European Site Conservation Objectives: Supplementary advice on conserving and restoring site features

Brown Moss Special Area of Conservation (SAC)
Site code: UK0030100

Brown Moss SAC, photo credit Natural England

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About this document

This document provides Natural England's supplementary advice about the European Site Conservation Objectives relating to Brown Moss 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

About this site

European Site information

Name of European Site	Brown Moss Special Area of Conservation (SAC)
Location **Site Maps**	Shropshire The designated boundary of this site can be viewed here on the MAGIC website
Designation Date	1st April 2005
Qualifying Features	See section below
Designation Area	32.03ha
Designation Changes	N/A
Feature Condition Status	Details of the feature condition assessments made at this site can be found using Natural England's Designated Sites System
Names of component Sites of Special Scientific Interest (SSSIs)	Brown Moss SSSI
Relationship with other European or International Site designations	Ramsar Midland Meres and Mosses Phase 1

Site background and geography

Situated in the low-lying Shropshire, Cheshire and Staffordshire Plain National Character Area, Brown Moss is an area of former open grassland and heathland, comprising 32.03ha, now largely colonised by secondary woodland, with a series of shallow pools. The site holds open habitats including drawdown zones, marsh, swamp and fen communities associated with the pools, which occupy hollows in the sand and gravel substrate.

The pool water levels fluctuate considerably and also vary in their water chemistry. The drawdown zones of the pools support the National Vegetation Classification community type OV35 *Lythrum portula-Ranunculus flammula* community and is particularly important for species such as *Luronium natans* Floating water-plantain*, Baldellia ranunculoides,* Lesser Water-plantain*, Pilularia globulifera* Pillwort *Sparganium natans* Least Bur-reed and *Carex oederi* Small Fruited Yellow-sedge with more recent records for *Apium inundatum* Lesser Marshwort*, Lythrum portula* Water-purslane*, Hypericum elodes* Marsh St John's-wort*, Alopecurus aequalis* Water Foxtail and *Riccia canaliculata* Channelled Crystalwort (Whild Assocs. 2003).

Marginal vegetation includes taller communities with *Typha latifolia* Bulrush, *Juncus effusus* Soft Rush, *Sparganium erectum* Branched Bur-reed, *Carex rostrata* Bottle Sedge and *C. vesicaria* Bladder Sedge.

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 Species:

- **S1831*. Luronium natans;* Floating water-plantain**

Floating water-plantain *Luronium natans* occurs in a range of freshwater situations, including nutrient-poor lakes in the uplands and slowly-flowing lowland rivers, pools, ditches and canals that are moderately nutrient-rich.

Luronium natans occurs as two forms: in shallow water with floating oval leaves, and in deep water with submerged rosettes of narrow leaves. The plant thrives best in open situations with a moderate degree of disturbance, where the growth of emergent vegetation is held in check.

Populations fluctuate greatly in size, often increasing when water levels drop to expose the bottom of the water body. Populations fluctuate from year to year, and at many sites records of *L. natans* have been infrequent, suggesting that only small populations occur, in some cases possibly as transitory colonists of the habitat. Its habitat in rivers has been greatly reduced by channel-straightening, dredging and pollution, especially in lowland situations.

Floating water-plantain *Luronium natans* was first formally recorded at Brown Moss in 1955 with its presence within its pools well documented until the mid-1980s. The species was last recorded at Brown Moss in 2006. The site possibly represents a relict natural lowland population that behaves as a 'metapopulation', colonising the various pools according to their suitability. The habitat at Brown Moss suitable for *Luronium natans* is effectively in hydrological isolation so reappearance of the plant would be from the seed bank (or seed carried in by animals), two seeds were found by Lansdown (2016) but testing at Kew showed they were not viable.

Floating water-plantain is listed on Schedule 2 of the Conservation of Habitats and Species Regulations 2017, making it a 'European Protected Species'. A Licence may therefore be required for any activities that may involve the picking, cutting, uprooting, collecting, destruction, possession, transport or selling of plants.

