



## **European Site Conservation Objectives: supplementary advice on conserving and restoring site features**

**Fenland Special Area of Conservation (SAC)  
Site Code: UK0014782**



Molinia meadow at Chippenham Fen. Photo credit Natural England/Peter Wakely

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## **About this document**

This document provides Natural England's supplementary advice about the European Site Conservation Objectives relating to Fenland SAC.

This advice should therefore be read together with the SAC Conservation Objectives available [here](#).

You should use the Conservation Objectives, this Supplementary Advice and any case-specific advice given by Natural England when developing, proposing or assessing an activity, plan or project that may affect this site.

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](mailto:HDIRConservationObjectivesNE@naturalengland.org.uk)**

## About this site

### European Site information

<b>Name of European Site</b>	Fenland Special Area of Conservation (SAC)
<b>Location</b>	Cambridgeshire
<b>Site Map</b>	The designated boundary of this site can be viewed <a href="#">here</a> on the MAGiC website
<b>Designation Date</b>	1 April 2005
<b>Qualifying Features</b>	See section below
<b>Designation Area</b>	618.64 ha
<b>Designation Changes</b>	None
<b>Feature Condition Status</b>	Details of the feature condition assessments made at this site can be found using Natural England's <a href="#">Designated Sites System</a>
<b>Names of component Sites of Special Scientific Interest (SSSIs)</b>	Chippenham Fen and Snailwell Poor's Fen SSSI Wicken Fen SSSI Woodwalton Fen SSSI
<b>Relationship with other European or International Site designations</b>	<a href="#">Chippenham Fen Ramsar</a> <a href="#">Wicken Fen Ramsar</a> <a href="#">Woodwalton Fen Ramsar</a>

### Site background and geography

The three sites that comprise the Fenland SAC are located within the Fens National Character Area ([NCA Profile 46](#)) in Cambridgeshire, but they are located some 27 miles apart. They all overlie peat soils of varying depth and all are primarily calcareous fen with areas of grassland and woodland.

Chippenham Fen is a shallow basin located close to the start of the Chippenham River and is surrounded by higher land over chalk. The site is fed both by water emerging in some places from the chalk aquifer, and from the chalk streams to begin nearby. Drainage ditches have been cut throughout, and are now used to enable management and to increase water levels during the summer. A rich diversity of fenland and aquatic plants can be found there, including the very rare Cambridge milk parsley (*Selinum carvifolia*), and the site is also known for its impressive invertebrate community. Stands of saw sedge (*Cladium mariscus*) are still managed and cut for thatching.

Woodwalton Fen is a former raised bog that was dug for peat in the late 19<sup>th</sup> century, removing most of the acid peat (although remnant areas remain) and exposing the underlying fen peat. Nowadays the site is almost completely cut off from natural hydrology, perched above the surrounding arable land where the peat has oxidised and land levels have dropped. Summer water is obtained from a large irrigation/drainage channel via the network of drainage ditches that cross the site. Two meres have been dug, adding to the area of open water, and a large reedbed dominates the north of the site. Areas of fen are floristically rich, with rarities such as fen violet (*Viola persicifolia*), fen woodrush (*Luzula pallescens*) and heath dog violet (*Viola canina* subsp. *montana*). There is a diverse invertebrate community, including the rare tansy beetle (*Chrysolina graminis*) and a diverse community of breeding birds is monitored by the BTO's Constant Effort Sites (CES) scheme.

Wicken Fen is largely undrained, supported by a high water table of calcareous groundwater. North of Wicken Lode the peat is deeper, despite some historic peat cutting, while to the south the land has seen more excavation and there is more open water. Wicken Lode, running through the middle of the site, is thought to be part of a Roman transport system. The site became popular from the mid-19<sup>th</sup> century onwards to visiting naturalists, and this tradition has continued, partly due to the proximity of Cambridge University. All stages of succession are supported within the site, which allows maintenance of the extremely high biodiversity. Of particular importance are the rare fenland plants and invertebrates, and the site also supports large numbers of wintering birds.

## 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:

- **H6410. Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinia caerulea*): 'Purple moor-grass meadows'**

In all three sites of the Fenland SAC, *Molinia* meadows are generally found within mosaics of other vegetation, particularly tall-herb fen and mire. They loosely conform to UK NVC type M24 (*Molinia caerulea* - *Cirsium dissectum* fen meadow) and are species-rich, where the purple moor-grass is accompanied by a wide range of associated species, including rushes, sedges and tall-growing herbs.

At Chippenham Fen, fen meadow and rush pasture are found in the same areas through much of the site, mainly managed through buffalo grazing with some cutting where necessary to prevent over-dominance by rush. Here, the fen meadow community is associated with Cambridge milk parsley (*Selinum carvifolia*) and in some areas a number of orchid species (*Dactylorhiza incarnata* var. *ochroleuca*, *D. praetermissa*, *D. traunsteineri*, *D. fuchsia*, *Epipactis palustris*).

At Woodwalton Fen, *Molinia* fen meadow is found in a small area in the south of the site where the water levels are lower. It is less species-rich here than in the other sites, associated particularly with *Galium palustre* and *Potentilla erecta*, and it is also one of the only remaining locations for *Cirsium dissectum* in Cambridgeshire.

At Wicken Fen, areas of *Molinia* meadow are found in Sedge Fen, where vegetation undergoes rotational cutting, with a few areas also found in mosaics with other vegetation communities in the extensively grazed Verrall's Fen. A large number of herbs are found in fen meadow areas, such as milk parsley (*Peucedanum palustre*), meadow rue (*Thalictrum flavum*) and yellow loose-strife (*Lysimachia vulgaris*).

- **H7210. Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae*: 'Calcium-rich fen dominated by great fen sedge (saw sedge)'**

Saw sedge is a component of much of the tall fen vegetation particularly at Chippenham Fen and Wicken Fen (for example in UK NVC types S24 - *Phragmites australis* - *Peucedanum palustre* tall-herb fen and S25 - *Phragmites australis* - *Eupatorium cannabinum* tall-herb fen). Where it is cut on a three-four year rotation it can dominate the community, forming stands of NVC type S2 - *Cladium mariscus* swamp and sedge-beds. At Woodwalton Fen and Wicken fen it can also occur at lower density in fen meadow communities, such as M24 *Molinia caerulea* - *Cirsium dissectum* fen-meadow, generally in mosaics with other fen vegetation. At Woodwalton Fen there are small stands in several areas in mosaic with other swamp vegetation (for example M13 *Schoenus nigricans* - *Juncus subnodulosus* mire).

### Qualifying Species:

- **S1166. *Triturus cristatus*: Great crested newt**

The great crested newt is the largest native British newt, reaching up to around 17cms in length. Newts require aquatic habitats for breeding. Eggs are laid singly on pond vegetation in spring, and larvae develop over summer to emerge in August – October, normally taking 2–4 years to reach maturity. Juveniles spend most time on land, and all terrestrial phases may range a considerable distance from breeding sites.

At Woodwalton Fen, high numbers of great crested newts have been found in a group of 20 rain-fed, steep-sided experimental ponds excavated in the 1960s. Little management is carried out in this area other than scrub removal, which is known to be important for maintaining the habitat in the most suitable condition.

At notification, great crested newts weren't found Wicken Fen. They have subsequently colonised a group of ponds that are used for educational visits

Great crested newts are not thought to be present at Chippenham Fen.

The great crested newt is also fully protected under Schedule 5 of the Wildlife and Countryside Act 1981 (as amended) and Schedule 2 of the Conservation of Habitats and Species Regulations 2017 (as amended), making it a 'European Protected Species'. A Licence may therefore be required for any activities likely to harm or disturb great crested newts.

- **S1149. Cobitis taenia; Spined loach**

The spined loach is a small bottom-living fish that has a restricted microhabitat associated with a specialised feeding mechanism. Optimal habitat is patchy cover of submerged (and possibly emergent) macrophytes, which are important for spawning, and a sandy (also silty) substrate, into which juvenile fish tend to bury themselves.

In the UK, spined loach appears to be restricted to just five east-flowing river systems in eastern England – the Rivers Trent, Welland, Witham, Nene and Great Ouse, with their associated waterways (Perrow & Jowitt 2000). Within these catchments it appears to occur patchily in a variety of waterbodies, including small streams, large rivers and both large and small drainage ditches. With limited means of dispersal, the UK populations are largely genetically isolated from each other.

