European Site Conservation Objectives: Supplementary Advice on Conserving and Restoring Site Features

Cothill Fen Special Area of Conservation (SAC)
Site Code: UK0012889

Southern marsh-orchid and black bog rush. Photo: Graham Steven@Natural England

Date of Publication: 23 March 2016

About this document

This document provides Natural England's supplementary advice about the European Site Conservation Objectives relating to Cothill Fen SAC. This advice should therefore be read together with the SAC Conservation Objectives available here.

You should use the Conservation Objectives, this Supplementary Advice and any case-specific advice given by Natural England, when developing, proposing or assessing an activity, plan or project that may affect this site. Any proposals or operations which may affect the site or its qualifying features should be designed so they do not adversely affect any of the attributes listed in the objectives and supplementary advice.

This supplementary advice to the Conservation Objectives describes in more detail the range of ecological attributes which are most likely to contribute to a site's overall integrity and the minimum targets each qualifying feature needs to achieve in order to meet the site's objectives.

The tables provided below bring together the findings of the best available scientific evidence relating to the site's qualifying features, which may be updated or supplemented in further publications from Natural England and other sources. The local evidence used in preparing this supplementary advice has been cited. The references to the national evidence used are available on request. Where evidence and references have not been indicated, Natural England has applied ecological knowledge and expert judgement. You may decide to use other additional sources of information.

In many cases, the attribute targets shown in the tables indicate whether the current objective is to 'maintain' or 'restore' the attribute. This is based on the best available information, including that gathered during monitoring of the feature's current condition. As new information on feature condition becomes available, this will be added so that the advice remains up to date.

The targets given for each attribute do not represent thresholds to assess the significance of any given impact in Habitats Regulations Assessments. You will need to assess this on a case-by-case basis using the most current information available.

Some, but not all, of these attributes can also be used for regular monitoring of the actual condition of the designated features. The attributes selected for monitoring the features, and the standards used to assess their condition, are listed in separate monitoring documents, which will be available from Natural England.

These tables do not give advice about SSSI features or other legally protected species which may also be present within the European Site.

If you have any comments or queries about this Supplementary Advice document please contact your local Natural England adviser or email HDIRConservationObjectivesNE@naturalengland.org.uk

About this site

European Site information

Name of European Site	Cothill Fen Special Area of Conservation (SAC)
Location	Oxfordshire
Site Map	The designated boundary of this site can be viewed here on the MAGIC website.
Designation Date	April 2005
Qualifying Features	See section below
Designation Area	43.55 hectares
Designation Changes	n/a
Feature Condition Status	Details of the feature condition assessments made at this site can be found using Natural England's Designated Sites System
Names of component Sites of Special Scientific Interest (SSSIs)	Cothill Fen SSSI
Relationship with other European or International Site designations	n/a

Site background and geography

Cothill Fen SAC lies in the Vale of the White Horse between the Berkshire Downs and the River Thames in Oxfordshire, forming part of the Mid Vale Ridge National Character Area. Although close to Oxford and Abingdon, the surrounding area is largely rural. The site is screened by woodland, giving it a secluded feel. The site includes the Cothill National Nature Reserve.

The SAC owes its existence to unusual hydrological conditions arising from changes in the underlying geology. At the edge of the Vale of the White Horse, a Corallian limestone ridge merges with the Kimmeridge clay of the Oxfordshire clay vales. The ridge is sandy and free draining while the clay is impermeable. As a result, at the boundary between the two, calcareous springs which form fens and flushes arise, the most significant of which is Cothill Fen.

In places, where the site is waterlogged, layers of peat have built up, reaching a maximum depth of over four metres. The pollen record contained within the peat is nationally significant for the information it provides about vegetation in southern England since the last Ice Age.

The site shows succession through open water to fen and carr habitats. Historic management of the site by grazing, peat digging and creation of ponds has created a short fen blunt-flowered rush *Juncus subnodulosus*-black bog-rush *Schoenus nigricans* mire community that is botanically very rich. Another rare fen habitat, the purple moor-grass *Molinia caerulea*-meadow thistle *Cirsium dissectum* fen meadow is also present.

