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

Dawlish Warren Special Area of Conservation (SAC)
Site Code: UK0030130

Photo: Steve Ayres, Teignbridge District Council

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About this document

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

Where this site overlaps with other European Sites, you should also refer to the separate European Site Conservation Objectives and Supplementary Advice (where available) provided for those sites.

This advice replaces a draft version dated January 2019 following the receipt of comments from the site's stakeholders.

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	Dawlish Warren Special Area of Conservation (SAC)
Location	Devon
Site Map	The designated boundary of this site can be viewed here on the MAGIC website.
Designation Date	1 April 2005
Qualifying Features	See section below
Designation Area	58.84 ha
Designation Changes	NA
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)	Dawlish Warren SSSI
Relationship with other European or International Site designations	The whole area of the Dawlish Warren SAC lies within the Exe Estuary Ramsar Site and Exe Estuary Special Protection Area. Conservation Objectives for the SPA can be found here

Site background and geography

The site is located adjacent to the coastal holiday resort of Dawlish Warren. On the coastal side of the site is a south-east facing sandy beach stretching for 2.2 km, which makes the holiday resort so popular. On the other side is the Exe Estuary, which is popular for water sports and bird-watching. Both sides of the Estuary have been developed for walkers and cyclists with popular off-road surfaced paths forming part of the National Cycle Network. Teignbridge District Council manage about 33ha of the area as a nature reserve and Devon Wildlife Trust let about 25ha of the area to be managed as a golf course.

This complex sand spit, exhibiting two parallel ridges, at the mouth of the estuary is within the Devon Redlands National Character Area (NCA Profile 148). The sand spit system is predominantly composed of sandy sediments (unlike many other gravel dominated systems on the south coast) and contains a variety of habitats from bare sand and embryo sand dunes, to mobile dunes, fixed dunes, dune grassland and dune slack.

The spit contains a relict swash aligned barrier in what is today the golf course which reflects a historic phase of sediment starvation. The shift from this starved state to the more recent drift alignment is thought to be linked to the Little Ice Age (c. 14th – 19th Century), when a colder, wetter climate increased rates of coastal erosion and sub-aerial weathering, enhancing sediment supply. The end of the Little Ice Age, along with the construction of the railway and associated defences in the mid19th Century, returned Dawlish Warren to a state of sediment deficit. Left unmanaged, the spit would have returned to its historic swash aligned state, at which point it would have entered a new equilibrium.

However, the construction of coastal defences on Dawlish Warren itself has held the spit in an unnatural drift alignment for around a century, which is likely to be significantly longer than the system could naturally have sustained. Consequently, throughout this period, there has been a net reduction in beach volume as longshore drift transported sediment towards the distal recurves, with offshore losses occurring during storms and under the influence of tidal currents in the Exe inlet channel.

Today, Dawlish Warren is a sediment starved system, eroding largely in a downdrift direction to compensate for the reduction in sediment supply from updrift. The result is net beach erosion between the proximal end of the spit to the south west and a null point located approximately at the north eastern end of the Bight. Beyond this point the beach experiences net accretion as cannibalised material is deposited as drift aligned ridges. By maintaining the current beach alignment, the 2017 Beach Management Scheme will therefore effectively maintain a high potential rate of longshore drift and for the time being prevent evolution towards a more stable swash alignment in which sediment loss from the system would be minimised.

Ecologically the site functions as a high tide roost for wintering waders from the Exe Estuary. For further details on the birdlife of European importance please refer to the Conservation Objectives for the Exe Estuary SPA. The site itself is important for a range of species, including the liverwort, Petalwort **(***Petalophyllum ralfsii*), which relies on short turf within the dune slacks and is of European importance; important vascular plants include Sand Crocus *Romulea columnae;* Sand Lizard is also present. It holds a significant invertebrate fauna typical of sand dune systems, including at least 132 species that have some kind of national or 'local' status. A list of 21 'notified features' is provided within the Dawlish Warren SSSI details on Natural England's Designated Sites System and a fuller description of the wildlife interest is provided within the Dawlish Warren National Nature Reserve (NNR) Management Plan (draft) published by Teignbridge District Council 2017 and the Inner Warren Nature Reserve Management Plan un-published draft by Devon Wildlife Trust 2016.

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:

A fuller description of the habitats and associated species at Dawlish Warren is contained within the Dawlish Warren NNR Management Plan (available from Teignbridge District Council). Some of the species and NVC types have been taken from that plan and attributed to particular SAC habitat types below but may be more widespread.

- **H2130. Fixed dunes with herbaceous vegetation ("grey dunes"); Dune grassland**

Fixed dune communities are recorded as UK NVC types: SD7 *Ammophila arenaria* (Marram Grass) – *Festuca rubra* (Red Fescue); SD7bi *Ammophila arenaria* (Marram Grass) – Festuca Rubra (Red Fescue) semi-fixed dune with *Arenaria serpyllifolia* (Thyme-leaved Sandwort)*, Erodium cicutarium* (Common Storks-bill*), Epilobium lanceolatum (*Spear-leaved Willowherb*) and Aira praecox* (Early Hair-grass); SD7bii *Ammophila arenaria* (Marram Grass), *Euphorbia portlandium* (Portland Spurge), *Rumex acetosella* (Sheep's Sorrel); SD9a *Ammophila arenaria* (Marram Grass) – *Arrhenatherum elatius* (False Oat Grass); SD11b *Carex arenaria* (Sand Sedge)- *Cornicularia aculeata* dune community with *Festuca ovina* sub-community; SD12 *Carex arenaria* (Sand Sedge) – *Festuca ovina* (Sheep's Fescue) – *Rumex acetosella* (Sheep's sorrel) grassland with no determinable sub-community

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The Sand (or Warren) Crocus *Romulea Columnae* (var. occidentalis) is perhaps the highest profile flowering plant at Dawlish Warren and this is one of just two mainland Britain populations. This Nationally Rare plant is found on short-turf grassland areas. The short-turf grassland also supports characteristic species such as Upright Chickweed *Moenchia erecta*, Birds-foot Clover *Trifolium ornithopodioides*, Early Forget-me-not *Myosotis Ramosissima* and Red Fescue *Festuca rubra*, along with good populations of four nationally scarce species: Bulbous Meadow Grass *Poa bulbosa*, Early Meadow Grass *Poa infirma*, Suffocated Clover *Trifolium suffocatum* and Clustered Clover *Trifolium glomeratum*. The semi-fixed/fixed dune grasslands also support two other Nationally Scarce grasses, Bearded fescue *Vulpia ciliata* and Dune Fescue *Vulpia fasciculata*.