Spined loach surveys have been carried out in Wicken Lode and Monk's Lode, and most recently the density of the species was found to be about the same in both water courses. Both water courses have good water quality and good communities of aquatic macrophytes. No surveys have been carried out in the infield drains within Wicken Fen, but it is possible that the species might also be present in these at low numbers as has been found at other sites in the fens.

Spined loach is not thought to be present at Chippenham Fen or Woodwalton Fen.



**Table 1: Supplementary Advice for Qualifying Features: H6410. *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*); Purple moor-grass meadows**

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
<b>Extent and distribution of the feature</b>	<b>Extent of the feature within the site</b>	<p><b>Restore</b> the total extent of the feature to approximately 32ha :</p> <p><b>Chippenham Fen:</b> 12.4 ha</p> <p><b>Wicken Fen:</b> Total combined extent of the mosaic of lowland 'open' fen communities is 56ha on Verrall's Fen and 42 ha on Sedge Fen, total of 98ha.</p> <p>M24 to be present as a proportion of between 10% and 20% of total mosaic on Sedge and Verrall's Fens combined</p> <p><b>Woodwalton Fen:</b> 5 ha</p>	<p>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.</p> <p>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.</p> <p>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.</p> <p><b>Reason for restore target:</b> The extent at Woodwalton Fen is less than it was when surveyed in 1997/98. This is thought to be due partly to water management (compartments that previously supported the M24 community are now wetter) and partly due to nutrient enrichment from unintentional flooding.</p>	<p><b>Chippenham Fen</b> Natural England (2008a) Natural England (2014a)</p> <p><b>Wicken Fen</b> National Trust (2016) Natural England (2011)</p> <p><b>Woodwalton Fen</b> Natural England (2008) Natural England (2014b)</p> <p>This attribute will be periodically monitored as part of Natural England's <a href="#">SSSI Condition Assessments</a></p>
<b>Extent and distribution of the feature</b>	<b>Spatial distribution of the feature within the site</b>	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	See above under 'extent'

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			<p>use habitat. Such fragmentation can impact on their viability and the wider ecological composition of the Annex I habitat.</p> <p>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.</p>	
<b>Structure and function (including its typical species)</b>	<b>Vegetation community composition</b>	<p>Ensure the component vegetation communities of the feature are referable to and characterised by the following National Vegetation Classification type:</p> <p>M24 <i>Molinia caerulea</i> – <i>Cirsium dissectum</i> fen-meadow</p>	<p>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).</p> <p>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).</p> <p>Molinia meadows at Chippenham Fen are either typical of M24b (<i>Molinia caerulea</i> - <i>Cirsium dissectum</i> typical sub-community) or occur as an intermediate community between M24a (<i>Molinia caerulea</i> - <i>Cirsium dissectum</i>, <i>Eupatorium cannabinum</i> sub-community) and M13 (<i>Schoenus nigricans</i> mire). The rare and protected <i>Selinum carvifolia</i> is particularly associated with M24 communities at Chippenham Fen</p> <p>Molinia meadows at Wicken Fen show most affinity with M24a (<i>Molinia caerulea</i> - <i>Cirsium dissectum</i>, <i>Eupatorium cannabinum</i> sub-community) but occur often in transition with other fen meadow communities</p>	See above under 'extent'



Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			<p>The remaining M24 community at Woodwalton Fen is small and moderately species-rich. Other constant species include <i>Carex panacea</i>, <i>C. viridula brachyrrhyncha</i>, <i>Calamagrostis epigejos</i>, <i>Hydrocotyle vulgaris</i>, <i>Juncus effusus</i>, <i>Calliargon cuspidatum</i>, <i>Cirsium palustris</i>, <i>Potentilla erecta</i> and <i>Galium palustre</i>. Also particularly notable is the abundance of <i>Juncus articulatus</i> and <i>J. subnodulosus</i> and the presence of <i>Cirsium dissectum</i> and previous record for <i>Dactylorhiza traunsteineri</i></p>	
<b>Structure and function (including its typical species)</b>	<b>Key structural, influential and/or distinctive species</b>	<p>Restore the abundance of the typical species listed below to enable each of them to be a viable component of the Annex 1 habitat;</p> <ul style="list-style-type: none"> <li>• Constant and preferential plant species of the M24, M24a and M24b NVC vegetation types at this SAC</li> <li>• Cambridge Milk Parsley <i>Selinum carvifolia</i></li> <li>• Rich invertebrate fauna</li> </ul>	<p>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;</p> <ul style="list-style-type: none"> <li>• <b>Structural</b> 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').</li> <li>• <b>Influential</b> 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)</li> <li>• <b>Site-distinctive</b> species which are considered to be a particularly special and distinguishing component of an Annex I habitat on a particular SAC.</li> </ul> <p>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.</p> <p><b>Reason for restore target:</b> Much of the area previously</p>	See above under 'extent'

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			<p>ascribed to M24 in Woodwalton Fen is now dominated by species that indicate water logging and cannot presently be called Molina meadow.</p>	
<p><b>Structure and function (including its typical species)</b></p>	<p><b>Vegetation: undesirable species</b></p>	<p>Restore (at Woodwalton Fen) and maintain (at Chippenham Fen and Wicken Fen) the frequency/cover of the undesirable species to within acceptable levels and prevent changes in surface condition, soils, nutrient levels or hydrology which may encourage their spread.</p>	<p>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.</p> <p><i>Phragmites australis</i>: Less than 10% cover</p> <p><i>Cirsium palustre</i>: Less than 20%</p> <p><i>Juncus</i> species: Less than 80% combined with the combined cover of <i>Juncus conglomeratus</i>, <i>J. effusus</i> and <i>J. inflexus</i> less than 50%;</p> <p><i>Deschampsia cespitosa</i>: Less than 10% cover</p> <p><i>Senecio aquaticus</i>: No more than occasional should be no more than occasional though the sward;</p> <p><i>Cirsium arvense</i>, <i>Cirsium vulgare</i>, <i>Rumex crispus</i>, <i>Rumex obtusifolius</i>, <i>Urtica dioica</i>: No more than 5% cover combined</p> <p>Scrub: Combined cover no more than 5%</p> <p><b>Reason for restore target:</b> Within the areas previously ascribed to M24 in Woodwalton Fen, species indicating water levels that are too high to support the M24 habitat are present at high cover, particularly <i>Phragmites australis</i> and <i>Juncus effusus</i>. Cover of <i>Cirsium arvense</i> is also too high, likely indicating that silt from seasonal flooding has affected the soil nutrient levels.</p>	<p>This attribute will be periodically monitored as part of Natural England's <a href="#">SSSI Condition Assessments</a></p>

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
<b>Structure and function (including its typical species)</b>	<b>Vegetation community transitions</b>	Maintain the pattern of natural vegetation zonation/transitions	<p>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.</p> <p>Areas of <i>Molinia</i> meadow are often not well-defined, occurring instead as intermediaries with, or in close proximity to, other vegetation communities. In Chippenham Fen and Wicken Fen <i>Molinia</i> meadows are often found as intermediaries with <i>Juncus subnodulosus</i> fen meadow, or <i>Scoenus nigricans</i> mire</p>	See details of NVC surveys above under 'extent'
<b>Structure and function (including its typical species)</b>	<b>Soils, substrate and nutrient cycling</b>	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 <sup>-1</sup> )	<p>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.</p> <p>Very little is known about the soil nutrients or biota at any of the sites. There are concerns that the area where the majority of M24 has been found at Woodwalton Fen have undergone nutrient enrichment because of sediment remaining after flood water has drained from the site, but soil nutrient analysis has not been undertaken.</p>	
<b>Structure and function (including its typical species)</b>	<b>Water quality</b>	<p>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.</p> <p>All sites have a target of total phosphorus &lt;0.1mg/l in the ditches.</p>	<p>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.</p> <p>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</p>	<p>Water quality data is available from Natural England on request)</p> <p>Natural England (2014) <a href="#">Site Improvement Plan: Fenland SAC</a></p>