In places, along the Sandford Brook and on areas of waterlogged peat the fen merges into areas of wet woodland. Most notable is an alder-greater tussock sedge *Carex paniculata* woodland community with a canopy dominated by alder and ash.

The mosaic of fenland habitats supports a rich invertebrate fauna including the nationally rare Desmoulin's whorl snail *Vertigo moulinsiana* and the damselflies Variable Damselfly *Coenagrion pulchellum* and Small Red Damselfly *Ceriagrion tenellum*. The scarlet tiger moth *Calliomorpha dominula* is also found here and has been the subject of a long-term study.

About the qualifying features of the SAC

The following section gives you additional, site-specific information about this SAC's qualifying features. These are the natural habitats and/or species for which this SAC has been designated.

Qualifying Habitats:

- **H7230 Alkaline fens**

Alkaline fens consist of a complex assemblage of wetland vegetation characteristic of sites where there is tufa and/or peat formation with a high water table and a calcareous base-rich water supply. The core vegetation is typically short sedge mire (mire with low-growing sedge vegetation). A significant proportion of the alkaline fens surviving in Europe are believed to occur in the UK.

This lowland valley mire contains one of the largest surviving examples of alkaline fen vegetation in central England, a region where fen vegetation is rare. The M13 *Schoenus nigricans – Juncus subnodulosus* vegetation type found here occurs under a wide range of hydrological conditions, with frequent bottle sedge *Carex rostrata*, grass-of-Parnassus *Parnassia palustris*, common butterwort *Pinguicula vulgaris* and marsh helleborine *Epipactis palustris*.

The alkaline fen vegetation forms transitions to other vegetation types that are similar to M24 *Molinia caerulea – Cirsium dissectum* fen-meadow and S25 *Phragmites australis – Eupatorium cannabinum* tall-herb fen and wet alder wood.

- **H91E0 Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)* * Priority feature ('alder woodland on floodplains')**

Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*) comprises woods dominated by alder *Alnus glutinosa* and willow *Salix* spp. on flood plains in a range of situations from islands in river channels to low-lying wetlands alongside the channels. The habitat typically occurs on moderately base-rich, eutrophic soils subject to periodic inundation.

Many such woods are dynamic, being part of a successional series of habitats. Their structure and function are best maintained within a larger unit that includes the open communities, mainly fen and swamp, of earlier successional stages. On the drier margins of these areas other tree species, notably ash *Fraxinus excelsior* and elm *Ulmus* spp., may become abundant. In other situations the alder woods occur as a stable component within transitions to surrounding dry-ground forest, sometimes including other Annex I woodland types. These transitions from wet to drier woodland and from open to more closed communities provide an important facet of ecological variation.

Associated with the permanently waterlogged peat of the SAC is a base-rich spring-line alder-greater tussock sedge *Carex paniculata* NVC W5 woodland community with a canopy dominated by tall alder and ash. The ground flora is rich and reflects the transition from fen to woodland including five species of sedge including the thin-spiked wood sedge *Carex strigosa*. The herbs present include moschatel *Adoxa moschatellina*, common spotted-orchid *Dactylorhiza fuchsii*, yellow pimpernel *Lysmachia nemorum*, lady-fern *Athyrium felix-femina* and brooklime *Veronica beccabunga.*

References

RODWELL, J.S. (ed.) 1991. *British Plant Communities. Volume 1. Woodlands and scrub*. Cambridge University Press.
RODWELL, J.S. (ed.) 1991. *British Plant Communities. Volume 2. Mires and heath*. Cambridge University Press.

