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

Orton Pit Special Area of Conservation (SAC)
Site code: UK0030053

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 Orton Pit 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	Orton Pit Special Area of Conservation (SAC)
Location	Cambridgeshire
Site Map	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	141.24 ha
Designation Changes	Extensions to the Orton Pit SAC were designated on 10 December 2009
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)	Orton Pits SSSI
Relationship with other European or International Site designations	The SSSI extends slightly further west (on the western edge above the ponds) than the SAC

Site background and geography

Orton Pits SAC is a site created by workings from the brick industry in Peterborough. Clay extraction occurred from the 1940's to 1990's with the resulting workings forming a series of linear ridge and furrows which have developed into a network of ponds and associated habitats that contain a large population of great crested newts *Triturus cristatus* and stoneworts *Chara* spp. The ponds are at various successional stages, and there is associated surrounding habitat consisting of grassland, scrub and woodland.

The site sits within the Bedfordshire and Cambridgeshire Claylands National Character Area (NCA) and due to the abundance of Jurassic fossils found in the Oxford clays the site is included in the Orton Brick Works & Brick Pits Local Geological Site.

Part of the SAC is a nature reserve being currently managed by the Froglife Trust. The site is surrounded by the extensive housing developments of the Hamptons which brings along with them physical pressures and opportunities, from large populations on its doorstep.

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:

- **H3140 hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp. ('Calcium rich nutrient poor lakes, lochs and pools').**

  This habitat type is characterised by standing open water with a high base content, most often calcium, and is usually confined to areas of limestone and other base-rich substrates from which the dissolved minerals are derived. In part, the rarity of the habitat type is due to the fact that since calcareous rocks are free-draining, waterbodies occur on the surface of these rocks only very rarely. In addition, such waterbodies are characterised by very clear water and low nutrient status

  This SAC supports an example of hard oligo-mesotrophic waters with *Chara* spp., as a result of the presence of alkaline water low in nutrients, above the underlying clays. The hydrology of the site is important with the base of the clay workings being well below ground level the site fills with rainwater. Water levels are managed with a permanent pump set at an agreed level.

  Closely associated with this feature of this site is a rich assemblage of ten *Chara* spp., including bearded stonewort *Chara canescans*. It is an early coloniser of ponds and one that favours brackish water that comes from the release of salts from clays that become oxidised over a period of time. Other *Chara* spp. of note include four nationally scarce species (hedgehog stonewort *Chara aculeolata,* lesser bearded stonewort *Chara curta,* smooth stonewort *Nitella flexilis,* and clustered stonewort *Tolypella glomerata*). The distribution of the *Chara* spp. varies across the site with few being found in ponds over 25 years old.

  Bearded stonewort *Chara canescans* is listed in Schedule 8 of the 1981 Wildlife & Countryside Act. A Licence may therefore be required for any activities likely to harm this plant.

Qualifying Species:

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

  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 designation, the water-bodies at this SAC, created by the clay industry supported large populations of great crested newts. Froglife aim to restore the ponds, and surrounding habitats into improved condition through pond restoration projects, alongside carrying out annual newt population surveys.

  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, making it a 'European Protected Species'. A Licence may therefore be required for any activities likely to harm or disturb great crested newts.

References

CANAL & RIVERS TRUST. Long term monitoring of great crested newt species and the non-native Alpine newt. Records available on request from Natural England

FROGLIFE (2013) Second life for ponds project. http://www.froglife.org/wp-content/uploads/2013/06/SecondLifeForPonds2.pdf?x97996

FURNBOROUGH, P. & PETROVAN, S (2012) Big Newt Count 2012: 6th Report on the Hampton Nature Reserve Great Crested Newt Monitoring Programme. Records available on request from Natural England.

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LAMBERT, S.J. (2007) The Environmental Range and Tolerance Limits of British Stoneworts (Charophytes). MSc Thesis. University of East Anglia

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NATURAL ENGLAND (2008), Definitions of Favourable Condition – Orton Pit SSSI (Consultation Draft). Available on request from Natural England.