Table 1: Supplementary Advice for Qualifying Features: S1831. *Luronium natans*; Floating water-plantain

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Supporting habitat: structure/ function	**Habitat structure**	Maintain the water bodies within the SAC sufficiently free of other competing vegetation to allow space for *Luronium natans* to thrive.	*Luronium natans* is intolerant of competition and occurs in a range of freshwater habitats – oligotrophic and mesotrophic lakes, slow flowing rivers and associated floodplain pools and small pools in heathland. There are also populations in a number of disused or recently restored canals (BSBI 2010 Species Account for *Luronium natans*, from Botanical Society of Britain and Ireland website: Species Account). Cattle grazing reinstated in 2014 will reduce competition on the margins. Grazing by wildfowl may also help keep the margins open but with concurrent negative effects on increasing turbidity of the water and eutrophication.	COUSINS, M., 2018. Trial plots to ascertain effects of grazing and organic sediment removal on *Luronium natans* at Brown Moss, in prep. LANSDOWN, R., 2016 Seed bank assessment for floating water-plantain (*Luronium natans*) at Brown Moss NNR, Shropshire, unpublished report for the Freshwater Habitats Trust. LOCKTON, A., 2016 The status of Brown Moss in 2016, unpublished report for Shropshire Ecological Data Network. MCCULLAGH, F., (2016) Site Assessment of Brown Moss SHROPSHIRE COUNCIL, 2014, Brown Moss Management Plan, 2013-2019, as amended by Clive Dean. WHILD ASSOCIATES (2003) A Botanical Survey of Brown Moss

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Supporting habitat: structure/ function	**Vegetation structure**	Maintain supporting habitat free of shade or competitive vegetation; taller species associated with *Luronium* patches should be no more than occasional.	Excessive overhanging vegetation results in both shading of aquatic vegetation and large inputs of organic matter in the form of leaf litter.	NATURAL ENGLAND, Photographic Monitoring Tree Clearance of Pools 3b, 4 and 5 2015-18, Cousins, M. for Natural England. NATURAL ENGLAND Scrub spraying and clearance monitoring 2015-18, Handley, J., unpublished report for Natural England. COUSINS, M., 2018, Site Restoration Summary, unpublished record of site management at Brown Moss SSSI for Natural England. SHROPSHIRE COUNCIL Management records.
	Water clarity	Restore a high degree of water clarity, typically to a depth of 1.5m	Elevated turbidity levels as a result of, for example, high phytoplankton densities, large numbers of waterfowl, and swimming dogs, or the presence of benthic-feeding fish, will have adverse impacts on submerged plant communities. *Luronium natans* can occur in naturally dystrophic waters with humic staining but elevated turbidity levels will have adverse impacts. The plant requires high levels of light, so algal growth, shade and turbidity can be fatal to it. (BSBI, 2010). Water clarity is generally poor at Pool 6, due to humic staining and stirring of sediment by disturbance by wildfowl and dog swimming and exacerbated by diffuse pollution. This objective will currently vary between pools, some having better water clarity than others.	NATURAL ENGLAND, 2014 – 2018. Pool profiles, inflow drains photographic record, Cousins, M. for Natural England. ATKINS, 2016, Midland Meres Water Quality Analysis of Inflows, Final report, Natural England, 14th March 2017 COUSINS, M. Water quality monitoring of pools, unpublished report