- **H2190. Humid dune slacks**

The humid dune slacks are recorded as UK NVC communities: SD15c *Salix repens* Creeping willow – *Calliergon cuspidatum* Pointed Spear Moss with *Carex flacca* Glaucous Sedge– *Pulicaria dysenterica* Common Fleabane sub-community.

Of local importance the Warren's dune slacks hold good populations of Yellow Bartsia *Parentucellia viscosa* and Adder's-tongue *Ophioglossum vulgatum.*

Rabbit Moss *Cheilothela chloropus*, a Nationally Rare moss, is also present and the Nationally Scarce Petalwort *Petallophyllum ralfsii*, an Annex II species in the Habitats Directive, is abundant in locations in areas of some of the dune slacks. Elsewhere the liverwort Weedy Frillwort *Fossombronia incurva* occurs in more acidic parts of the dune slacks. There are also good populations of Southern Marsh Orchid *Dactylorhiza praetermissa* and Marsh Helleborine *Epipactis palustris*. Other plants of note include Small Adders-tongue *Ophioglossum azoricum* and Autumn Lady's-tresses *Spiranthes spiralis.*

- **H2120. Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes"); Shifting dunes with marram**

The strandline, embryo and mobile dune communities are recorded as UK NVC types: SD4 *Elytrigia juncea* (Sand Couch Grass) ssp *Boreali-atlanticus*; SD6a *Ammophila arenaria* (Marram Grass) with *Elytrigia juncea* (Sand Couch Grass) sub-community; SD6d *Ammophila arenaria* (Marram Grass) with

typical sub-community and SD6e *Ammophila arenaria* (Marram Grass) with *Festuca rubra* (Red Fescue) sub-community

This habitat supports an interesting community of lichens growing on the ground, many of which are usually found on trees. Of most significance are two *Peltigeras* species, *P. neckeri* (Nationally Scarce) and *P. didactyla* (Locally Scarce) both terricolous species found on the south facing mobile dune ridge.

Qualifying Species:

- **S1395. *Petalophyllum ralfsii*; Petalwort**

Petalwort *Petalophyllum ralfsii* is a pale green thalloid liverwort with erect lamellae on its upper surface that grows in the dune slacks on compacted sandy/muddy bryophyte-rich turf. It favours short turf or bare ground, including trampled areas at the sides of paths. It does not grow where willow (*Salix* spp.) scrub predominates.

Petalwort *Petallophyllum ralfsii,* is an Annex II species in the European Habitats Directive and is nationally scarce; it is also protected by Schedule 8 of Wildlife and Countryside Act 1981.

Large populations of petalwort occur in two dune slacks at Dawlish Warren. One near the Visitor Centre and the other within Greenland Lake.

A SAC selection species account is available from the JNCC here.

Table 1: Supplementary Advice for Qualifying Features: H2120. Shifting dunes along the shoreline with Ammophila arenaria ("white dunes"); Shifting dunes with marram

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Extent and distribution of the feature	**Extent of the feature within the site**	Maintain the total extent of the feature to about 16ha	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. A figure of 16ha was provided by the Nature Conservancy Council Sand Dune Survey of Great Britain Site Report Number 85 (1990) and cited by the 2008 Favourable Condition Tables (FCT) for the SSSI; the area of mobile dunes was mapped in 2008 (see baseline map attached to FCT drawn 4/3/08 by James Diamond). The area shown on the map as mobile dunes, including an area at the distal end (which is technically outside the SAC boundary) covers about 17ha according to measurements using aerial photography from 2015 and 2016. A detailed map based on remote sensing was also created by the Environment Agency in 2014 titled: Dawlish Warren	Nature Conservancy Council (1990) Sand Dune Survey of Great Britain Site Report Number 85 Natural England (2008) Definition of Favourable Condition – Dawlish Warren SSSI (Available on request from Natural England) Environment Agency (2014) Dawlish Warren Habitat Map.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			Habitat Map.	
Extent and distribution of the feature	**Spatial distribution of the feature within the site**	Restore the distribution and configuration of the feature, including where applicable its component vegetation types, across the site	A contraction in the range, or geographic spread, of the feature (and its component vegetation and typical species, plus transitional communities) across the site will reduce its overall area, the local diversity and variations in its structure and composition, and may undermine its resilience to adapt to future environmental changes. This may also reduce and break up the continuity of a habitat within a site and how well its typical species are able to move around the site to occupy and use habitat. Such fragmentation can impact on their viability and the wider ecological composition of the Annex I habitat. Smaller fragments of habitat can typically support smaller and more isolated populations which are more vulnerable to extinction. These fragments also have a greater amount of open edge habitat which will differ in the amount of light, temperature, wind, and even noise that it receives compared to its interior. These conditions may not be suitable for some of the typical and more specialist species associated with the Annex I habitat feature. For this feature, this strongly relates to the coastal processes (sand deposition by wind, tideline debris to initiate sand trapping and lack of disturbance during growing season) as well as seed/propagule supply that determine the presence of the habitat. Distribution of habitat relates to the availability of blown sand from the beach plain, as well as seed/propagule supply that determine the presence of the habitat. Ammophila arenaria (Marram grass) plants also have a mycorrhizal association. Mobile dunes are distributed as a thin (about 30 to 50m width measured from March 2003 aerial photography) strip behind the seafront. Their area is subject to rapid change from either accretion or erosion. At 'The Neck' this strip has reduced significantly since 2010. A larger area of mobile dunes exists at Warren Point (the distal end of the sand spit). The narrowing of the strip of mobile dunes behind the seafront makes the	Wheeler BR & Wilson PJ (2012) Botanical survey of Dawlish Warren NNR