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		In all sites the surface water and ground water is largely mixed.	<p>cases more stringent standards may be needed. Further site-specific investigations may be required to establish appropriate water quality standards for the SAC.</p> <p><b>Reason for restore target:</b> The Great Raveley Drain, the watercourse feeding Woodwalton Fen providing summer water when rainfall is insufficient, has previously been high in phosphates because of local sewage works. Although water quality is now within the phosphorus target in the summer, there continues to be a legacy of high phosphates in the internal drains. Total nitrogen and total phosphorus within the Great Raveley Drain are also thought to be high in winter because of agricultural run-off leading to sediment rich water.</p> <p>There is often unintended flooding as this water overtops the southern bank into Woodwalton Fen, with impacts on the water quality in the internal drains and on soil nutrients.</p> <p>Chippenham Fen is reliant on upwellings from the aquifer, which is known to be high in nitrates.</p>	
<b>Structure and function (including its typical species)</b>	<b>Hydrology: Water table</b>	Restore 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 $\pm$ at the surface. Inundation should be absent or only occasional to a minor degree in winter	<p>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.</p> <p><b>Reason for restore target:</b> Woodwalton Fen and Wicken Fen are situated in manmade landscapes and restoring natural hydrology is unlikely to be possible. Chippenham Fen, however, is situated close to the start of the small Chippenham River catchment, and restoring natural hydrology, as far as possible, is a long-term aim.</p>	<p><b>Chippenham Fen:</b> Eades and Shaw (2018)</p> <p>Dipwell data is available on request from Natural England</p> <p>Natural England (2014) <a href="#">Site Improvement Plan: Fenland SAC</a></p>
<b>Structure and function (including its</b>	<b>Maintaining integrity of hydrological</b>	Restore the full range of hydrological/hydrogeological aspects of a site's catchment that	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	<b>Chippenham Fen:</b> Environment Agency (2009)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
typical species)	catchment	contribute to its functioning and the maintenance of the feature	<p>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.</p> <p>Groundwater levels at Wicken Fen were for a few years too low to sustain the habitat, and a wind pump was installed to deliver calcareous water with good water quality to the fen. Since the installation in 2011 ground water levels have increased to the point that the wind pump isn't necessary. The reason for the decrease and subsequent increase in groundwater isn't understood.</p> <p>The aquifer below Chippenham Fen is important because it supplies calcareous water to the site through upwellings and springs. It is currently over-abstracted, but any negative effects on Chippenham Fen can be offset through the Lodes Granta groundwater support scheme.</p> <p><b>Reason for restore target:</b> Woodwalton Fen is currently a designated flood storage reservoir, although it hasn't needed to perform this function since 1998. Inundation of sediment-rich floodwater is thought to be extremely damaging to the fen, so there is a long-term aim to secure alternative land that can be used for flood storage instead of Woodwalton Fen.</p>	<p><b>Woodwalton Fen:</b> OHES (2016) Natural England (2014) <a href="#">Site Improvement Plan: Fenland SAC</a></p>
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	<p>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.</p>	<p>Great Fen Project : <a href="http://www.greatfen.org.uk/">http://www.greatfen.org.uk/</a> Wicken Vision: <a href="https://www.nationaltrust.org.uk/wicken-fen-nature-reserve/documents/wicken-fen-vision-strategy-document.pdf">https://www.nationaltrust.org.uk/wicken-fen-nature-reserve/documents/wicken-fen-vision-strategy-document.pdf</a></p> <p><b>Chippenham Fen:</b> Eades and Shaw (2018)</p>

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			<p>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.</p> <p><b>Reason for restore target:</b> Fenland habitat is heavily influenced by surrounding land use because of its reliance on good quality ground and surface water. Small, isolated sites surrounded by arable farmland on peat will become increasingly difficult to manage as arable land drops because of peat oxidation. Restoration of surrounding land is considered necessary to prevent deterioration of the three sites, and there are already large-scale projects underway in order to achieve this.</p> <p>The Great Fen is a project to create 3700 ha of wetland adjacent to Woodwalton Fen. Wicken Vision plans to restore fenland of up to 5300 ha around Wicken Fen. There is a long-term vision to restore, as much as possible, the natural hydrology around Chippenham Fen.</p>	
<b>Structure and function (including its typical species)</b>	<b>Adaptation and resilience</b>	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	<p>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.</p> <p>Using best available information, any necessary or likely adaptation or adjustment by the feature and its management in response to actual or expected climatic change should be allowed for, as far as practicable, in order to ensure the feature's long-term viability.</p> <p>The overall vulnerability of this SAC to climate change has</p>	<p>NATURAL ENGLAND (2015)<a href="#">Climate Change Theme Plan and supporting National Biodiversity Climate Change Vulnerability assessments ('NBCCVAs') for SACs and SPAs in England</a></p> <p>Natural England (2014a)</p> <p>Natural England (2014b)</p> <p><a href="#">National Character Area 46: The Fens</a></p>



Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			<p>been assessed by Natural England (2015) as being high taking into account the sensitivity, fragmentation, topography and management of its [habitats/supporting habitats].</p> <p>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, change will be inevitable so appropriate monitoring would be advisable.</p> <p><b>Reason for restore target:</b> M24 at Woodwalton Fen has been assessed as highly vulnerable to climate change because of the likelihood of decreased summer rainfall and increased frequency of flood events. While Woodwalton Fen is a designated flood storage area, increased flood events are likely to not only damage plant and invertebrate communities but also increase nutrient levels from the sediment load of flood water.</p> <p>The groundwater at Wicken Fen was, for several years, well below the level required for M24. It has now recovered but, despite significant research, the reason for this has not been identified. Chippenham Fen is naturally fed by upwellings from the aquifer, as well as surface water. The aquifer is over-abstracted, and the Lode's Granta scheme has been adopted to ensure that the fen has sufficient water in times of drought.</p>	
<b>Supporting processes (on which the feature relies)</b>	<b>Air quality</b>	Maintain 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 ( <a href="http://www.apis.ac.uk">www.apis.ac.uk</a> ).	<p>This habitat type is considered sensitive to changes in air quality. 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.</p> <p>Critical Loads and Levels are recognised thresholds below</p>	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 ( <a href="http://www.apis.ac.uk">www.apis.ac.uk</a> ).

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			<p>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 (NH<sub>3</sub>), oxides of nitrogen (NO<sub>x</sub>) and sulphur dioxide (SO<sub>2</sub>), 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.</p> <p>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.</p>	
<b>Supporting processes (on which the feature relies)</b>	<b>Conservation measures</b>	Restore the management measures (either within and/or outside the site boundary as appropriate) which are necessary to maintain/restore the structure, functions and supporting processes associated with the feature	<p>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.</p> <p>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.</p> <p>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</p> <p>Chippenham Fen: The vegetation is managed in 3 different ways in different areas: mown, grazed by the water buffalo and grazed by water buffalo and cattle.</p>	<p>National Trust (2016)</p> <p>Natural England (2014a)</p> <p>Natural England (2014b)</p>

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			<p>Wicken Fen: Some areas are extensively grazed, and it is here where small patches of M24 develop in amongst other fen meadow and tall herb fen habitats. Areas specifically managed for M24 are cut annually.</p> <p>Woodwalton Fen: M24 areas are grazed with a cut later in the year. Molinia tussocks are protected.</p> <p><b>Reason for restore target:</b> Water management and unintentional flooding at Woodwalton Fen has led to some areas that previously supported M24 becoming too wet for this community.</p>	
<p><b>Version Control</b> Advice last updated: N/A</p>				
<p><b>Variations from national feature-framework of integrity-guidance:</b> N/A</p>				