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
				for Natural England, in prep.
Supporting habitat: structure/ function	**Water levels/ hydrology**	Restore naturally functioning hydrology where appropriate; in shallow pools natural fluctuations in water level should be allowed to occur.	In shallow pools *Luronium* often flowers and fruits on draw-down zones (temporarily exposed bare wet mud) as summer water levels recede. These processes should not be artificially interrupted, but will vary greatly from year to year depending on weather. Brown Moss has modified drainage, with shallow ditches connecting all pools, Pool 3 appearing to be the last in the series. Also there are several pipe outfalls which bring surface and underground field drainage into the site which affects water quality, quantity and timing of delivery. The pools also receive shallow surface groundwater through the sands and gravels. Prior to artificial drainage the site probably received diffuse surface water via natural flow pathways on the surrounding land so it is not thought essential to block these drains to restore to more natural hydrology which could have adverse impacts if carried out suddenly, on the fen, marsh and swamp communities. Currently the main concern is the poor water quality from these outfalls so the ditches should not be cleared out, but allowed to infill gradually providing more opportunity for amelioration of the pollution by biological processes, whilst also addressing sources of diffuse pollution in the catchment and encouraging restoration of natural hydrology in the whole catchment.	ATKINS, 2012 Implementing Diffuse Water Pollution Action Plans for Selected SSSIs of North Shropshire, unpublished report for Natural England. ATKINS, 2016, Midland Meres Water Quality Analysis of Inflows, Final report, Natural England, 14th March 2017 ATKINS AND COUSINS, M. 2017. Brown Moss Water level Data 1997-2001 and 2013-2015. Un-published report for Natural England. ESI, 2002. Upper Severn Area hydrogeological and Hydrological Assessment: Brown Moss ECUS, 2001. Meres and Mosses Conservation Plans: Brown Moss ENVIROS, 2000. Brown Moss Hydrogeological Monitoring Programme. ASPINWALL, 1994.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
				Hydrogeological Assessment of SSSI: Brown Moss
Supporting habitat: structure/ function	**Substrate**	Restore a habitat substrate which is characterised by cohesive sediments which are neither too coarse nor too fine and unconsolidated	Fine unconsolidated sediments are an unsuitable rooting medium and plants may be subject to uprooting. Conversely, where sediment is too coarse and mineral there may be scouring and poor root anchorage. Reducing tree cover in close proximity to pools will reduce leaf fall and build-up of unconsolidated organic matter. Also cattle grazing will reduce litter build-up of vegetation on pool edges.	LANSDOWN, R., 2016 Seed bank assessment for floating water-plantain (*Luronium natans*) at Brown Moss NNR, Shropshire, unpublished report for the Freshwater Habitats Trust, June 2016. COUSINS, M., Investigations into sediment removal 2010-2012. COUSINS, M. 2018. Trial plots to ascertain effects of grazing and organic sediment removal on *Luronium natans* at Brown Moss, unpublished report for Natural England, in prep.
Supporting processes (on which the feature and/or its supporting habitat relies)	**Disturbance from human activity**	Ensure the duration, intensity and/or frequency of disturbance events does not affect the environmental conditions necessary to support the feature	Changes to the naturally-occurring disturbance regime (for example, grazing, water-level fluctuations, flood scouring) that would normally arrest succession is likely to be particularly significant. Cattle grazing was reinstated in Oct. 2014 and has associated tractor movements and dog swimming is frequent and has increased in recent years.	BSBI 2010 Species Account for *Luronium natans*, from Botanical Society of Britain and Ireland website: Species Account
	Regeneration (vegetative)	Restore and maintain sufficient areas of open shallow and still water for the development of ascending stolons bearing chains of plantlets, and for the	*Luronium natans* can produce sterile clones that only reproduce vegetatively, so the management actions described elsewhere will contribute to providing adequate habitat for this to occur. Where populations reproduce principally, or exclusively, through vegetative means, evidence of regeneration may be difficult to observe.	COUSINS, M., 2018 Favourable Condition Tables for Brown Moss SSSI, report for Natural England.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		production of floating *Luronium* leaves.	Perennial populations should exhibit a range of plant sizes as this implies that there are a range of different aged individuals. Annual populations, such as those of shallow pools, should flower and set seed.	
Supporting processes (on which the feature and/or its supporting habitat relies)	**Regeneration (sexual)**	Ensure that, in shallow pools, where flowering and seeding *Luronium* plants occur they are able to successfully ripen	In the case of populations of annual plants in shallow pools it is important to obtain evidence of sexual reproduction. The degree of seed dormancy in *Luronium natans* is poorly understood but estimated to be relatively short lived. In any case repeated recruitment from the seedbank without effective replenishment will reduce the long-term stability of the population. Two seeds were found in the sediment at Pool 6 by Lansdown (2016) but testing at Kew showed they were not viable. Management of regeneration may entail protection if practicable from excessive disturbance or damage.	LANSDOWN, R., 2016 Seed bank assessment for floating water-plantain (*Luronium natans*) at Brown Moss NNR, Shropshire, unpublished report for the Freshwater Habitats Trust, June 2016.
	Regeneration	Maintain the regenerative ability of the population as indicated by a range of different plant sizes of *Luronium* being consistently present.	This implies effective ageing and recruitment of plants. Plants of differing sizes present or >50 % plants producing flowers or fruits indicates successful regeneration is occurring.	COUSINS, M., 2018 Favourable Condition Tables for Brown Moss SSSI, report for Natural England.
Supporting habitat: structure/ function	**Vegetation composition: invasive non-native species**	Ensure the following invasive non-native species are being contained at a level which does not significantly affect the *Luronium natans* feature; *Crassula helmsii, Azolla filiculoides*.	These alien plant species are highly invasive and could impact negatively on *Luronium natans*, which is not tolerant of competition. *Crassula helmsii* is widespread and abundant at Brown Moss and *Azolla filiculoides* is also widespread but the abundance is more variable year to year. However it is thought that these species may not have such a detrimental effect on the native flora as was once anticipated (Lockton and Whild, 2003, Smith 2015). Control measures have been used at Brown Moss against *Crassula* (spraying and silt scraping) and have been futile at best and damaging to other flora at worst and there is not thought to be a viable means of controlling it at Brown Moss until more effective measures can be developed. Other introduced species may have effects on ecosystem functioning through the food web or via direct effects on the plant community, e.g. artificially large waterfowl populations or non-native fish and crayfish species.	CAPM, 2003. Report on the extent of *Crassula helmsii* growth at Hatchet Pond, Hampshire, Swanholme lake, Lincoln and Brown Moss, Shropshire and suggestions for future management. CHAICHANA, R. *et al.* 2011. Seasonal impact of waterfowl on communities of macrophytes in a shallow lake. *Aquatic Botany* 95, 39-44