Table 1: Supplementary Advice for Qualifying Features: H7230 Alkaline Fens

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Extent and distribution of the feature	Extent of the feature within the site	Maintain the total extent of the H7230 feature at 4.95 hectares.	There should be no measurable net reduction (excluding any trivial loss) in the extent and area of this feature, and in some cases, the full extent of the feature may need to be restored. The baseline-value of extent given has been generated using data gathered during site surveys carried out by Natural England staff. The figure given for baseline extent is intended to be indicative only given the dynamic nature of the habitats on site, and this value may be updated in future to reflect more accurate information. The extent of an Annex I habitat feature covers the sum extent of all of the component vegetation communities present and includes transitions and mosaics with other closely-associated habitat features. Where a feature is susceptible to natural dynamic processes, there may be acceptable variations in its extent through natural fluctuations. Where a reduction in the extent of a feature is considered necessary to meet the Conservation Objective for another Annex I feature, Natural England will advise on this on a case-by-case basis.	LOW R, MEADE R & PENDLETON E (2016) Eco-hydrological assessment of the risks to the long-term integrity of Cothill Fen SAC, Oxon, Natural England.
	Spatial distribution of the feature within the site	Maintain the distribution and configuration of the H7230 feature, including where applicable its component vegetation types, across the site	Distribution includes the spatial pattern or arrangement of this habitat feature, and its component vegetation types, across the site. Changes in distribution may affect the nature and range of the vegetation communities present, the operation of the physical, chemical, and biological processes in the system and the resiliency of the site and its features to changes or impacts. Alkaline fen is present in SSSI unit 2 (Cothill Fen NNR and Parsonage Moor BBOWT Reserve) and SSSI unit 5 (Lashford Lane Fen BBOWT Reserve). The vegetation varies in composition in relation to factors such as depth of peat, water chemistry and water level.	
Structure and function (including its typical species)	Vegetation community composition	Ensure the component vegetation communities of the H7230 feature are referable to and characterised by the following National Vegetation Classification type (s) M13 *Schoenus nigricans-Juncus subnodulosus* mire	This habitat feature will comprise a number of associated semi-natural vegetation types and their transitional zones, reflecting the geographical location of the site, altitude, aspect, soil conditions (especially base-status and drainage) and vegetation management. In the UK these have been categorised by the National Vegetation Classification (NVC). Maintaining or restoring these characteristic and distinctive vegetation types, and the range of types as appropriate, will be important to sustaining the overall habitat feature.	This attribute will be periodically monitored as part of Natural England's site condition assessments.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			The M13 mire is a nationally rare vegetation type characteristic of highly alkaline situations. The community grades into associated habitats including open water, reed bed, alder woodland and willow carr.	
Structure and function (including its typical species)	Invasive, non-native and/or introduced species	Ensure invasive and introduced non-native species are either rare or absent, but if present are causing minimal damage to the H7230 feature	Invasive or introduced non-native species can be a serious threat to the structure and function of these habitats, because they are able to exclude, damage or suppress the growth of their associated typical species, reduce structural diversity of the habitat and prevent the natural regeneration of characteristic site-native species. Once established, the measures to control such species may also impact negatively on the features of interest (eg use of broad-spectrum pesticides).	These attributes will be periodically monitored as part of Natural England's site condition assessments.
	Presence/cover of woody species	Maintain a low cover of woody species of not more than 10% scrub/tree cover across the H7230 feature.	Native trees and shrubs occur naturally on fen surfaces but an abundance of scrub and trees is regarded as detrimental because they are indicators and perpetrators of drying out and may cause damage to vegetation structure through shading effects. The presence of scattered, low scrub at this SAC is acceptable, indeed desirable, as this provides important structural complexity of value for invertebrates. However, excessive scrub cover will usually have damaging effects in this habitat.	