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			habitat susceptible to loss or fragmentation by storm erosion, whilst the dunes at the distal end are susceptible to complete loss during storm events. The current artificially held alignment of the coast has promoted lowering of beach levels as well as associated cliffing of the overly steep frontal dunes. As active coastal processes are limited the system is unable to facilitate processes that promote this feature (including; sand deposition by wind, tideline debris to initiate sand trapping and lack of disturbance during growing season).	
Structure and function (including its typical species)	**Vegetation community composition**	Ensure the component vegetation communities of the feature are referable to and characterised by the following National Vegetation Classification types: SD4 *Elytrigia juncea* (Sand Couch Grass) ssp *Boreali-atlanticus*; SD6a *Ammophila arenaria* (Marram Grass) with *Elytrigia juncea* (Sand Couch Grass) sub-community; SD6d *Ammophila arenaria* (Marram Grass) with typical sub-community SD6e *Ammophila arenaria* (Marram Grass) with *Festuca rubra* (Red Fescue) sub-community	This habitat feature will comprise a number of associated semi-natural vegetation types and their transitional zones. In the UK these have been categorised by the National Vegetation Classification (NVC). Maintaining or restoring the presence, variety and composition of these vegetation types at this site will help to conserve the typical species composition of the SAC feature at this site at appropriate levels (recognising natural fluctuations). The species composition of shifting dunes is constrained by the harsh conditions, but the vegetation is by no means uniform. The most marked floristic variation relates to the degree of instability. Where sand accretion is extremely rapid it is possible to find vegetation that consists only of *Ammophila arenaria*. As rates of sand deposition decline the Marram is joined by more species. There are a number of sub-communities and there will be natural fluxes in the transition between the mobile dunes and fixed dunes seaward as sand deposition changes.	Wheeler BR & Wilson PJ (2012) Botanical survey of Dawlish Warren NNR

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Structure and function (including its typical species)	**Vegetation: undesirable species**	Restore the frequency/cover of the following undesirable species to within acceptable levels and prevent changes in surface condition, soils, nutrient levels or hydrology which may encourage their spread. • Negative indicator species to be no more than occasional throughout sward, or singly or together the cover to be no more than 5% • Other non-native species to be no more than rare.	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. For this feature, two types of negative species can occur: invasive non-natives, or species indicative of poor or declining condition (e.g. nettle or creeping thistle. For known or likely invasive species, there should be zero tolerance. Invasive non-native species may be an issue, the presence of non-natives and other undesirable species could be an indication of increased stability. Some species are potentially more invasive into areas of bare sand and will require specific management on site. Negative indicators include *Senecio jacobaea, Cirsium arvense, Cirsium vulgare, Urtica dioica, Lolium perenne*, and *Arrhenatherum elatius*. *Urtica dioica* and *Cirsium* species are indicative of poor condition because of enrichment. Abundance of *Senecio jacobaea* may indicate possible overgrazing in summer or other factors causing disturbed ground Invasive non-native species within the SAC include Tree lupin *Lupin arboreus*, Michealmas daisy *Aster* spp, Buddleja *Buddleja davidii,* Canadian fleabane *Conyza canadensis* agg. (including *C. sumatrensis),* Japanese rose *Rosa rugosa),* American blue-eyed grass *Sisyrinchium montanum,* Yucca *Yucca recurvifolia and* Evening primrose *Oenothera biennis*	This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments Wheeler BR & Wilson PJ (2012) Botanical survey of Dawlish Warren NNR
Structure and function (including its typical	**Vegetation community transitions**	Restore the full natural range of vegetation zones and the transitions between them.	Zonations are seen as indicative of good conservation of structure and function. It is essential that the relationship between this habitat and other elements of the sand dune system are recognised. As much of the dune frontage as	This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
species)			possible should have intact zonation to the next stage in succession (generally fixed dunes). This target needs to be determined at a site level, as there may be specific factors that naturally limit continuous coverage. Restore target set as 2010 SSSI condition assessment found the site to be unfavourable due to the lack of zonation over most of the site. The Beach Management Scheme (BMS) was implemented in 2017, initial evidence is that the scheme has not performed as expected and the erosion of the beach/dunes has been more rapid than initially thought. Triggers and actions outlined in the monitoring and management plan for the scheme have been brought forward as a result. Further investigations into alternative ways forward and solutions are being undertaken.	Environment Agency (2017) Dawlish Warren Beach Management Scheme policy paper, published on the GOV.UK website at: https://www.gov.uk/government/publications/dawlish-warren-beach-management-scheme/dawlish-warren-beach-management-scheme
Structure and function (including its typical species)	**Dune topography**	Restore a natural topography to the shifting dune feature.	Dune topography may be influenced by the operation of geomorphological processes, which should be allowed to continue in order to maintain the dune system in its naturally dynamic form. Maintaining this zone in a natural form, and as part of the wider dune zonation, will provide optimal conditions for the full range of characteristic flora and fauna. The low shifting dunes on the foreshore provide a vital structural element to any dune system: the varied natural topography provides important means of dune-building and progradation seawards. Key dune-building plants such as *Ammophila arenaria* (Marram grass) is sensitive to salinities over 1.5% so only persists on higher dune ridges. The outer barrier and associated dunes are overly steep and currently exhibit no connectivity with either the beach in front or the slack/dunes behind – this is illustrated by the current cliffing of the base of the dunes and beach lowering. The dunes are not in a naturally dynamic form, apart from those at the systems distal end.	Orford J (2013) Geomorphological Advice in respect of Dawlish Warren (South Devon). (Report commissioned by Natural England).
Structure and function (including its	**Presence of unvegetated surfaces**	Maintain the extent of bare sand which typically covers up to 50% of the feature extent, of varying	In these developing, dynamic zones, bare sand should be expected. Lack of bare sand would suggest an artificially stabilised system. Blow-throughs are a natural element of this	This attribute will be periodically monitored as part of Natural England's SSSI Condition