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
				HANDLEY, J., 2106. Survey of the distribution of *Crassula helmsii* at Brown Moss and development of a Monitoring Protocol, supported by the Freshwater Habitats Trust. LOCKTON, A. AND WHILD, S., 2003 A Botanical Survey of Brown Moss, English Nature contract NMT/1/02, unpublished report by Whild Associates Ecological Consultancy. SMITH, T. & BUCKLEY, P., 2015. The growth of non-native *Crassula helmsii* (Crassulaceae) increases the rarity scores of aquatic macrophyte assemblages in south-eastern England. *New Journal of Botany*, 5(3), pp. 192-199.
Population (of the feature)	**Population abundance**	Restore the number of *Luronium* populations to the SAC, with persistent populations in at least 2 pools Maintain the cover of existing *Luronium* populations	Due to the dynamic nature of population change, the target for *Luronium natans* at this site is difficult to determine, however ideally the species should be appearing annually and regenerating reliably and consistently, stable for a period of at least 10 years so as to contribute to the Favourable Condition Status of the species in the UK. Given the likely fluctuations in numbers over time, any impact-assessments should focus on the current size of the site's population,	COUSINS, M., 2018 Favourable Condition Tables for Brown Moss SSSI, report for Natural England.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			as derived from the latest known and best available data and impacts on the habitat. 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.	
Supporting processes (on which the feature and/or its supporting habitat relies)	**Conservation measures**	Continue with the management measures, both within and/or outside the site boundary as appropriate, which are necessary to restore and then maintain the structure, function and supporting processes associated with *Luronium natans* and/or its supporting habitats.	Active and ongoing conservation management is needed to restore this feature at this site, including scrub and tree control, grazing and tackling diffuse water pollution, 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 and the Favourable Condition Tables.	NATURAL ENGLAND, 2015. Site improvement Plan: Brown Moss (SIP 031) ENGLISH NATURE, 2005. Views About Management: Brown Moss SSSI, English Nature. COUSINS, M., 2018 Favourable Condition Tables for Brown Moss SSSI, report for Natural England. COUSINS, M., 2018, Site Restoration Summary, unpublished record of site management at Brown Moss SSSI for Natural England. MCCULLAGH, F., 2016 Site Assessment of Brown Moss SHROPSHIRE

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
				COUNCIL, 2014, Brown Moss Management Plan, 2013-2019, as amended by Clive Dean and management records.
Supporting habitat: extent and distribution	**Extent of supporting habitat**	Restore and maintain the overall area of open, naturally-fluctuating or shallow standing water and their margins a.	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. Brown Moss experiences naturally-fluctuating water levels therefore surface water extent can vary enormously. Complete drying of several pools is not uncommon, with Pools 3a/3b usually the last to recede and conversely in wet years pools can amalgamate. Consequently it is not possibly to provide a precise area (ha) for open water and drawdown zone where the plant could potentially germinate. The target area of open habitats including acid grassland, heath, pools and margins was estimated at 18.8ha (Shropshire Council Brown Moss Management Plan, 2014).	MCCULLAGH, F. (2016) Site Assessment of Brown Moss SHROPSHIRE COUNCIL, 2014, Brown Moss Management Plan, 2013-2019, as amended by Clive Dean. NATURAL ENGLAND (2004) Brown Moss: Review of monitoring Visit WHILD ASSOCIATES (2003) A Botanical Survey of Brown Moss
	Distribution of supporting habitat	Restore and maintain the distribution and continuity of the wetlands across the site, and thereby habitat for *Luronium natans*.	A contraction in the range, or geographic spread, of the wetlands and changes to structure and composition of the vegetation may undermine the ability of *Luronium natans* to persist and thrive at Brown Moss and 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, that it receives compared to its interior. These conditions may not be suitable for this feature and this may affect its viability, therefore the wetlands at Brown Moss should be kept open, clear of trees and some connectivity through open corridors restored (Shropshire Council, Management Plan 2014).	MCCULLAGH (21016) Site Assessment of Brown Moss SHROPSHIRE COUNCIL, 2014, Brown Moss Management Plan, 2013-2019, as amended by Clive Dean. NATURAL ENGLAND (2004) Brown Moss: Review of monitoring Visit

