioica</i>	Red campion		✓
<i>Torilis japonica</i>	Upright hedge-parsley		✓
<i>Trifolium pratense</i>	Red clover	✓	✓
<i>Trisetum flavescens</i>	Yellow oat-grass	✓	
<i>Vicia cracca</i>	Tufted vetch		✓
<i>Vicia sativa ssp. segetalis</i>	Common vetch		✓

Mixed Woodland, Woodland Edge and including screening mixes

3.4.4 Planting mixes will include tree and shrub species which are commonly present in surrounding woodland and scrub. The size of planting stock, density of planting and choice of plant forms (such as the use of multi-stems and feathers) has been a key consideration. Larger planting stock (including species up to 2.5m in supply height) and faster growing species such as birch and hazel, combined with relatively high planting densities up to 1/ m² for perimeter woodland is proposed to encourage relatively early screening of the building and compound wall. Planting at the site entrance on Whielden Lane uses a small number of shrubs arranged in discrete clumps which are designed primarily to break up the visible extent of the compound wall and create a softer appearance. A detailed planting schedule is provided on drawing 1MC05-ALJ-TP-DPL-CS02_CL04-334152 and summarised in **Table 2** below.

Table 2: Species planting mixes

Scientific name	Common name	Mixed woodland	Woodland Edge – Type 1	Woodland Edge – Type 2 (A404 boundary)	Whielden Lane Entrance
<i>Acer campestre</i>	Field maple	✓			
<i>Betula pendula</i>	Silver birch	✓		✓	
<i>Carpinus betulus</i>	Hornbeam	✓			
<i>Cornus sanguinea</i>	Dogwood		✓	✓	✓
<i>Corylus avellana</i>	Hazel	✓	✓	✓	✓
<i>Crataegus monogyna</i>	Hawthorn		✓	✓	
<i>Euonymus europaeus</i>	Spindle		✓	✓	✓
<i>Ilex aquifolium</i>	Holly		✓	✓	
<i>Ligustrum vulgare</i>	Privet		✓	✓	
<i>Malus sylvestris</i>	Crab apple		✓	✓	
<i>Prunus avium</i>	Wild cherry	✓			
<i>Prunus spinosa</i>	Blackthorn		✓	✓	
<i>Quercus robur</i>	Pedunculate oak	✓			
<i>Rhamnus cathartica</i>	Sea buckthorn		✓		
<i>Rosa canina</i>	Dog rose		✓		
<i>Sambucus nigra</i>	Common elder		✓	✓	
<i>Sorbus aucuparia</i>	Rowan	✓		✓	
<i>Taxus baccata</i>	Yew	✓			
<i>Viburnum opulus</i>	Guelder Rose		✓	✓	✓

3.5 Habitat features

3.5.1 Within the overall site the small-scale habitat features outlined below are also proposed to attract specific species as set out in the target species contained in section 3.1 above.

Hibernacula

3.5.2 One hibernacula will be included within the site boundary. The exact location is shown on the landscape design drawing albeit this will be subject to micro-siting at

the implementation stage. This will provide habitat for species of reptile and amphibian to hibernate although it may also be used during the active period.

3.5.3 The design will follow the general principles set out below:

- The body of the hibernacula can be made of a variety of materials and is a good way of using waste or temporary works materials which may include timber, brash, tree roots, hardcore, rubble, aggregate, wood chippings, soil;
- Heavy, larger materials that will not decompose should be placed at the base of a hibernaculum.
- Turf, if available, can be placed on the surface of the structure or topsoil can be left to vegetate naturally. The turf and soil should not cover over access points;
- Access points should be designed around the edges through crevices that can be accessed by the target species but not potential predators, such as mustelids or rats;
- The position should be well-drained, away from potential disturbance, in suitable habitat for dispersal preferably on a habitat edge – e.g. between scrub and grassland;
- It should be at least 5 m long, 2 m wide, and 1 m high - and ideally as large as space will allow.

Reptile and invertebrate basking banks

3.5.4 Two basking banks for reptiles and invertebrates are proposed with locations shown on landscape design drawings (as with hibernacula this will be subject to micro-siting). Banks will be designed to create a small-scale mosaic of bare ground and poorly vegetated habitat that will create a warm micro-climate suitable for supporting a variety of species, e.g. reptiles, bees, solitary wasps, spiders, beetles and butterflies, as well as a distinct grassland/bare ground mosaic habitat.