**Table 2: 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)
<b>Extent and distribution of the feature</b>	<b>Extent of the feature within the site</b>	<p>Maintain the total extent of the feature to approximately 44ha :</p> <p>Chippenham Fen: 8 ha of S25 and 13 ha of S2</p> <p>Wicken Fen: Approximately 20 ha</p> <p>Woodwalton Fen: Approximately 3 ha</p>	<p>This target is included as there should be no measurable net 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.</p> <p>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.</p> <p>It is difficult to estimate the extent with much accuracy, particularly at Woodwalton Fen and Wicken Fen because <i>Cladium</i> mainly occurs in mosaics with other fen types.</p>	<p><b>Chippenham Fen</b></p> <p>Natural England (2008a) Natural England (2014a)</p> <p><b>Wicken Fen</b></p> <p>National Trust (2016) Natural England (2011)</p> <p><b>Woodwalton Fen</b></p> <p>Natural England (2008b) Natural England (2014b)</p> <p>This attribute will be periodically monitored as part of Natural England's <a href="#">SSSI Condition Assessments</a></p>
<b>Extent and distribution of the feature</b>	<b>Spatial distribution of the feature within the site</b>	Maintain 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.	See above under 'extent'
<b>Structure and function (including its typical species)</b>	<b>Vegetation community composition</b>	<p>Ensure the component vegetation communities of the feature are referable to and characterised by National Vegetation Classification types</p> <p>S24 <i>Phragmites australis</i> – <i>Peucedanum palustris</i> tall-herb fen,</p>	<p>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).</p> <p>Maintaining or restoring these characteristic and distinctive vegetation types, and the range of types as appropriate, will be</p>	See above under 'extent'

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		<p>S25 <i>Phragmites australis</i> - <i>Eupatorium cannabinum</i> tall-herb fen (where <i>Cladium mariscus</i> forms a substantial component of the community),</p> <p>S2 <i>Cladium mariscus</i> swamp and sedge-beds,</p> <p>M13 <i>Schoenus nigricans</i> – <i>Juncus subnodulosus</i> mire and</p> <p>M24 <i>Molinia caerulea</i> – <i>Cirsium dissectum</i> fen-meadow</p>	important to sustaining the overall habitat feature.	
<b>Structure and function (including its typical species)</b>	<b>Invasive, non-native and/or introduced species</b>	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).	This attribute will be periodically monitored as part of Natural England's <a href="#">SSSI Condition Assessments</a>
<b>Structure and function (including its typical species)</b>	<b>Presence/cover of woody species</b>	Maintain a low cover of not more than 10% of scrub or trees within stands of H7210.	<p>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.</p> <p>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.</p>	This attribute will be periodically monitored as part of Natural England's <a href="#">SSSI Condition Assessments</a>
<b>Structure and function (including its typical species)</b>	<b>Exposed substrate</b>	<p>Maintain a low cover of exposed substrate of between 5% &amp; 10% within areas of S25.</p> <p>Exposed substrate is unlikely in</p>	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.	This attribute will be periodically monitored as part of Natural England's <a href="#">SSSI Condition Assessments</a>

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		areas of <i>Cladium</i> -dominated S2, which is periodically cut; there should be no more than 10% exposed substrate.	For some strongly spring-fed sites, a higher value may be appropriate.	
<b>Structure and function (including its typical species)</b>	<b>Key structural, influential and/or distinctive species</b>	<p>Maintain the abundance of the typical species listed below to enable each of them to be a viable component of the Annex 1 habitat;</p> <ul style="list-style-type: none"> <li>• Constant and preferential plant species of the M24, S2, S25, S24 and M13 NVC vegetation types at this SAC</li> <li>• Cambridge Milk Parsley <i>Selinum carvifolia</i></li> <li>• Rich invertebrate fauna</li> </ul>	<p>See explanatory notes for this attribute in Table 1.</p> <p>All three sites have areas of species-poor S2 where <i>Cladium</i> dominates the community, particularly in Chippenham Fen where there is a significant amount of this community. In tall herb fen it often occurs where <i>Phragmites</i> is constant. At Wicken Fen it occurs particularly as part of an S25 community where other constant species are <i>Juncus subnodulosus</i>, <i>Lysimachia vulgaris</i>, <i>Symphytum officinale</i>, and <i>Calamagrostis canescens</i>, for example. At all sites it also occurs scattered through several different community types, for example M24 fen meadow</p> <p>All three sites support important invertebrate assemblages, but there are no species known to be particularly associated with <i>Cladium</i>.</p>	<p><b>Chippenham Fen:</b> Natural England (2014a)</p> <p><b>Wicken Fen:</b> National Trust (2016) Natural England (2011)</p> <p><b>Woodwalton Fen:</b> Natural England (2014b)</p>
<b>Structure and function (including its typical species)</b>	<b>Hydrology</b>	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	<p>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.</p> <p>Wheeler et al. (2009) provide range and mean for summer &amp; 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.</p> <p><b>Reason for restore target:</b> Woodwalton Fen and Wicken Fen</p>	<p>Chippenham Fen: Eades and Shaw (2018)</p> <p>Dipwell data is available on request from Natural England</p> <p>Natural England (2014) <a href="#">Site Improvement Plan: Fenland SAC</a></p>



Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			are situated in manmade landscapes and restoring natural hydrology is unlikely to be possible. Chippenham Fen, however, is situated close to the start of the small Chippenham River catchment, and restoring natural hydrology, as far as possible, is a long-term aim.	
<b>Structure and function (including its typical species)</b>	<b>Water chemistry</b>	<p>Restore the low nutrient status of irrigating water, ensuring it is rich in base ions, particularly calcium.</p> <p>All sites have targets for ditches of total phosphorus &lt;0.1mg/l in the ditches and at least biological and chemical GQA Class 'B'.</p> <p>In all sites the surface water and ground water is largely mixed.</p>	<p>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.</p> <p>Woodwalton Fen is irrigated through rainfall in the winter and by abstraction of calcium-rich water from the adjacent drainage channel when rainfall is insufficient in summer months. In the past the drainage channel water was high in phosphates, but it is now within the targets.</p> <p>Wicken Fen has a good supply of base-rich, low nutrient groundwater.</p> <p><b>Reason for restore target:</b> The groundwater in the aquifer that supplies Chippenham Fen is calcium-rich but high in nitrates.</p>	<p>Water quality data is available from Natural England on request</p> <p>Natural England (2014) <a href="#">Site Improvement Plan: Fenland SAC</a></p>
<b>Structure and function (including its typical species)</b>	<b>Hydrology</b>	<p>Restore a high piezometric head and permanently high water table (allowing for natural seasonal fluctuations) on groundwater dependent sites.</p>	<p>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.</p> <p>There is some limited evidence for groundwater movement into Woodwalton Fen, but this has never been proven. It is generally accepted that the site is fed by rainfall in the winter and through abstraction from the adjacent drainage channel in the summer.</p>	<p>Environment Agency (2005) Final Methodology and Proforma for Stage 3 of the Review of Consents under the Habitats Directive: Chippenham Fen and Snailwell Poor's Fen SSSI, component of Fenland SAC</p> <p>Natural England (2014) <a href="#">Site Improvement Plan: Fenland SAC</a></p>

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			<p>The role of groundwater at Wicken Fen isn't understood but it is thought to be important. Prior to 2011 there had been insufficient calcium-rich summer water for several years, but in recent years the levels have been close to ideal.</p> <p><b>Reason for restore target:</b> The restore target refers to Chippenham Fen only.</p> <p>The Review of Consents identified that the aquifer that supplies Chippenham Fen with water is over-abstracted, and that during dry summers the fen may receive insufficient water naturally. To mitigate, a pump has been installed allowing water to be artificially introduced onto the site if necessary. Restoration of a more natural hydrological system is the long-term aim.</p>	
<b>Structure and function (including its typical species)</b>	<b>Adaptation and resilience</b>	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	<p>See explanatory notes for this attribute in Table 1</p> <p><b>Reason for restore target:</b> <i>Cladium</i> habitats are thought to be vulnerable to climate change because of the likelihood of decreased summer rainfall and increased frequency of flood events. Woodwalton Fen is a designated flood storage area; increased flood events are likely to not only damage plant and invertebrate communities but also increase nutrient levels from the sediment load of flood water. The groundwater at Wicken Fen was, for several years, well below the level required for M24. It has now recovered but, despite significant research, the reason for this has not been identified. Chippenham Fen is naturally fed by upwellings from the aquifer, as well as surface water. The aquifer is over-abstracted, and the Lode's Granta scheme has been adopted to ensure that the fen has sufficient water in times of drought.</p>	<p>NATURAL ENGLAND (2015) <a href="#">Climate Change Theme Plan and supporting National Biodiversity Climate Change Vulnerability assessments ('NBCCVAs') for SACs and SPAs in England</a></p> <p>Natural England (2014a)</p> <p>Natural England (2014b)</p> <p><a href="#">National Character Area 46: The Fens</a></p>
<b>Structure and function (including its typical species)</b>	<b>Supporting off-site habitat</b>	Restore the extent, quality and spatial configuration of land or habitat surrounding or adjacent to the site which is known to support the feature.	<p>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 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</p>	<p>Great Fen Project : <a href="http://www.greatfen.org.uk/">http://www.greatfen.org.uk/</a></p> <p>Wicken Vision: <a href="https://www.nationaltrust.org.uk/wicken-fen-nature-reserve/documents/wicken-fen-vision-strategy-document.pdf">https://www.nationaltrust.org.uk/wicken-fen-nature-reserve/documents/wicken-fen-vision-strategy-document.pdf</a></p>