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
typical species)		sizes, in a mosaic with the vegetation.	zone. If extent of sand is towards the upper end of the range, it will become important to assess whether recreational pressures are over-riding natural dynamics. The 2017 beach management scheme included major engineering works that created an excess of bare ground. This has since been repaired through, for example, planting marram grass. The erosion of the seaward-facing dune faces also appeared to be developing an excess of un-vegetated surfaces but this might change following the works. The attribute will need re-assessment.	Assessments
Structure and function (including its typical species)	**Key structural, influential and/or distinctive species**	Maintain the abundance of the typical species listed below to enable each of them to be a viable component of the Annex 1 habitat; • Constant and preferential plant species of SD4, SD6a, SD6d and SD6e dune NVC vegetation types which comprise the H2120 feature within this SAC • Important lichen species including *Peltigeras neckeri* (Nationally Scarce) and *P. didactyla* (Locally Scarce) • Vascular plant species including Dune Fescue *Vulpia fasciculata;* Bearded Fescue *Vulpia ciliata ssp ambigua* and Wall Bedstraw *Galium parisiense* • Sand lizard *Lacerta agilis* • Important invertebrate	Some plant or animal species (or related groups of such species) make a particularly important contribution to the necessary structure, function and/or quality of an Annex I habitat feature at a particular site. These species will include; • **Structural** species which form a key part of the Annex I habitat's structure or help to define that habitat on a particular SAC (see also the attribute for 'vegetation community composition'). • **Influential** species which are likely to have a key role affecting the structure and function of the habitat (such as bioturbators (mixers of soil/sediment), grazers, surface borers, predators or other species with a significant functional role linked to the habitat) • **Site-distinctive** species which are considered to be a particularly special and distinguishing component of an Annex I habitat on a particular SAC. There may be natural fluctuations in the frequency and cover of each of these species. The relative contribution made by them to the overall ecological integrity of a site may vary, and Natural England will provide bespoke advice on this as necessary. The list of species given here for this Annex I habitat feature at this SAC is not necessarily exhaustive. The list may evolve, and species may be added or deleted, as new information about this site becomes available.	Wheeler, B. & Wilson, P.J. (2013) 2012 Botanical survey of Dawlish Warren NNR Species lists for Dawlish Warren are published by the Dawlish Warren Recording Group on their website www.dawlishwarren.co.uk

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		assemblage typical of sand dune systems	The habitat supports an interesting community of lichens growing on the ground, many of which are usually found on trees. Of most significance are two *Peltigeras* species, *P. neckeri* (Nationally Scarce) and *P. didactyla* (Locally Scarce) both terricolous species found on the south facing mobile dune ridge	
Structure and function (including its typical species)	**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 feature. Maintain 2.8ha of buffer habitat between the SAC and built development of the beach resort	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 prevent/reduce/absorb damaging impacts from adjacent land uses e.g. pesticide drift, nutrient enrichment. At the proximal end there is an area of fixed dune grassland with dune slacks that covers about 2.8ha. Although this area is degraded by intensive trampling by visitors to the adjacent beach resort, it does share some of the plant species that are found within the SSSI and offers a potential opportunity for habitat spread besides buffering.	More information may be available on the buffer zone from Teignbridge District Council but it is not monitored formally by Natural England
Structure and function (including its typical species)	**Functional connectivity with wider landscape**	Maintain the overall extent, quality and function of any supporting features within the local landscape which provide a critical functional connection with the site	This recognises the potential need at this site to maintain or restore the connectivity of the site to its wider landscape in order to meet the conservation objectives. These connections may take the form of landscape features, such as habitat patches, hedges, watercourses and verges, outside of the designated site boundary which are either important for the migration, dispersal and genetic exchange of those typical species closely associated with qualifying Annex I habitat features of the site. These features may also be important to the operation of the supporting ecological processes on which the designated site and its features may rely. In most cases increasing actual and functional landscape-scale connectivity would be beneficial.	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			Where there is a lack of detailed knowledge of the connectivity requirements of the qualifying feature, Natural England will advise as to whether these are applicable on a case by case basis. Dawlish Warren is mostly surrounded by sea and estuary that effectively buffer the habitat from damage (by inappropriate recreational use, air borne pollutants etc). At the proximal end there is an area of fixed dune grassland with dune slacks that covers about 2.8ha. The other land uses are a stone-surfaced car park that serves as an extension-only to the main tarmac-surfaced car park; and a railway line (which effectively isolates the SAC from the adjacent village and caravan parks.	
Structure and function (including its typical species)	**Adaptation and resilience**	Restore the feature's ability, and that of its supporting processes, to adapt or evolve to wider environmental change, either within or external to the site	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. 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 SAC to climate change has been assessed by Natural England (2015) as being high, taking into account the sensitivity, fragmentation, topography and management of its habitats This means that this site is considered to be one of the most vulnerable sites overall and is	English Nature (1993) Site Management Brief – Dawlish Warren SSSI (Available on request from Natural England) UKCP2018 factsheet on sea level rise and storm surge Orford J (2013) Geomorphological Advice in respect of Dawlish Warren (South Devon). 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].

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			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. The system's ability to adapt or evolve to wider environmental change is currently compromised. The overriding issue is the artificially held alignment of Dawlish Warren. Sand spits move up estuaries with diminishing sediment supply to maintain their long-term coherence, adjusting to the effects of storminess and sea level rise. Allowing the system to evolve through active coastal processes (with limited engineered intervention) would facilitate a more adaptive and resilient feature. Erosion of the sand dunes and lowering of beach levels in recent decades not only reduces natural zonation (from embryonic to semi-fixed dunes) along the outer barrier but also removes the supply of wind-blown sand for dune formation. The Beach management plan prevents natural realignment of the spit as it responds to sea level rise due to climate change and variation in storminess, it is therefore anticipated that in the long term (by 2049 or sooner) these artificial features will be removed and unconstrained active coastal processes will predominate.	
Structure and function (including its typical species)	**Soils, substrate and nutrient cycling**	Maintain the properties of the underlying soil types, including structure, bulk density, total carbon, pH, soil nutrient status and fungal: bacterial ratio, to within typical values for the habitat.	Soil is the foundation of basic ecosystem function and a vital part of the natural environment. Its properties strongly influence the colonisation, growth and distribution of those plant species which together form vegetation types, and therefore provides a habitat used by a wide range of organisms. Soil biodiversity has a vital role to recycle organic matter. Changes to natural soil properties may therefore affect the ecological structure,	British Geological Survey (1976) Sheet No. 339, 'Newton Abbot', solid and drift edition, 1:50000 scale Ian Farmer Associates (2010) Report on Ground Investigation

