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

Norfolk Valley Fens Special Area of Conservation (SAC)
Site Code: UK0012892

Natural England

Date of Publication: 8 February 2019

About this document

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

A number of the component parts of this SAC are adjacent to Breckland SAC (Conservation Objectives and Supplementary Advice available here) and Breckland SPA (Conservation Objectives and Supplementary Advice 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 presents attributes which are ecological characteristics of the designated species and habitats within a site. The listed attributes are considered to be those that best describe the site's ecological integrity and which, if safeguarded, will enable achievement of the Conservation Objectives. Each attribute has a target which is either quantified or qualitative depending on the available evidence. The target identifies as far as possible the desired state to be achieved for the attribute.

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	Norfolk Valley Fens Special Area of Conservation (SAC)
Location	Norfolk
Site Map	The designated boundary of this site can be viewed here on the MAGIC website
Designation Date	1 April 2005
Qualifying Features	See section below
Designation Area	*616.21*
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)	*Badley Moor SSSI Booton Common SSSI Buxton Heath SSSI Coston Fen, Runhall SSSI East Walton and Adcock's Common SSSI Flordon Common SSSI Foulden Common SSSI Great Cressingham Fen SSSI Holt Lowes SSSI Potter & Scarning Fens, East Dereham SSSI Sheringham and Beeston Regis Commons SSSI Southrepps Common SSSI Swangey Fen, Attleborough SSSI Thompson Water, Carr and Common SSSI*
Relationship with other European or International Site designations	At Thompson Water, Carr and Common SSSI, the Norfolk Valley Fens SAC adjoins the Breckland SAC At Thompson Water, Carr and Common SSSI, Foulden Common SSSI and Great Cressingham Fen SSSI the Norfolk Valley Fens SAC adjoins the Breckland SPA

Site background and geography

This SAC comprises a series of 14 valley-head spring-fed fens scattered across 200km2 of central and north Norfolk; and falling within a number of National Character Areas (NCA) including Mid Norfolk NCA, North West Norfolk NCA, The Brecks NCA, South Norfolk & High Suffolk Claylands NCA; and Central North Norfolk NCA.

Such spring-fed flush fens are very rare in the lowlands. The spring-heads are dominated by the small sedge fen type, mainly referable to black-bog-rush – blunt-flowered rush (*Schoenus nigricans – Juncus subnodulosus*) mire, but there are transitions to reedswamp and other fen and wet grassland types. The individual fens vary in their structure according to intensity of management and provide a wide range of variation. There is a rich flora associated with these fens, including species such as grass-of-Parnassus *Parnassia palustris*, common butterwort *Pinguicula vulgaris*, marsh helleborine *Epipactis palustris* and narrow-leaved marsh-orchid *Dactylorhiza traunsteineri*.

In places the calcareous fens grade into acidic flush communities on the valley sides. Purple moor-grass *Molinia caerulea* is often dominant with a variety of mosses including thick carpets of bog-moss *Sphagnum spp*. Marshy grassland may be present on drier ground and purple moor-grass is again usually dominant but cross-leaved heath *Erica tetralix* can be frequent. Alder *Alnus glutinosa* forms carr

woodland in places by streams. Wet and dry heaths and acid, neutral and calcareous grassland surround the mires.

Within the Norfolk Valley Fens there are a number of marginal fens associated with pingos – pools that formed in hollows left when large blocks of ice melted at the end of the last Ice Age. These are very ancient wetlands and several support strong populations of Desmoulin's whorl snail *Vertigo moulinsiana* as part of a rich assemblage of rare and scarce species in standing water habitat. At Flordon Common a strong population of narrow-mouthed whorl snail *Vertigo angustior* occurs in flushed grassland with yellow iris *Iris pseudacorus*.

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:

The site is designated under article 4(4) of the Directive (92/43/EEC) as it hosts the following habitats listed in Annex I:

- H7230. Alkaline fens. (Calcium-rich springwater-fed fens)
- H91E0. Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*). (Alder woodland on floodplains)*
- H7210. Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae*.(Calcium-rich fen dominated by great fen sedge (saw sedge))*
- H4030. European dry heaths
- H6410. *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinia caeruleae*). (Purple moor-grass meadows).
- H4010. Northern Atlantic wet heaths with *Erica tetralix*. (Wet heathland with cross-leaved heath)
- H6210. Semi-natural dry grasslands and scrubland facies: on calcareous substrates (*Festuco-Brometalia*). (Dry grasslands and scrublands on chalk or limestone)

Annex I priority habitats are denoted by an asterisk (*).

Qualifying Species:

The site is designated under article 4(4) of the Directive (92/43/EEC) as it hosts the following species listed in Annex II:

- **S1014. Narrow-mouthed whorl snail *Vertigo angustior***

The tiny narrow-mouthed whorl snail *Vertigo angustior* is found primarily in marshy ground of high, even humidity, with flowing groundwater, but subject neither to deep or prolonged flooding nor to periodic desiccation. It requires unshaded conditions and lives amongst short vegetation, composed of grasses, mosses or low herbs that is quickly warmed by the sun. The vegetation may be grazed. In the British Isles it has been found in wet base-rich meadows, in coastal marshes, dune slacks and maritime turf, and in depressions within limestone pavement; several of these habitats are listed on Annex I of the Habitats Directive. In the UK the largest known population is found where freshwater seeps onto the upper edges of a saltmarsh in south Wales. However, elsewhere in Europe calcareous fen is the species' most typical habitat. Because of its specific microhabitat requirements, the species is often restricted to a narrow zone around wetlands, only a few metres wide.

Norfolk Valley Fens represents narrow-mouthed whorl snail *Vertigo angustior* in East Anglia. At Flordon Common a strong population occurs in flushed grassland with yellow iris *Iris pseudacorus* maintained by light grazing.

- **S1016. Desmoulin's whorl snail *Vertigo moulinsiana***

Desmoulin's whorl snail *Vertigo moulinsiana* is the largest *Vertigo* species, with a shell height up to about 2.6 mm. It is restricted to calcareous wetlands, usually bordering lakes or rivers, or in fens. High humidity appears to be important in determining local distribution within sites. It normally lives on reed-grasses and sedges, such as reed sweet-grass *Glyceria maxima* and tussocks of greater pond-sedge *Carex riparia* and lesser pond-sedge *C. acutiformis*, where it feeds on the microflora, and in autumn it may ascend taller reeds and scrub. Like all Annex II *Vertigo* species, it is highly dependent on maintenance of existing local hydrological conditions.

Norfolk Valley Fens is one of several sites representing Desmoulin's whorl snail *Vertigo moulinsiana* in East Anglia. Within Norfolk Valley Fens there are a number of marginal fens around pingos – pools that

formed in hollows left when large blocks of ice melted at the end of the last Ice Age. These are very ancient wetlands and several support strong populations of *V. moulinsiana* as part of a rich assemblage of Red Data Book and Nationally Scarce species in standing water habitat.

Table A: Distribution of features:

	H7230 Alkaline Fens	H91E0 Alluvial forests with Alder and Ash	H7210 Calcareous fens with Cladium	H4030 European Dry Heaths	H6410 Molinia meadows	H4010 Northern Atlantic wet heaths	H6210 Semi-natural dry grasslands on calcareous substrates	S1014 Narrow-mouthed whorl snail *Vertigo angustior*	S1016 Desmoulin's Whorl snail *Vertigo moulinsiana*
Badley Moor SSSI	■				■				
Booton Common SSSI	■	■	■		■				
Buxton Heath SSSI	■			■	■	■			
Coston Fen, Runhall SSSI	■								
East Walton and Adcock's Common SSSI	■	■	■				■		■
Flordon Common SSSI	■	■			■			■	
Foulden Common SSSI	■	■	■				■		
Great Cressingham Fen SSSI	■		■						
Holt Lowes SSSI	■			■	■	■			
Potter & Scarning Fens, East Dereham SSSI	■								
Sheringham and Beeston Regis Commons SSSI	■								
Southrepps Common SSSI	■								
Swangey Fen, Attleborough SSSI	■								
Thompson Water, Carr and Common SSSI	■	■	■				■		■

Table 1: Supplementary Advice for Qualifying Features: H4010. Northern Atlantic wet heaths with *Erica tetralix*; Wet heathland with cross-leaved heath

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**	Restore the total extent of the feature to 6.78 has	There should be no measurable 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 from the listed site-based surveys. Area measurements given may be approximate depending on the methods, age and accuracy of data collection, and as a result 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 may include 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.	https://eunis.eea.europa.eu/sites/UK0012892 This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments
Extent and distribution of the feature	**Spatial distribution of the feature within the site**	Maintain the distribution and configuration of the 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. Across the 14 component SSSIs of the SAC, this feature is reported as occurring at Buxton Heath SSSI and Holt Lowes, SSSI.	Shaw, S. & Tratt, R. (2015) Shaw, S. & Tratt, R. (2016a): Shaw, S. & Tratt, R. (2016b):

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Structure and function	**Vegetation community transitions**	Maintain any areas of transition between this and communities which form other heathland-associated habitats, such as dry and humid heaths, mires, acid grasslands, scrub and woodland.	Transitions/zonations between adjacent but different vegetation communities are usually related to naturally-occurring changes in soil, aspect or slope. Such 'ecotones' retain characteristics of each bordering community and can add value in often containing species not found in the adjacent communities. Retaining such transitions can provide further diversity to the habitat feature, and support additional flora and fauna. This is an important attribute as many characteristic heathland species utilise the transitions between vegetation types or use different vegetation types during different stages of their life cycle. On both sites the H4101 North Atlantic wet heath feature is present in a mosaic with other mire habitats and some drier habitats. At Buxton Heath the mire communities are found alongside dry heath and woodland as well as a mosaic with M22a, M13b/M24b and M24b communities.	Shaw, S. & Tratt, R. (2015)
Structure and function (including its typical species)	**Adaptation and resilience**	Maintain the 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 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 sea levels, 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. The overall vulnerability of this SAC to climate change has been assessed by Natural England (2015) as being high, taking into account the sensitivity, fragmentation, topography and management of its supporting habitats. This means that this site is considered to be the most vulnerable sites overall and are likely to require the most adaptation action, most urgently. A site based assessment should be carried out as a priority. 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,	NATURAL ENGLAND, 2015. Climate Change Theme Plan and supporting National Biodiversity Climate Change Vulnerability assessments ('NBCCVAs') for SACs and SPAs in England Shaw, S. & Tratt, R. (2015)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			change will be inevitable so appropriate monitoring would be advisable.	
Structure and function (including its typical species)	**Functional connectivity with wider landscape**	Restore 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 at this site 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, 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 features may also be important to the operation of the supporting ecological processes on which the designated site and its features may rely. In most cases increasing actual and functional landscape-scale connectivity 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.	Shaw, S. & Tratt, R. (2015)
Structure and function (including its typical species)	**Key structural, influential and/or distinctive species**	Maintain the abundance of the typical species listed below to enable each of them to be a viable component of the Annex 1 habitat; • Constant and preferential plant species of the M16 *Erica tetralix – Sphagnum compactum* wet heath and M14 - *Schoenus nigricans - Narthecium ossifragum* mire vegetation types at this SAC • Silver-studded Blue butterfly *Plebejus argus*	Some plant or animal species (or related groups of such species) make a particularly important contribution to the necessary 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 Annex I habitat's structure or help to define that habitat on a particular SAC (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 SAC. 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	This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			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. Populations of silver-studded blue butterfly are present at Buxton Heath SSSI.	
Structure and function (including its typical species)	**Vegetation community composition**	Ensure the component vegetation communities of the feature are referable to and characterised by the following National Vegetation Classification type: • M16 *Erica tetralix – Sphagnum compactum* wet heath • M14 - *Schoenus nigricans - Narthecium ossifragum* 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 will also help to conserve their typical plant species (i.e. the constant and preferential species of a community), and therefore that of the SAC feature, at appropriate levels (recognising natural fluctuations).	Shaw, S. & Tratt, R. (2015) Shaw, S. & Tratt, R. (2016a) Shaw, S. & Tratt, R. (2016b) This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments
Structure and function (including its typical species)	**Vegetation composition: bracken cover**	Maintain a cover of dense bracken which is low, typically at <5%	The spread of bracken *Pteridium aquilinum* is a problem on many lowland heathlands. The unpalatable nature and density of bracken as a tall-herb fern, and its decomposing litter, can smother and shade out smaller and more characteristic heathland vegetation. Usually active management of bracken is required to reduce or contain its cover across this habitat feature. But this fern has also some nature conservation value, for example on sites where fritillary butterflies occur and utilise bracken litter habitat. Grazing cattle at Holt Lowes were replaced with Dartmoor ponies in 2011 in order to help control invasive scrub and bracken, but also to create a varied structure in the vegetation (J. Milton, NWT, *pers. comm*.). The ponies are removed from the site in winter.	Shaw, S. & Tratt, R. (2015) This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments
Structure and function (including	**Vegetation structure: cover of**	Maintain an overall cover of dwarf shrub species which is typically between 25-90%	Variations in the structure of the heathland vegetation (vegetation height, amount of canopy closure, and patch structure) is needed to maintain high niche diversity and hence high species richness of	This attribute will be periodically monitored as part of Natural England's SSSI Condition