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NATURAL ENGLAND, 2015. Climate Change Theme Plan and supporting National Biodiversity Climate Change Vulnerability Assessments (NBCCVAs) for SACs and SPAs in England [Available at http://publications.naturalengland.org.uk/publication/4954594591375360

O&H & FROGLIFE (2012), Hampton Nature Reserve Management plan April 2012-March 2017, includes mapping of present distribution of ponds. Available from Natural England on request

PIEC, D. (2006). Rotenone as a conservation tool in amphibian conservation. A case study of fish control operation undertaken at Orton Pit SSSI, Peterborough, UK. Froglife Ltd. A report to O&H Hampton. Available on request from Natural England

UK AMPHIBIAN AND REPTILE GROUPS (ARG-UK) (2010) Advice Note 5 on the Great Crested Newt Habitat Suitability Index (May 2010).

Table 1: Supplementary Advice for Qualifying Features: H3140. Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp.; Calcium-rich nutrient-poor lakes, lochs and pools'

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Extent and distribution of the feature	**Extent of the feature within the site**	Maintain the total extent of the H3140 feature at an est. 40ha of standing water	There should be no measurable reduction (excluding any trivial loss) in the extent and area of this feature, and in some cases, the full extent of the feature may need to be restored. The baseline-value of extent given has been generated using data gathered from the listed site-based surveys. Area measurements given may be approximate depending on the methods, age and accuracy of data collection, and as a result this value may be updated in future to reflect more accurate information. The extent of an Annex I habitat feature covers the sum extent of all of the component vegetation communities present and may include transitions and mosaics with other closely-associated habitat features. Where a feature is susceptible to natural dynamic processes, there may be acceptable variations in its extent through natural fluctuations. Where a reduction in the extent of a feature is considered necessary to meet the Conservation Objective for another Annex I feature, Natural England will advise on this on a case-by-case basis.	Hampton Nature Reserve Management plan April 2012-march 2017, prepared by O&H and Froglife, includes mapping of present distribution of ponds. NATURAL ENGLAND, 2008. Orton Pit SSSI FCT 2008. (Available from Natural England)
Structure and function (including its typical species)	**Invasive, non-native and/or introduced species**	Ensure that non-native species categorised as 'high-impact' in the UK under the Water Framework Directive are either rare or absent but if present are causing minimal damage to the feature	Non-native species constitute a major threat to many open water systems. Impacts may be on the habitat itself (e.g. damage to banks and consequent siltation) or directly on characteristic biota (through predation, competition and disease), or a combination of these. For example, species such as signal crayfish have been responsible for much of the decline of native crayfish through competition, habitat damage and the introduction of crayfish plague. The UK Technical Advisory Group of the Water Framework Directive produces a regularly updated classification of aquatic alien species (plants and animals) according to their level of impact. In general high impact species are of greatest concern but low or unknown impact species may be included in the target on a site-specific basis where there is evidence that they are causing a negative impact (for example high cover values or abundances). Those taxa considered likely to colonise lakes, are indicated by an 'L' in the UKTAG guidance. Examples of such high-impact species may include Water Fern, New Zealand pygmyweed and the zebra mussel.	Information about non-native species and water framework directive http://www.nonnativespecies.org/index.cfm?sectionid=116