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			function and processes associated with this Annex I feature. This Annex 1 habitat has essentially raw soils with little humus and low nutrient status. Natural England do not routinely monitor soils except for the assessment of extent of bare ground. The geological map indicates the site to be underlain by superficial deposits of Marine Beach Deposits and Tidal Flats. Core samples taken by Ian Farmer Associates for the Environment Agency found generally very little topsoil with predominantly sand to about 0.9 to 2m depth then lower down silt, gravels, cobbles and clays on a weathered mudstone bedrock around 9 to 12m below the surface. The Ian Farmer Associates report also provides a chemical analysis of the core samples. Dune slack areas have developed shallow (less than 0.1m) humic surface layers over more clayey substrates.	carried out at Dawlish Warren Prepared for Environment Agency
Supporting processes (on which the feature relies)	**Conservation measures**	Maintain the management measures (either within and/or outside the site boundary as appropriate) which are necessary to maintain the structure, functions and supporting processes associated with the feature	Active and ongoing conservation management is needed to protect, maintain or restore this feature at this site. Further details about the necessary conservation measures for this site can be provided by contacting Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, Site Management Strategies or Plans, the Views about Management Statement for the underpinning SSSI and/or management agreements. The site is proactively managed by both the Devon Wildlife Trust (and their tenant the Golf Club) and Teignbridge District Council for the conservation of the environment. Management includes grazing, scrub control, invasive plant control, grass cutting and visitor management. The conservation measures are described in the management plans of each organisation.	Teignbridge District Council (2018) Dawlish Warren National Nature Reserve Draft Management Plan 2018-2022 Devon Wildlife Trust (2017) Inner Warren Nature Reserve Management Plan (Draft)
Supporting processes (on which the	**Air quality**	Maintain the concentrations and deposition of air pollutants to at or below the site-relevant Critical	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	Air Pollution Information System (www.apis.ac.uk).

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
feature relies)		Load or Level values given for this feature of the site on the Air Pollution Information System (www.apis.ac.uk).	damaging plant growth, altering its vegetation structure and composition and causing the loss of sensitive typical species associated with it. Critical Loads and Levels are recognised thresholds below which such harmful effects on sensitive UK habitats will not occur to a significant level, according to current levels of scientific understanding. There are critical levels for ammonia (NH3), oxides of nitrogen (NOx) and sulphur dioxide (SO2), and critical loads for nutrient nitrogen deposition and acid deposition. There are currently no critical loads or levels for other pollutants such as Halogens, Heavy Metals, POPs, VOCs or Dusts. These should be considered as appropriate on a case-by-case basis. Ground level ozone is regionally important as a toxic air pollutant but flux-based critical levels for the protection of semi-natural habitats are still under development. It is recognised that achieving this target may be subject to the development, availability and effectiveness of abatement technology and measures to tackle diffuse air pollution, within realistic timescales. Critical loads of air pollutants are within limits for mobile dunes according to the UK Air Pollution Information System (APIS).	
Supporting processes (on which the feature relies)	**Aeolian (wind-blow) processes**	Restore the ability of wind-blow processes to transport sand from the beach plain to the foredune.	Allowing natural wind-blow (or 'aeolian') processes to shape the topography of this habitat feature is important to its long-term conservation. The beach plain needs to be dry to allow sand to be transported into the dune system. The system has exhibited a long-term trend of erosion, with beaches experiencing lowering – removing sediment from the system alongshore and into the nearshore. Coupled with the overly steep contiguous outer barrier/dunes, the ability for aeolian processes to occur significantly is low; although the introduction of the Beach Management Scheme did briefly produce a pulse of aeolian sand across the site Beach drying is insufficient predominantly due to the system being held seaward of a more natural position.	Orford J (2013) Geomorphological Advice in respect of Dawlish Warren (South Devon).

Attributes	Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Version Control Advice last updated: **28 February 2019**. Following stakeholder feedback, more detail added about invertebrate interest to the 'K**ey structural, influential and/or distinctive species'** attribute			
Variations from national feature-framework of integrity-guidance: The attribute **Water Quality** has been removed as it is not relevant to this feature.			

Table 2: Supplementary Advice for Qualifying Features: H2130. Fixed dunes with herbaceous vegetation ("grey dunes"); Dune grassland *

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Extent and distribution of the feature	**Extent of the feature within the site**	Maintain the total extent of the feature to 31 hectares.	See the explanatory notes for this attribute above in Table 1' For this feature if loss (or gain) of area is from natural causes dynamism this is not a decline in condition, but any significant loss due to human interference (e.g. sand extraction, visitor impacts, ploughing or conversion to improved grassland) is to be regarded as unfavourable. Increase in area is favourable unless related to coast protection. In a naturally functioning dune system there is likely to be varying proportions of fixed and mobile dune communities over time. 31 hectares is the baseline figure cited by the Favourable Condition Tables and used for SSSI condition assessment. This figure is based on the NCC Sand Dune Survey of GB Site Report Number 85 (1990). The area of fixed dunes was also mapped in 2008 (see baseline map attached to FCT drawn 4/3/08 by James Diamond). A detailed map based on remote sensing was also created by the Environment Agency in 2014 titled: Dawlish Warren Habitat Map	Nature Conservancy Council (1990) Sand Dune Survey of Great Britain Report Number 85 Natural England (2008) Definition of Favourable Condition – Dawlish Warren SSSI (Available on request from Natural England) Environment Agency (2014) Dawlish Warren Habitat Map.
Extent and distribution of the feature	**Spatial distribution of the feature within the site**	Maintain the distribution and configuration of the feature, including where applicable its component vegetation types, across the site	A contraction in the range, or geographic spread, of the feature (and its component vegetation and typical species, plus transitional communities) across the site will reduce its overall area, the local diversity and variations in its structure and composition, and may undermine its resilience to adapt to future environmental changes. This may also reduce and break up the continuity of a habitat within a site and how well its typical species are able to move around the site to occupy and use habitat. Such fragmentation can impact on their viability and the wider ecological composition of the Annex I habitat. Smaller fragments of habitat can typically support smaller and more isolated populations which are more vulnerable to extinction. These fragments also have a greater amount of open edge habitat which will differ in the amount of light,	See above