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			<p>prevent/reduce/absorb damaging impacts from adjacent land uses e.g. pesticide drift, nutrient enrichment.</p> <p><b>Reason for restore target:</b> Fenland habitat is heavily influenced by surrounding land use because of its reliance on good quality ground and surface water. Small, isolated sites surrounded by arable farmland on peat will become increasingly difficult to manage as arable land drops because of peat oxidation. Restoration of surrounding land is considered necessary to prevent deterioration of the three sites, and there are already large-scale projects underway in order to achieve this. The Great Fen is a project to create 3700 ha of wetland adjacent to Woodwalton Fen. Wicken Vision plans to restore fenland of up to 5300 ha around Wicken Fen. There is a long-term vision to restore, as much as possible, the natural hydrology around Chippenham Fen.</p>	Chippenham Fen: Eades and Shaw (2018)
supporting processes (on which the feature relies)	Air quality	Maintain 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 ( <a href="http://www.apis.ac.uk">www.apis.ac.uk</a> ).	See explanatory notes for this attribute 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 ( <a href="http://www.apis.ac.uk">www.apis.ac.uk</a> ).
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	<p>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.</p> <p>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.</p>	<p>National Trust (2016)</p> <p>Natural England (2014a)</p> <p>Natural England (2014b)</p>

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			Cladium will tend to increase dominance and height in habitats where it isn't managed. Areas managed for Cladium habitat should generally be cut on a 3-4 year rotation, which will maintain the cover of Cladium.	
<b>Version Control</b>				
Advice last updated: N/A				
<b>Variations from national feature-framework of integrity-guidance:</b> N/A				

**Table 3: Supplementary Advice for Qualifying Features: S1149. *Cobitis taenia*; Spined loach**

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
<b>Population (of the feature)</b>	<b>Juvenile densities</b>	<p>Restore juvenile densities at those expected under unimpacted conditions throughout the site, taking into account natural habitat conditions and allowing for natural fluctuations</p> <p>At least 50% of the population should consist of 0+ fish</p>	<p>Impacts on physical, chemical or hydrological integrity, or from non-native species, may suppress juvenile densities.</p> <p>In the most recent survey (ECON 2009), young of the year contributed 28% of the catch. In the previous survey (APEM 2002) only 11% of the catch was young of the year.</p>	<p>Natural England (2011)</p> <p>This attribute will be periodically monitored as part of Natural England's <a href="#">site condition assessments</a></p> <p>ECON (2009)</p> <p>APEM (2002)</p>
<b>Population (of the feature)</b>	<b>Population abundance</b>	<p>Maintain the abundance of the population at a density which is close to that expected under unimpacted conditions throughout the site (subject to natural habitat conditions and allowing for natural fluctuations), whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent.</p> <p>There should be no reduction in densities from existing levels, and in any case no less than 0.1 m<sup>-2</sup></p> <p>At least three year-classes should be present at significant densities.</p>	<p>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.</p> <p>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.</p> <p>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</p>	<p>Natural England (2011)</p> <p>This attribute will be periodically monitored as part of Natural England's <a href="#">site condition assessments</a></p> <p>ECON (2009)</p> <p>APEM (2002)</p>

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			<p>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.</p> <p>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 possible, local Natural England staff can advise that the figures stated are the best available.</p> <p>In the most recent survey (ECON 2009), an average density of 0.154 individuals per m<sup>2</sup> was found in Wicken Lode and Monk's Lode. This was higher than the previous survey (APEM 2002), where an average of 0.07 individuals per m<sup>2</sup> was found.</p>	
<b>Supporting habitat: extent and distribution</b>	<b>Distribution of supporting habitat</b>	<p>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</p> <p>Spined loach is not thought to be present within Chippenham Fen or Woodwalton Fen</p>	<p>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.</p>	
<b>Supporting habitat: extent and distribution</b>	<b>Extent of supporting habitat</b>	<p>Maintain the total extent of the habitat which support the feature at:</p> <p>Wicken Lode: approximately 2.3 km Monks Lode: approximately 180m within the SAC boundary, and another 1 km outside the</p>	<p>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.</p> <p>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</p>	Natural England (2011)



Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		SAC boundary	in data.	
<b>Supporting habitat: structure/function</b>	<b>Biological connectivity</b>	No artificial barriers significantly impairing essential fish movement	Even weirs with small vertical drops will prevent recolonisation of upper reaches affected by lethal pollution episodes or drought, and more generally will also lead to constraints on genetic interactions that may have adverse consequences.  There are no water control structure within the notified section of Wicken Lode.	Environment Agency (1996)
<b>Supporting habitat: structure/function</b>	<b>Biotope mosaic</b>	Maintain the characteristic physical form of Wicken Lode and Monks Lode, which provide supporting habitat for spined loach.  Substrate character should be at least 20% sand and no more than 40% silt.	Habitat conditions for spined loach vary naturally in rivers. Some sections may provide optimal habitat whilst others may be largely unsuitable. A natural river morphology provides the diversity of breeding/nursery habitat, cover from predators, refuge against high flows, and feeding opportunities that best meet the full life cycle requirements of the species.  The close proximity of riffles and pools is particularly important for this sedentary animal. For optimal conditions substrates should be at least 20% sand and no more than 40% silt. Whilst the species can tolerate silt and mud, it has a preference for sandy substrates, High sediment cohesiveness is likely to affect the feeding process. A mosaic of bare substrate and submerged beds of higher plants provides optimal conditions in relation to feeding, cover from predators and spawning (which occurs on submerged plants).  Marginal emergents also provide important cover and feeding opportunities. A characteristically diverse biotope mosaic allows the spined loach and other species to move within the river channel to locate optimal habitat conditions in the face of a fluctuating flow regime. The advice for H3260 is based on natural river function, which provides a characteristic biotope mosaic that caters for spined loach to a degree characteristic of the river. Comments above relating to substrate and macrophyte cover are equally applicable to ditch sites.  Wicken Lode and Monks Lode are engineered channels, not natural channels. They have flood defence, navigation and water transfer functions that have determined the management, which in turn has produced a habitat that supports a healthy	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			population of spined loach. A natural river morphology is not appropriate for Wicken Lode or Monks Lode	
<b>Supporting habitat: structure/function</b>	<b>Control of livestock grazing activity</b>	There is limited/no livestock grazing on the banks of the lodes	Over-grazing of riparian areas can have a dramatic effect on spined loach habitat, eliminating marginal habitat and generating excessive loads of very fine sediment.	
<b>Supporting habitat: structure/function</b>	<b>Fisheries - introduction of fish species</b>	Ensure fish stocking/introductions do not interfere with the ability of the river to support self-sustaining populations of the feature	<p>The presence of artificially high densities of fish can create unacceptably high levels of predatory pressure on spined loach. The management aim is to provide conditions in the river that support a healthy, natural and self-sustaining salmon population, achieved through habitat protection/restoration and the control of exploitation as necessary.</p> <p>Stocking represents a loss of naturalness and, if successful, obscures the underlying causes of poor performance (potentially allowing these risks to perpetuate). It carries various ecological risks, including the loss of natural spawning from broodstock, competition between stocked and naturally produced individuals, disease introduction and genetic alterations to the population.</p> <p>No fish stocking would be permitted in Wicken Lode</p>	
Supporting habitat: structure/function	Flow regime	Flow regime should be characteristic of the river. As a guideline, at least 90% of the naturalised daily mean flow should remain in the river throughout the year.	The natural flow regime is critical to all aspects of the spined loach life cycle, maintaining the biotope mosaic that is optimal for the species.	Environment Agency (1996)
<b>Supporting habitat: structure/function</b>	<b>Integrity of off-site habitats</b>	Maintain any supporting habitats beyond the SAC boundary upon which the SAC spined loach population may depend.	<p>Spined loach populations within the SAC may be dependent on the integrity of sections of river channel and riparian areas that lie outside of the site boundary. Headwater areas and tributaries may not fall within the site boundary, yet spined loach may use these areas for spawning and juvenile development and be critical for sustaining populations within the site.</p> <p>It is possible that spined loach also inhabit the field drains within Wicken Fen at lower densities, but these haven't been surveyed. A density of 0.15 individuals per m<sup>2</sup> has been found</p>	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			in Reach Lode, outside the designated site boundary (Perrow and Jowitt 1998). It should be assumed that there may be spined loach in any of the good quality lodes within the Wicken Vision area.	
<b>Supporting habitat: structure/function</b>	<b>Invasive non-native species</b>	<p>Mean cover of each very aggressive non-native plant not exceeding 1%. Mean total combined cover of all non-native species and introduced species less than 30%.</p> <p>Populations of invasive non-native species should be monitored, and controlled if there is any evidence for effects on spined loach populations</p>	<p>Non-native plant invasions may result in gross distortions to aquatic plant communities. The very aggressive <i>Azolla</i> spp., <i>Crassula helmsii</i> and <i>Hydrocotyle ranunculoides</i> can blanket sections of ditch and out-compete native species, resulting in a significant loss in diversity. <i>Myriophyllum aquaticum</i> may also have this potential in ditches. A more stringent target may be necessary on large ditch systems.</p> <p>Native plants are able to co-exist somewhat more easily with other non-native species, such as <i>Acorus calamus</i>, <i>Elodea</i> spp. and <i>Lagarosiphon major</i>. The non-native <i>Lemna minuta</i> is not included in this assessment unless it is found to be dominant, because it is very difficult to distinguish from <i>Lemna minor</i>. Where invasive native plants with a restricted natural distribution in the UK (e.g. <i>Stratiotes aloides</i> and <i>Nymphoides peltata</i>) are introduced to a site outside their natural range, these species should be treated as 'non-native'.</p> <p>Species such as signal crayfish may have a serious effect on spined loach habitat (by destabilising banks and enhancing very fine sediment input), and may predate heavily on spined loach if present at high densities. Chinese mitten crab has the potential to migrate long distances up rivers and may cause similar damage to spined loach habitat.</p> <p>No invasive species are known to be present in Wicken Lode</p>	
<b>Supporting habitat: structure/function</b>	<b>Riparian zone</b>	Maintain vegetation management to no more than 50% of the channel width (for submerged plants) and 50% of the bank length (for marginal fringing plants)	<p>Active marginal vegetation including riparian trees provides important cover for spined loach. A mosaic of vegetation types and sward heights provides suitable conditions for the whole characteristic biological community including spined loach.</p> <p>Trees are removed on the banks of Wicken Lode and Monk's Lode because they are deemed a flood risk. This isn't thought to have any negative effect on spined loach.</p>	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			Annual weed cuts are undertaken, leaving 50% of the channel uncut to avoid any negative effect on spined loach.	
<b>Supporting habitat: structure/function</b>	<b>Screening of intakes and discharges</b>	No artificial barriers significantly impairing essential fish movement	Spined loach can be entrained in intakes and discharges along with other fish species.  There are no water control structure within the notified section of Wicken Lode.	Environment Agency (1996)
<b>Supporting habitat: structure/function</b>	<b>Sediment regime</b>	Optimum habitat is no more than 40% silt.	Excessive delivery of very fine sediment, from the catchment or artificially enhanced bank erosion, can produce sub-optimal feeding conditions for spined loach and can interfere with submerged plant communities on which the species relies for cover and spawning.  There is no ongoing desilting programme for Wicken Lode, and at present it is not thought to be necessary.	
<b>Supporting habitat: structure/function</b>	<b>Vegetation structure: cover of submerged macrophytes</b>	For ditch sites, cutting operations should leave sufficient vegetation to maintain cover and spawning substrate. Rotational cutting regimes to maintain ditch habitat should be adequate for the species.  Vegetation management of no more than 50% of the channel width (for submerged plants) and 50% of the bank length (for marginal fringing plants)	Submerged and marginal vegetation provides vital cover for spined loach. Submerged plants are used for egg-laying.	
<b>Supporting habitat: structure/function</b>	<b>Water quality - nutrients</b>	Maintain the natural nutrient regime of the river/watercourse, with any anthropogenic enrichment above natural/background concentrations limited to levels at which adverse effects on the feature are unlikely.  Water quality should be equivalent to class 'B' in the	Nutrient enrichment can lead to loss of substrate condition for spined loach due to benthic algal growth and associated enhanced siltation. It also increases the risk of impacts on the submerged plant community, which the spined loach uses for cover. In ditches, spined loach can be abundant in enriched conditions with high levels of filamentous algal cover - however, this is not considered to be optimal habitat conditions for the species, and is not consistent with the conservation of ditch habitat.  The spined loach is susceptible to both episodic and chronic	Environment Agency (1996)  The Environment Agency routinely collects water quality data from Wicken Lode, which can be found <a href="#">here</a> .

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		<p>Biological module of the General Quality Assessment scheme and equivalent to class 'C' in the chemical module.</p> <p>Soluble reactive phosphorus should have an annual mean of no more than 0.1 mg L<sup>-1</sup></p>	<p>organic pollution. Episodic pollution causes direct mortalities whilst chronic pollution affects substrate condition through the build-up of sediment oxygen demand and excessive microbial populations. If the organic content of the substrate becomes too high, reduced oxygen availability near the sediment/water interface may lead to enhanced egg and juvenile mortality.</p>	
<b>Supporting processes (on which the feature and/or its supporting habitat relies)</b>	<b>Adaptation and resilience</b>	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 explanatory notes for this attribute in Table 1.	NATURAL ENGLAND(2015) <a href="#">Climate Change Theme Plan and supporting National Biodiversity Climate Change Vulnerability assessments ('NBCCVAs') for SACs and SPAs in England</a>
<b>Supporting processes (on which the feature and/or its supporting habitat relies)</b>	<b>Air quality</b>	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 ( <a href="http://www.apis.ac.uk">www.apis.ac.uk</a> ).	<p>See explanatory notes for this attribute in Table. 1</p> <p>There is very little information on the effect of nitrogen or acid deposition on spined loach, and no critical load targets are available. This should be a priority for investigation.</p>	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 ( <a href="http://www.apis.ac.uk">www.apis.ac.uk</a> ).
<b>Supporting processes (on which the feature and/or its supporting habitat relies)</b>	<b>Conservation measures</b>	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.	<p>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.</p> <p>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.</p>	Environment Agency (1996)
<b>Supporting processes (on which the feature and/or its supporting habitat relies)</b>	<b>Water quantity/ quality</b>	Where the feature or its supporting habitat is dependent on surface water and/or groundwater, maintain 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.	<p>Environment Agency (1996)</p> <p>The Environment Agency routinely collects water quality data from Wicken Lode and Monk's Lode, which can be found <a href="#">here</a>.</p>

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		<p>Water quality should be equivalent to class 'B' in the Biological module of the General Quality Assessment scheme and equivalent to class 'C' in the chemical module.</p> <p>Soluble reactive phosphorus should have an annual mean of no more than 0.1 mg L<sup>-1</sup></p>	<p>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.</p>	
<p><b>Version Control</b> Advice last updated: N/A</p>				
<p><b>Variations from national feature-framework of integrity-guidance:</b>  '<b>Soils, substrate and nutrient cycling</b>' attribute removed because the feature is aquatic.  '<b>Woody debris</b>' attribute removed because of the incompatibility with the function of Moreton's Leam as a drainage channel.  '<b>Invasive non-native species</b> attribute amended to include aquatic fauna and flora</p>				