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
				WHILD ASSOCIATES (2003) A Botanical Survey of Brown Moss
Supporting processes (on which the feature and/or its supporting habitat relies)	**Adaptation and resilience**	Restore and 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	Resilience may be described as the ability of an ecological system to cope with, and adapt to environmental stress and change whilst retaining the same basic structure and ways of functioning. Such environmental changes may include changes in precipitation and temperature for example, which are likely to affect the extent, distribution, composition and functioning of the wetlands at Brown Moss. The vulnerability and response of features to such changes will vary. Using best available information, any necessary or likely adaptation or adjustment by the feature and its management in response to actual or expected climatic change should be allowed for, as far as practicable, in order to ensure the feature's long-term viability. The overall vulnerability of this particular SAC to climate change has been assessed by Natural England as being **high**, taking into account the sensitivity, fragmentation, topography and management of its habitats/supporting habitats. These sites are considered to be the most vulnerable sites overall and are likely to require the most adaptation action, most urgently. Conservation partners and Natural England are actively seeking and reviewing opportunities for increasing connectivity within the landscape.	NATURAL ENGLAND, 2018. Generating more integrated biodiversity objectives – rationale, principles and practice. Research Report 071 NATURAL ENGLAND, 2015. Climate Change Theme Plan and supporting National Biodiversity Climate Change Vulnerability Assessments (NBCCVA) for SACs and SPAs in England [Available at http://publications.naturalengland.org.uk/publication/4954594591375360].
Supporting habitat: structure/ function	**Soils, substrate and nutrient cycling**	Maintain the properties of the underlying soil types, including structure, bulk density, total carbon, pH, soil nutrient status and fungal:bacterial ratio, within typical values for the supporting habitat	Soil supports basic ecosystem function and is a vital part of the natural environment. Its properties strongly influence the colonisation, growth and distribution of those plant species which together form vegetation types, and therefore provides a habitat used by a wide range of organisms. Soil biodiversity has a vital role to recycle organic matter. Changes to natural soil properties may therefore affect the ecological structure, function and processes associated with the supporting habitat of this Annex II feature.	
Supporting processes (on which the feature and/or its supporting	**Water quantity/ quality**	Restore water quality and quantity to the following standards to provide the necessary conditions to support the feature;	For many SAC features which are dependent on wetland habitats supported by surface and/or ground water, maintaining the quality and quantity of water supply will be critical, especially at certain times of year. Poor water quality and inadequate quantities of water can adversely affect the structure and function of this habitat type. Typically,	CHAICHANA R. *et al.* (2011) Conservation of pond systems as case study of intractability. *In* Hydrobiologia 664: 17-33