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			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. For this feature it is also important to maintain transitions between fixed/semi-fixed dunes and other dune/terrestrial habitats to seaward or landward.	
Structure and function (including its typical species)	**Vegetation community composition**	Ensure the component vegetation communities of the feature are referable to and characterised by the following National Vegetation Classification types: SD7 *Ammophila arenaria* Marram Grass – *Festuca rubra* Red Fescue; SD7bi *Ammophila arenaria* Marram Grass – Festuca Rubra Red Fescue semi-fixed dune with *Arenaria serpyllifolia* Thyme-leaved Sandwort*, Erodium cicutarium* Common Storks-bill*, Epilobium lanceolatum S*pear-leaved Willowherb *and Aira praecox* Early Hair-grass; SD7bii *Ammophila arenaria* Marram Grass, *Euphorbia portlandium* Portland Spurge, *Rumex acetosella* Sheep's Sorrel; SD9a *Ammophila arenaria* Marram Grass – *Arrhenatherum elatius* False Oat Grass; SD11b *Carex arenaria* Sand	This habitat feature will comprise a number of associated semi-natural vegetation types and their transitional zones, reflecting the geographical location of the site, altitude, aspect, soil conditions (especially base-status and drainage) and vegetation management. In the UK these have been categorised by the National Vegetation Classification (NVC). Maintaining or restoring these characteristic and distinctive vegetation types, and the range of types as appropriate, will be important to sustaining the overall habitat feature. This will also help to conserve their typical plant species (i.e. the constant and preferential species of a community), and therefore that of the SAC feature, at appropriate levels (recognising natural fluctuations).	Wheeler BR & Wilson PJ (2012) Botanical survey of Dawlish Warren NNR

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		Sedge - *Cornicularia aculeata* dune community with *Festuca ovina* sub-community; SD12 *Carex arenaria* Sand Sedge – *Festuca ovina* Sheep's Fescue – *Rumex acetosella* Sheep's sorrel grassland		
Structure and function (including its typical species)	**Vegetation: undesirable species**	Restore the frequency/cover of the following undesirable species to within acceptable levels and prevent changes in surface condition, soils, nutrient levels or hydrology which may encourage their spread;	Undesirable non-woody and woody vascular plants species may require active management to avert an unwanted succession to a different and less desirable state. Often they may be indicative of a negative trend relating to another aspect of a site's structure and function. These species will vary depending on the nature of the particular feature, and in some cases these species may be natural/acceptable components or even dominants. For this feature where sea buckthorn is native this species is not counted as a negative indicator (It has been widely introduced elsewhere and has proved very invasive. Species such as *Urtica dioica, Cirsium arvense* and *C. vulgare* species are indicative of poor condition because of enrichment. *Senecio jacobaea* is a natural constituent of dune vegetation and should only to be included as a negative indicator where extensive dense stands of robust plants are present. Undesirable species include: *Rosa spp., Cirsium arvense, Cirsium vulgare, Urtica dioica, Lolium perenne, Arrhenatherum elatius (not SD9), Pteridium aquilinum, Rubus fruticosus, Chamaenerion angustifolium,* sea buckthorn *Hippophae rhamnoides* Bramble cover exceeds desired limits across some parts of the SSSI and is being reduced to less than 5%	This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments
Structure and function (including its typical	**Vegetation community transitions (range and**	Restore the patterns of natural zonations/transitions, with full zonation from beach inland to fixed dune should be intact over	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	This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
species)	**zones)**	at least 95% of coastal frontage.	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. Some dunes are on naturally sediment-deficit coasts: on these there is likely to be less than 95% frontage of strandline and embryo dunes. The Beach Management Scheme (BMS) was implemented in 2017, initial evidence is that the scheme has not performed as expected and the erosion of the beach / dunes continues. Further investigations into alternative ways forward and solutions are being undertaken.	Environment Agency (2017) Dawlish Warren Beach Management Scheme policy paper, published on the GOV.UK website at: https://www.gov.uk/government/publications/dawlish-warren-beach-management-scheme/dawlish-warren-beach-management-scheme
Structure and function (including its typical species)	**Vegetation structure diversity**	Maintain variation to sward structure, so that typically 30-70% of sward comprises species-rich short turf (between 2 and 10cm tall).	A varied vegetation structure and a succession of flowers and seeds through the year are important for maintaining the habitat's diversity. Targets for ratio of short to taller vegetation should be set on a site-specific basis. In addition, a proportion of the short turf area should be <5cm tall. The ratio of short to tall vegetation can be lower (but not <30%) in semi-fixed dune grassland (SD7) where Ammophila arenaria (Marram grass) is still abundant. Levels and timing of stock grazing should be sufficient to allow adequate seed production. A varied management regime of cutting and/or grazing is undertaken to manage grass swards by both Teignbridge District Council and the Golf Club.	This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments
Structure and function (including its typical species)	**Dune topography**	Restore a natural topography to the fixed dune feature.	Dune topography may be influenced by the operation of geomorphological processes, which should be allowed to continue in order to maintain the dune system in its naturally dynamic form. Fixed dunes occur where the dune stabilises and the organic content of the soil increases. Maintaining this zone in a natural form, and as part of the wider dune zonation, will provide optimal conditions for the full range of characteristic flora and fauna. The outer barrier of mobile dunes are overly steep and currently exhibit no connectivity with either the fixed dunes behind – this is illustrated by the current cliffing of the base of the mobile dunes and beach lowering. The dunes are not in a	Orford J (2013) Geomorphological Advice in respect of Dawlish Warren (South Devon).