	Exposed substrate	Maintain the exposure of the fen substrate to appropriate levels, which will typically be between 1 - 5% of the open fen areas.	For this wetland habitat type, maintaining availability of exposed, open ground surface is required to support the establishment and supply of those component species which often rely on wet and sparsely-vegetated conditions. The open nature and sometimes skeletal nature of the substrate supporting these features requires a higher upper threshold than for some other wetlands. At this site this means bare, exposed peat, very short bryophyte-dominated mats, pools of open water and small runnels of flowing water. This should not be interpreted as to mean that activities which cause damage to the fen surface are desirable or acceptable. The aim is to maintain high structural diversity with suitable conditions for specialised plants and invertebrates.	
	Key structural, influential and distinctive species	Maintain the abundance of the species listed below to enable each of them to be a viable component of the H7230	It is important that the alkaline fen is maintained so that it continues to support the wide range of plants and animals representative of the community type which is of special interest, i.e. the M13 mire.	PORTER, K. 2002. Fens of Oxfordshire: their importance for invertebrates.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		habitat: Assemblage of higher plants characteristic of the M13 type including bog pimpernel *Anagallis tenella* sedges *Carex spp.* meadow thistle *Cirsium dissectum,* southern marsh-orchid *Dactylorhiza praetermissa,* marsh helleborine *Epipactis palustris,* broad-leaved cotton-grass *Eriophorum latifolium* bog asphodel *Narthecium ossifragum,* parsley water-dropwort *Oenanthe lachenalii* grass-of-Parnassus *Parnassia palustris,* lousewort *Pedicularis sylvatica* common butterwort *Pinguicula vulgari,* fen pondweed *Potamogeton coloratus,* black bog-rush *Schoenus nigricans* Assemblage of wetland bryophytes, including *Campylium stellatum, Climacium dendroides, Mnium seligeri, Palustriella commutata Philonotis calcarea, Scorpidium cossonii, Scorpidium (Drepanocladus) revolvens, Scorpidium scorpioides Tetraphis pellucida.* Assemblage of wetland invertebrates including Orange-horned green general *Odontomyia angulate,* Clubbed	Some plant or animal species (or related groups of such species) make a particularly important contribution to the structure, function and/or quality of an Annex I habitat feature at a particular site. These species will include; – **Structural species** which form a key part of the habitat's structure or help to define an Annex I habitat on a site (see also the attribute for 'vegetation community composition'). – **Influential species** which are likely to have a key role affecting the structure and function of the habitat (such as bioturbators (mixers of soil/sediment), grazers, surface borers, predators or other species with a significant functional role linked to the habitat). – **Site-distinctive species** which are considered to be a particularly special and distinguishing component of an Annex I habitat on a particular site. – There may be natural fluctuations in the frequency and cover of each of these species. The relative contribution made by them to the overall ecological integrity of a site may vary, and Natural England will provide bespoke advice on this as necessary. The list of species given here for this Annex I habitat feature at this SAC is not necessarily exhaustive. The list may evolve, and species may be added or deleted, as new information about this site becomes available.	*Fritillary* 3: 47-54.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		general *Stratiomys chamaeleon* Small red damselfly *Ceriagrion tenellum,* Azure damselfly *Coenagrion puella,* Variable damselfly *Coenagrion pulchellum,* Southern damselfly *Coenagrion mercurial,* Whirlygig beetle *Gyrinus suffriani* Desmoulin's whorl snail *Vertigo moulinsiana*		
Structure and function (including its typical species)	Hydrology	At a site, unit and/or catchment level (as necessary), maintain natural hydrological processes to provide the conditions necessary to sustain the H7230 feature within the site, including a high piezometric head and permanently high water table with groundwater at or very near surface level (allowing for natural seasonal fluctuations).	Defining and maintaining the appropriate hydrological regime is critical to achieving the conservation objectives for this site and sustaining this feature. Changes in the source, depth, duration, frequency, magnitude and timing of water supply to the SAC can have significant implications for the assemblage of characteristic plants and animals present. The site has been the subject of hydrological monitoring studies and it is known that water levels in the fen are remarkably stable. The extent of the groundwater catchment has been defined by the Environment Agency, which is effectively the zone around the site where there is the potential for impacts on water supply and quality.	ENVIRONMENT AGENCY 2001 Habitats Directive Stage 2 Report Cothill Fen candidate SAC. Water Resources Thames Region MORRIS P 1988. The Hydrology of Cothill Fen SSSI. Nature Conservancy Council. MORRIS P 2002. The Hydrology and Plant Communities of Cothill Fen SSSI. *Fritillary* 3, 20-36. HILLS QUARRY PRODUCTS LTD Upwood Park Besselsleigh Environmental statement Non-technical