3.5.5 The design will follow the general principles set out below:

- The core of the bank should be stone (hardcore, rubble, aggregate) and timber/tree roots can also be used.
- The surface of the bank should use site-won sub soil mixed with finer stone ameliorants to create a loose top surface suitable for burrowing invertebrates.
- The bank does not need to be seeded and will colonise sparsely and naturally.
- The largest slope should be south-facing and should have a shallower and longer slope than the north-facing aspect. The bank can be long/straight, curved or sinusoidal and can be incorporated into existing earthworks/bunding or kept separate.
- The banks should be at least 20 m long, 5-10 m wide and 1-2 m in height.

Reptile egg-laying heap

3.5.6 Reptile egg laying heaps will be created in two locations within the site, using grass arisings from site cutting. The heaps are intended to attract specific species such as grass snake *Natrix natrix* which typically nest in heaps of decomposing organic material which helps to incubate the eggs.

3.5.7 The design will follow the general principles set out below:

- They should be sited in sun or partial sun. If scrub or other tall vegetation grows up around them, it should be cut back sufficiently to prevent full shading of the heaps.
- Heaps should be close to connecting habitat, ideally located within scrub and at least 5 m from nutrient-poor grassland habitat to prevent nutrient enrichment.
- The heap can be placed inside a wooden structure that will constrain its extent, but this is not necessary, and the decision can be made by a suitably experienced ecologist when micro-siting the heap/s.
- It is usually beneficial to add brash to the base of a heap to allow a structure that grass snakes can access more easily.
- Heaps should not be disturbed between June and September when nesting occurs. For this reason, it will be necessary to have two or more heaps if cuttings need to be added during this period. Cutting frequency and timing will be decided by a suitably experienced ecologist

3.6 Hardstanding & Surface Treatments

3.6.1 The pavement construction details and layout are shown on drawing 1MC05-ALJ-TP-DGA-CS02_CL04-334204. Generally other surface treatments comprise the bituminous access track, paved footway and reinforced seeded verge with supporting kerbwork. A crushed stone access track is proposed to the east of Whielden Lane. No other hard landscape treatment is proposed.

4 Management Principles and Monitoring Periods

4.1 Introduction

- 4.1.1 The management and monitoring proposals set out below and in Appendix 1 are included here for information purposes and are not subject to restoration agreement under Schedule 17 to the HS2 Act.
- 4.1.2 The proposals are aligned with recommendations set out in HS2 Ltd Information Paper E26 (indicative periods for the management and monitoring of habitat) which gives broad generic indications of the likely durations of monitoring, maintenance and management and provides a basis for developing site specific requirements.
- 4.1.3 The management regime is tailored, in the short term (first five years), to ensure plant and seed establishment to promote initial cover; and, in the longer term, to encourage diverse, healthy habitats and maintain landscape screening. During all periods the vegetation will be managed to allow safe operation of the railway.

4.2 Habitat management principles

- 4.2.1 The following section summarises the key management activities during the initial establishment period for each of the habitat types, whilst habitat management objectives, including performance target/ indicators, are set out in **Table 3**.
- 4.2.2 Further detail on management prescriptions and monitoring proposals for each habitat during the lifespan of the project are contained in Appendix 1.

Woodland and woodland edge planting

- 4.2.3 Planted trees and shrubs will be maintained to promote establishment of a diverse and ecologically rich woodland, whilst providing a screening function as necessary.
- 4.2.4 During the initial establishment period (first five years) trees will be checked and dead or dying trees replaced. Watering and weed control (typically spot treatment with a non-residual herbicide and hand weeding) will be undertaken as required and guided by the maintenance specification.
- 4.2.5 Rabbit fences or biodegradable guards/ shelters will be provided for all planted areas. These will be checked on a regular basis and replaced as necessary during

the establishment period. Where deer grazing is identified as an issue, the plant protection will be designed accordingly. Where guards are used, then these will be removed once plants are sufficiently mature to withstand animal predation.

Grassland

- 4.2.6 Grassland areas will need to be managed once established using infrequent cutting to maintain a healthy sward. Arisings will be used for reptile egg laying heaps.
- 4.2.7 During the initial establishment period (typically the first growing season) the requirements for watering will be monitored and appropriate irrigation applied if necessary. Where wildflower turf is used to establish the outer edges of the core site a tailored watering regime will be applied following supplier recommendations and is likely to be a more intensive watering regime than for traditionally sown areas.
- 4.2.8 In the longer term, the maintenance of grassland beneath closing/ closed tree and shrub canopies will decrease and revert to natural cycles of growth and die back. This will be monitored and maintenance tailored accordingly.
- 4.2.9 Cutting should be timed so that most flowering plants can set seed but should not be too late in the year that the soil may be too wet and easily damaged by machinery – a single cut in July-September would be typical for this habitat type.

Other features: Reptile basking banks, hibernacula and egg-laying heaps

- 4.2.10 These features should be subject to annual checks to control any dense growth of invasive plants and to cut back vegetation growth to maintain open south-facing sides of basking banks and the hibernaculum and to assess condition and make repairs as required.