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			naturally dynamic form, apart from those at the systems distal end. .	
Structure and function (including its typical species)	**Presence of unvegetated surfaces**	Maintain an appropriate cover of bare ground or sand, which is typically between 5-20% and in patches in a mosaic with vegetated surfaces.	Patches of bare sand are essential for a wide range of typical dune invertebrates and 'dune annual' plants. For semi-fixed/fixed dunes the range of bare ground/sand is typically between 5-20%. Areas of bare sand which are maintained by frequent human disturbance should not increase in extent.	This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments
Structure and function (including its typical species)	**Key structural, influential and/or distinctive species**	Maintain the abundance of the typical species listed below to enable each of them to be a viable component of the Annex 1 habitat. • Constant and preferential plant species of SD7, SD9, SD11 and SD12 dune NVC vegetation types which comprise the H2130 feature within this SAC • Vascular plant assemblage including: Early meadow grass *Poa infirma;* bulbous meadow grass *Poa bulbosa*; suffocated clover *Trifolium suffocatum*; clustered clover *Trifolium glomeratum*; Sand crocus *Romulea columnae;* Small Adder's-tongue fern *Ophioglossum azoricum;* Smooth Cat's-ear *Hypochaeris glabra;* Shepherd's Cress *Teesdalia nudicaulis;* Autumn Lady's-tresses *Spiranthes spiralis;* Green-winged	Some plant or animal species (or related groups of such species) make a particularly important contribution to the necessary structure, function and/or quality of an Annex I habitat feature at a particular site. These species will include; • **Structural** species which form a key part of the Annex I habitat's structure or help to define that habitat on a particular SAC (see also the attribute for 'vegetation community composition'). • **Influential** species which are likely to have a key role affecting the structure and function of the habitat (such as bioturbators (mixers of soil/sediment), grazers, surface borers, predators or other species with a significant functional role linked to the habitat) • **Site-distinctive** species which are considered to be a particularly special and distinguishing component of an Annex I habitat on a particular SAC. There may be natural fluctuations in the frequency and cover of each of these species. The relative contribution made by them to the overall ecological integrity of a site may vary, and Natural England will provide bespoke advice on this as necessary. The list of species given here for this Annex I habitat feature at this SAC is not necessarily exhaustive. The list may evolve, and species may be added or deleted, as new information about this site becomes available.	Wheeler BR & Wilson PJ (2012) Botanical survey of Dawlish Warren NNR Species lists for Dawlish Warren are published by the Dawlish Warren Recording Group on their website www.dawlishwarren.co.uk

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		Orchid *Anacamptis morio* • Important invertebrate assemblage typical of sand dune systems	Annual species will vary in population size so only presence and distribution might be relevant.	
Structure and function (including its typical species)	**Functional connectivity with wider landscape**	Maintain the overall extent, quality and function of any supporting features within the local landscape which provide a critical functional connection with the site	This recognises the potential need at this site to maintain or restore the connectivity of the site to its wider landscape in order to meet the conservation objectives. These connections may take the form of landscape features, such as habitat patches, hedges, watercourses and verges, outside of the designated site boundary which are either important for the migration, dispersal and genetic exchange of those typical species closely associated with qualifying Annex I habitat features of the site. These features may also be important to the operation of the supporting ecological processes on which the designated site and its features may rely. In most cases increasing actual and functional landscape-scale connectivity would be beneficial. Where there is a lack of detailed knowledge of the connectivity requirements of the qualifying feature, Natural England will advise as to whether these are applicable on a case by case basis. Dawlish Warren is mostly surrounded by sea and estuary that buffer the habitat from damage to some extent (by inappropriate recreational use, air borne pollutants etc). At the proximal end there is an area of fixed dune grassland with dune slacks that covers about 2.8ha. The other land uses are a stone-surfaced car park that serves as an extension-only to the main tarmac-surfaced car park; and a railway line (which effectively isolates the SAC from the adjacent village and caravan parks.	
Structure and function (including its typical	**Adaptation and resilience**	Restore the feature's ability, and that of its supporting processes, to adapt or evolve to wider environmental change, either	See the explanatory notes for this attribute above in Table 1 The system's ability to adapt or evolve to wider environmental change is currently compromised. The overriding issue is the	English Nature (1993) Site Management Brief – Dawlish Warren SSSI (Available on request from Natural England)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
species)		within or external to the site	artificially held alignment of Dawlish Warren. Sand spits move up estuaries with diminishing sediment supply to maintain their long-term coherence, adjusting to the effects of storminess and sea level rise. Allowing the system to evolve through active coastal processes (with limited engineered intervention) would facilitate a more adaptive and resilient feature. Erosion of the sand dunes and lowering of beach levels in recent decades not only reduces natural zonation (from embryonic to semi-fixed dunes) along the outer barrier but also removes the supply of wind-blown sand for dune formation. The Beach management plan prevents natural realignment of the spit as it responds to sea level rise due to climate change and variation in storminess, it is therefore anticipated that in the long term (by 2049 or sooner) these artificial features will be removed and unconstrained active coastal processes will predominate.	UKCP2018 factsheet on sea level rise and storm surge Orford J (2013) Geomorphological Advice in respect of Dawlish Warren (South Devon). 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].
Structure and function (including its typical species)	**Soils, substrate and nutrient cycling**	Maintain the properties of the underlying soil types, including structure, bulk density, total carbon, pH, soil nutrient status and fungal: bacterial ratio, to within typical values for the habitat.	Soil is the foundation of basic ecosystem function and a vital part of the natural environment. Its properties strongly influence the colonisation, growth and distribution of those plant species which together form vegetation types, and therefore provides a habitat used by a wide range of organisms. Soil biodiversity has a vital role to recycle organic matter. Changes to natural soil properties may therefore affect the ecological structure, function and processes associated with this Annex I feature.	See Table 1
Supporting processes (on which the feature relies)	**Conservation measures**	Maintain the management measures (either within and/or outside the site boundary as appropriate) which are necessary to maintain the structure, functions and supporting processes associated with the feature	Active and ongoing conservation management is needed to protect, maintain or restore this feature at this site. Further details about the necessary conservation measures for this site can be provided by contacting Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, Site Management Strategies or Plans, the Views about Management Statement for the underpinning SSSI and/or management agreements.	See Table 1