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
				summary
Structure and function (including its typical species)	Water chemistry	Maintain the low nutrient status of irrigating water, ensuring it is rich in base ions, particularly calcium.	The H7230 feature is a type of wetland which critically depends on specific groundwater flows and chemistries. This feature is typically found in permanently saturated, base-poor, oligotrophic conditions where there is flowing, rather than standing, water. There should be no indications of localised nutrient enrichment or pollution which might be attributed to water quality. This includes the presence of algal blooms in watercourses. However, obvious pollution of the surface streams may not necessarily indicate deteriorating water quality in the supplies feeding the flushes and mires on the valley sides so care is needed when assessing this attribute.	
	Adaptation and resilience	Maintain the H7230 feature's ability, and that of its supporting processes, to adapt or evolve to wider environmental change, either within or external to the site	This recognises the increasing likelihood of natural habitat features having to absorb or adapt to wider environmental changes. Resilience may be described as the ability of an ecological system to cope with and adapt to environmental stress and change whilst retaining the same basic structure and ways of functioning. Such environmental changes may include changes in precipitation and temperature for example, which are likely to affect the extent, distribution, composition and functioning of a feature within a site. The vulnerability and response of features to such changes will vary. Using best available information, any necessary or likely adaptation or adjustment by the feature and its management in response to actual or expected climatic change should be allowed for, as far as practicable, in order to ensure the feature's long-term viability. The vulnerability of the habitats of this particular SAC to climate change has been assessed by Natural England as being *high*. This means that action to address specific issues is likely, such as reducing habitat fragmentation, creating more habitat to buffer the site or expand the habitat into more varied landscapes and addressing particular management and condition issues. Individual species may be more or less vulnerable than their habitat itself. In many cases, change will be inevitable so appropriate monitoring would be required.	NATURAL ENGLAND, 2015. Climate Change Theme Plan and supporting NBCCV Assessment results for SACs and SPAs [both available at http://publications.naturalengland.org.uk/publication/4954594591375360].
	Functional connectivity with wider landscape	Maintain the overall extent, quality and function of any supporting features within the	This recognises the potential need to maintain or restore the connectivity of the site to its wider landscape in order to meet the conservation objectives.	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		local landscape which provide a critical functional connection with the SAC	These connections may take the form of landscape features, such as habitat patches, hedges, watercourses and verges, outside of the designated site boundary which are either important for the migration, dispersal and genetic exchange of those typical species closely associated with qualifying Annex I habitat features of the site. These supporting features may also be important to the operation of the supporting ecological processes on which the designated site and its features may rely. Where opportunities arise to increase actual and functional landscape-scale connectivity this is likely to be beneficial. Where there is a lack of detailed knowledge of the connectivity requirements of the qualifying feature, Natural England will advise as to whether these are applicable on a case by case basis.	
Supporting processes (on which the feature relies)	Air quality	Maintain as necessary, the concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System (www.apis.ac.uk.	This habitat type is considered sensitive to changes in air quality. Exceedance of critical values for air pollutants may modify the chemical status of its substrate, accelerating or damaging plant growth, altering its vegetation structure and composition and causing the loss of sensitive typical species associated with it. Critical Loads and Levels are recognised thresholds below which such harmful effects on sensitive UK habitats will not occur to a significant level, according to current levels of scientific understanding. There are critical levels for ammonia (NH3), oxides of nitrogen (NOx) and sulphur dioxide (SO2), and critical loads for nutrient nitrogen deposition and acid deposition. There are currently no critical loads or levels for other pollutants such as Halogens, Heavy Metals, POPs, VOCs or Dusts. These should be considered as appropriate on a case-by-case basis. Ground level ozone is regionally important as a toxic air pollutant but flux-based critical levels for the protection of semi-natural habitats are still under development. It is recognised that achieving this target may be subject to the development, availability and effectiveness of abatement technology and measures to tackle diffuse air pollution, within realistic timescales.	More information about site-relevant Critical Loads and Levels for this SAC is available by using the 'search by site' tool on the Air Pollution Information System (www.apis.ac.uk).
	Conservation measures	Maintain the management measures (either within and/or outside the site boundary as appropriate) which are necessary to maintain the	Active and ongoing conservation management is needed to protect, maintain or restore this feature at this site. Light grazing is particularly associated with maintaining this feature. Further details about the necessary conservation measures for this site can	NATURAL ENGLAND, 2014. Cothill NNR Management Plan. NATURAL