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
its typical species)	**dwarf shrubs**		characteristic heathland plants and animals. Many species also utilise the transitions between vegetation types or use different vegetation types during different stages of their life cycle. The structural character of the heathland feature is strongly influenced by the growing habits of its dominant species which in most cases will be ericoids (i.e. plants that look like heathers, including members of the Ericaceae and Empetraceae families). Dwarf-shrubs include: *Calluna vulgaris, Empetrum nigrum, E. cinerea, E. tetralix, Genista anglica, G. pilosa, Ulex gallii, U. minor, Vaccinium myrtillus,*	Assessments
Structure and function (including its typical species)	**Vegetation structure: cover of gorse** **.**	Cover of common gorse is low typically at <10%	Gorse as a component of heathland is a very valuable wildlife habitat, and often a marker of relict heath and common. Both dense and spiny, it provides good, protected cover for many wildlife species: birds, mammals and reptiles; breeding habitat for rare or declining bird species, and excellent winter roosting. The flowers, borne at a time of year when other sources of pollen or nectar are in short supply, are particularly good for insects and other invertebrate pollinators. However gorse may cause problems if unchecked by dominating an area, eliminating other typical heathland species. Mature stands en masse may also be serious fire hazards. Both sites have history of neglected management for gorse and scrub but for the past two decades, restoration work has reversed this trend. This has included more regular grazing by ponies and regular removal of scrub including areas of gorse in order to maintain the prescribed percentage cover. Buxton Heath: "Wheeler & Shaw (1992) included a comment based on B. D. Wheeler's field notes that, between 1972 and 1991, this zone of vegetation had been subject to 'impoverishment, invasion by Ulex…" this suggesting that gorse cover was above the desirable level for this feature	Shaw, S. & Tratt, R. (2015) Shaw, S. & Tratt, R. (2016a) Shaw, S. & Tratt, R. (2016b) This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments Norfolk Valley Fens SAC Review of current status, identification of remedies and investigations required. Shaw, S. & Tratt, R. (2015)
Structure and function (including its typical	**Vegetation structure: heather age structure**	Restore a diverse age structure amongst the ericaceous shrubs typically found on the site	Each phase of growth associated with the characteristic heathers which dominate this feature also represents different microclimatic conditions and microhabitats which may provide shelter or food to other organisms. Therefore, it is important to maintain a mosaic of	This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
species)			heather in different phases of growth. Typically this age structure will consist of between 10-40% cover of (pseudo) pioneer heathers; 20-80% cover of building/mature heathers; <30% cover of degenerate heathers and less than <10% cover of dead heathers	
Structure and function (including its typical species)	**Vegetation structure: tree cover**	Maintain the open character of the feature, with a typically scattered and low cover of trees and scrub <20% cover	Scrub (mainly trees or tree saplings above 1 m in height) and isolated trees are usually very important in providing warmth, shelter, cover, foodplants, perches, territorial markers and sources of prey for typical heathland invertebrates and vertebrates. But overall cover of scrub and trees across this habitat feature should be maintained or restored to a fairly sparse level, with a structurally complex edge and with characteristic heathland vegetation as ground cover. If scrub is locally important for any associated species with their own specific conservation objectives, then a higher level of cover will be acceptable. The area of scrub/tree cover should be stable or not increasing as a whole. For both sites, as described above in relation to gorse cover, there is evidence that regular grazing is controlling the precession of birch *Betula pendula.* Also evident is that periodic removal by hand or by mechanical means is taking place in order to maintain this feature at a favourable level.	Shaw, S. & Tratt, R. (2015) Shaw, S. & Tratt, R. (2016a) Shaw, S. & Tratt, R. (2016b) This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments
Structure and function (including its typical species)	**Vegetation: undesirable species**	Maintain and where necessary restore the frequency/cover of the following undesirable species to within acceptable levels and prevent changes in surface condition, soils, nutrient levels or hydrology which may encourage their spread;	Undesirable non-woody and woody vascular plants species may require active management to avert an unwanted succession to a different and less desirable state. Often they may be indicative of a negative trend relating to another aspect of a site's structure and function. These species will vary depending on the nature of the particular feature, and in some cases these species may be natural/acceptable components or even dominants. Undesirable species include: *Rhododendron ponticum, Gaultheria shallon, Apium nodiflorum, Cirsium arvense, Digitalis purpurea, Epilobium spp. (excl. E. palustre), Glyceria fluitans, Juncus effusus, J. squarrosus, Oenanthe crocata, Phragmites spp., Ranunculus repens, Fallopia japonica, Senecio jacobaea, Rumex obtusifolius, Typha spp., Urtica spp. Alnus glutinosa, Betula spp., Prunus spinosa, Pinus spp., Rubus spp., Quercus spp.*	Shaw, S. & Tratt, R. (2015) This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments
Supporting	**Air quality**	Restore as necessary, the	This habitat type is considered sensitive to changes in air quality.	More information about site-

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
processes (on which the feature relies)		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).	Exceedance of these 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. The Site Improvement Plan for the NVF SAC (Natural England, 2014) notes that nitrogen deposition exceeds site relevant nitrogen critical loads, but does not identify any specific component SSSIs as being particularly affected.	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). Shaw, S. & Tratt, R. (2015) Natural England (2014): Site Improvement Plan – Norfolk Valley Fens SAC (SIP Profile: 150)
Supporting processes (on which the feature relies)	**Conservation measures**	Maintain the management measures (either within and/or outside the site boundary as appropriate) which are necessary to restore the structure, functions and supporting processes associated with the feature	Active and ongoing conservation management is needed to protect, maintain or restore this feature at this site. Further details about the necessary conservation measures for this site can be provided by contacting Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, Site Management Strategies or Plans, the Views about Management Statement for the underpinning SSSI and/or management agreements. In recent decades scrub and woodland has spread due to the cessation of traditional cutting and grazing management and the drying-out of the fens. These sites are now largely isolated from the rural/agricultural economy of which they were once a part, and in many	Shaw, S. & Tratt, R. (2015) Shaw, S. & Tratt, R. (2016a) Shaw, S. & Tratt, R. (2016b) JNCC data form

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			instances this traditional management has become uneconomic. Since 2010 an extensive grazing management regime using Dartmoor ponies and cattle has been implemented to control invasive scrub and bracken and to create a varied structure in the vegetation It is considered unlikely that grazing along will control tree seedling growth; but sensitive ground conditions restrict the use of machinery to control regrowth.	
Supporting processes (on which the feature relies)	**Hydrology**	At a site, unit and/or catchment level (as necessary, restore the natural hydrological regime to provide the conditions necessary to sustain the feature within the site.	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, magnitude and timing of water supply can have significant implications for the assemblage of characteristic plants and animals present. This target is generic and further site-specific investigations may be required to fully inform conservation measures and/or the likelihood of impacts. A hydrological monitoring programme in East Anglia was started by the Environment Agency in the 1990s. Further installations were added from 2003 to *c.* 2007 under the Environment Agency Groundwater Level Monitoring Network programme. A review undertaken between 2009 and 2011 resulted in the abandonment of recording at some of the dipwells where vegetation monitoring plots (see above) have been installed. There are monitoring installations at most of the component SSSI's of the Norfolk Valley Fen SAC. Holt Lowes does not have installations. Dehydration of fens in East Anglia has long been a cause for concern, and has prompted various studies and investigations. In 1992, Wheeler and Shaw undertook a study of biological indicators of the dehydration and changes to East Anglian fens, which included all of the NVF sites. The main conclusion was that although many of the sites had shown a floristic change, it was difficult to separate the effects of dehydration and dereliction, but that for many sites dehydration had been or threatened to be a major threat to their botanical value.	Shaw, S. & Tratt, R. (2015) Hydrological monitoring may be available from **data.info@environment-agency.gov.uk** Norfolk Valley Fens SAC Review of current status, identification of remedies and investigations required. Shaw, S. & Tratt, R. (2015)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Supporting processes (on which the feature relies)	**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 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. This Annex 1 habitat has essentially raw soils with little humus and low nutrient status. Only a few sites have been identified as showing evidence of nutrient enrichment, and one site (Holt Lowes) was identified as at risk from sediment erosion into mire from adjoining heathland. Peat soils within the Norfolk Valley Fens SAC are considered vulnerable to trampling, These habitats are sensitive to visitor pressure and increased visitor numbers may be detrimental to the peat substrates.	Shaw, S. & Tratt, R. (2015) Shaw, S. & Tratt, R. (2016a) Shaw, S. & Tratt, R. (2016b)
Supporting processes (on which the feature relies)	**Water quality**	Where the feature is dependent on surface water and/or groundwater, restore water quality and quantity to a standard which provides the necessary conditions to support the feature	For many SAC features which are dependent on wetland habitats supported by surface and/or ground water, maintaining the quality and quantity of water supply will be critical, especially at certain times of year. 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	Shaw, S. & Tratt, R. (2015)
Version Control Advice last updated: N/A				
Variations from national feature-framework of integrity-guidance: N/A				

Table 2: Supplementary Advice for Qualifying Features: H4030. European dry heaths

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**	Restore the total extent of the feature 75.83 has	There should be no measurable 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 from the listed site-based surveys. Area measurements given may be approximate depending on the methods, age and accuracy of data collection, and as a result 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 may include 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.	https://eunis.eea.europa.eu/sites/UK0012892 This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments
Extent and distribution of the feature	**Spatial distribution of the feature within the site**	Maintain the distribution and configuration of the 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	Shaw, S. & Tratt, R. (2015) Norfolk Wildlife Trust (2000)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			the typical and more specialist species associated with the Annex I habitat feature. Across the Norfolk Valley Fens SAC, this feature is reported as occurring at Buxton Heath SSSI and Holt Lowes SSSI,	
Structure and function (including its typical species)	**Adaptation and resilience**	Restore the feature's ability, and that of its supporting processes, to adapt or evolve to wider environmental change, either within or external to the site	See relevant general text in table 1	Shaw, S. & Tratt, R. (2015)
Structure and function (including its typical species)	**Functional connectivity with wider landscape.**	Restore 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 at this site 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, 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 features may also be important to the operation of the supporting ecological processes on which the designated site and its features may rely. In most cases increasing actual and functional landscape-scale connectivity 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.	Shaw, S. & Tratt, R. (2015)
Structure and function (including its typical species)	**Vegetation community composition**	Ensure the component vegetation communities of the feature are referable to and characterised by the following National Vegetation Classification type	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	Shaw, S. & Tratt, R. (2015) Norfolk Wildlife Trust (2000) This attribute will be periodically monitored as part of Natural England's SSSI Condition

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		• H8 *Calluna vulgaris – Ulex gallii* heath	vegetation types, and the range of types as appropriate, will be important to sustaining the overall habitat feature. This will also help to conserve their typical plant species (i.e. the constant and preferential species of a community), and therefore that of the SAC feature, at appropriate levels (recognising natural fluctuations). At Buxton Heath SSSI the H8a dry heath community is found extensively throughout the dry areas of the site. Structure varies with past management, from very short in foraged areas, to tall and rank in areas where only extensive grazing has occurred. The proportions of *Ulex gallii, Calluna vulgaris* and *Erica cinerea* vary somewhat, but the first two are nearly always dominant.	Assessments
Structure and function (including its typical species)	**Vegetation community transitions**	Maintain any areas of transition between this and communities which form other heathland-associated habitats, such as dry and humid heaths, mires, acid grasslands, scrub and woodland.	Transitions/zonations between adjacent but different vegetation communities are usually related to naturally-occurring changes in soil, aspect or slope. Such 'ecotones' retain characteristics of each bordering community and can add value in often containing species not found in the adjacent communities. Retaining such transitions can provide further diversity to the habitat feature, and support additional flora and fauna. This is an important attribute as many characteristic heathland species utilise the transitions between vegetation types or use different vegetation types during different stages of their life cycle. Buxton Heath & Holt Lowes: Some of the transition zones on both sites have been changed as a result of scrub clearance and the introduction of grazing, especially since 2010. The dry heath communities form a mosaic consisting of bracken, U1e acid grassland/*Molinia* H8a, gorse and scrub.	Shaw, S. & Tratt, R. (2015) Shaw, S. & Tratt, R. (2016a) Shaw, S. & Tratt, R. (2016b) Norfolk Wildlife Trust (2000) Natural England (2011a) This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments
Structure and function (including its typical species)	**Vegetation composition: bracken cover**	Restore a cover of dense bracken which is low, typically at <5%.	The spread of bracken *Pteridium aquilinum* is a problem on many lowland heathlands. The unpalatable nature and density of bracken as a tall-herb fern, and its decomposing litter, can smother and shade out smaller and more characteristic heathland vegetation. Usually active management of bracken is required to reduce or contain its cover across this habitat feature. But this fern has also some nature conservation value,	Natural England (2011a) Natural England (2011b) This attribute will be periodically monitored as part of Natural England's SSSI Condition