Invasive plants

- 4.2.11 There are currently no records of invasive plant species for the site. Should the site be colonised, measures will be implemented to promote bio-security and minimise the risk that invasive non-native species and diseases are spread because of the project. Specific methods for removal or treatment of invasive species would be specified in a Biosecurity Management Plan.
- 4.2.12 Appropriate handling, treatment and disposal procedures will be implemented in relation to species listed in Schedule 9 of the Wildlife and Countryside Act 1981, as amended, or the Weeds Act 1959 and the Ragwort Control Act 2003 to prevent the spread of such species.

- 4.2.13 Removal of invasive species will take account of ecological best practice guidance and appropriate measures will be taken to identify and protect other features of environmental importance (e.g. heritage assets)

4.3 Earthworks, soils, and substrates

- 4.3.1 Soils are critical to terrestrial ecosystems, with a large proportion of their biodiversity living below the ground. The physical and chemical characteristics of the soils lead to the development of diverse communities of soil organisms interacting within complex food webs that are intimately linked to plants and above ground fauna
- 4.3.2 To provide the right conditions for the proposed habitats to thrive, specific outline soil profiles have been designed for each habitat type (refer to Figures 6.10 and 6.15 in the Design and Access Statement). These will be refined accordingly during the detailed design stage based on assessment of soils recovered from site (and currently in stockpiles). A suitably qualified soil specialist will oversee this process and advise on any requirements to provide amelioration or other treatments should this be needed to promote plant establishment and future longevity.
- 4.3.3 In broad terms, for woodland areas, fertile, nutrient-rich soils will be created with sufficient depth for rooting. The calcareous grasslands will develop within a thin upper subsoil layer placed at the surface immediately above a free-draining substrate. The soil will provide a low-nutrient medium sufficiently low in phosphorus and nitrogen and high in organic matter to support herb-rich communities of plants that will not become dominated by coarse grasses.
- 4.3.4 Where applicable and advantageous in terms of sustainable reuse of materials, upper subsoils used for seeding will be ameliorated with site recovered crushed concrete, limestone aggregate (from use in construction) to increase calcium carbonate levels. There is confidence that there will be a sufficient supply of crushed concrete and limestone aggregate to deliver amelioration across all areas where it is needed.
- 4.3.5 Soil placement and cultivation ahead of planting and seeding is controlled by the landscape specification which will form part of the detailed design production information handed to the contractor.

4.4 Monitoring oversight

- 4.4.1 The independent HS2 Ecology Review Group (ERG) require annual monitoring reports. The ERG may make recommendations for remedial measures to the nominated undertaker where progress against objectives is considered not to be sufficient. Should this take place, the plan will need to be revised to take account of any agreed changes.
- 4.4.2 Table 3 however sets out the likely tasks that will be undertaken by the contractor as set out in internal specifications, for each of the species mix and types shown in the table.

Table 3: Site management objectives

HMP site feature	Objective		Performance indicator / target	Timescale
Habitat objectives				
Habitat areas (according to planting and seeding locations) are shown in Drawing 1MC05-ALJ-EV-DGA-CS02_CL04-329206				
Calcareous Grassland	CG1	Create and manage species-rich calcareous grassland of the following type: - lowland calcareous grassland habitat of principal importance Error! Reference source not found. Establish species-rich grassland vegetation similar to the National Vegetation Community (NVC) plant community [2]. - CG2 <i>Festuca ovina-Avenula pratensis</i> grassland typical of species-rich chalk grassland. The created grassland may include floristic elements of NVC plant communities typical of other lowland calcareous grassland vegetation of high conservation value such as - CG3 <i>Bromus erectus</i> grassland. - CG4 <i>Brachypodium pinnatum</i> grassland.	Approximately 0.4 ha of grassland qualifying as lowland calcareous grassland habitat of principal importance established	Estimated to be 30 years for creating good quality lowland calcareous grassland
	CG2	Manage created calcareous grassland so that it meets the criteria for 'good' condition.	- Percentage of bare ground less than 10 %. - Cover of non-target species such as invasive non-native species and ruderal species² less than 5 %. - Cover of trees and shrubs less than 5 %.	Estimated to be within 5 years – albeit if wildflower turf is specified this will be relatively instantaneous across parts of the site which are restored using this method

² For this site defined as broad-leaved dock (*Rumex obtusifolius*), creeping thistle (*Cirsium arvense*), curled dock (*R. crispus*), common nettle (*Urtica dioica*), cow parsley (*Anthriscus sylvestris*), ragwort (*S. jacobaea*) and spear thistle (*C. vulgare*).