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		structure, functions and supporting processes associated with the H7230 feature	be provided by contacting Natural England. This information will typically be found within supporting documents such as Natura 2000 Site Improvement Plan, NNR Management Plan, the Views about Management Statement for the underpinning SSSI and/or management agreements.	ENGLAND, 2014. Cothill Fen SAC Site Improvement Plan (SIP047). Available: http://publications.naturalengland.org.uk/publication/6482436405854208 ENGLISH NATURE, 2005. Views about the Management of the Cothill Fen SSSI. Available at http://www.sssi.naturalengland.org.uk/Special/sssi/search.cfm
Version Control Advice last updated: not applicable				
Variations from national feature-framework of integrity-guidance: not applicable				

Table 2: Supplementary Advice for Qualifying Features: H91E0 Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae)* ('alder woodland on floodplains')

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Extent and distribution of the feature	Extent of the feature within the site	Maintain the total extent of the H91E0 feature, including transitions to other habitats, at 33.5 hectares	There should be no measurable net reduction (excluding any trivial loss) in the extent and area of this feature, and in some cases, the full extent of the feature may need to be restored. The baseline-value of extent given has been estimated using aerial photographs and knowledge of the site. This value may be updated in future to reflect more accurate information. The extent of an Annex I habitat feature covers the sum extent of all of the component vegetation communities present and includes transitions and mosaics with other closely-associated habitat features. Where a feature is susceptible to natural dynamic processes, there will be acceptable variations in its extent through natural fluctuations. Where a reduction in the extent of a feature is considered necessary to meet the Conservation Objective for another Annex I feature, Natural England will advise on this on a case-by-case basis	
	Spatial distribution of the feature within the site	Maintain the distribution and configuration of the H91E0 feature, including where applicable its component vegetation types, across the site.	A contraction in the range, or geographic spread, of the feature (and its component vegetation and typical species, plus transitional communities) across the site will reduce its overall area, the local diversity and variations in its structure and composition and may undermine its resilience to adapt to future environmental changes. This may also reduce and break up the continuity of a habitat within a site and how well its typical species are able to move around the site to occupy and use habitat. Such fragmentation can impact on their viability and the wider ecological composition of the Annex I habitat. Smaller fragments of habitat can typically support smaller and more isolated populations which are more vulnerable to extinction. These fragments also have a greater amount of open edge habitat which will differ in the amount of light, temperature, wind, and even noise that it receives compared to its interior. These conditions may not be suitable for some of the typical and more specialist species associated with the Annex I habitat feature.	
Structure and function	Vegetation structure -	Maintain an appropriate tree canopy cover across the H91E0	Canopy cover is the overall proportion of vegetative cover consisting of any woody layer ranging from established regeneration to mature and veteran	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
(including its typical species)	canopy cover	feature, which will typically be between 80-95% of the stand area.	stages. Woodland canopy density and structure is important because it affects ecosystem function and in particular microclimate, litter-fall, soil moisture, nutrient turnover and shading; this in turn influences the composition of plants and animals in lower vegetation layers and soil. In general, the woodland canopy of this feature should provide a core of woodland interior conditions with some open and edge habitat as well. Wet woodland typically has a predominantly closed canopy with only occasional gaps created by the collapse of the larger trees. It is not usually desirable to seek to intervene to create more open space through management because of the sensitivity of the peat surface to ground damage.	