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			for example on sites where fritillary butterflies occur and utilise bracken litter habitat. The extent of bracken is an issue at both sites and will require management in order to reduce its extent. Bracken litter blankets these areas and where bracken is controlled, it will be necessary to remove this in order to expose mineral soils. During the phase after scrub removal, the site will be particularly vulnerable to an expansion of bracken, and this high level of vulnerability will remain until the heather canopy has closed. Bracken must therefore be controlled, either by mechanical or chemical means.	Assessments
Structure and function (including its typical species)	**Key structural, influential and/or distinctive species**	Maintain the abundance of the typical species listed below to enable each of them to be a viable component of the Annex 1 habitat; • Constant and preferential plant species of the H8 *Calluna vulgaris – Ulex gallii* heath vegetation types at this SAC • Silver-studded Blue butterfly *Plebejus argus*	Some plant or animal species (or related groups of such species) make a particularly important contribution to the necessary 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 Annex I habitat's structure or help to define that habitat on a particular SAC (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 SAC. 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,	This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			and species may be added or deleted, as new information about this site becomes available. Populations of silver-studded blue butterfly are present at Buxton Heath SSSI.	
Structure and function (including its typical species)	**Vegetation structure: cover of dwarf shrubs**	Restore an overall cover of dwarf shrub species which is typically between 25-90%.	Variations in the structure of the heathland vegetation (vegetation height, amount of canopy closure, and patch structure) is needed to maintain high niche diversity and hence high species richness of characteristic heathland plants and animals. Many species also utilise the transitions between vegetation types or use different vegetation types during different stages of their life cycle. The structural character of the heathland feature is strongly influenced by the growing habits of its dominant species which in most cases will be ericoids (i.e. plants that look like heathers, including members of the *Ericaceae* and *Empetraceae* families). Dwarf shrub species within the Norfolk Valley Fens SAC include: *Calluna vulgaris, Empetrum nigrum, Erica cinerea, Erica. tetralix, Genista anglica, G. pilosa, Ulex gallii, U. minor, Vaccinium myrtillus*.	Natural England (2011a) Natural England (2011b) This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments
Structure and function (including its typical species)	**Vegetation structure: cover of gorse**	Restore cover of common gorse *Ulex europaeus* at <25% and the combined cover of *U. europaeus* and *U. gallii* at <50%.	Gorse as a component of heathland is a very valuable wildlife habitat, and often a marker of relict heath and common. Both dense and spiny, it provides good, protected cover for many wildlife species: birds, mammals and reptiles; breeding habitat for rare or declining bird species, and excellent winter roosting. The flowers, borne at a time of year when other sources of pollen or nectar are in short supply, are particularly good for insects and other invertebrate pollinators. However gorse may cause problems if unchecked by dominating an area, eliminating other typical heathland species. Mature stands en masse may also be serious fire hazards. The management of *Ulex europaeus* on both sites is an issue and its extent needs to be monitored. It should cover <25% overall of the heathland area. It should be uncommon and restricted to disturbed areas. It will be important to ensure that	Natural England (2011a) Natural England (2011b) This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			a programme of control is in place, particularly during the phase until closure of the heather canopy has occurred.	
Structure and function (including its typical species)	**Vegetation structure: heather age structure**	Restore a diverse age structure amongst the ericacerous shrubs typically found on the site	Each phase of growth associated with the characteristic heathers which dominate this feature also represents different microclimatic conditions and microhabitats which may provide shelter or food to other organisms. Therefore, it is important to maintain a mosaic of heather in different phases of growth. Typically this age structure will consist of between 10-40% cover of (pseudo) pioneer heathers; 20-80% cover of building/mature heathers; <30% cover of degenerate heathers and less than <10% cover of dead heathers	This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments
Structure and function (including its typical species)	**Vegetation structure: tree cover**	Maintain the open character of the feature, with a typically scattered and low cover of trees and scrub (<20% cover) Buxton Heath: Total *Ulex* and/or *Genista* spp. cover <50%, with *Ulex europaeus* <25%. Holt Lowes: Total *Ulex* and/or *Genista* spp. cover <50%, with *Ulex europaeus* <25%.	Scrub (mainly trees or tree saplings above 1 m in height) and isolated trees are usually very important in providing warmth, shelter, cover, foodplants, perches, territorial markers and sources of prey for typical heathland invertebrates and vertebrates. But overall cover of scrub and trees across this habitat feature should be maintained or restored to a fairly sparse level, with a structurally complex edge and with characteristic heathland vegetation as ground cover. If scrub is locally important for any associated species with their own specific conservation objectives, then a higher level of cover will be acceptable. The area of scrub/tree cover should be stable or not increasing as a whole. Within heathland mosaics, there should be no more than 5% scrub on both sites, and no more than rare if scattered. However, there is a balance that needs to be struck as scrub adds diversity to the physical structure of the site and is therefore important in relation to invertebrate assemblages. However, while there open conditions and bare ground remain, the site will be particularly vulnerable to regeneration (particularly of birch), and it will be necessary to ensure that this is controlled, particularly during the period up until the heather canopy closes. Tree and scrub spp include: *Betula* spp., *Prunus spinosa*, *Pinus* spp., *Rubus* spp., *Sarothamnus scoparius, Quercus* spp.,	Natural England (2011a) Natural England (2011b) This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments for Buxton Heath, and Holt Lowes.
Structure and function	**Vegetation: undesirable**	Restore the frequency/cover of the following undesirable	Undesirable non-woody and woody vascular plants species may require active management to avert an unwanted	Natural England (2011a)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
(including its typical species)	**species. *Rhododendron ponticum, Gaultheria shallon, Fallopia japonica.***	species to within acceptable levels and prevent changes in surface condition, soils, nutrient levels or hydrology which may encourage their spread.	succession to a different and less desirable state. Often they may be indicative of a negative trend relating to another aspect of a site's structure and function. These species will vary depending on the nature of the particular feature, and in some cases these species may be natural/acceptable components or even dominants. *Rhododendron* is present at Holt Lowes and should be controlled	Natural England (2011b) This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments
Supporting processes (on which the feature relies)	**Air quality**	Restore 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).	See the explanatory notes for this attribute above in Table 1	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). Shaw, S. & Tratt, R. (2015) Natural England (2014): Site Improvement Plan – Norfolk Valley Fens SAC (SIP Profile: 150)
Supporting processes (on which the feature relies)	**Conservation measures**	Maintain the management measures (either within and/or outside the site boundary as appropriate) which are necessary to maintain the structure, functions and supporting processes associated with the feature	Active and ongoing conservation management is needed to protect, maintain or restore this feature at this site. Further details about the necessary conservation measures for this site can be provided by contacting Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, Site Management Strategies or Plans, the Views about Management Statement for the underpinning SSSI and/or management agreements. In recent decades scrub and woodland has spread due to the cessation of traditional cutting and grazing management and the drying-out of the fens. These sites are now largely isolated from the rural/agricultural economy of which they were once a part, and in many instances this traditional management has become uneconomic.	Shaw, S. & Tratt, R. (2015) Shaw, S. & Tratt, R. (2016a) Shaw, S. & Tratt, R. (2016b)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			Since 2010 an extensive grazing management regime using Dartmoor ponies and cattle has been implemented to control invasive scrub and bracken and to create a varied structure in the vegetation It is considered unlikely that grazing along will control tree seedling growth; but sensitive ground conditions restrict the use of machinery to control regrowth.	
Supporting processes (on which the feature relies)	**Hydrology**	At a site, unit and/or catchment level (as necessary, restore the natural hydrological regime to provide the conditions necessary to sustain the feature within the site.	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, magnitude and timing of water supply can have significant implications for the assemblage of characteristic plants and animals present. This target is generic and further site-specific investigations may be required to fully inform conservation measures and/or the likelihood of impacts. A hydrological monitoring programme in East Anglia was started by the Environment Agency in the 1990s. Further installations were added from 2003 to *c.* 2007 under the Environment Agency Groundwater Level Monitoring Network programme. A review undertaken between 2009 and 2011 resulted in the abandonment of recording at some of the dipwells where vegetation monitoring plots (see above) have been installed. There are monitoring installations at most of the component SSSI's of the Norfolk Valley Fen SAC. Holt Lowes does not have installations. Dehydration of fens in East Anglia has long been a cause for concern, and has prompted various studies and investigations. In 1992, Wheeler and Shaw undertook a study of biological indicators of the dehydration and changes to East Anglian fens, which included all of the NVF sites. The main conclusion was that although many of the sites had shown a floristic change, it was difficult to separate the effects	Shaw, S. & Tratt, R. (2015) Hydrological monitoring may be available from **data.info@environment-agency.gov.uk** Norfolk Valley Fens SAC Review of current status, identification of remedies and investigations required. Shaw, S. & Tratt, R. (2015)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			of dehydration and dereliction, but that for many sites dehydration had been or threatened to be a major threat to their botanical value.	
Supporting processes (on which the feature relies)	**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 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. This Annex 1 habitat has essentially raw soils with little humus and low nutrient status. Only a few sites have been identified as showing evidence of nutrient enrichment, and one site (Holt Lowes) was identified as at risk from sediment erosion into mire from adjoining heathland. Peat soils within the Norfolk Valley Fens SAC are considered vulnerable to trampling, These habitats are sensitive to visitor pressure and increased visitor numbers may be detrimental to the peat substrates.	Shaw, S. & Tratt, R. (2015) Shaw, S. & Tratt, R. (2016a) Shaw, S. & Tratt, R. (2016b)
Supporting processes (on which the feature relies)	**Water quality**	Where the feature is dependent on surface water and/or groundwater, restore water quality and quantity to a standard which provides the necessary conditions to support the feature	For many SAC features which are dependent on wetland habitats supported by surface and/or ground water, maintaining the quality and quantity of water supply will be critical, especially at certain times of year. 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	Shaw, S. & Tratt, R. (2015)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			appropriate water quality standards for the SAC	
Version Control Advice last updated: N/A				
Variations from national feature-framework of integrity-guidance: N/A				

Table 3: Supplementary Advice for Qualifying Features: H6210. Semi-natural dry grasslands and scrubland facies: on calcareous substrates (Festuco-Brometalia); Dry grasslands and scrublands on chalk or limestone

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**	Restore the total extent of the feature to 10.48 ha	There should be no measurable 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 from the listed site-based surveys. Area measurements given may be approximate depending on the methods, age and accuracy of data collection, and as a result 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 may include 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.	https://eunis.eea.europa.eu/sites/UK0012892 This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments
Extent and distribution of the feature	**Spatial distribution of the feature within the site**	Maintain and restore the distribution and configuration of the 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.	Shaw, S. & Tratt, R. (2015) Shaw, S. & Tratt, R. (2016c) Shaw, S. & Tratt, R (2016d) Wild Frontier Ecology (2013)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			This feature is reported as occurring at East Walton and Adcock's Commons SSSI, Foulden Common SSSI and Thompson Common SSSI, all three represented by CG2, with one unit at Foulden Common SSSI recorded as CG6. All three site surveys point to how little of this feature exists on the three SSSIs where it has been found. It is, however, an important part of the mosaic of communities, appearing when grazing is increased, largely on the drier parts between wetter areas, such as the rims of the 'pingo' features or the slightly higher areas of ground between.	
Structure and function (including its typical species)	**Adaptation and resilience**	Maintain the feature's ability, and that of its supporting processes, to adapt or evolve to wider environmental change, either within or external to the site	See relevant general text in Table 1.	
Structure and function (including its typical species)	**Functional connectivity with wider landscape**	Restore 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 at this site 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, 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 features may also be important to the operation of the supporting ecological processes on which the designated site and its features may rely. In most cases increasing actual and functional landscape-scale connectivity 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.	Shaw, S. & Tratt, R. (2015)
Structure and function (including its typical species)	**Key structural, influential and/or distinctive species**	Maintain the abundance of the typical species listed below to enable each of them to be a viable component of the Annex 1 habitat;	Some plant or animal species (or related groups of such species) make a particularly important contribution to the necessary 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 Annex I habitat's	Hagget, G.M (2010) This attribute will be periodically monitored as part of Natural England's SSSI Condition