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Structure and function (including its typical species)	**Macrophyte community structure**	Maintain a characteristic zonation of macrophyte vegetation; *Chara* beds should normally cover a minimum of 50% of the photic zone, although extent will be variable according to site and seasonal changes.	This is a strongly characteristic structural aspect of this habitat feature. In many cases *Chara* (stoneworts) will be the dominant feature. 'Holes' in *Chara* beds can indicate that ponds are moving out of favourable condition.	
	Macrophyte community structure	Maintain maximum depth of plant colonisation. This is likely to be the maximum depth colonised by *Chara* spp.	This is a strongly characteristic structural aspect of this habitat feature. It will be a response to water transparency, sediment type and disturbance.	
	Macrophyte community structure	Maintain a characteristic and well defined hydrosere associated with the water body where this is present	A hydrosere is a naturally-occurring plant succession which occurs in an area of standing fresh water. Over time, an area of open freshwater will naturally dry out, ultimately becoming woodland. During this change, a range of different wetland habitat types such as swamp and marsh, will succeed each other. This structure around the margins of the lake creates a buffer zone that can help protect the lake from a limited amount of sediment and nutrient inputs. It also increases habitat heterogeneity providing additional food sources and refugia.	
	Physical structure - pond shoreline	Maintain the character of the shoreline of the ponds.	Inclusion of hard engineering solutions to lake management may have detrimental effects on lake ecology, replacing near-natural substrates with man-made materials. Alteration of the shoreline may also result in changes in water movements within the lake, which would have effects on patterns of sediment deposition.	
	Physical structure - pond substrate	Maintain the characteristic substrate for the ponds.	Marl production is desirable, although this may be low or absent in oligotrophic hard waters. The distribution of sediment particle size and organic content influences the biology of the ponds and will affect the suitability of within-pond habitats for invertebrates and macrophytes, and fish spawning grounds. Increases in sediment loading from activities in the catchment area, including those on the pond shore, may result in the smothering of coarse sediments. Increased inputs of leaf litter, as a result of scrub encroachment, may also be cause for concern, as organic-rich sediments may be a poor rooting medium for macrophytes.	
	Key structural, influential and distinctive species	Maintain the abundance of the species listed below to enable each of them to be a viable component of the H3140 Annex 1 habitat;	Some plant or animal species or related groups of such species make a particularly important contribution to the necessary structure, function and/or quality of an Annex I habitat feature at a particular site. These species will include; • Structural species which form a key part of the Annex I habitat's structure	JNCC Habitat account - Freshwater habitats http://jncc.defra.gov.uk/protectedsites/sacselection/habitat.asp?Fe

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		Chara aspera Chara canescens, Chara contraria, Chara curta, Chara globularis, Chara hispida, Chara aculeolata, Chara virgate, Chara vulgaris, Nitella flexilis agg., Tolypella glomerata.	or help to define that habitat on a particular SAC see also the attribute for 'vegetation community composition'. • Influential species which are likely to have a key role affecting the structure and function of the habitat such as bioturbators (mixers of soil/sediment), grazers, surface borers, predators or other species with a significant functional role linked to the habitat • Site-distinctive species which are considered to be a particularly special and distinguishing component of an Annex I habitat on a particular SAC. There may be natural fluctuations in the frequency and cover of each of these species. The relative contribution made by them to the overall ecological integrity of a site may vary, and Natural England will provide bespoke advice on this as necessary. The list of species given here for this Annex I habitat feature at this SAC is not necessarily exhaustive. The list may evolve, and species may be added or deleted, as new information about this site becomes available.	atureIntCode=H3140 Orton Pit SSSI/SAC Aquatic Plant monitoring survey for CES, Report for Froglife by Sarah Lambert, 2014. Available from Natural England on request
Structure and function (including its typical species)	**Fisheries**	Maintain a total projected estimate for biomass of total fish production at less than 200kg/ha (this should take into account the growth potential of the resident and stocked fish).	Fish communities may exert a strong influence on overall pond ecology and may cause or exacerbate eutrophication symptoms. Where fisheries are present it should be a balanced mixed fishery. There should be a presumption against stocking non-native species, carp and bream. 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 pond water conditions. Some may also actively hunt adult Great Crested Newts and their larvae. Similarly fish can be significant predators of newt larvae. The presence of waterfowl and fish can reduce habitat suitability. These should be wholly absent form sites which support fewer than 5 ponds.	Piec, D. (2006). Rotenone as a conservation tool in amphibian conservation. A case study of fish control operation undertaken at Orton Pit SSSI, Peterborough, UK. Froglife Ltd. A report to O&H Hampton. Big Newt Count 2012 6th Report on the Hampton Nature Reserve Great Crested Newt Monitoring Programme Survey and report by