HMP site feature	Objective		Performance indicator / target	Timescale
			- Cover of wildflowers and sedges at least 30 % throughout the area of this habitat created. - At least two calcareous grassland indicator species³ frequent and three occasional throughout the area of this habitat created.	
Woodland and scrub	W1	Establish and maintain stands of broadleaved woodland and scrub comprised of native broadleaved species characteristic of the local area	Establish approximately 1ha of broadleaved woodland and scrub	Estimated to be at least 32 years
	W2	Maintain planted habitats so that they meet the criteria for 'good' condition.	- Meets the following criteria: - Native species are dominant in the canopy and non-native and invasive species account for less than 10% of the vegetation cover - A diverse age and height structure of trees is present - The vegetation is free from damage from stock and wild mammals, with evidence of tree regeneration - Standing and fallen dead trees over 20 cm diameter are present - The area is protected from adjacent operations	Estimated to be at least 32 years
	W3	Maintain planting to function as screening in areas designated for this purpose.	Ensure that a varied canopy structure is maintained including presence of lower growing species to block views beneath higher tree canopies. Maintain dense growth	Estimated to be within 10 years.

³ Lists of indicator species for Lowland Meadows habitat of principal importance are provided in the *Farm Environment Manual* available at <http://adlib.eversysite.co.uk/resources/000/251/202/NE264.pdf>

HMP site feature	Objective		Performance indicator / target	Timescale
			around perimeter of planting areas and avoid excessive thinning which may create unwanted views	
Other habitat features				
Hibernacula	HB1	Provide hibernacula as habitat principally for reptiles, amphibians, and invertebrates and to diversify the habitat types and topography of the site. Hibernacula locations are shown on drawing 1MC05-ALJ-EV-DGA-CS02_CL04-339206.	Create one feature	To be completed as part of earthworks
	HB2	Maintain hibernacula so that they retain their structural integrity and intended function. Typical design details are shown in Drawing 1MC05-ALJ-EV-DDE-CS01_CL02-214421.	- Hibernacula should be at least 5 m long by 2 m wide by 1 m high, and ideally as large as space will allow. - Access points should be present around the edges through crevices that can be accessed by the target species but not potential predators, such as mustelids or rats.	Project lifetime
Basking banks	BB1	Basking banks will be incorporated into the earthworks in one location. Basking bank locations are shown on drawing 1MC05-ALJ-EV-DGA-CS02_CL04-339206. The banks will be designed to create a small-scale mosaic of bare ground and poorly vegetated habitat that will create a warm micro-climate suitable for supporting a variety of species, e.g. reptiles, bees, solitary wasps, spiders, beetles and butterflies, as well as a distinct grassland/bare ground mosaic habitat. The basking banks should also function as a hibernacula	Create two features	To be completed as part of earthworks

HMP site feature	Objective		Performance indicator / target	Timescale
		type feature with entrance points built in and maintained and a variety of fill materials used.		
	BB2	Maintain basking banks so that they retain their structural integrity and intended function. Typical design details are shown in drawing 1MC05-ALJ-EV-DDE-CS01_CL02-214421.	- The banks should be at least 20 m long and 5-10 m wide and 1-2 m in height. - The bank will not be seeded and will colonise sparsely and naturally. - Banks will continue to function as hibernacula throughout their lifetime. - Access points should be present around the edges through crevices that can be accessed by the target species but not potential predators, such as mustelids or rats.	Project lifetime
Reptile egg-laying heap	R1	Store grass cuttings and any other vegetation harvested from the site in two compost heaps to provide habitat for reptiles. Reptile egg-laying heap locations are shown on drawing 1MC05-ALJ-EV-DGA-CS02_CL04-339206.	Two features created	1 year
Site-wide objectives				
Management infrastructure	B1	Maintain fencing and other boundary assets - Boundary fencing where this denotes land ownership. - Safety / edge restraint fencing - All gates and access points. - Secure compound wall	Integrity of all assets maintained. Inspection of gates and fencing at regular intervals including prompt repair/ replacement of damaged or defunct elements where necessary.	Project lifetime.
Biosecurity	B1	Prevent the spread of non-native species	- Compliance with HS2 Plant Procurement Strategy. - Compliance with legislation and good practice.	Project lifetime.