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		• Constant and preferential plant species of CG2 *Festuca ovina-Avenula pratensis* and CG6 *Avenula pubescens* grassland vegetation NVC types at this SAC • Barred tooth-striped moth *Trichopteryx polycommata*	structure or help to define that habitat on a particular SAC (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 SAC. 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. There have been several surveys carried out for the barred tooth-striped moth, *Trichopteryx polycommata*, with the greatest number of records at Foulden Common.	Assessments
Structure and function (including its typical 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 habitat.	Soil is the foundation of basic ecosystem function and 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.	
Structure and function (including its typical species)	**Supporting off-site habitat**	Restore the extent, quality and spatial configuration of land or habitat surrounding or adjacent to the site	Include only where applicable. The structure and function of the qualifying habitat, including its typical species, may rely upon the continued presence of areas which surround and are outside of the designated site boundary. Changes in surrounding land-use may adversely (directly/indirectly) affect the functioning of the feature and its	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		which is known to support the feature	component species. This supporting habitat may be critical to the typical species of the feature to support their feeding, breeding, roosting, population dynamics ('metapopulations'), pollination or to prevent/reduce/absorb damaging impacts from adjacent land uses e.g. pesticide drift, nutrient enrichment.	
Structure and function (including its typical species)	**Vegetation community composition** **.**	Ensure the component vegetation communities of the feature are referable to and characterised by the following National Vegetation Classification types • CG2 *Festuca ovina-Avenula pratensis* • CG6 *Avenula pubescens* grassland	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 will also help to conserve their typical plant species (i.e. the constant and preferential species of a community), and therefore that of the SAC feature, at appropriate levels (recognising natural fluctuations).	Shaw, S. & Tratt, R. (2015) This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments
Structure and function (including its typical species)	**Vegetation community transitions**	Maintain and restore the pattern of natural vegetation zonations/transitions	Transitions/zonations between adjacent but different vegetation communities are usually related to naturally-occurring changes in soil, aspect or slope. Such 'ecotones' retain characteristics of each bordering community and can add value in often containing species not found in the adjacent communities. Retaining such transitions can provide further diversity to the habitat feature, and support additional flora and fauna. Where present, the H6210 calcareous grassland feature is found in a mosaic of fen, mire and swamp communities. It is, however, an important part of the mosaic of communities, appearing when grazing is increased, largely on the drier parts between wetter areas, such as the rims of the 'pingo' features or the slightly higher areas of ground between.	This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments
Structure and function (including its typical species)	**Vegetation: proportion of herbs (including**	Maintain the proportion of herbaceous species within the range 40%-90%	CG2 is one of three short-sward communities associated with heavy grazing, within the lowland calcicolous grassland group, and is regarded as "typical" chalk grassland. A high cover of characteristic herbs, including sedges (*Carex* species) is typical of the structure of	English Nature (1993) Foulden Common NVC Survey. Unpublished report (Available from Natural

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
	***Carex* spp)**		this habitat type. This feature appears primarily as a constituent within a mosaic of other communities, usually larger in area and (apparently) of greater conservation value on this SAC.	England on request) This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments
Structure and function (including its typical species)	**Vegetation: undesirable species**	Maintain the frequency/ cover of the following undesirable species to within acceptable levels and prevent changes in surface condition, soils, nutrient levels or hydrology which may encourage their spread. No undesirable species/taxa more than occasional throughout the sward, or singly or together more than 5% cover: Cover of the grasses *Brachypodium pinnatum* and *Bromopsis erecta* should be comprise less than 10% cover Tree and shrub species should be no more than occasional throughout the sward, but less than 5% cover	There will be a range of undesirable or uncharacteristic species which, if allowed to colonise and spread, are likely to have an adverse effect on the feature's structure and function, including its more desirable typical species. These may include invasive non-natives such as Cotoneaster spp, or coarse and aggressive native species which may uncharacteristically dominate the composition of the feature. Undesirable species include: *Cirsium arvense, Cirsium vulgare, docks Rumex crispus, Rumex obtusifolius, ragwort Senecio jacobaea, common nettle Urtica dioica.*	This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments
Supporting processes (on which the feature	**Air quality**	Restore as necessary, the concentrations and deposition of air	See the explanatory notes for this attribute above in Table 1 Notes: Leaching will cause a decrease in soil base saturation,	More information about site-relevant Critical Loads and Levels for this SAC is

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
relies)		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).	increasing the availability of Al3+ ions; mobilisation of Al3+ may cause toxicity to plants and mycorrhiza; may have direct effect on lower plants (bryophytes and lichens).	available by using the 'search by site' tool on the Air Pollution Information System (www.apis.ac.uk). Natural England (2014): Site Improvement Plan – Norfolk Valley Fens SAC (SIP Profile: 150)
Supporting processes (on which the feature relies)	**Conservation measures**	Restore the management measures (either within and/or outside the site boundary as appropriate) which are necessary to restore the structure, functions and supporting processes associated with the feature	Active and ongoing conservation management is needed to protect, maintain or restore this feature at this site. Further details about the necessary conservation measures for this site can be provided by contacting Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, Site Management Strategies or Plans, the Views about Management Statement for the underpinning SSSI and/or management agreements. Management of this feature may include continuation / introduction of suitable grazing regime and control of scrub to desired levels. This may a challenge where the land is designated as Common Land.	Natural England (2014): Site Improvement Plan – Norfolk Valley Fens SAC (SIP Profile: 150)
Version Control Advice last updated: N/A				
Variations from national feature-framework of integrity-guidance: N/A				

Table 4: Supplementary Advice for Qualifying Features: H6410. Molinia meadows on calcareous, peaty or clayey-silt-laden soils (Molinia caeruleae); Purple moor-grass meadows

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Extent and distribution of the feature	**Spatial distribution of the feature within the site**	Restore the distribution and configuration of the 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. This feature is recorded at 10 of the 14 component SSSIs that make up this SAC: Badley Moor SSSI, Booton Common SSSI, Buxton Heath SSSI, Flordon Common SSSI, Great Cressingham Fen SSSI, Holt Lowes SSSI, Sheringham and Beeston Regis Commons SSSI, Southrepps Common SSSI and Swangey Fen SSSI.	
Extent and distribution of the feature:	**Extent of the feature within the site:**	Restore the total extent of the feature to 12.95ha.	[There should be no measurable 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 from the listed site-based surveys. Area measurements given may be approximate depending on the methods, age and accuracy of data collection, and as a result 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	https://eunis.eea.europa.eu/sites/UK0012892 This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			may include 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. It is difficult to provide an accurate extent target for the H6410 feature as it occurs in a mosaic with other mire / fen communities. The extent target covers the wider mire / fen habitats on these sites and will include vegetation types not associated with the H6510 feature. Further surveys may be required to support the assessment of plans or projects impacting on this feature.	
Structure and function (including its typical species)	**Adaptation and resilience**	Maintain the feature's ability, and that of its supporting processes, to adapt or evolve to wider environmental change, either within or external to the site	See relevant general text in Table 1.	
Structure and function (including its typical species)	**Functional connectivity with wider landscape**	Restore 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 at this site 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, 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 features may also be important to the operation of the supporting ecological processes on which the designated site and its features may rely. In most cases increasing actual and functional landscape-scale connectivity would be beneficial.	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			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.	
Structure and function (including its typical species) **See list above.**	**Hydrology: Water table**	Maintain a hydrological regime that provides a sub-surface water table during the summer (range -2 to -48 cm below ground level) and a winter water table ± at the surface. Inundation should be absent or only occasional to a minor degree in winter	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 depth, duration, frequency, magnitude and timing of water supply can have significant implications for the assemblage of characteristic plants and animals present. This target is generic and as precise tolerances are not known, further site-specific investigations may be required to fully inform conservation measures and/or the likelihood of impacts.	Natural England (2014): Site Improvement Plan – Norfolk Valley Fens SAC (SIP Profile: 150)
Structure and function (including its typical species)	**Key structural, influential and/or distinctive species**	Maintain and restore the abundance of the typical species listed below to enable each of them to be a viable component of the Annex 1 habitat; • Constant and preferential plant species of the M24 *Molinia caerulea – Cirsium dissectum* fen meadow NVC vegetation types at this SAC	Some plant or animal species (or related groups of such species) make a particularly important contribution to the necessary 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 Annex I habitat's structure or help to define that habitat on a particular SAC (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 SAC. 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	JNCC Habitat account – Natural and semi-natural grassland formations 6410 *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) EUNIS (European Environment Agency) Molinia meadows on calcareous, peaty or clayey-silt-laden soils (Molinion caeruleae) This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			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.	
Structure and function (including its typical species)	**Maintaining integrity of hydrological catchment**	Maintain the full range of hydrological/ hydrogeological aspects of a site's catchment that contribute to its functioning and the maintenance of the feature	The movement, quality and distribution of water within a site's wider catchment and outside of the site's boundary will affect its ability to support this wetland habitat feature. Catchment size will vary. A site's water table and other hydrological aspects may be affected by changes in the use of the land surface, water abstraction, flood alleviation, development and mineral extraction in the wider catchment.	
Structure and function (including its typical 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 habitat. For this feature, soil P index should typically be index 0 (< 9 mg l -1)	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.	
Structure and function (including its typical species)	**Vegetation community composition**	Ensure the component vegetation communities of the feature are referable to and characterised by the following National Vegetation Classification type: M24 *Molinia caerulea – Cirsium dissectum* fen meadow.	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 will also help to conserve their typical plant species (i.e. the constant and preferential species of a community), and therefore that of the SAC feature, at appropriate levels (recognising natural fluctuations).	Natural England (2011c) Shaw, S. & Tratt, R. (2016a,b,d,f,g,h,i,j,k) This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Structure and function (including its typical species)	**Vegetation community transitions**	Maintain the pattern of natural vegetation zonations/transitions	Transitions/zonations between adjacent but different vegetation communities are usually related to naturally-occurring changes in soil, aspect or slope. Such 'ecotones' retain characteristics of each bordering community and can add value in often containing species not found in the adjacent communities. Retaining such transitions can provide further diversity to the habitat feature, and support additional flora and fauna. In virtually all the SSSI units comprising the SAC, this community (represented by M24 type) appears as part of a mosaic consisting largely of a mix of M13, M22 and, on some sites, M9.	
Structure and function (including its typical species)	**Vegetation: undesirable species**	Maintain the frequency/cover of the following undesirable species to within acceptable levels and prevent changes in surface condition, soils, nutrient levels or hydrology which may encourage their spread.	Undesirable non-woody and woody vascular plants species may require active management to avert an unwanted succession to a different and less desirable state. Often they may be indicative of a negative trend relating to another aspect of a site's structure and function. These species will vary depending on the nature of the particular feature, and in some cases these species may be natural/acceptable components or even dominants. The optimum conditions that favour the development of this feature are those that maintain the correct level of grazing and control of the woody or shrubby species that can take over, especially when grazing pressure is reduced and/or when the site becomes dry enough to favour the establishment of these species. Negative indicators include: *Cirsium arvense, Cirsium vulgaris, Juncus effuses, Phragmites australis, Senecio spp, Rubus sp, Urtica dioica*	This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments Natural England (2014): Site Improvement Plan – Norfolk Valley Fens SAC (SIP Profile: 150)
Structure and function (including its typical species) **.**	**Water quality**	Where the feature is dependent on surface water and/or groundwater, maintain water quality and quantity to a standard which provides the necessary conditions to	For many SAC features which are dependent on wetland habitats supported by surface and/or ground water, maintaining the quality and quantity of water supply will be critical, especially at certain times of year. 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	Natural England (2014): Site Improvement Plan – Norfolk Valley Fens SAC (SIP Profile: 150)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		support the feature.	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. With regard to chemistry of groundwater, it will be seen in the text relating to each of the component sites that some sites are more at risk than others. Those sites that are at highest risk are the sites that are fed by both chalk groundwater and drift groundwater, and where abstraction from the chalk aquifer has been licensed. Risks relate to the fact that drift groundwater is more vulnerable to nutrient enrichment. The consequences of abstraction in these situations are to reduce the overall discharge on the mire surface, but also to reduce the chalk groundwater component of the overall discharge at the mire surface thereby reducing water quality. In order to ensure site integrity of the Norfolk Valley Fens SAC with regards to nutrient enrichment, and nutrient levels of groundwater discharged at Norfolk Valley Fen sites, it is recommended that the phosphorus levels of drift groundwater should not exceed annual average total phosphorus of 0.1mg/l. Attention should also be paid to the risk of nutrient-rich runoff from adjacent agricultural activity, localised flooding with sewage-enriched storm-water, or from pre-existing sewerage pipes.	
Supporting processes (on which the feature relies)	**Air quality**	Restore 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	See the explanatory notes for this attribute above in Table 1	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). Natural England (2014): Site Improvement Plan – Norfolk

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		System (www.apis.ac.uk).		Valley Fens SAC (SIP Profile: 150)
Supporting processes (on which the feature relies)	**Conservation measures**	Restore the management measures (either within and/or outside the site boundary as appropriate) which are necessary to restore the structure, functions and supporting processes associated with the feature	Active and ongoing conservation management is needed to protect, maintain or restore this feature at this site. Further details about the necessary conservation measures for this site can be provided by contacting Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, Site Management Strategies or Plans, the Views about Management Statement for the underpinning SSSI and/or management agreements. Conservation measures for this feature typically include grazing, cutting, scrub management, weed control, recreation/ visitor management. Also covered is maintenance of surface drainage features such as drains, grips, gutters and foot drains. Retention of suitable land use infrastructure/patterns to enable site management e.g. pastoral livestock farming	Natural England (2014): Site Improvement Plan – Norfolk Valley Fens SAC (SIP Profile: 150)
Version Control Advice last updated: N/A				
Variations from national feature-framework of integrity-guidance: N/A				

Table 5: Supplementary Advice for Qualifying Features: H7210. Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae*; Calcium-rich fen dominated by great fen sedge (saw sedge) *