Structure and function (including its typical species)	Vegetation structure - dead wood	Maintain the continuity and abundance of standing or fallen dead and decaying wood as part of the H91E0 feature.	Woodland structure includes variations in age, tree form, layering, the distribution and abundance of open space and dead wood. It plays a critical role in woodland ecosystem functioning. Dead and actively decaying wood, either as part of a standing tree or as a fallen tree on the woodland floor, is an important component of woodland ecosystems, and may support a range of specialist invertebrates, fungi, lichens and bryophytes, and associated hole-nesting birds and roosting bats, all of which may be very typical of the feature.	
	Vegetation structure - woodland edge	Maintain a graduated woodland edge into open fen or scrub.	Woodland edge is defined as being the transitional zone between the alluvial forest feature and adjacent but different habitat types - the best woodland edges will have a varied structure in terms of height and cover. Many of the component species of the wetland invertebrate assemblage depend upon this transitional zone for feeding, basking, resting and over-wintering	
	Regeneration potential	Maintain the potential for sufficient natural regeneration of desirable trees and shrubs; typically tree seedlings of desirable species (measured by seedlings and <1.3m saplings - above grazing and browsing height) should be visible in sufficient numbers in gaps, at the wood edge and/or as regrowth as appropriate.	The regeneration potential of the woodland feature must be maintained if the woodland is to be sustained and survive in the long-term, both in terms of the quantity of regeneration and in terms of the recruitment of appropriate species. This will include the regeneration of the trees and shrubs from saplings or suckers and regrowth from coppice stools. Browsing and grazing levels must not be at levels which prevent this and the long-term maintenance of woodland canopy cover.	
Structure and	Adaptation and	Maintain a canopy and under-	Native trees and shrubs in general support a greater diversity of associated	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
function (including its typical species)	Resilience / Tree and shrub species composition	storey of which 95% is composed of site native trees and shrubs characteristic of the woodland community types	species than non-native species, especially amongst groups of invertebrates which depend directly on trees for food and shelter. There are many plants and animals which use or co-exist with non-native trees, but many rare and threatened woodland species are specialists adapted to one or a few native trees or shrub species (birches, willows and oaks, are examples of trees that host many specialist insect species). The wet woodland present is of three main community types: ash-alder woodland (NVC type W8), alder – tussock sedge woodland (NVC type W5) and willow/birch bog woodland (NVC type W2).	
Structure and function (including its typical species)	Key structural, influential and distinctive species	Maintain the abundance of the species listed below to enable each of them to be a viable component of the H91E0 habitat: Higher plants; alder *Alnus glutinosa,* ash *Fraxinus excelsior* downy birch *Betula pubescens* willows *Salix* spp., sedges *Carex* spp*.,* narrow buckler-fern *Dryopteris carthusiana,* broad buckler-fern *Dryopteris dilatata,* hemp agrimony *Eupatorium cannabinum,* marsh marigold *Caltha palustris* Assemblage of wet woodland bryophytes including *Fissidens adianthoides,Mnium affine, Mnium hornum, Polytrichum commune, Sphagnum fimbriatum* Assemblage of wet woodland invertebrates, including ground beetle *Badister sodalist,* Cone-horn cranefly *Ctenophora pectinicornis,* Cranefly *Diogma glabrata,* Cranefly *Thaumastoptera calceata,* Killer	See supporting notes for this attribute in table 1 above.	NATURAL ENGLAND. Cothill Fen National Nature Reserve Management Plan 2009-2014. PORTER K 2002. Fens of Oxfordshire: their importance for invertebrates. *Fritillary* 3: 47-54.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		fly *Laphria marginata,* Fly *Neurigona suturalis,* Wood snipe-fly *Rhagio annulatus,* Hoverfly *Xylota tarda*		
Structure and function (including its typical species)	Invasive, non-native and/or introduced species	Ensure invasive and introduced non-native species are either rare or absent, but if present are causing minimal damage to the H91E0 feature	Invasive or introduced non-native species are a serious potential threat to the biodiversity of native and ancient woods, because they are able to exclude, damage or suppress the growth of native tree, shrub and ground species (and their associated typical species), reduce structural diversity and prevent the natural regeneration of characteristic site-native species. Once established, the measures to control such species may also impact negatively on the features of interest (e.g. use of broad spectrum pesticides). Such species can include Rhododendron, snowberry, Japanese knotweed and Himalayan balsam, for example. Similarly, this would include pheasants and non-native invertebrate 'pest' species.	