**Table 4: Supplementary Advice for Qualifying Features: S1166. *Triturus cristatus*; Great crested newt**

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
<b>Population (of the feature)</b>	<b>Population abundance</b>	<p>Maintain the abundance of the population at a level which is above 6 adults in the dipping ponds at Wicken Fen and 57 adults at Woodwalton Fen, whilst avoiding deterioration from its current level as indicated by the latest mean peak count or equivalent.</p> <p>At least 20% of peak count should be recorded for 4 consecutive years (i.e. fail if total falls below 20% of peak for 4 consecutive years).</p>	<p>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.</p> <p>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.</p> <p>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.</p> <p>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</p>	<p>Survey data available from Natural England on request</p> <p><b>Wicken Fen:</b> Natural England (2011)</p> <p><b>Woodwalton Fen:</b> Natural England (2008b)</p>

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			<p>possible, local Natural England staff can advise that the figures stated are the best available. Estimating the average size of the GCN population will normally be based on the peak count of adults undertaken in the known peak season for the area, and in-year weather conditions; likely to be Mid-April to Mid-May in central areas. The peak count is derived by summing the counts across the site on 'best' night for each season. Considerable natural between-year variation in population counts is frequent.</p> <p>Wicken Fen: torch surveys in 2010 found a peak count of 6 adults. In the absence of any other data, this should be considered to be the baseline, until such time further more detailed surveys establish otherwise. Data is incomplete and further surveys are required.</p> <p>Woodwalton Fen: The highest recorded number of adults was 113, recorded in 1987 by a torch survey, but this was much higher than any other recorded total. The target has been set at 57 adults, the second highest total recorded. Although surveys have only been carried out at the experimental ponds in the past, great crested newts have also been seen in other ponds. Surveys will be carried out in other suitable locations in future years. Torch surveys between 2014 and 2017 found 12, 7, 28 and 16 adults, but this is thought to be an underestimation of the total population at Woodwalton Fen.</p>	
<b>Population (of the feature)</b>	<b>Population viability</b>	Maintain the presence of great crested newt eggs in breeding ponds at/to a level which is likely to maintain the abundance of the population at or above its target level.	<p>A "breeding pond" is defined as a pond in which egg-laying and successful metamorphosis (e.g the pond doesn't dry up too soon) is likely to occur at least once every three years. The optimum time to survey for eggs is mid-March to mid-May. Presence of eggs can be recorded by day or night visits and surveys should be combined with visits for the adult component</p> <p>Eggs should be present in sample breeding ponds at least once every 4 years. (i.e. acceptable for eggs to be absent from individual ponds 3 years out of 4; fail if any breeding pond lacks eggs for 4 years).</p>	<p><b>Wicken Fen:</b> Natural England (2011)</p> <p><b>Woodwalton Fen:</b> Natural England (2008b)</p>

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
<b>Supporting habitat: extent and distribution</b>	<b>Distribution of supporting habitat</b>	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	<p>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.</p> <p>Supporting habitat is the breeding ponds and the terrestrial habitat surrounding them.</p>	<p><b>Wicken Fen</b></p> <p>National Trust (2016) Natural England (2011)</p> <p><b>Woodwalton Fen:</b></p> <p>Natural England (2008b) Natural England (2014b)</p> <p>This attribute will be periodically monitored as part of Natural England's <a href="#">SSSI Condition Assessments</a></p>
<b>Supporting habitat: extent and distribution</b>	<b>Extent of supporting habitat</b>	<p>Maintain the total extent of the habitat(s) which support the feature at:</p> <p>Approximately 3 ha in Woodwalton Fen (breeding ponds and surrounding terrestrial habitat). There is evidence to suggest that great crested newts also use some of the nearby ditches and other ponds on the site.</p> <p>Approximately 3 ha in Wicken Fen (educational dipping ponds and surrounding terrestrial habitat)</p>	<p>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.</p> <p>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.</p>	<p><b>Wicken Fen</b></p> <p>National Trust (2016) Natural England (2011)</p> <p><b>Woodwalton Fen:</b></p> <p>Natural England (2008b) Natural England (2014b)</p> <p>This attribute will be periodically monitored as part of Natural England's <a href="#">SSSI Condition Assessments</a></p>
<b>Supporting habitat: structure/function</b>	<b>Presence of fish and wildfowl</b>	<p>Fish should be absent from &gt;75% of ponds</p> <p>No more than 4 pairs of wildfowl per ha of open water from March to September.</p>	<p>At high densities waterfowl (i.e. most water birds such as ducks, geese and swans but excluding moorhen) can remove all aquatic vegetation, adversely affect water quality and create turbid pondwater conditions. Some may also actively hunt adult GCNs and their larvae. Similarly fish can be significant predators of GCN larvae. The presence of waterfowl and fish can reduce habitat suitability. These should be wholly absent</p>	<p><b>Wicken Fen</b></p> <p>National Trust (2016) Natural England (2011)</p> <p><b>Woodwalton Fen:</b></p>

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			<p>form sites which support fewer than 5 ponds.</p> <p>Fish refers to all species known to be predators of great crested newt larvae, including stickleback, goldfish, orfe, rudd, pike, roach, and perch.</p> <p>Surveys for fish/wildfowl presence should look for characteristic disturbance at water surface for fish, high turbidity, nests, and droppings at pond margin, major loss of aquatic macrophytes, presence of algal blooms, heavily grazed grasses on bank.</p>	<p>Natural England (2008b) Natural England (2014b)</p> <p>This attribute will be periodically monitored as part of Natural England's <a href="#">SSSI Condition Assessments</a></p>
<b>Supporting habitat: structure/function</b>	<b>Shading of ponds</b>	<p>Ensure pond perimeters are generally free of shade (typically no more than 60% cover of the shoreline)</p> <p>&lt;25% of breeding ponds to have &gt;20% of southern margin solidly shaded</p>	<p>Shading from trees and/or buildings (not including emergent pond vegetation) can negatively affect the abundance of marginal vegetation in ponds, water temperature and the rate of hatching and development of great crested newt eggs and larvae.</p> <p>Ponds fringed by scrub have been found to be less utilised as breeding ponds (Cooke <i>et al</i> 1994), so scrub around ponds, particularly on the southern side, should be controlled.</p> <p>Not all of the experimental ponds at Woodwalton Fen are breeding ponds; some were designated as non-intervention when they were dug, and this is still the case.</p>	<p>Cooke <i>et al</i> (1994) <a href="#">Conservation and Management of Great Crested Newts</a>.</p> <p><b>Wicken Fen</b></p> <p>National Trust (2016) Natural England (2011)</p> <p><b>Woodwalton Fen:</b></p> <p>Natural England (2008b) Natural England (2014b)</p> <p>This attribute will be periodically monitored as part of Natural England's <a href="#">SSSI Condition Assessments</a></p>
<b>Supporting habitat: structure/function</b>	<b>Cover of macrophytes</b>	<p>Maintain a high cover of macrophytes, typically between 50-80%, within ponds</p> <p>Good* cover of marginal vegetation, emergent, submerged and/or floating vegetation to be present in at least 50% of breeding ponds between May and mid-</p>	<p>Marginal and emergent vegetation are important components of a great crested newt pond as they provide excellent egg-laying sites. Good plants for this purpose include water forget-me-not <i>Myosotis scorpioides</i>, floating sweet grass <i>Glyceria fluitans</i> and great hairy willowherb <i>Epilobium hirsutum</i>. They are, however, an integral part of the natural successional change of a waterbody and whilst it is preferable to have a good range and area of marginal plants, they should not extend across the entire water surface. In most circumstances it will be desirable to retain a fringe of marginal and emergent vegetation</p>	<p><b>Wicken Fen:</b></p> <p>Natural England (2011)</p> <p><b>Woodwalton Fen:</b></p> <p>Natural England (2008b)</p> <p>This attribute will be periodically monitored as part of Natural</p>