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
				Paul Furnborough and Dr. Silviu Petrovan (Records available from Natural England)
Supporting processes (on which the feature relies)	**Water quality - phosphate**	Maintain stable phosphate levels at a maximum annual mean concentration of <20mg/l for shallow (<3m) oligo-mesotrophic hard standing waters.	Increased loadings of Phosphate (P) to a water body are likely to lead to higher algal biomass in the water column, which in turn can have significant impacts on the standing water ecosystem through, for example, competition with vascular plants for nutrients and light, changes in pH, oxygen depletion and production of toxins. Decreasing dissolved oxygen and increasing ammonia levels are associated with death and decay of algal blooms, as is a release of toxins from toxin-producing species. If palaeolimnological techniques or hindcast modelling have been employed to reconstruct natural background phosphorus concentrations for a particular lake, these can be used to set targets, although it may be necessary to accept a small deviation from these background conditions. Alternatively, historical water chemistry data may exist for individual lakes. Where existing, site-specific water column TP concentrations are consistently lower than the standard appropriate for the habitat type, a lower target should be applied to prevent deterioration from current status. Water chemistry tested by Froglife as part of a pond restoration project in 2011, Life for Ponds.	Water chemistry testing at Orton Pits http://www.froglife.org/wp-content/uploads/2013/06/SecondLifeForPonds2.pdf?x97996 The Environmental Range and Tolerance Limits of British Stoneworts (Charophytes) By Stephen John Lambert M.Sc. (University of East Anglia), 2007
Supporting processes (on which the feature relies)	**Water quality - nitrogen**	Maintain a stable nitrogen concentration at <0.58mg/l	There is an increasing understanding that some standing waters are sensitive to nitrogen (N) enrichment and eutrophication may be driven by increases in N, but site-specific information is usually required to determine whether N or P is more important. Where P levels are significantly above their target values and there is evidence that the lake is N limited (for example by N levels falling to negligible levels in summer), N targets should be set in addition to P targets. We recommend that such targets should preferably be developed using site-specific information, but should be based around the threshold of 1-2mg/l identified by James et al. (2005). In this situation N targets should be used in combination with P targets to drive a management strategy for the lake that reduces all nutrient inputs.	Water chemistry testing at Orton Pits http://www.froglife.org/wp-content/uploads/2013/06/SecondLifeForPonds2.pdf?x97996 The Environmental Range and Tolerance Limits of British Stoneworts (Charophytes) By Stephen John