	Soils, substrate and nutrient cycling	Maintain the properties of the underlying soil types, including structure, bulk density, total carbon, pH, soil nutrient status and fungal:bacterial ratio, to within typical values for the H91E0 habitat.	Soil is the foundation of basic ecosystem function and a vital part of the natural environment. Its properties strongly influence the colonisation, growth and distribution of those plant species which together form vegetation types, and therefore provides a habitat used by a wide range of organisms. Soil biodiversity has a vital role to recycle organic matter. Changes to natural soil properties may therefore affect the ecological structure, function and processes associated with this Annex I feature.	
Supporting processes (on which the feature relies)	Water quality/quantity	Maintain water quality and quantity to a standard which provides the necessary conditions to support the H91E0 feature.	For many SAC features which are dependent on wetland habitats supported by surface and/or ground water, such as the H91E0 habitat, maintaining the quality and quantity of water supply will be critical. Poor water quality and inadequate quantities of water can adversely affect the structure and function of this habitat type. Typically, meeting the surface water and groundwater environmental standards set out by the Water Framework Directive (WFD 2000/60/EC) will also be sufficient to support the achievement of SAC Conservation Objectives but in some cases more stringent standards may be needed. Further site-specific investigations may be required to establish appropriate water quality standards for the SAC.	
	Hydrology	At a site, unit and/or catchment level (as necessary), maintain natural hydrological processes to	Defining and maintaining the appropriate hydrological regime is a key step in moving towards achieving the conservation objectives for this site and sustaining this feature. Changes in source, depth, duration, frequency,	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		provide the conditions necessary to sustain the H91E0 feature.	magnitude and timing of water supply can have significant implications for the assemblage of characteristic plants and animals present. Critical aspects are that water levels should be at or very close to surface level at all times (subject to natural variation), water chemistry should remain unaltered, and flow rates maintained.	
Supporting processes (on which the feature relies)	Functional connectivity with wider landscape	Maintain the overall extent, quality and function of any supporting features within the local landscape which provide a critical functional connection with the site	This recognises the potential need to maintain or restore the connectivity of the site to its wider landscape in order to meet the conservation objectives. These connections may take the form of landscape features, such as habitat patches, hedges, watercourses and verges, including those outside of the designated site boundary which are important for the migration, dispersal and genetic exchange of those typical species closely associated with qualifying Annex I habitat features of the site. These supporting features may also be important to the operation of the supporting ecological processes on which the designated site and its features may rely. Where opportunities arise to increase actual and functional landscape-scale connectivity it is likely that this would be beneficial. Where there is a lack of detailed knowledge of the connectivity requirements of the qualifying feature, Natural England will advise as to whether these are applicable on a case by case basis.	
Version Control Advice last updated: not applicable				
Variations from national feature-framework of integrity-guidance: Generic attributes not considered relevant to this site are: Vegetation Structure (Open space); Water Quality and Quantity – same as Hydrology for all intents and purposes therefore deleted; Browsing and grazing by herbivores; Adaptation and Resilience (merged with Tree and Shrub species composition); Vegetation community composition merged with Key species: Illumination				