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		September.  *25% - 100% of margin covered by marginal and emergent species, and 25% - 75% of pond bottom/ midwater/ surface covered by submerged or floating species	around at least half of a pond's edge. Where the marginal vegetation is particularly invasive, and provides no specific benefit to crested newts, it may be decided that its complete removal is necessary.	England's <a href="#">SSSI Condition Assessments</a>
<b>Supporting habitat: structure/ function</b>	<b>Overall Habitat Suitability Index score</b>	For this SAC, maintain an overall Great Crested Newt Habitat Suitability Index score of no less than 0.8.	The Habitat Suitability Index provides a measure of evaluating habitat quality and quantity for Great Crested Newts. The Index score lies between 0 and 1, with 1 representing optimal GCN habitat. In general, the higher the index score the more likely the site is to support great crested newts.  The HSI methodology is documented in <a href="#">ARG-UK Advice Note 5 (May 2010)</a> . The HSI should not be used as a substitute for more detailed surveys and consideration of other attributes where necessary.	
<b>Supporting habitat: structure/ function</b>	<b>Permanence of ponds</b>	Maintain the permanence of water within ponds present within the site	Ponds to include breeding ponds as well as non-breeding ponds, since the latter may be used for foraging or sustaining prey populations. Ponds should have a high degree of permanence (they never or rarely dry out other than through natural drought) and this may be adversely affected by changes in the supply or flow of water (from either surface water and/or groundwater sources) to the ponds.  In both Wicken Fen and Woodwalton Fen there is limited or no control of water levels because the ponds are rainfall-fed. Although some of the ponds in Woodwalton Fen have been known to dry out in very dry summers, this is extremely rare	<b>Wicken Fen:</b> National Trust (2016)  <b>Woodwalton Fen:</b> Natural England (2014b)
<b>Supporting habitat: structure/ function</b>	<b>Presence of ponds</b>	Maintain the number or surface area of ponds present within the site.	Ponds to include breeding ponds as well as non-breeding ponds, since the latter may be used for foraging or sustaining prey populations. The surface area of a pond is taken from when water reaches its highest level (excluding flooding events), which will usually be in the spring.  Woodwalton Fen: the 20 experimental ponds (Moore's ponds) in compartment 74 support the main population of great-crested newt, but there is also evidence that they use some	<b>Wicken Fen:</b> National Trust (2016)  <b>Woodwalton Fen:</b> Natural England (2014b)  This attribute will be periodically monitored as part of Natural England's <a href="#">SSSI Condition</a>

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			<p>drains. 6 are 'non-intervention' ponds, but the remaining 14 are considered breeding ponds or potential breeding ponds.</p> <p>Wicken Fen: Breeding ponds are the two ponds used for pond dipping in St Edmunds Fen. There are other ponds within the protected site, but not nearby. Nearby drains provide further open water.</p>	<a href="#">Assessments</a>
<b>Supporting habitat: structure/function</b>	<b>Soils, substrate and nutrient cycling</b>	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	<p>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.</p> <p>Changes to natural soil properties may therefore affect the ecological structure, function and processes associated with the supporting habitat of this Annex II feature.</p>	
<b>Supporting habitat: structure/function</b>	<b>Supporting terrestrial habitat</b>	<p>Maintain the quality of terrestrial habitat likely to be utilised by Great Crested Newts, with no fragmentation of habitat by significant barriers to newt dispersal.</p> <p>Areas around the ponds should have long grass and access to nearby scrub for refugia. Scrub should, on the whole, not be present on the edge of ponds.</p>	<p>Great crested newts need both aquatic and terrestrial habitat. Good quality terrestrial habitat, particularly within 500m of the breeding ponds, provides important sheltering, dispersing and foraging conditions and can include all semi-natural habitat along with meadows, rough tussocky grassland, scrub, woodland, as well as 'brownfield' land or low-intensity farmland.</p> <p>Good quality terrestrial habitat for GCNs has structural diversity which can be provided by features such as hedges, ditches, stone walls, old farm buildings, loose stone/rocks, rabbit burrows and small mammal holes. Good habitat provides a range of invertebrates, such as earthworms, insects, spiders and slugs, on which GCNs are known to feed. Fragmentation refers to significant barriers to GCN movement such as walls and buildings, but not footpaths or tracks. Newts disperse over land to forage for food, and move between ponds.</p> <p>The distances moved during dispersal vary widely according to habitat quality and availability. At most sites, the majority of adults probably stay within around 250m of the breeding pond but may well travel further if there are areas of high quality foraging and refuge habitat extending beyond this</p>	<p><b>Wicken Fen</b> National Trust (2016) Natural England (2011)</p> <p><b>Woodwalton Fen:</b> Natural England (2008) Natural England (2014b)</p> <p>This attribute will be periodically monitored as part of Natural England's <a href="#">SSSI Condition Assessments</a></p>

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			range.  Ponds fringed by scrub have been found to be less utilised as breeding ponds (Cooke <i>et al</i> 1994), so scrub around ponds, particularly on the southern side, should be controlled.	
<b>Supporting processes (on which the feature and/or its supporting habitat relies)</b>	<b>Adaptation and resilience</b>	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 explanatory notes for this attribute in Table 1.	NATURAL ENGLAND (2015) <a href="#">Climate Change Theme Plan and supporting National Biodiversity Climate Change Vulnerability assessments ('NBCCVAs') for SACs and SPAs in England</a>
<b>Supporting processes (on which the feature and/or its supporting habitat relies)</b>	<b>Air quality</b>	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 ( <a href="http://www.apis.ac.uk">www.apis.ac.uk</a> ).  No critical loads are currently available for great crested newt.	See explanatory notes for this attribute 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 ( <a href="http://www.apis.ac.uk">www.apis.ac.uk</a> ).
<b>Supporting processes (on which the feature and/or its supporting habitat relies)</b>	<b>Conservation measures</b>	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.  Sites with <20 breeding ponds: <25% of breeding ponds to have >20% of southern margin solidly shaded.  Areas around the ponds with long grass and access to nearby	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.  At Woodwalton Fen, much of the scrub around the ponds is now kept under control (other than the 6 'non-intervention' ponds), with some ponds having all the scrub removed and others having varying levels of cover. There is also some clearance of vegetation within the ponds.  At Wicken Fen the vegetation surrounding the ponds is on a	<b>Wicken Fen</b> National Trust (2016) Natural England (2011)  <b>Woodwalton Fen</b> Natural England (2008b) Natural England (2014b)  This attribute will be periodically monitored as part of Natural England's <a href="#">SSSI Condition Assessments</a>



Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		scrub for refugia.	three-year cutting rotation, with paths cut regularly and willows pollarded	
<b>Supporting processes (on which the feature and/or its supporting habitat relies)</b>	<b>Water quantity</b>	Minimum summer water depth 10cm for at least 50% of all or sample 1 breeding ponds on each year of assessment.	<p>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.</p> <p>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.</p> <p>Water control is limited or impossible for the breeding ponds at Wicken Fen and at Woodwalton Fen. Ponds at Woodwalton Fen do occasionally dry out, but this is unusual. Ponds at Wicken Fen have not been known to dry out.</p>	
<b>Supporting processes (on which the feature or its supporting habitat relies)</b>	<b>Water quality</b>	Maintain the quality of pondwaters within the site as indicated by the presence of an abundant and diverse invertebrate community.	<p>As the clarity and chemical status of water bodies supporting GCNs can be subjective, the presence of an abundant and diverse community of freshwater invertebrates can be indicative of suitable water quality standards. Invertebrate groups present should include groups such as mayfly larvae and water shrimps. This will ensure ponds support a healthy (mainly invertebrate) fauna to provide food for developing GCN larvae and adults.</p> <p>The water quality of one of the breeding ponds at Woodwalton Fen has been analysed and both total phosphorus and total nitrogen were low. The ponds are entirely rainfall-fed, so have been largely isolated from previous water quality issues on Woodwalton Fen. Sediment from flood events may affect water quality.</p> <p>No information is available for the water quality of the breeding</p>	<p>Natural England (2014b)</p> <p>Water quality results for Woodwalton Fen available from Natural England on request.</p>

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			<p>ponds at Wicken Fen, but they are also rainfall-fed and likely to have good water quality.</p> <p>The invertebrate communities of the ponds have not been investigated.</p>	
<p><b>Version Control</b> Advice last updated: N/A</p>				
<p><b>Variations from national feature-framework of integrity-guidance:</b> 'Supporting metapopulations' attribute removed because the locations of both sites are relatively isolated from other suitable breeding areas and metapopulation connectivity is unlikely.</p>				

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