5 Conclusions

- 5.1.1 The proposals included in this restoration agreement are intended to help integrate the buildings and compound into the landscape setting and contribute to local biodiversity improvement as far as practicable.
- 5.1.2 The proposed landscape structure comprising radial bands of screen planting and more extensive woodland planting away from the core site, set above species rich calcareous grassland is considered an improvement over the mitigation-led scheme that was originally envisaged by the ES. The key benefits include:
- A more contextual and refined planting approach which responds to site characteristics including topography, and which complements the building design and geometry.
 - Increased amounts of screening to achieve concealment of the building and compound wall in key views in keeping with a recessive design approach.
 - Integration of contextually appropriate hard materials within the landscape design, reflective of the materials palette used for the built elements of the scheme; and
 - A more refined mosaic of proposed habitats, introduced alongside retained habitats, including preservation of important plant communities.
- 5.1.3 The restoration scheme submitted for agreement is considered, with suitable management and monitoring, to both mitigate the effects set out in the main ES, and, enhance the long-term landscape and ecological value of the site.

Appendix 1 – Landscape Habitat Prescriptions

1 Introduction

- 1.1.1 This appendix has been repurposed since version C01 to be clearer on the management of habitats and to avoid repeating information contained in the main body of the document.
- 1.1.2 The landscape and habitat objectives are set out in Section 3, 4 and Table 3 of the main body of the document and are not repeated here. These objectives underpin each of the management and monitoring phases which are described below.
- 1.1.3 Management of the delivered restoration scheme will comprise two stages. An initial management establishment stage of 5 years duration. During this stage, the contractor delivering the works is required to monitor for defects or failure within the design; duties will be placed on the contractor to replace deceased plants and rectify seeding failures within the first available planting/ seeding season. The contractor is also required to carry out the initial focussed maintenance activities to promote successful establishment of habitats. This will likely comprise a contractor appointed directly by either the Main Works or Rail Systems contractor, with possible novation or overall control by HS2 Ltd. Albeit it is likely to vary from site to site, at Amersham this is likely to be for an initial 5 years.
- 1.1.4 Following the initial establishment period, longer term monitoring and maintenance of the delivered habitat and landscape will take place. It will be for the landowner to determine whom should undertake these activities. However, both the initial and long term management will facilitate the overall objectives (detailed in the main body of this document) for the site and the activities are set out on this basis below.

2 Initial Maintenance Activities

- 2.1.1 The following table A1 identifies the initial maintenance activities for each of the habitat types and planting mixes to be provided on the Amersham vent shaft site. Tables A2-A6 then shows likely maintenance Schedules for the first 5 years at the intervention shaft site.

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Table A1: Initial Maintenance Tasks

HMP site feature	Task ref	Description	Rationale	Timing
Habitat tasks				
Grassland	IM-G1	Areas sown with grassland seed mixes will be mown approximately once a year to maintain a sward height of 100 to 150 mm (but not less than 50 mm). This regime applies also to the seeded areas within the reinforced overrun strip at the site entrance. Additional mowing may be required depending on vegetation growth and condition. Mowing will aim to create structural diversity by leaving some areas uncut on a rotational basis, to be determined by land managers. Where not immediately established by wildflower turf, grassland will be allowed to colonise the top surface of the gabions and maintained at a height which will not expose the steel frame. Arisings will be collected and removed to reptile egg-laying piles on site designated by land managers. Piles will be sited at least 5 m from grassland areas so as not to cause damage to them through nutrient enrichment. Initial cuts of the pre-established wildflower turf will be to supplier's recommendation.	Mowing will be required to maintain structural and species diversity and to prevent the vegetation from becoming over-grown. Cutting should be timed so that flowering plants can set seed but should not be too late in the year that the soil may be too wet and easily damaged by machinery.	The main cut is likely to take place during July or early August. The exact timing may be varied by land managers depending on presence of ground-nesting birds, vegetation establishment, rate of growth and weather. Additional mowing may be required if the vegetation is too grass-dominated during summer, and could take place in September or March, simulating after-math grazing of traditional hay meadows.
	IM-G2	Growth of perennial weeds will be controlled if this could lead to a deterioration in grassland condition. Control by herbicide will be avoided if possible, and will be carried out by mechanical means, such as topping.	Remove vegetation that may adversely affect the development of target habitat.	As required.
	IM-G3	Formation of thatch within grassland will be controlled by scarification or similar methods if required.	As the habitat is unlikely to be grazed, mowing may be inadequate to prevent the formation of a dense thatch of low-growing grasses. Thatch out-competes wildflower species and prevents their regeneration by creating a complete vegetation cover, eliminating bare ground in which seeds can germinate, resulting in the deterioration of habitat condition. The requirement for de-thatching will be determined by land managers.	As required
Woodland and scrub	IM-W1	Plant inspections, replacements, firming tree stakes and guards (where used) and repairs to plant protection fencing.	Good establishment rates of the woodland habitat will be necessary to achieve necessary habitat quality/ condition required to reach thresholds needed for NNL targets.	Check twice in first year, then annually after that for the first five years.
	IM-W2	Following planting, the base of all transplants (within a 500mm diameter of the stem) will be kept clear of vegetation (1000mm diameter for larger feathers). This is sufficient control to allow establishment of an initial grass sward between the majority of trees (including areas planted at 1m centres). Beyond the establishment period the grass sward will be allowed to extend into areas around tree stems.	This will reduce competition from weed and grass growth and encourage establishment of tree species resulting in the development of canopy structure.	This maintenance operation shall be carried out twice in the first year (spring and late summer), then annually in years two to five following planting.
	IM-W3	Removal of standing and fallen dead/dying/diseased trees from woodland planting	Required to prevent damage to other trees, gaps developing in the canopy, degradation of screening function.	Once the woodland planting has become established and after five years an assessment shall be carried out on an annual basis to determine any trees which need to be removed or coppiced.
	IM-W4	Where installed, inspecting and maintaining the integrity of rabbit / deer fencing.	Minimise damage to tree stock during the establishment period.	Twice yearly
	IM-W6	Control of pernicious weeds within planted areas.	Control to ensure legislative compliance.	Within the first five years, weed growth shall be monitored on an annual basis and dealt with as necessary.