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**	Restore the total extent of the feature to 14.18ha.	This target is included as there should be no measurable reduction (excluding any trivial loss) in the extent of this feature. Area measurements given may be approximate depending on the nature, age and accuracy of data collection. The extent of an Annex I habitat feature covers the sum extent of all of the component vegetation communities present and may include transitions and mosaics with other closely-associated habitat features. 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.	https://eunis.eea.europa.eu/sites/UK0012892 Natural England (2011c) This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments
Extent and distribution of the feature	**Spatial distribution of the feature within the site**	Restore the distribution and configuration of the 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. Within the Norfolk Valley Fens SAC, the H7210 feature has been recorded at Booton Common SSSI, East Walton & Adcock's Commons SSSI, Foulden Common SSSI, Great Cressingham Fen SSSI, Thompson Common SSSI, In many cases only a small amount of this feature is present on each site and it is found in conjunction with other fen habitats. At Thompson Common SSSI the feature occurs in restricted areas within pingo basins.	Shaw, S. & Tratt, R. (2015) This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments
Structure and function (including its typical species)	**Adaptation and resilience**	Maintain the feature's ability, and that of its supporting processes, to adapt or evolve to wider environmental change, either within or external to	See the explanatory notes for this attribute above in Table 1	Shaw, S. & Tratt, R. (2015)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		the site		
Structure and function (including its typical species)	**Exposed substrate**	Maintain a low cover of exposed substrate of between 5% & 25% across feature.	For this wetland habitat type, maintaining some continuous extent 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. This will vary depending on nature of vegetation community. For some strongly spring-fed sites, a higher value may be appropriate. A high frequency and cover of exposed substrate will usually be undesirable and may indicate, inter alia, over-grazing, and water scour.	Natural England (2011d,e,f,g,)
Structure and function (including its typical species)	**Hydrology**	At a site, unit and/or catchment level (as necessary, restore natural hydrological processes to provide the conditions necessary to sustain the feature within the site.	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, magnitude and timing of water supply can have significant implications for the assemblage of characteristic plants and animals present. This target is generic and further site-specific investigations may be required to fully inform conservation measures and/or the likelihood of impacts. Wheeler *et al*. (2009) provide range and mean for summer & winter water levels for those wetland NVC types constituting Annex 1 habitats. This provides a rough guide to appropriate levels, but it is critical that individual sites and their needs are considered as there is considerable variation within the NVC communities listed and recorded water levels. Dehydration of fens in East Anglia has long been a cause for concern, and has prompted various studies and investigations. In 1992, Wheeler and Shaw undertook a study of biological indicators of the dehydration and changes to East Anglian fens, which included all of the NVF sites. The main conclusion was that although many of the sites had shown a floristic change, it was difficult to separate the effects of dehydration and dereliction, but that for many sites dehydration had been or threatened to be a major threat to their botanical value.	Shaw, S. & Tratt, R. (2015) Natural England (2014): Site Improvement Plan – Norfolk Valley Fens SAC (SIP Profile: 150) Shaw, S. & Tratt, R. (2015) Norfolk Valley Fens SAC Review of current status, identification of remedies and investigations required.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Structure and function (including its typical species)	**Hydrology**	Restore a high piezometric head and permanently high water table (allowing for natural seasonal fluctuations) on groundwater dependent sites.	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, magnitude and timing of water supply can have significant implications for the assemblage of characteristic plants and animals present. This target is generic and further site-specific investigations may be required to fully inform conservation measures and/or the likelihood of impacts. Dipwells included in the Environment Agency monitoring programme may, depending on local circumstances, have potential for providing measurements of piezometric heads rather than phreatic water tables, especially on seepage slopes where there is only a thin (< 50 cm) layer of peat. Artesian conditions have been shown in several supposed 'dipwells' within the Norfolk Valley Fen SAC, including at East Walton Common SSSI and Scarning Fen SSSI.	Shaw, S. & Tratt, R. (2015) Natural England (2014): Site Improvement Plan – Norfolk Valley Fens SAC (SIP Profile: 150)
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 feature	Invasive or introduced non-native species can be a serious potential 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 (e.g. use of broad spectrum pesticides). Spread of invasive alien spp. can often be very rapid once established. Invasive aliens within lowland fens may include *Crassula helmsii, Acorus calamus, Mimulus spp., Impatiens glandulifera, Fallopia japonica, Heracleum mantegazzianum*. May include graminoids such as *Phragmites australis, Phalaris arundinacea, Glyceria maxima, Typha latifolia, Juncus spp., Molinia caerulea; tall herbs such as Epilobium hirsutum, Urtica dioica, Pteridium aquilinum, Rubus fruticosus; and bryophytes such as Brachythecium rutabulum, Eurhynchium praelongum, Sphagnum recurvum*.	This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments Natural England (2014): Site Improvement Plan – Norfolk Valley Fens SAC (SIP Profile: 150)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Structure and function (including its typical species)	**Key structural, influential and/or distinctive species**	Maintain the abundance of the typical species listed below to enable each of them to be a viable component of the Annex 1 habitat; • Constant and preferential plant species of the S2, S25 and S25c NVC vegetation types at this SAC • *Vertigo moulinsiana* Desmoulin's whorl snail:	Some plant or animal species (or related groups of such species) make a particularly important contribution to the necessary 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 Annex I habitat's structure or help to define that habitat on a particular SAC (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 SAC. 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. See Table 9 for further information on the requirements of Desmoulin's whorl snail.	Natural England (2011d) This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments
Structure and function (including its typical species)	**Presence/cover of woody species**	Maintain and Restore a low cover of not more than 10% of scrub or trees within stands of H7210.	Native trees and shrubs occur naturally on bog and fen surfaces but an abundance of scrub and trees on bogs and fens is sometimes regarded as detrimental because they are indicators and perpetrators of drying out and may cause damage to vegetation structure through shading effects. Birch, pine, willow and rhododendron (an invasive non-native species) are the main species of concern. The seeds of most invasive woody species are wind dispersed, so trees are able to establish on raised bog	This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments .

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			and fen surfaces.	
Structure and function (including its typical species)	**Vegetation community composition**	Ensure the component vegetation communities of the feature are referable to and characterised by the following National Vegetation Classification types S2 *Cladium mariscus* swamp and sedge-beds S25: *Phragmites australis-Eupatorium cannabinum* tall-herb fen typical sub-community S25c *Phragmites australis-Eupatorium cannabinum* tall-herb fen, *Cladium mariscus* sub-community	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. Booton Common SSSI – S25c East Walton & Adcock's Commons SSSI – S2, S25c Foulden Common SSSI – S2, S25c Great Cressingham Fen SSSI – S25 Thompson Common SSSI – S2	This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments
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.	UKTAG (2012) provides threshold values for nitrate concentration in groundwaters for different wetland types. The threshold values will mainly be used in the characterisation of GWDTE status for the WFD, primarily as a risk screening tool, to assess if sites are 'at risk' or 'not at risk' from groundwater mediated nutrient pressure. Due to the complex cycling of nutrients within many GWDTE, these threshold values are less well suited for application within sites but rather just to groundwater that is directly feeding the site.	Shaw, S. & Tratt, R. (2015)
supporting processes (on which the feature relies)	**Air quality**	Restore as necessary, the concentrations and deposition of air pollutants to at or below	See the explanatory notes for this attribute above in Table 1	More information about site-relevant Critical Loads and Levels for this SAC is available by using the 'search by site' tool on the Air

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		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).		Pollution Information System (www.apis.ac.uk). Natural England (2014): Site Improvement Plan – Norfolk Valley Fens SAC (SIP Profile: 150)
Supporting processes (on which the feature relies)	**Conservation measures**	Restore the management measures (either within and/or outside the site boundary as appropriate) which are necessary to restore the structure, functions and supporting processes associated with the feature	Active and ongoing conservation management is needed to protect, maintain or restore this feature at this site. Further details about the necessary conservation measures for this site can be provided by contacting Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, Site Management Strategies or Plans, the Views about Management Statement for the underpinning SSSI and/or management agreements. This habitat in most cases requires ongoing cutting or grazing maintain its open character.	Natural England (2011c) Natural England (2014): Site Improvement Plan – Norfolk Valley Fens SAC (SIP Profile: 150)
Version Control Advice last updated: N/A				
Variations from national feature-framework of integrity-guidance: N/A				

Table 6: Supplementary Advice for Qualifying Features: H7230. Alkaline fens; Calcium-rich springwater-fed 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**	Restore the total extent of the feature to baseline-value of 61.65ha.	There should be no measurable 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 from the listed site-based surveys. Area measurements given may be approximate depending on the methods, age and accuracy of data collection, and as a result 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 may include 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.	https://eunis.eea.europa.eu/sites/UK0012892 This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments
Extent and distribution of the feature	**Spatial distribution of the feature within the site**	Maintain and Restore the distribution and configuration of the 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. The H7230 feature is recorded across all 14 of the SSSIs that underpin the Norfolk Valley Fens SAC.	Shaw, S. & Tratt, R. (2015) Shaw, S. & Tratt, R. (2016c, d, k)
Structure and function (including its typical species)	**Adaptation and resilience**	Maintain the feature's ability, and that of its supporting processes, to adapt or evolve to wider environmental change, either within or external to the site	See the explanatory notes for this attribute above in Table 1	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Structure and function (including its typical species)	**Browsing and grazing by herbivores**	Restore appropriate levels of grazing.	These habitat features are often preferentially grazed and may be vulnerable to significant overgrazing pressure associated with the management of the wider local landscape. Grazing currently occurs across the majority of the component SSSIs that underpin the Norfolk Valley Fens SAC; where grazing is not possible then cutting has been implemented.	Shaw, S. & Tratt, R. (2015) Natural England (2014): Site Improvement Plan – Norfolk Valley Fens SAC (SIP Profile: 150) This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments
Structure and function (including its typical species)	**Exposed substrate**	Maintain and where necessary restore the exposure of the subtstrate to appropriate levels, which will typically be between 5% & 25% across feature.	For this wetland habitat type, maintaining some continuous extent 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.	This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments
Structure and function (including its typical species)	**Functional connectivity with wider landscape**	Restore 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 at this site 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, 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 features may also be important to the operation of the supporting ecological processes on which the designated site and its features may rely. In most cases increasing actual and functional landscape-scale connectivity 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. Opportunities to extend that area of alkaline fen should be considered where it is eco-hydrologically appropriate and feasible for this to occur.	Shaw, S. & Tratt, R. (2015)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Structure and function (including its typical species)	**Hydrology**	At a site, unit and/or catchment level (as necessary, restore natural hydrological processes to provide the conditions necessary to sustain the feature within the site, including a high piezometric head and permanently high water table (allowing for natural seasonal fluctuations).	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, magnitude and timing of water supply can have significant implications for the assemblage of characteristic plants and animals present. This target is generic and further site-specific investigations may be required to fully inform conservation measures and/or the likelihood of impacts. Wheeler *et al.* (2009) provide range and mean for summer & winter water levels for those wetland NVC types constituting Annex 1 habitats. This provides a rough guide to appropriate levels, but it is critical that individual sites and their needs are considered as there is considerable variation within the NVC communities listed and recorded water levels. Surveys were instigated by the Environment Agency in 2007 to ascertain the status and species composition of the M13 and M9 communities in the Norfolk valley fens in order to inform hydrological impact assessments made during the review of water resources consents, and to identify (where possible) the plant communities associated with dipwells of the Environment Agency Groundwater Observation Network (where present). Since 2010 the Agency has been keen to continue collecting species and water level data so that it may be possible to interpret any changes to the status of the M13 mire noted in future in the context of water abstraction and climatic conditions. In addition to the annual assessment of the condition of the M13 vegetation, fixed vegetation monitoring plots were established between 2010 and 2012 on 12 of the 14 component NVF SSSIs (*i.e.* all except Swangey and Thompson).	Shaw, S. & Tratt, R. (2015) Natural England (2014): Site Improvement Plan – Norfolk Valley Fens SAC (SIP Profile: 150)
Structure and function (including its typical species)	**Integrity of tufa features**	Ensure that no more than 1% of the vegetation in which tufa is visible is showing signs of damage or disturbance	Tufa is a fragile soft porous rock composed of calcium carbonate which is deposited as lime-rich subterranean water issues out from springs and chemically interacts with the air. It is easily damaged or disturbed. Tufa has been recorded at three locations within the SAC: Badley Moor SSSI, Flordon Common SSSI, and Sheringham & Beeston Regis Commons; the latter site may represent historic tufa deposition due to uncertainty over current water levels.	Killeen, I. (2001) Surveys of EU Habitats Directive *Vertigo* species in England: *Vertigo angustior* at Flordon Common SAC, Norfolk and Fritton Marshes pSSSI, Suffolk. English Nature Research Reports 419

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
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 feature	Invasive or introduced non-native species can be a serious potential 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 (e.g. use of broad spectrum pesticides). Undesirable species include: Himalayan Balsam *Impatiens glandulifera*, Common Rhododendron *Rhododendron ponticum,* Reed canary grass *Phalaris arundinacea* , Orange balsam *Impatiens capensis* , Sycamore *Acer pseudoplatanus,* New Zealand pygmyweed *Crassula helmsii*	Shaw, S. & Tratt, R. (2015) Natural England (2014): Site Improvement Plan – Norfolk Valley Fens SAC (SIP Profile: 150) This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments
Structure and function (including its typical species)	**Key structural, influential and/or distinctive species**	Maintain and Restore the abundance of the typical species listed below to enable each of them to be a viable component of the Annex 1 habitat; • Constant and preferential plant species of the M9 *Carex rostrata – Calliergon cuspidatum/ giganteum* mire and M13 *Schoenus nigricans – Juncus subnodulosus* mire NVC vegetation types at this SAC	See the explanatory notes for this attribute above in Table 1	Shaw, S. & Tratt, R. (2015) This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments
Structure and function (including its typical species)	**Presence/ cover of woody species**	Restore a low cover of woody species of not more than 10% scrub/tree cover.	Native trees and shrubs occur naturally on bog and fen surfaces but an abundance of scrub and trees on bogs and fens is sometimes regarded as detrimental because they are indicators and perpetrators of drying out and may cause damage to vegetation structure through shading effects.	Shaw, S. & Tratt, R. (2015) Natural England (2014): Site Improvement Plan – Norfolk Valley Fens SAC (SIP Profile:

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		No woody species in flushes or springs; low *Salix* spp acceptable more than 5m from edge of spring/flush feature	Birch, pine, willow and rhododendron (an invasive non-native species) are the main species of concern. The seeds of most invasive woody species are wind dispersed, so trees are able to establish on raised bog and fen surfaces.	150) This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments
Structure and function (including its typical species)	**Vegetation community composition** **.**	Ensure the component vegetation communities of the feature are referable to and characterised by the following National Vegetation Classification types. • M9 *Carex rostrata – Calliergon cuspidatum/giganteum* mire, • 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. For this feature this may typically be the M9, M10 & M13 types. Badley Moor SSSI – M13 Booton Common SSSI – M9, M13 Buxton Heath SSSI – M13 Coston Fen SSSI – M13 East Walton Common & Adcock's Common SSSI – M9, M13 Flordon Common SSSI – M9, M13 Foulden Common SSSI – M13 Great Cressingham Fen SSSI – M13 Holt Lowes SSSI – M13 Potter & Scarning Fens SSSI – M13 Sheringham & Beeston Regis Commons SSSI – M13 Southrepps Common SSSI – M13 Swangey Fen – M9, M13 Thompson Common SSSI – M9	Shaw, S. & Tratt, R. (2015) This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments
Structure and function (including its typical species)	**Water chemistry**	Maintain and Restore the low nutrient status of irrigating water, ensuring it is rich in base ions, particularly calcium. .	UKTAG (2012) provides threshold values for nitrate concentration in groundwaters for different wetland types. The threshold values will mainly be used in the characterisation of GWDTE status for the WFD, primarily as a risk screening tool, to assess if sites are 'at risk' or 'not at risk' from groundwater mediated nutrient pressure. Due to the complex cycling of nutrients within many GWDTE, these threshold values are less well suited for application within sites but rather just to groundwater that is directly feeding the site.	Shaw, S. & Tratt, R. (2015) Natural England (2014): Site Improvement Plan – Norfolk Valley Fens SAC (SIP Profile: 150)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			Of the 14 Norfolk Valley Fens, only a few sites have been identified as showing evidence of nutrient enrichment, and one site (Holt Lowes) was identified as at risk from sediment erosion into mire from adjoining heathland. The Site Improvement Plan for the NVF SAC (NE, 2014) notes that nitrogen deposition exceeds site relevant nitrogen critical loads, but does not identify any specific component SSSIs as being particularly affected.	
supporting processes (on which the feature relies)	**Air quality**	Restore 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).	See the explanatory notes for this attribute above in Table 1 The Site Improvement Plan for the NVF SAC (NE, 2014) notes that nitrogen deposition exceeds site relevant nitrogen critical loads, but does not identify any specific component SSSIs as being particularly affected.	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). Natural England (2014): Site Improvement Plan – Norfolk Valley Fens SAC (SIP Profile: 150)
Supporting processes (on which the feature relies)	**Conservation measures**	Maintain and Restore the management measures (either within and/or outside the site boundary as appropriate) which are necessary to Maintain and restore the structure, functions and supporting processes associated with the feature	Active and ongoing conservation management is needed to protect, maintain or restore this feature at this site. Further details about the necessary conservation measures for this site can be provided by contacting Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, Site Management Strategies or Plans, the Views about Management Statement for the underpinning SSSI and/or management agreements. Alkaline fen vegetation must be managed to prevent the vegetation from becoming rank and invaded by scrub. Much of the Norfolk Valley Fens SAC is managed through a regime of light or moderate grazing regime, with only three of the component SSSIs (Sheringham/Beeston Commons, Southrepps Common and Swangey Fen) regularly mown. Heavy grazing can be detrimental but conversely, light grazing can also be detrimental in allowing the build-up of litter, and in some sites the dominance of a tussocky vegetation structure, particularly if grazed whilst the substratum is very wet – this can lead to the shading-out	Shaw, S. & Tratt, R. (2015) Natural England (2014): Site Improvement Plan – Norfolk Valley Fens SAC (SIP Profile: 150)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			of some of low-growing species that are confined to runnels and tussock-sides, especially mosses and liverworts. Grazing alone does not control tree seedling growth and periodic scrub management is also required.	
Version Control Advice last updated: N/A				
Variations from national feature-framework of integrity-guidance: N/A				

Table 7: 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 feature to 6.78ha. The SAC is considered to support a significant presence of this feature.	There should be no measurable 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 from the listed site-based surveys. Area measurements given may be approximate depending on the methods, age and accuracy of data collection, and as a result 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 may include 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. For this feature tree roots (particularly of veteran trees) can extend a considerable distance beyond the boundary of the site - they can be impacted by soil compaction (such as caused by vehicles or construction works); agricultural operations or other soil disturbance (like trenches); and agro chemicals or other chemicals which get into the soil. Any loss of woodland area - whether at the edge or in the middle of a site will reduce the core woodland area where woodland conditions are found - these support significant assemblages of species dependent on woodland conditions (e.g. lichens and bryophytes - being one example). Loss of any woodland area which fragments a site into different parts will clearly disturb the movement of species between the remaining parts of the woodland.	https://eunis.eea.europa.eu/sites/UK0012892 Natural England (2011d) This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Extent and distribution of the feature	**Spatial distribution of the feature within the site**	Maintain the distribution and configuration of the 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. Across the 14 sites of the SAC, this feature is reported as occurring on Booton Common SSSI (W6), East Walton Common / Adcock's Common SSSI (W6 and W7), Flordon Common SSSI (W6), Foulden Common (incl. Gooderstone Fen)(W5) SSSI, and Thompson Common SSSI (W5 and W6).	Shaw, S. & Tratt, R. (2015)
Structure and function (including its typical species)	**Adaptation and resilience**	Maintain the resilience of the feature by ensuring a diversity (at least 3 species) of site-native trees (e.g. alder, willow - *Salix* spp, ash, elm - *Ulmus* spp, black poplar) across the site.	See the explanatory notes for this attribute above in Table 1	This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments
Structure and function (including its typical species)	**Browsing and grazing by herbivores**	Maintain browsing at a (low) level that allows well developed understorey with no obvious browse line, & lush ground vegetation with some grazing sensitive species evident (bramble, ivy etc.), and tree seedlings and sapling common in	Herbivores, especially deer, are an integral part of woodland ecosystems. They are important in influencing woodland regeneration, composition and structure and therefore in shaping woodland wildlife communities. In general, both light grazing and browsing is desirable to promote both a diverse woodland structure and continuous seedling establishment. Short periods with no grazing at all can allow fresh natural	This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		gaps.	regeneration of trees, but a long-term absence of herbivores can result in excessively dense thickets of young trees which shade out ground flora and lower plant species. However, heavy grazing by deer or sheep prevents woodland regeneration, and can cause excessive trampling and/or poaching damage, canopy fragmentation, heavy browsing, barkstripping and a heavily grazed sward.	
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 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 Rhododendrons, snowberry, Japanese knotweed, giant hogweed and Himalayan balsam, for example. Similarly, this would include pheasants, rabbits and non-native invertebrate 'pest' species.	This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments
Structure and function (including its typical species)	**Key structural, influential and/or distinctive species**	Maintain] the abundance of the typical species listed below to enable each of them to be a viable component of the Annex 1 habitat; Constant and preferential plant species of W5 *Alnus glutinosa - Carex paniculata* woodland, W6 *Alnus glutinosa - Urtica dioica* woodland and W7 *Alnus glutinosa - Fraxinus excelsior - Lysimachia nemorum* woodland vegetation NVC types at this SAC	See the explanatory notes for this attribute above in Table 1	This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Structure and function (including its typical species)	**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 wood is to be sustained and survive, both in terms of quantity of regeneration and in terms of appropriate species. This will Include regeneration of the trees and shrubs from saplings or suckers, regrowth from coppice stools or pollards, and where appropriate planting. Browsing and grazing levels must permit regeneration at least in intervals of 5 years every 20. The density of regeneration considered sufficient is less in parkland sites than in high forest. Regeneration from pollarding of veteran trees should be included where this is happening.	This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments
Structure and function (including its typical 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 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.	
Structure and function (including its typical species)	**Tree and shrub species composition**	Maintain a canopy and under-storey of which 95% is composed of site native trees and shrubs [adviser to list examples of species relevant to the site]	Native trees and shrubs in general support a greater diversity of associated 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).	This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments
Structure and function (including its typical species)	**Vegetation community composition**	Ensure the component vegetation communities of the feature are referable to and characterised by the following National Vegetation Classification types: • W5 *Alnus glutinosa - Carex paniculata* woodland • W6 *Alnus glutinosa - Urtica*	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 will also	This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		dioica woodland • W7 *Alnus glutinosa* - *Fraxinus excelsior* - *Lysimachia nemorum* woodland	help to conserve their typical plant species (i.e. the constant and preferential species of a community), and therefore that of the SAC feature, at appropriate levels (recognising natural fluctuations).	
Structure and function (including its typical species)	**Vegetation structure - age class distribution**	Maintain at least 3 age classes (pole stage/ medium/ mature) spread across the average life expectancy of the commonest trees.	A distribution of size and age classes of the major site-native tree and shrub species that indicate the woodland will continue in perpetuity, and will provide a variety of the woodland habitats and niches expected for this type of woodland at the site in question.	This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments
Structure and function (including its typical species)	**Vegetation structure - canopy cover**	Maintain an appropriate tree canopy cover across the feature, which will typically be between 40-90% of the site	Canopy cover is the overall proportion of vegetative cover consisting of any woody layer ranging from established regeneration to mature and veteran stages. Woodland canopy density and structure is important because it affects ecosystem function and in particular microclimate, litterfall, soil moisture, nutrient turnover and shading; this in turn influences the composition of plants and animals in lower vegetation layers and soil. Open canopies with just scattered trees will have less of a woodland character and reduced diversity of woodland-dependent species (although they may be still be important as a form of woodland-pasture). Completely closed canopies across the whole woodland are not ideal either however, as they cast heavier shade and support fewer species associated with edges, glades and open grown trees, and have little space where tree regeneration could occur. In general, the woodland canopy of this feature should provide a core of woodland interior conditions with some open and edge habitat as well.	This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments
Structure and function (including its typical species)	**Vegetation structure - dead wood**	Maintain the continuity and abundance of standing or fallen dead and decaying wood, typically between 30 - 50 m3 per hectare of standing or fallen timber or 3-5 fallen trees >30cm per hectare, and >10 standing dead trees per hectare	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. The targets set within this attribute should reflect the most appropriate structure for the woodland feature on a particular site, taking account of its known interest, history, past management and the landscape context. 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 supports a range of specialist	This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			invertebrates, fungi, lichens and bryophytes, and associated hole-nesting birds and roosting bats, all of which may be very typical of the feature.	
Structure and function (including its typical species)	**Vegetation structure - old growth**	Maintain the extent and continuity of undisturbed, mature/old growth stands (typically comprising at least 20% of the feature at any one time) and the assemblages of veteran and ancient trees (typically >10 trees per hectare).	Good 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. The targets set within this attribute should reflect the most appropriate structure for the woodland feature on a particular site, taking account of its known interest, history, past management and the landscape context. For this habitat type, old or over-mature elements of the woodland are particularly characteristic and important features, and their continuity should be a priority.	This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments
Structure and function (including its typical species)	**Vegetation structure - open space**	Maintain areas of permanent/temporary open space within the woodland feature, typically to cover approximately 10%of area	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. The targets set within this attribute should reflect the most appropriate structure for the woodland feature on a particular site, taking account of its known interest, history, past management and the landscape context. Having some open, sunlit and largely tree-less areas as part of the woodland community is often important to facilitate natural tree and shrub regeneration and also to provide supporting habitat for specialist woodland invertebrates, birds, vascular and lower plants. Such open space can be permanent or temporary and may consist of managed grazed areas, linear rides and glades, or naturally-produced gaps caused by disturbance events such as windthrow/fire/tree falling over/snow damage.	This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments
Structure and function (including its typical species)	**Vegetation structure - shrub layer**	Maintain an understorey of shrubs covering 10 - 60% of the stand area (this will vary with light levels and site objectives)	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. The targets set within this attribute should reflect the most appropriate structure for the woodland feature on a particular site, taking account of its known interest, history, past management and the landscape context.	This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Structure and function (including its typical species)	**Vegetation structure - woodland edge**	Maintain OR Restore] a graduated woodland edge into adjacent semi-natural open habitats, other woodland/wood-pasture types or scrub.	Woodland edge is defined as being the transitional zone between the forest feature and adjacent but different habitat types - the best woodland edges will have a varied structure in terms of height and cover. Many typical forest species make regular use of the edge habitats for feeding due to higher herb layer productivity and larger invertebrate populations. Grasslands / arable fields managed with high doses of agro-chemicals could potentially not allow this gradation of woodland edge and could have other impacts on the integrity of the site (pollution/ nutrient enrichment etc.).	This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments
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 at this site 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, 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 features may also be important to the operation of the supporting ecological processes on which the designated site and its features may rely. In most cases increasing actual and functional landscape-scale connectivity 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.	
Supporting processes (on which the feature relies)	**Hydrology**	At a site, unit and/or catchment level (as necessary, maintain natural hydrological processes to provide the conditions necessary to sustain the feature within the site	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, magnitude and timing of water supply can have significant implications for the assemblage of characteristic plants and animals present. This target is generic and further site-specific investigations may be required to fully inform conservation measures and/or the likelihood of impacts. Alluvial forests can be dynamic in nature, being part of successional habitats and transitions to drier woodlands. Hydrological processes (including periodic	Natural England (2014): Site Improvement Plan – Norfolk Valley Fens SAC (SIP Profile: 150)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			inundation) are critical to how they function and must not be negatively impacted.	
Supporting processes (on which the feature relies)	**Illumination**	Ensure artificial light is maintained to a level which is unlikely to affect natural phenological cycles and processes to the detriment of the feature and its typical species at this site.	Woodland biodiversity has naturally evolved with natural patterns of light and darkness, so disturbance or modification of those patterns can influence numerous aspects of plant and animal behaviour. For example, light pollution (from direct glare, chronically increased illumination and/or temporary, unexpected fluctuations in lighting) can affect animal navigation, competitive interactions, predator-prey relations, and animal physiology. Flowering and development of trees and plants can also be modified by un-natural illumination which can disrupt natural seasonal responses.	
Supporting processes (on which the feature relies)	**Water quality/ quantity**	Where the feature is dependent on surface water and/or groundwater, restore water quality and quantity to a standard which provides the necessary conditions to support the feature	For many SAC features which are dependent on wetland habitats supported by surface and/or ground water, maintaining the quality and quantity of water supply will be critical, especially at certain times of year. 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.	Natural England (2014): Site Improvement Plan – Norfolk Valley Fens SAC (SIP Profile: 150)
Version Control Advice last updated: N/A				
Variations from national feature-framework of integrity-guidance: N/A				