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			Water chemistry tested by Froglife as part of a pond restoration project in 2011, Life for Ponds.	Lambert M.Sc. (University of East Anglia), 2007
Supporting processes (on which the feature relies)	**Water quality - acidity**	Ensure acidity levels reflect unimpacted conditions - values of Acid Neutralising Capacity (ANC) should be typically pH 7.5-9.5 for oligo-mesotrophic hard lakes.	Changes in pH can alter the entire freshwater community present within a water body affecting all trophic levels. Potential causes of a shift in pH include air pollution and direct application of lime to the water column as an acidification amelioration strategy (this should not be carried out). Acidity levels should reflect unimpacted conditions - values of Acid Neutralising Capacity (ANC) considered to avoid significant impact on characteristic biota are laid out in the site's FCT (these are the same numerical values as used to protect high ecological status under the WFD in the UK). As a guide, pH 7.5-9.5 for oligo-mesotrophic hard lakes. Although, pH naturally fluctuates throughout the year, e.g. snow melt may lead to pulses of acid water, and increased plant biomass in summer may result in large fluctuations in pH, including daytime increases in pH values. Therefore pH is not used as a monitoring target, however its importance in affecting many in lake processes means that the pH of a water body should not be artificially altered. Water chemistry tested by Froglife as part of a pond restoration project in 2011, Life for Ponds.	Water chemistry testing at Orton Pits http://www.froglife.org/wp-content/uploads/2013/06/SecondLifeForPonds2.pdf?x97996 The Environmental Range and Tolerance Limits of British Stoneworts (Charophytes) By Stephen John Lambert M.Sc. (University of East Anglia), 2007
	Water quality - other pollutants	Maintain water quality to good chemical status (i.e. compliance with relevant Environmental Quality Standards).	A wide range of pollutants may impact on habitat integrity depending on local circumstance. Good chemical status includes a list of EQSs for individual pollutants that are designed to protect aquatic biota with high levels of precaution.	
	Water quality - dissolved oxygen	Maintain adequate dissolved oxygen levels for health of characteristic fauna. DO>7mg/l for salmonid waters and >6mg/l for cyprinid waters throughout the year.	As for species in terrestrial environments, dissolved oxygen (DO) is required for respiration by aquatic organisms. Anthropogenic activities leading to phytoplankton blooms and increased loadings of organic matter to lakes can cause decreases in the concentration of dissolved oxygen available to support the species present. Mean dissolved oxygen refers to DO being measured at 0.5m intervals throughout the entire water column where the water column is not stratified and measurements taken at 0.5 m intervals below the thermocline only where stratification occurs.	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Supporting processes (on which the feature relies)	**Water transparency**	Maintain the clarity of water at or to at least a depth of 3.5 metres	Water transparency is the major determinant of the depth of colonisation by macrophytes, therefore, it should not be reduced. This should allow plant colonisation to at least 3.5m, but if maximum depth of colonisation has previously been recorded at greater water depths this should be maintained. Increased nutrient loads leading to increased algal growth will reduce water transparency, disturbance of the sediment by water sports and bottom feeding fish such as carp and bream also increase turbidity and reduce water transparency. Increased sediment loads to a lake would also have this effect.	
	Water quality - algae	Ensure that Chlorophyll a concentration comply with WFD high ecological status	Chlorophyll is the pigment used for photosynthesis by plants, and the concentration of chlorophyll in the water column during the growing season therefore provides a good measure of the abundance of phytoplankton. Phytoplankton is an important driver of structure and function in lakes and high phytoplankton levels (algal blooms) are usually associated with nutrient enrichment. Characteristic and representative non-charophyte algal cover may be significant, but excessive growths of uncharacteristic, filamentous algae on lake substrate or macrophytes are indicative of nutrient enrichment.	UKTAG Lake Assessment Methods: Phytoplankton. Chlorophyll a and Percentage Nuisance Cyanobacteria. Available online at: http://www.wfduk.org/sites/default/files/Media/Characterisation%20of%20the%20water%20environment/Biological%20Method%20Statements/lake%20phytoplankton.pdf