HMP site feature	Task ref	Description	Rationale	Timing
Other Habitat features				
Hibernacula Basking banks Reptile egg-laying heaps	IM-Hi1	These features should be subject to annual checks to control any dense growth of invasive plants and to cut back vegetation growth, if necessary, and to assess condition and make repairs as required.	To maintain the integrity and function of these features	Annually
Site-wide tasks				
Fencing	IM-F1	Maintain fencing and other boundary assets.	To maintain the integrity and function of fencing.	Annually
Biosecurity	IM-Bio1	Colonisation and spread of invasive plant species should be checked as part of the monitoring of habitats and remedial action taken to control where required.	Spread of invasive plant species will potentially reduce establishment rates of the wildflower and grassland seed mixtures which are necessary to achieve necessary habitat quality/ condition.	As necessary and according to best practice for controlling the relevant species

Table A2: Year 1 Maintenance Tasks

Item	Description	Frequency	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
IT.0	Individual trees (large feathers)													
IT.1	Check stakes, ties	2		1						1				
IT.2	Maintain 500mm radius clear of weeds and grass	3				1		1		1				
IT.3	Straighten trees and refirm around root	3		1				1					1	
IT.4	Remove damaged branches, growth/ thin/ prune	1		1										
IT.5	Replace losses	1										1		
IT.6	Watering (as required)	-												
T.0	Transplants and shrubs													
T.1	Check shelters and ties	2		1						1				
T.2	Maintain 250mm radius clear of weeds and grass	3				1		1		1				
T.3	Straighten plants and refirm around root	3		1				1					1	
T.4	Remove damaged branches, growth/ thin/ prune	1		1										
T.5	Replace losses	1										1		
T.6	Watering (as required)	-												
W.0	Wildflower and species rich and marshy grassland areas													
W.1	Establishment cuts (if autumn seeding)	4			1		1		1		1			
W.2	Establishment cuts (if spring seeding)	3					1		1		1			
W.3	Watering (as required)	-												

Item	Description	Frequency	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
G.0	General operations													
G.1	Collect windblown litter and dispose off-site	2		1						1				
G.2	Spot treatment of weeds (as necessary, schedule provisional)	2				1				1				

Table A3: Year 2 Maintenance Task

Item	Description	Frequency	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
IT.0	Individual trees (large feathers)													
IT.1	Check stakes, ties	2		1						1				
IT.2	Maintain 500mm radius clear of weeds and grass	3				1		1		1				
IT.3	Straighten trees and refirm around root	3		1				1					1	
IT.4	Remove damaged branches, growth/ thin/ prune	1		1										
IT.5	Replace losses	1										1		
IT.6	Watering (as required)	-												
IT.7	Slow-release fertiliser	1				1								
T.0	Transplants and shrubs													
T.1	Check shelters and ties	2		1						1				
T.2	Maintain 250mm radius clear of weeds and grass	3				1		1		1				
T.3	Straighten plants and refirm around root	3		1				1					1	
T.4	Remove damaged branches, growth/ thin/ prune	1		1										
T.5	Replace losses	4										1		
T.6	Watering (as required)	-												
T.7	Slow-release fertiliser	1				1								
W.0	Wildflower and species rich and marshy grassland areas													
W.1	Cutting	1							1*		1			
W.2	Watering (as required)	-												
G.0	General operations													
G.1	Collect windblown litter and dispose off-site	2		1						1				
G.2	Spot treatment of weeds (as necessary, schedule provisional)	2				1				1				

* Additional cut in may be required for biodiversity suppressed by competitive exclusion. Landscape and/or ECoW to be notified before additional cut is undertaken.