Table 8: Supplementary Advice for Qualifying Features: S1014. *Vertigo angustior*; Narrow-mouthed whorl snail

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Population (of the feature)	**Population abundance**	Maintain the abundance of the population at a level which is above a mean population density of 340p/m2, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent.	This will ensure there is a viable population of the feature which is being maintained at or increased to a level that contributes as appropriate to its Favourable Conservation Status across its natural range in the UK. Due to the dynamic nature of population change, the target-value given for the population size or presence of this feature is considered to be the minimum standard for conservation/restoration measures to achieve. This minimum-value may be revised where there is evidence to show that a population's size or presence has significantly changed as a result of natural factors or management measures and has been stable at or above a new level over a considerable period (generally at least 10 years). The values given here may also be updated in future to reflect any strategic objectives which may be set at a national level for this feature. Given the likely fluctuations in numbers over time, any impact-assessments should focus on the current size of the site's population, as derived from the latest known or estimated level established using the best available data. This advice accords with the obligation to avoid deterioration of the site or significant disturbance of the species for which the site is designated, and seeks to avoid plans or projects that may affect the site giving rise to the risk of deterioration. Similarly, where there is evidence to show that a feature has historically been more abundant than the stated minimum target and its current level, the ongoing capacity of the site to accommodate the feature at such higher levels in future should also be taken into account in any assessment. Unless otherwise stated, the population size or presence will be that measured using standard methods, such as peak mean counts or breeding surveys. This value is also provided recognising there will be inherent variability as a result of natural fluctuations and margins of error during data collection. Whilst we will endeavour to keep these values as up to date as	Killeen, I. (2001) Surveys of EU Habitats Directive *Vertigo* species in England: *Vertigo angustior* at Flordon Common SAC, Norfolk and Fritton Marshes pSSSI, Suffolk. English Nature Research Reports 419 .

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			possible, local Natural England staff can advise that the figures stated are the best available. Flordon Common: It should be noted that the mean population of 340p/m^2 does not take into account the uneven distribution of densities across the site. These densities ranged from 5 – 1100 individuals per m^2, believed to be a result of small-scale differences in ground moisture and topography, soil and vegetation structure and composition.	
Supporting habitat: extent and distribution	**Distribution of supporting habitat** **.**	Maintain the distribution and continuity of the feature and its supporting habitat, including where applicable its component vegetation types and associated transitional vegetation types, across the site. .	A contraction in the range, or geographic spread, of the feature (and its component vegetation) 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. Contraction may also reduce and break up the continuity of a habitat within a site and how well the species feature is able to occupy and use habitat within the site. Such fragmentation may 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 this feature and this may affect its viability. Within the Norfolk Valley Fens SAC, *V. angustior* is currently only recoded from Flordon Common SSSI. Flordon Common: Howlett & Baker (2006) suggest that *V. angustior* shows no consistent associations with specific plant communities but that there are some associations with particular environmental conditions, i.e. friable soils which are permanently damp but not subject to inundation. Vegetation should be open with few tall herbs or woodland, and lightly grazed.	Shaw, S. & Tratt, R. (2015) Killeen, I. (2001) Surveys of EU Habitats Directive *Vertigo* species in England: *Vertigo angustior* at Flordon Common SAC, Norfolk and Fritton Marshes pSSSI, Suffolk. English Nature Research Reports 419 This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments
Supporting habitat: extent and distribution	**Extent of supporting habitat**	Maintain and extend the total extent of the habitat(s) which support the feature currently at: < 2 hectares.	In order to contribute towards the objective of achieving an overall favourable conservation status of the feature at a UK level, it is important to maintain or if appropriate restore the extent of supporting habitats and their range within this SAC. The information available on the extent and distribution of	Natural England (2012) Shaw, S. & Tratt, R. (2015) Killeen, I. (2001) Surveys of EU

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		Flordon Common: No more than 25% reduction from baseline in core habitat area or abundance of foodplant where the ecology is sufficiently fully understood for this to be meaningfully surveyed.	supporting habitat used by the feature may be approximate depending on the nature, age and accuracy of data collection, and may be subject to periodic review in light of improvements in data. The habitat requirements of the snail are thought to differ from those of the Alkaline Fen vegetation, and an assessment is needed regarding the extent to which the distributions of the snail and the SAC habitats coincide and whether conditions to favour both can be easily accommodated (and even extended) on the site.	Habitats Directive *Vertigo* species in England: *Vertigo angustior* at Flordon Common SAC, Norfolk and Fritton Marshes pSSSI, Suffolk. English Nature Research Reports 419 . This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments
Supporting habitat: structure/ function	**Grazing pressure**	Maintain a grazing regime using cattle to keep the sward short (preferably 2-5cm).	At Flordon Common SSSI light grazing and trampling pressure will normally be expected to be continued and that excessive trampling be avoided as much as possible. Where possible, grazing should be excluded grazing between May and August	Natural England (2012) Killeen, I. (2001) Surveys of EU Habitats Directive *Vertigo* species in England: *Vertigo angustior* at Flordon Common SAC, Norfolk and Fritton Marshes pSSSI, Suffolk. English Nature Research Reports 419 This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments
Supporting habitat: structure/ function	**Ground moisture class**	Maintain appropriate ground moisture conditions and their stability, avoiding change towards excessively dry or wet states.	Ground moisture is an important aspect of the supporting habitat for this feature. Ground moisture classes can be generally described as 1. ground dry, possibly with crack and no evidence of surface moisture; 2. ground damp, moisture observed on the surface but water does not rise under light pressure; 3. ground wet, no surface veneer, but water rises under light (foot) pressure; 4. ground Wet, surface veneer of less than 1-2cm deep; and 5. ground very wet, water depth greater than 2cm, may cover	Shaw, S. & Tratt, R. (2015) Natural England (2014): Site Improvement Plan – Norfolk Valley Fens SAC (SIP Profile: 150)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			the sward and tussocks. However, at Flordon Common, there needs to be a balance between achieving the ground moisture requirements of the fen vegetation types (including SAC features) with those of *V.angustior* for which raised water levels may not be desirable.	
Supporting habitat: structure/ function	**Soils, substrate and nutrient cycling**	[Maintain OR Restore] the properties of the underlying soil types, including structure, bulk density, total carbon, pH, soil nutrient status and fungal :bacterial ratio, within typical values for the supporting habitat	Soil supports basic ecosystem function and is 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 the supporting habitat of this Annex II feature.	
Supporting habitat: structure /function	**Vegetation structure**	Maintain an abundance of tussocks with litter/ leaf litter layer/ moss to maintain sward dampness, and a low cover of shading trees and scrub Less than 1/3 of occupied area with to have vegetation no shorter than 5cm tall, or without short grass, *Juncus* or *Iris* tussocks, or without an obvious layer of litter below the sward. No more than 1/3 of occupied area with rank grasses and tall herbs.	The 2 principal habitats in the UK are very different, ranging from base rich seepage sites in fen meadows, and limestone depressions on pavement. The presence of tussocking-forming vegetation and associated leaf litter provides a critical microhabitat for this feature. Marshy grass or sedge sward on damp but not saturated soil, with sparse and short *Iris pseudacorus* plants. Tall monocots should remain sparse. Other plants indicative of suitably damp conditions include *Mentha aquatica*, *Hydrocotyle vulgaris*, *Equisetum palustre* and *Lotus uliginosus*, but the absence of these plants may not indicate that conditions have become unsuitable. The monocot element may also include *Juncus* or *Phalaris.*	Natural England (2012) This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments
Supporting processes (on which the feature and/or its supporting habitat relies)	**Adaptation and resilience**	[Maintain OR Restore] the feature's ability, and that of its supporting habitat, to adapt or evolve to wider environmental change, either within or external to the site	See the explanatory notes for this attribute above in Table 1 The snail is particularly vulnerable in Europe at wetland sites, which are difficult to protect, and in coastal sites which may be subject to increasing inundation. The UK sites are currently in good condition, but the future prospects are considered to be potentially poor as the vast majority of the population is found along sea wall defences and in estuarine habitats that are	The IUCN Red List of Threatened Species.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			becoming increasingly vulnerable to inundation.	
Supporting processes (on which the feature and/or its supporting habitat relies)	**Air quality**	Maintain or, where necessary, restore 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).	See the explanatory notes for this attribute above in Table 1	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). Natural England (2014): Site Improvement Plan – Norfolk Valley Fens SAC (SIP Profile: 150)
Supporting processes (on which the feature and/or its supporting habitat relies) **Specific management of the site to maintain the conditions required by this feature.**	**Conservation measures**	Maintain the management measures (either within and/or outside the site boundary as appropriate) which are necessary to maintain the structure, functions and supporting processes associated with the feature and/or its supporting habitats.	Active and ongoing conservation management is needed to protect, maintain or restore this feature at this site. Further details about the necessary conservation measures for this site can be provided by contacting Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, site management strategies or plans, the Views about Management Statement for the underpinning SSSI and/or management agreements. The main threats to this species are the modification of site hydrology, heavy grazing, lack of grazing, supplementary feeding of livestock, scrub encroachment, eutrophication, pesticides, exposure to leisure activities *V. angustior* is found primarily in marshy ground of high, even humidity, with flowing groundwater, but subject neither to deep or prolonged flooding nor to periodic desiccation. It requires unshaded conditions and lives amongst short vegetation (note that Desmoulin's whorl snail prefers taller vegetation), composed of grasses, mosses or low herbs, that is quickly warmed by the sun. Because of its specific microhabitat requirements, the species is often restricted to a narrow zone around wetlands, only a few metres wide.	The IUCN Red List of Threatened Species.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Supporting processes (on which the feature and/or its supporting habitat relies)	**Water quantity/ quality**	Where the feature or its supporting habitat is dependent on surface water and/or groundwater, restore water quality and quantity to a standard which provides the necessary conditions to support the feature	For many SAC features which are dependent on wetland habitats supported by surface and/or ground water, maintaining the quality and quantity of water supply will be critical, especially at certain times of year. 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 to reflect the ecological needs of the species feature. Further site-specific investigations may be required to establish appropriate water quality standards for the SAC.	Natural England (2014): Site Improvement Plan – Norfolk Valley Fens SAC (SIP Profile: 150)
Version Control Advice last updated: N/A				
Variations from national feature-framework of integrity-guidance: N/A				

Table 9: Supplementary Advice for Qualifying Features: S1016. *Vertigo moulinsiana*; Desmoulin`s whorl snail