	Hydrology	At a site, unit and/or catchment level, maintain natural hydrological processes to provide the conditions necessary to sustain the H3140 feature within the site	Defining and maintaining the appropriate hydrological regime is a key step in moving towards achieving the conservation objectives for this site and sustaining this feature. Changes in source, depth, duration, frequency, magnitude and timing of water supply can have significant implications for the assemblage of characteristic plants and animals present. This target is generic and further site-specific investigations may be required to fully inform conservation measures and/or the likelihood of impacts. Hydrology influences lake ecosystem functioning in two ways: determining residence time (flushing) and water level fluctuations. Flushing of lakes is important for dilution and removal of nutrients and phytoplankton, and for reduction in sedimentation. The timing of different flushing rates within the year influences the biology of the lake. For example, reduced flushing in summer would encourage bloom conditions. Modifications of inflows and outlets or changes in hydrology, e.g. from flood control regimes,	Hampton Nature Reserve Management plan April 2012-march 2017, prepared by O&H and Froglife.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			abstraction and gravel removal can lead to unnatural changes in lake levels. Water levels across the site are maintained by a permanent automated pump.	
Supporting processes (on which the feature relies)	**Sediment load**	Maintain the natural sediment load	Increases in the sediment load also increases nutrient loads to a site. Increases in non-calcium carbonate siltation could result from increased lake productivity, changes in catchment land-use and drainage, lake level fluctuations, climatic fluctuations or changes in sewage treatment. Some peat slumping is acceptable, provided this is not induced due to land drainage.	
	Supporting off-site habitat	Maintain the extent, quality and spatial configuration of land or habitat surrounding or adjacent to the site which is known to support the H3140 feature.	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 prevent/reduce/absorb damaging impacts from adjacent land uses e.g. pesticide drift, nutrient enrichment. The site is surrounded by housing/industrial development and infrastructure. Any changes to the land use immediately around the site may have implications for the qualifying habitat, particularly in terms of hydrology. Development within 500 metres of the site may have the potential to affect hydrology. The site appears to be rainfall fed. It sits on a clay plateau and does not appear to receive surface or ground water flows from the surrounding areas.	
	Air quality	Maintain the concentrations and deposition of air pollutants at within any site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System (www.apis.ac.uk).	This habitat type is considered sensitive to changes in air quality. Exceedance of these critical values for air pollutants may modify the chemical status of its substrate, accelerating or damaging plant growth, altering its vegetation structure and composition and causing the loss of sensitive typical species associated with it. Critical Loads and Levels are recognised thresholds below which such harmful effects on sensitive UK habitats will not occur to a significant level, according to current levels of scientific understanding. There are critical levels for ammonia (NH3), oxides of nitrogen (NOx) and sulphur dioxide (SO2), and critical loads for nutrient nitrogen deposition and acid deposition. There are currently no critical loads or levels for other pollutants such as Halogens, Heavy Metals, POPs, VOCs or Dusts. These	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)
			should be considered as appropriate on a case-by-case basis. Ground level ozone is regionally important as a toxic air pollutant but flux-based critical levels for the protection of semi-natural habitats are still under development. It is recognised that achieving this target may be subject to the development, availability and effectiveness of abatement technology and measures to tackle diffuse air pollution, within realistic timescales.	
Supporting processes (on which the feature relies)	**Functional connectivity /isolation**	Maintain the lack of connectivity of the water body to other water bodies	The natural isolation of some standing water bodies can provide some protection from threats such as pollution and invasive species. Hydrological isolation can also lead to unique or diverse species assemblages this may be due to genetic isolation or the absence of predators. These water bodies should have their isolated state maintained. In contrast other standing water bodies naturally rely on hydrological connectivity to other freshwater systems for water supply, and can support migratory species. Hydrological connectivity may also be important for geneflow, and habitat and species resilience. These water bodies should have their hydrological connectivity maintained. Many of the oligo-mesotrophic hard waters will be aquifer-fed. Connectivity between lakes and surrounding wetlands are important for resource protection and ecosystem functioning and are particularly at risk from drainage, water level stabilisation and shoreline modifications.	
Version Control Advice last updated: n/a				
Variations from national feature-framework of integrity-guidance: n/a				