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
habitat relies		Stable nutrient levels appropriate for the lake type (High Alkalinity Shallow) WFD waterbody ID 34791: Total Phosphorus target <35µg/l P (or 0.035mg/l) Total Nitrogen < 1.4mg/l No excessive growth of cyanobacteria or green algae.	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, see sections above for figures for water quality and detail on hydrology of Brown Moss. *Luronium natans* populations are present across a wide range of habitats with a corresponding range of water chemistry. "The sites where it occurs include oligotrophic to mesotrophic lakes and pools - often those with fluctuating water levels, as it tends to flower and fruit prolifically when exposed on bare mud." (BSBI, 2010). Its tolerances to water chemistry parameters and links between presence/persistence and water quality are not yet fully understood. As such the water quality targets set out for freshwater habitat at Brown Moss should be sufficient to protect populations from adverse impacts: Stable nutrient levels appropriate for the lake type (High Alkalinity Shallow) WFD waterbody ID 34791: Total Phosphorus target <35µg/l P (or 0.035mg/l) CSM and WFD GES) (Ruth Hall, NE, Nov 2016). Total Nitrogen 1.4mg/l (Ruth Hall, NE, Nov 2016). Stable pH values appropriate for the lake type – no target set as variable between pools and with ambient conditions. Adequate dissolved oxygen levels for health of characteristic fauna - target not set as oxygen levels likely to vary with conditions. Chris Bainger (EA, email 8/7/2017) measured dissolved oxygen at 128% in Pool 6 when Mirror Carp were observed in the receding water trying to mate and spawn, prior to netting and removal in 2017. No excessive growth of cyanobacteria or green algae. In shallow pools *Luronium* often flowers and fruits on draw-down zones (bare wet mud) as summer water levels recede. These processes should not be artificially interrupted, but will vary greatly from year to year depending on weather. Brown Moss has modified drainage, with shallow ditches connecting all pools, Pool 3 appearing to be the last in the series. Also there are	HALL, R., November 2016, Lake targets, Natural England, Lakes Specialist advice. CHAICHANA R. *et al.* (2011) Conservation of pond systems as case stufy of intractability. *In* Hydrobiologia 664: 17-33 ATKINS, 2012 Implementing Diffuse Water Pollution Action Plans for Selected SSSIs of North Shropshire, unpublished report for Natural England. ATKINS, 2016, Midland Meres Water Quality Analysis of Inflows, Final report, Natural England, 14th March 2017 ATKINS AND COUSINS, M. 2017. Brown Moss Water level Data 1997-2001 and 2013-2015, summarised, by unpublished report for Natural England. ESI(2002) Upper Severn Area hydrogeological and Hydrological Assessment: Brown Moss

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			several pipe outfalls which bring surface and underground field drainage into the site which affects water quality, quantity and timing of delivery. The pools also receive shallow surface groundwater through the sands and gravels. Prior to artificial drainage the site probably received diffuse surface water via natural flow pathways on the surrounding land so it is not thought essential to block these drains to restore to more natural hydrology which could have adverse impacts if carried out suddenly, on the fen, marsh and swamp communities. Currently the main concern is the poor water quality from these outfalls so the ditches should not be cleared out, but allowed to infill gradually providing more opportunity for amelioration of the pollution by biological processes, whilst also addressing sources of diffuse pollution in the catchment and encouraging restoration of natural hydrology in the whole catchment.	ECUS(2001) Meres and Mosses Conservation Plans: Brown Moss ENVIROS (2000) Brown Moss Hydrogeological Monitoring Programme. ASPINWALL (1994) Hydrogeological Assessment of SSSI: Brown Moss
Supporting processes (on which the feature and/or its supporting habitat relies)	**Air quality**	Restore concentrations and deposition of air pollutants to within the site-relevant Critical Load or Level values given for this feature's supporting habitats on the Air Pollution Information System (www.apis.ac.uk).	The supporting habitat of this feature is considered sensitive to changes in air quality. Exceedance of critical values for air pollutants may modify the chemical status of its substrate, accelerating or damaging plant growth, altering its vegetation structure and composition (including food-plants) and reducing supporting habitat quality and population viability of this feature. The critical level for nitrogen of 3-10 kg N/ha/year is currently being exceeded at this site [source: APIS, accessed July 2018]. Critical Loads and Levels are recognised thresholds below which such harmful effects on sensitive UK habitats will not occur to a significant level, according to current levels of scientific understanding. There are critical levels for ammonia (NH3), oxides of nitrogen (NOx) and sulphur dioxide (SO2), and critical loads for nutrient nitrogen deposition and acid deposition. There are currently no critical loads or levels for other pollutants such as Halogens, Heavy Metals, POPs, VOCs or Dusts. These should be considered as appropriate on a case-by-case basis. Ground level ozone is regionally important as a toxic air pollutant but flux-based critical levels for the protection of semi-natural habitats are still under development. It is recognised that achieving this target may be subject to the	More information about site-relevant Critical Loads and Levels for this SAC is available by using the 'search by site' tool on the Air Pollution Information System (www.apis.ac.uk).

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			development, availability and effectiveness of abatement technology and measures to tackle diffuse air pollution, within realistic timescales.	
Version Control Advice last updated: N/A				
Variations from national feature-framework of integrity-guidance: N/A				