Table A4: Year 3 Maintenance Tasks

tem	Description	Frequency	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
IT.0	Individual trees (large feathers)													
IT.1	Check stakes, ties	2		1						1				
IT.2	Maintain 500mm radius clear of weeds and grass	3				1		1		1				
IT.3	Straighten trees and refirm around root	3		1				1					1	
IT.4	Remove damaged branches, growth/ thin/ prune	1		1										
IT.5	Replace losses	1										1		
IT.6	Watering (as required)	-												
T.0	Transplants and shrubs													
T.1	Check shelters and ties	2		1						1				
T.2	Maintain 250mm radius clear of weeds and grass	3				1		1		1				
T.3	Straighten plants and refirm around root	3		1				1					1	
T.4	Remove damaged branches, growth/ thin/ prune	1		1										
T.5	Replace losses	1										1		
T.6	Watering (as required)	-												
W.0	Wildflower and species rich and marshy grassland areas													
W.1	Cutting	1							1*		1			
W.2	Watering (as required)	-												
G.0	General operations													
G.1	Collect windblown litter and dispose off-site	2		1						1				
G.2	Spot treatment of weeds (as necessary, schedule provisional)	2				1				1				

* Additional cut in may be required for biodiversity suppressed by competitive exclusion. Landscape and/or ECoW to be notified before additional cut is undertaken.

Table A5: Year 4 Maintenance Tasks

Item	Description	Frequency	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
IT.0	Individual trees (large feathers)													
IT.1	Check stakes, ties, underground guys	2		1						1				
IT.2	Maintain 500mm radius clear of weeds and grass	3				1		1		1				
IT.3	Straighten trees and refirm around root	3		1				1					1	
IT.4	Remove damaged branches, growth/ thin/ prune	1		1										
IT.5	Replace losses	1										1		
IT.6	Watering (as required)	-												
IT.7	Slow-release fertilizer	1				1								
T.0	Transplants and shrubs													
T.1	Check shelters and ties	2		1						1				
T.2	Maintain 250mm radius clear of weeds and grass	3				1		1		1				
T.3	Straighten plants and refirm around root	3		1				1					1	
T.4	Remove damaged branches, growth/ thin/ prune	1		1										
T.5	Replace losses	1										1		
T.6	Watering (as required)	-												
T.7	Slow-release fertilizer	1				1								
W.0	Wildflower and species rich and marshy grassland areas													
W.1	Cutting	1							1*		1			
W.2	Watering (as required)	-												
G.0	General operations													
G.1	Collect windblown litter and dispose off-site	2		1						1				
G.2	Spot treatment of weeds (as necessary, schedule provisional)	2				1				1				

* Additional cut in may be required for biodiversity suppressed by competitive exclusion. Landscape and/or ECoW to be notified before additional cut is undertaken.

Table A6: Year 5 Maintenance Tasks

Item	Description	Frequency	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
IT.0	Individual trees and hedgerow trees (Heavy standard, standard and feathered)													
IT.1	Check stakes, ties, underground guys	2		1						1				
IT.2	Maintain 500mm radius clear of weeds and grass	3				1		1		1				
IT.3	Straighten trees and refirm around root	3		1				1					1	
IT.4	Remove damaged branches, growth/ thin/ prune	1		1										
IT.5	Replace losses	1										1		
IT.6	Watering (as required)	-												
T.0	Transplants and shrubs													
T.1	Check shelters and ties	2		1						1				
T.2	Maintain 250mm radius clear of weeds and grass	3				1		1		1				
T.3	Straighten plants and refirm around root	3		1				1					1	
T.4	Remove damaged branches, growth/ thin/ prune	1		1										
T.5	Replace losses	1										1		
T.6	Watering (as required)	-												
W.0	Wildflower and species rich and marshy grassland areas													
W.1	Cutting	1							1*		1			
W.2	Watering (as required)	-												
AQ.0	Aquatic planting													
AQ.1	Handweeding	3				1		1		1				
G.0	General operations													
G.1	Collect windblown litter and dispose off-site	2		1						1				

* Additional cut in may be required for biodiversity suppressed by competitive exclusion. Landscape and/or ECoW to be notified before additional cut is undertaken.

3 Longer Term Maintenance

- 3.1.1 This section describes the long-term management tasks for the Amersham Shaft Site. The habitat creation has been designed around the needs of long-term management, which is defined as the period following the initial maintenance stage for the lifetime of the project.
- 3.1.2 Table A7 below provides a description of the management tasks to be undertaken, the rationale for it, and the likely frequency during this period. Tables A8-A12 provide a longer term representation of the likely frequency of monitoring and maintenance for each of the habitat types to be provided.