Table 2: Supplementary Advice for Qualifying Features: S1166. *Triturus cristatus*; Great crested newt

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Supporting processes (on which the feature and/or its supporting habitat relies)	**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 Great Crested Newt and/or its supporting habitats.	Active and ongoing conservation management is needed to protect, maintain or restore this feature at this site. Further details about the necessary conservation measures for this site can be provided by contacting Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, site management strategies or plans, the Views about Management Statement for the underpinning SSSI and/or management agreements.	Hampton Nature Reserve Management plan April 2012-march 2017, prepared by O&H and Froglife. NATURAL ENGLAND, 2014. Site Improvement Plan: Orton Pit (SIP159) http://publications.naturalengland.org.uk/publication/5570370673311744
Supporting habitat: extent and distribution	**Extent of supporting habitat**	Maintain the total extent of the aquatic and terrestrial habitat which support the great crested newt - core habitats include freshwater ponds for breeding, and grasslands, scrub, deadwood and rock/brick rubble habitat for hibernacula and connections.	In order to contribute towards the objective of achieving an overall favourable conservation status of the feature at a UK level, it is important to maintain or if appropriate restore the extent of supporting habitats and their range within this SAC. The information available on the extent and distribution of supporting habitat used by the feature may be approximate depending on the nature, age and accuracy of data collection, and may be subject to periodic review in light of improvements in data. The site contains is a mosaic of ponds, grassland, scrub and more wooded areas which can be used by newts when travelling between ponds or from hibernacula to breeding ponds. Scrub, tussocky grass areas and brick rubble piles can also be used as hibernacula for newts throughout winter. There are more than 400 separate ponds.	FROGLIFE, Second life for ponds project. http://www.froglife.org/wp-content/uploads/2013/06/SecondLifeForPonds2.pdf?x97996 Natural England designated sites view https://designatedsites.naturalengland.org.uk/SiteDetail.aspx?SiteCode=S2000482&SiteName=Pit&countyCode=4&responsiblePerson=
Supporting habitat: extent and distribution	**Distribution of supporting habitat**	Maintain the distribution and continuity of supporting habitat, including where applicable its component vegetation types and associated transitional vegetation	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	HAYES, C.J. 2009. Habitat and Newt Assessment 2009 Report to Natural England.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		types, across the site	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.	
Supporting processes (on which the feature and/or its supporting habitat relies)	**Adaptation and resilience**	Restore the feature's ability, and that of its supporting habitat, to adapt or evolve to wider environmental change, either within or external to the site	This recognises the increasing likelihood of supporting 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. 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 low taking into account the sensitivity, fragmentation, topography and management of its habitats and supporting habitats. This means that the site is considered to be vulnerable overall but are a lower priority for further assessment and action. Individual species may be more or less vulnerable than their supporting habitat itself. In many cases, change will be inevitable so appropriate monitoring would be required. The site is increasingly isolated from other suitable great crested newt sites nearby through increased housing developments and roads, although several newt tunnels were constructed to mitigate loss of habitat connectivity. Long term monitoring will provide us with data on how the population is	NATURAL ENGLAND, 2015. Climate Change Theme Plan and supporting National Biodiversity Climate Change Vulnerability Assessments (NBCCVAs) for SACs and SPAs in England [Available at http://publications.naturalengland.org.uk/publication/4954594591375360 Long term monitoring of great crested newt species and the non-native Alpine newt (Paul Wilkinson, Canal & River Trust – annual records available from Natural England)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			coping with factors such as habitat management, climate change, and fragmentation. A potential environmental change that might influence the habitat features would be changes or fluctuations in rainfall which might affect the holding capacity/duration of the individual ponds. Ponds in one area of the site (R2) have become drier in the last decade and no longer hold water. Increased fragmentation is a concern locally.	
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 habitat relies)	**Water quantity/ quality**	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. Pond levels should typically be between 200-1000mm but ponds are seasonal and can dry out completely in dry summers. .	For many SAC features which are dependent on wetland habitats supported by surface and/or ground water, maintaining the quality and quantity of water supply will be critical, especially at certain times of year. Poor water quality and inadequate quantities of water can adversely affect the structure and function of this habitat type. Typically, meeting the surface water and groundwater environmental standards set out by the Water Framework Directive (WFD 2000/60/EC) will also be sufficient to support the achievement of SAC Conservation Objectives but in some cases more stringent standards may be needed to reflect the ecological needs of the species feature. Further site-specific investigations may be required to establish appropriate water quality standards for the SAC. The site receives rainwater and possible some groundwater springs enter the site. There is some run off from drains to the north that passes through the site.	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Supporting processes (on which the feature and/or its supporting habitat relies)	**Air quality**	Maintain concentrations and deposition of air pollutants at within any site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System (www.apis.ac.uk).	See 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 (www.apis.ac.uk).
Supporting habitat: structure/ function	**Overall Habitat Suitability Index score**	Maintain an average Great Crested Newt Habitat Suitability Index score of no less than 0.7.	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 ARG-UK Advice Note 5 (May 2010). The HSI should not be used as a substitute for more detailed surveys and consideration of other attributes where necessary.	UK AMPHIBIAN AND REPTILE GROUPS (ARG-UK) Advice Note 5 on the Great Crested Newt Habitat Suitability Index (May 2010).