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Population (of the feature)	**Abundance**	Maintain a healthy adult: juvenile structure and population density (typically>250 individuals per m^2 in late summer), whilst avoiding deterioration from current levels as indicated by the latest peak count or equivalent.	This will ensure there is a viable population of the feature which is being maintained at or increased to a level that contributes as appropriate to its Favourable Conservation Status across its natural range in the UK. Due to the dynamic nature of population change, the target-value given for the population size or presence of this feature is considered to be the minimum standard for conservation/restoration measures to achieve. This minimum-value may be revised where there is evidence to show that a population's size or presence has significantly changed as a result of natural factors or management measures and has been stable at or above a new level over a considerable period (generally at least 10 years). The values given here may also be updated in future to reflect any strategic objectives which may be set at a national level for this feature. Given the likely fluctuations in numbers over time, any impact-assessments should focus on the current size of the site's population, as derived from the latest known or estimated level established using the best available data. This advice accords with the obligation to avoid deterioration of the site or significant disturbance of the species for which the site is designated, and seeks to avoid plans or projects that may affect the site giving rise to the risk of deterioration. Similarly, where there is evidence to show that a feature has historically been more abundant than the stated minimum target and its current level, the ongoing capacity of the site to accommodate the feature at such higher levels in future should also be taken into account in any assessment. Unless otherwise stated, the population size or presence will be that measured using standard methods, Plastic tray sampling, or white sheet beating surfaces are typically used as sample points in wetlands for assessments of this species. This value is also provided recognising there will be inherent variability as a result of natural fluctuations and margins of error	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			during data collection. Whilst we will endeavour to keep these values as up to date as possible, local Natural England staff can advise that the figures stated are the best available.	
Population (of the feature)	**Connectivity with other populations**	Restore the abundance and supporting habitat of Desmoulins whorl snail upstream of the SAC and the connectivity between populations	This recognises population vulnerability of the top-most population to localised extinction; it remains likely that colonies are moved in flood events to downstream sites, so loss of headstream populations weakens the opportunities to overcome localised extinction events further downstream.	Shaw, S. & Tratt, R. (2015)
Supporting habitat: extent and distribution	**Distribution of supporting habitat**	Restore the distribution and continuity of the feature and its supporting habitat, including where applicable its component vegetation types and associated transitional vegetation types, across the site	A contraction in the range, or geographic spread, of the feature (and its component vegetation) 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. Contraction may also reduce and break up the continuity of a habitat within a site and how well the species feature is able to occupy and use habitat within the site. Such fragmentation may 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 this feature and this may affect its viability. East Walton Common / Adcock's Common SSSI and Thompson Common SSSI are currently the only sites within the SAC at which *Vertigo moulinsiana* has been recorded.	This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments .
Supporting habitat: extent and distribution	**Extent of supporting habitat.**	Restore the total extent of the habitats which support the feature to: 70ha at Thompson Common SSSI, and 60ha at East Walton and Adcock's Common SSSI.	In order to contribute towards the objective of achieving an overall favourable conservation status of the feature at a UK level, it is important to maintain or if appropriate restore the extent of supporting habitats and their range within this SAC. The information available on the extent and distribution of supporting habitat used by the feature may be approximate depending on the nature, age and accuracy of data collection, and may be subject to periodic review in light of improvements in data.	Shaw, S. & Tratt, R. (2015) This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments
Supporting habitat:	**Ground moisture**	Maintain appropriate soil/ground moisture conditions so that water	High groundwater levels throughout the year are considered to be one of the most important factors influencing the distribution	Shaw, S. & Tratt, R. (2015) .

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
structure/ function		levels are continuously at or just above the ground surface throughout the year.	of Desmoulin's whorl snail. For this feature the water level must remain close to the surface so that the ground remains at least moist for most of the summer, although some seasonal drying appears to be acceptable. Relatively high groundwater also contributes to maintaining a high humidity in the vegetation. The optimal degree of ground moisture for this feature is usually measured as 2 or 3 using a version of the '5 Point Wetness scale' (Killeen & Moorkens 2003). 1. ground dry, possibly with crack and no evidence of surface moisture; 2. ground damp, moisture observed on the surface but water does not rise under light pressure; 3. ground wet, no surface veneer, but water rises under light (foot) pressure; 4. ground Wet, surface veneer of less than 1-2cm deep; and 5. ground very wet, water depth greater than 2cm, may cover the sward and tussocks.	
Supporting habitat: structure/ function	**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, within typical values for the supporting habitat	Soil supports basic ecosystem function and is 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 the supporting habitat of this Annex II feature.	
Supporting habitat: structure/ function	**Vegetation composition - invasive non-native plants**	Ensure invasive non-native plants are either rare or absent within the site	Desmoulin's whorl snails are potentially or actually at risk from non-native invasive plants. Such plants are considered a major threat to habitat due to their rapid growth and dominance over native species and the difficulty of controlling them. Species of concern include Japanese knotweed (*Polygonum [Fallopia] japonica*), Himalayan [Indian] balsam (*Impatiens glandulifera*) and giant hogweed (*Heracleum mantegazzianum*).These riparian plants may directly alter the composition of Desmoulin's whorl snail habitat by replacing preferred species and increasing shading.	This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Supporting habitat: structure/ function	**Vegetation structure**	Restore dense stands of tall vegetation, which is typically >70cms tall by August, with an abundance of tussocks and decaying leaf litter.	Humidity is important to all whorl snails (*Vertigo* spp.) and the different species achieve their requirements by occupying different levels (i.e. vertical movement) within their microhabitats. Desmoulin's whorl snail is a climbing species on emergent vegetation, living over a large vertical range at different times of year. The snail may over-winter in the lower levels of vegetation, within tussocks or in amongst decaying layer of leaf litter and vegetation. Associated supporting vegetation is usually tall, bulky marginal plants such as *Glyceria, Carex, Cladium, Sparganium & Iris.* Supporting habitat is typically tall herb swamp and fen communities such as NVC types S7, S5, S2, S3 & S6 NVC communities.	Shaw, S. & Tratt, R. (2015) This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments
Supporting processes (on which the feature and/or its supporting habitat relies)	**Adaptation and resilience**	Maintain the feature's ability, and that of its supporting habitat, to adapt or evolve to wider environmental change, either within or external to the site	See the explanatory notes for this attribute above in Table 1	.
Supporting processes (on which the feature and/or its supporting habitat relies)	**Air quality**	Maintain 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).	See the explanatory notes for this attribute above in Table 1	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).
Supporting processes (on which the feature and/or its supporting habitat relies)	**Conservation measures**	Restore the management measures (either within and/or outside the site boundary as appropriate) which are necessary to maintain the structure, functions and supporting processes associated with the feature and/or its supporting habitats.	Active and ongoing conservation management is needed to protect, maintain or restore this feature at this site. Further details about the necessary conservation measures for this site can be provided by contacting Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, site management strategies or plans, the Views about Management Statement for the underpinning SSSI and/or management agreements, The basic requirements for Desmoulin's snail is swampy,	Killeen, I. (2002) Survey of EU Habitats Directive Vertigo species in England: 3. (*Vertigo Moulinsiana*). ENRR450 Natural England (2014): Site Improvement Plan – Norfolk Valley Fens SAC (SIP Profile: 150)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			usually unshaded ground with tall waterside plants. Water levels must remain close to the surface so that ground remains at least moist for most of the summer. The snail will disappear from areas where conditions become dry enough for plants such as nettle *Urtica dioica* and great willowherb *Epilobium hirsutum* to become frequent; conversely conditions must not become so wet that aquatic plants such as watercress *Rorippa nasturtium-aqualatis* and fools watercress *Apium nodiflorum* take over. Ideally no grazing by domestic stock should take place in areas that support the snail, although it does live where grazing intensity is low and patchy. Cutting and mowing will remove tall vegetation that the snail requires. The management requirements for Desmoulin's snail may conflict the management required to support a number of the other SAC habitats; the needs of both features will need to be balanced on the parts of the SAC that it is recorded from.	
Supporting processes (on which the feature and/or its supporting habitat relies)	**Water quantity/ quality**	Where the feature or its supporting habitat is dependent on surface water and/or groundwater, restore water quality and quantity to a standard which provides the necessary conditions to support the feature	For many SAC features which are dependent on wetland habitats supported by surface and/or ground water, maintaining the quality and quantity of water supply will be critical, especially at certain times of year. 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 to reflect the ecological needs of the species feature. Further site-specific investigations may be required to establish appropriate water quality standards for the SAC. High groundwater levels throughout the year are considered to be one of the most important factors influencing the distribution of Desmoulin's whorl snail, at or slightly above the local ground surface for at least part of the year. Water levels must remain close to the surface so that the ground remains as least moist for most of the summer, although some seasonal drying may	Natural England (2011d)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			be acceptable. The relatively high groundwater level is also likely to contribute to maintaining high humidity in the vegetation, although conditions must not become wet enough to allow aquatic plants such as water cress to become dominant. Winter water levels are expected to be at the surface.	
Version Control Advice last updated: N/A				
Variations from national feature-framework of integrity-guidance: N/A				

References

Hagget, G.M (2010) The Barred Tooth-striped Moth *Trichopteryx polycommata* (Denis & Schiffermüller), Brecks Survey 2009. Butterfly Conservation Report No. S10-03, (Available on request from Natural England)

Killeen, I. (2001) Surveys of EU Habitats Directive Vertigo species in England: *Vertigo angustior* at Flordon Common SAC, Norfolk and Fritton Marshes pSSSI, Suffolk. English Nature Research Reports 419

Killeen, I. (2002) Survey of EU Habitats Directive *Vertigo* species in England: 3. (Vertigo Moulinsiana). English Nature Research Report 450

Natural England (2011a). Conservation objectives and definitions of favourable condition for designated features of interest: Holt Lowes SSSI.

Natural England (2011b). Conservation objectives and definitions of favourable condition for designated features of interest: Buxton Heath SSSI.

Natural England (2011c). Conservation objectives and definitions of favourable condition for designated features of interest: Booton Common SSSI.

Natural England (2011d). Conservation objectives and definitions of favourable condition for designated features of interest: East Walton & Adcock's Common SSSI.

Natural England (2011e). Conservation objectives and definitions of favourable condition for designated features of interest: Foulden Common SSSI.

Natural England (2011f). Conservation objectives and definitions of favourable condition for designated features of interest: Great Cressingham Fen SSSI.

Natural England (2011g). Conservation objectives and definitions of favourable condition for designated features of interest: Thompson Water, Carr and Common SSSI.

Natural England (2012). Conservation objectives and definitions of favourable condition for designated features of interest: Flordon Common SSSI.

Norfolk Wildlife Trust (2000) NVC of Buxton Heath SSSI by Robert Yaxley. Unpublished report to English Nature. (Available from Natural England on request).

Shaw, S. & Tratt, R. (2016a): Observations on *Schoenus nigricans–Juncus subnodulosus* mire (M13) sites in selected East Anglian Fens, 2015: Buxton Heath. Unpublished report for Environment Agency (Available on request from Natural England).

Shaw, S. & Tratt, R. (2016b): Observations on *Schoenus nigricans–Juncus subnodulosus* mire (M13) sites in selected East Anglian Fens, 2015: Holt Lowes. Unpublished report for Natural England (Available on request from Natural England).

Shaw, S. & Tratt, R. (2016c): Observations on *Schoenus nigricans–Juncus subnodulosus* mire (M13) sites in selected East Anglian Fens, 2015: East Walton Common. Unpublished report for Natural England (Available on request from Natural England).

Shaw, S. & Tratt, R. (2016d): Observations on *Schoenus nigricans–Juncus subnodulosus* mire (M13) sites in selected East Anglian Fens, 2015: Fouldon Common. Unpublished report for Natural England (Available on request from Natural England).

Shaw, S. & Tratt, R. (2016e): Observations on *Schoenus nigricans–Juncus subnodulosus* mire (M13) sites in selected East Anglian Fens, 2015: Badley Moor. Unpublished report for Natural England (Available on request from Natural England).

Shaw, S. & Tratt, R. (2016f): Observations on *Schoenus nigricans–Juncus subnodulosus* mire (M13) sites in selected East Anglian Fens, 2015: Booton Common. Unpublished report for Natural England (Available on request from Natural England).

Shaw, S. & Tratt, R. (2016g): Observations on *Schoenus nigricans–Juncus subnodulosus* mire (M13) sites in selected East Anglian Fens, 2015: Flordon Common. Unpublished report for Natural England (Available on request from Natural England).

Shaw, S. & Tratt, R. (2016h): Observations on *Schoenus nigricans–Juncus subnodulosus* mire (M13) sites in selected East Anglian Fens, 2015: Great Cressingham Fen. Unpublished report for Natural England (Available on request from Natural England).

Shaw, S. & Tratt, R. (2016i): Observations on *Schoenus nigricans–Juncus subnodulosus* mire (M13) sites in selected East Anglian Fens, 2015: Sheringham & Beeston Regis Commons. Unpublished report for Natural England (Available on request from Natural England).

Shaw, S. & Tratt, R. (2016j): Observations on *Schoenus nigricans–Juncus subnodulosus* mire (M13) sites in selected East Anglian Fens, 2015: Southrepps Common. Unpublished report for Natural England (Available on request from Natural England).

Shaw, S. & Tratt, R. (2016k): Observations on *Schoenus nigricans–Juncus subnodulosus* mire (M13) sites in selected East Anglian Fens, 2015: Swangey Fen. Unpublished report for Natural England (Available on request from Natural England).

Wild Frontier Ecology (2013) NVC Survey of Thompson Water, Carr and Common SSSI. Unpublished report to Natural England. (Available on request from Natural England)