Table A7: Longer Term Maintenance and Management Activities

Management	Management requirements	Target habitat(s)
Record keeping	Land managers will keep accurate and up-to-date records of all management activities	All
Mowing	Mowing of grassland beyond the initial maintenance period will be required indefinitely within secure, HS2 managed areas, and may be required outside of secure areas. This will be assessed by land managers and carried out if required.	Calcareous grassland
De-thatching	Formation of thatch within grassland will be controlled by scarification or similar methods if required. The requirement for de-thatching will be determined by land managers.	Calcareous grassland
Planting maintenance	Planted trees and shrubs will be maintained to ensure survival and development into wooded habitats. This will comprise checks for tree mortality and replacement of dead plants, and watering and weeding as required. If tree guards are used, then these will be removed once plantings have grown to a stage where they are less sensitive to attack by animals. For planting at site entrance, a rotational coppicing regime will be implemented once sufficient growth has been established. Planting groups will be coppiced at different times during the cycle to establish a varied height structure within the group. The frequency of coppicing will be determined as part of the monitoring of the site planting under the supervision of a suitably qualified ecologist but is expected to be on broadly a 5 year cycle to ensure planting does not become too tall.	- Woodland and scrub - Hedgerows

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Management	Management requirements	Target habitat(s)
	Coppicing of hazel within the woodland edge mix on land to the east and south of Whielden Lane will also be undertaken periodically.	
Tree management	- Where existing trees are likely to become exposed to potential changes in microclimate, such as to high winds, 'woodland edge management zones' shall be defined to allow for targeted maintenance of areas as required. - A qualified arboriculturist shall assess existing trees in 'woodland edge management zones' to ensure that they are undamaged, in good health and robust enough to withstand increased exposure to high winds. - No existing trees shall be allowed to remain where their roots or canopies pose a risk of damage to HS2 infrastructure. Prior to removal, the consequences for the stability of the surrounding soil shall be assessed. Maintenance and management works shall allow for the proactive removal of such trees before they become a risk to soil stability.	Woodland and scrub
Other habitat features checks	To maintain their integrity and function, hibernacula, basking banks and reptile egg-laying heaps will be regularly inspected, and remedial action taken where the features are failing to fulfil their function.	- Hibernacula - Basking banks - Reptile egg-laying heaps
Biosecurity	Control of invasive non-native plant species and noxious weeds may be required, using appropriate control methods, and avoiding use of chemical herbicides, where possible.	All
Infrastructure maintenance	Fencing and other infrastructure that support management of the site will be regularly maintained. This will include checking and replacement of fencing, access points and routes.	Not applicable

Table A8: Frequency of maintenance and monitoring operations for grassland habitats

Maintenance and monitoring operations	Years															
	0.5	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Mowing																
Monitoring																
Thatch removal																
Monitoring																
Weed control																
Monitoring																
Monitoring survey - objectives CG1 and CG2																

Table A9: Frequency of maintenance and monitoring operations for woodland and scrub habitats

Maintenance and monitoring operations	Years																							
	0.5	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	20	25	30	35	40	45	50	
Replacement inspection																								
Monitoring																								
Plant replacements																								
Monitoring																								
Re-firming trees/stakes																								
Monitoring																								
Removal of dead trees																								
Monitoring																								
Rabbit/deer fencing																								
Monitoring																								
Weed control																								
Monitoring																								

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[illegible]

Table A10: Frequency of maintenance and monitoring operations for habitat features

[illegible]

Table A11: Frequency of maintenance and monitoring operations for site-wide tasks

[illegible]

4 Hard Landscape Areas

4.1.1 This section covers hard landscape areas around buildings

Aim

4.1.2 The aim is to manage and maintain hard landscape areas so that they are safe, clean and tidy.

Objectives

4.1.3 The management objectives are to:

- Undertake regular conditions surveys;
- Carry out targeted reinstatement or replacement of exhausted or damaged features, lighting and materials including repairs to edgings and surfaces to ensure a smooth, safe surface is maintained free of trip hazards and ponding;
- Ensure that sustainable drainage systems (SUDS), where installed, are functionally operational
- Undertake a regular and time-tabled cleaning regime; and
- Where appropriate, apply a suitable herbicide to prevent weed growth.

Maintenance and monitoring operations

4.1.4 All hard landscape areas shall be inspected on annual monthly basis.

4.1.5 All hard surfaces shall be cleaned on a bi-annual basis.

4.1.6 Edges and surfacing shall be treated with a suitable herbicide on an annual basis.

4.1.7 Litter and debris shall be monitored and removed monthly. All areas shall be kept free of litter and any incidents of fly tipping reported immediately. Leaf litter shall be removed during autumn/winter as part of this operation.