	Presence of ponds	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.	
	Permanence of ponds	Maintain a certain level of permanence of ponds across the site: levels should be high enough in late winter through to mid-summer to maintain breeding habitat but can drop considerably or dry out altogether to eliminate potential predatory fish populations from establishing	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 though 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. Since November 2007 weather data has been recorded daily by Froglife; this includes wind speed and direction, min/max daily temperature, min/max humidity, percentage cloud cover, water level at pump, plus weekly water level readings and, since May 2012, daily rainfall readings.	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Supporting habitat: structure/ function	**Cover of macrophytes**	Maintain a high cover of macrophytes, typically between 50-80%, within ponds	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 *Myosotis scorpioides*, flote/sweet grass *Glyceria fluitans* and great hairy willowherb *Epilobium hirsutum*. 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 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.	
Supporting habitat: structure /function	**Supporting terrestrial habitat**	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.	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. 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. 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 range. Where surrounding housing and infrastructure development of the site has occurred, mitigation measures to attempt to	GCN connecting tunnels monitored by Froglife in 2010, 2011. (Records available from Natural England)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			maintain connectivity of habitats in the form of tunnels.	
Supporting habitat: structure/ function	**Shading of ponds**	Ensure pond perimeters are generally free of shade (typically no more than 60% cover of the shoreline)	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. Monitoring of habitat is made frequently by Froglife site managers. Clearance works are carried out each year on different ponds annually as per site management plan.	
Supporting habitat: structure/ function	**Presence of fish and wildfowl**	Ensure fish and wildfowl are rare or absent in all ponds (<5% of the total number of ponds).	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 from sites which support fewer than 5 ponds. Fish populations have previously been controlled with Rotenone by Froglife. Currently approximately 24% of ponds contain fish with almost 10% associated with high fish abundance.	Piec, D. (2006). Rotenone as a conservation tool in amphibian conservation. A case study of fish control operation undertaken at Orton Pit SSSI, Peterborough, UK. Froglife Ltd. A report to O&H Hampton. Big Newt Count 2012 6th Report on the Hampton Nature Reserve Great Crested Newt Monitoring Programme Survey and report by Paul Furnborough and Dr. Silviu Petrovan (Records available from Natural England)
Supporting processes (on which the feature or its supporting habitat relies)	**Water quality**	Maintain the quality of pond waters within the site as indicated by the presence of an abundant and diverse invertebrate community.	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.	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Population (of the feature)	**Population abundance**	Maintain the abundance of the Great Crested Newt population at a level which is consistently above 9462 individuals on the main reserve (areas H2, H3, CPZ and R4), whilst avoiding deterioration from its current level across the whole SAC as indicated by the latest mean peak count or equivalent.	This will ensure there is a viable population of the feature which is being maintained at or increased to a level that contributes as appropriate to its Favourable Conservation Status across its natural range in the UK. Due to the dynamic nature of population change, the target-value given for the population size or presence of this feature is considered to be the minimum standard for conservation/restoration measures to achieve. This minimum-value may be revised where there is evidence to show that a population's size or presence has significantly changed as a result of natural factors or management measures and has been stable at or above a new level over a considerable period. 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. The population estimate given is that from the 2014 occupancy modelling work undertaken by Froglife, commissioned by Natural England. The model only estimates the GCN population for the central part of the site (areas H2, H3, CPZ and R4). There are no available population estimates for other parts of the SAC but the model will be subject to further analysis and refinement. 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.	Natural England (2016) Natura 2000 Standard Data Form http://jncc.defra.gov.uk/protectedsites/sacselection/n2kforms/UK0030053.pdf

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			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.	
Population (of the feature)	**Population viability**	Maintain the presence of great crested newt eggs in breeding ponds at a level which is likely to Maintain the abundance of the population at or above its target level.	A "breeding pond" is defined as a pond in which egg-laying and successful metamorphosis (eg 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.	
Population (of the feature)	**Supporting meta-populations**	Restore the connectivity of the SAC great crested newt population to any associated metapopulations (either within or outside of the site boundary)	Great crested newts often exist in metapopulations. A meta-population is a group of associated populations made up of newts which breed in, and live around, a cluster of ponds. There will be some interchange of newts between these populations, even though most adults consistently return to the same pond to breed, and so it will be important to avoid the isolation of these populations from each other. A meta-population associated with a SAC may occur outside of the designated site boundary. The connectivity of the wider local landscape to the SAC may therefore be important as this may help to ensure the survival of the overall population even if sub-populations are temporarily affected by, for example, pond desiccation or fish introductions.	
Version Control Advice last updated: n/a				
Variations from national feature-framework of integrity-guidance: n/a				