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			For this feature conservation measures may include • Reduce nutrient levels to maintain high numbers of species through the management activities of grazing, burning, mowing, sod-cutting and scrub cutting. The reworking of sand through cultivation or sand-drift may help to conserve the dynamic habitat. Management of succession is a critical aspect of management for this habitat, by a combination of active processes and grazing/cutting. • A range of invertebrates and plants require bare sand where it is not too frequently disturbed by vehicles or feet. • Where damage initiates a blow-out, this can be a positive outcome in over- stabilized dunes, where sea defence concerns or critical infrastructure are not comprised. The site is proactively managed by both the Devon Wildlife Trust (and their tenant the Golf Club) and Teignbridge District Council for the conservation of the environment. Management includes grazing, scrub control, invasive plant control, grass cutting and visitor management. The conservation measures are described in the management plans of each organisation.	
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 (www.apis.ac.uk).	See the explanatory notes for this attribute above in Table 1	More information about site-relevant Critical Loads and Levels for this SAC is available by using the 'search by site' tool on the Air Pollution Information System (www.apis.ac.uk).
Supporting processes (on which the feature relies)	**Hydrology**	Restore natural hydrological processes to provide the conditions necessary to sustain the feature within the site	Defining and maintaining the appropriate hydrological regime is a key step in moving towards achieving the conservation objectives for this site and sustaining this feature. Changes in source, depth, duration, frequency, magnitude and timing of water supply can have significant implications for the assemblage of characteristic plants and animals present. This target is generic and further site-specific investigations may be	See references for this attribute Table 3

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			required to fully inform conservation measures and/or the likelihood of impacts. For this feature, hydrology can be influenced by dune topography, vegetation, substrate, flow regimes	
Supporting processes (on which the feature relies)	**Aeolian (wind-blow) processes**	Restore the ability of wind-blow processes to transport sand from the beach plain to the foredune.	Allowing natural wind-blow (or 'aeolian') processes to shape the topography of this habitat feature is important to its long-term conservation. The beach plain needs to be dry to allow sand to be transported into the dune system. The system has exhibited a long-term trend of erosion, with beaches experiencing lowering – removing sediment from the system alongshore and into the nearshore. Coupled with the overly steep contiguous outer barrier/dunes, the ability for aeolian processes to occur significantly is low. Beach drying is insufficient predominantly due to the system being held seaward of a more natural position.	See references in Table 1
Version Control Advice last updated: **28 February 2019**. Following stakeholder feedback, more detail added about invertebrate interest to the 'K**ey structural, influential and/or distinctive species'** attribute				
Variations from national feature-framework of integrity-guidance: The attribute for **Water Quality** has been removed as this is not considered relevant for this feature.				

Table 3: Supplementary Advice for Qualifying Features: H2190. Humid dune slacks

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Extent and distribution of the feature	**Extent of the feature within the site**	Maintain the total extent of the feature to baseline-value of 1.5 hectares	There should be no measurable reduction (excluding any trivial loss) in the extent and area of this feature, and in some cases, the full extent of the feature may need to be restored. The baseline-value of extent given has been generated using data gathered from the listed site-based surveys. Area measurements given may be approximate depending on the methods, age and accuracy of data collection, and as a result this value may be updated in future to reflect more accurate information. The extent of an Annex I habitat feature covers the sum extent of all of the component vegetation communities present and may include transitions and mosaics with other closely-associated habitat features. Where a feature is susceptible to natural dynamic processes, there may be acceptable variations in its extent through natural fluctuations. Where a reduction in the extent of a feature is considered necessary to meet the Conservation Objective for another Annex I feature, Natural England will advise on this on a case-by-case basis. For this feature if loss (or gain) of area is from natural physical dynamism this is not a decline in condition, but any significant loss due to human interference (e.g. sand extraction, visitor impacts, ploughing or conversion to improved grassland) is to be regarded as unfavourable. In a naturally functioning dune system some dune slacks will, over time, dry out but new ones will be created by sand blow (secondary slacks) or by beach development (primary slacks). Humid dune slacks represents the wetter and early succession elements of dune wetlands. All elements of the wet-dry and early-late succession spectrums should be represented on the site. Evidence of natural changes to extent should not justify further loss to development. As the site evolves (see earlier explanatory notes on geomorphology) it is likely that dune slack habitats within Greenland Lake will be lost through tidal inundation. Opportunities to create or restore alternative	Nature Conservancy Council (1990) Sand Dune Survey of Great Britain Site Report Number 85 Natural England (2008) Definition of Favourable Condition – Dawlish Warren SSSI (Available on request from Natural England) Environment Agency (2014) Dawlish Warren Habitat Map.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			locations for this habitat should be explored.	
Extent and distribution of the feature	**Dune topography**	Restore a natural dune topography, but allow natural change that is wind driven (some change may be necessary to maintain the continuity of slacks).	It is possible that on some sites there are over-riding constraints that will not allow natural dune dynamics to proceed. On these sites it may be necessary to artificially lower ground surface levels in slacks to extend their lives. See also 'Within-site sedimentary processes' component. The artificially fixed nature of the site (see explanatory notes on geomorphology) means that all the natural dune slacks are in the late successional stage of development. Artificial hollows are being created to provide some early successional dune slack habitat.	Teignbridge District Council (2018) Dawlish Warren National Nature Reserve Draft Management Plan 2018-2022
Extent and distribution of the feature	**Spatial distribution of the feature within the site**	Maintain the distribution and configuration of the feature, including where applicable its component vegetation types, across the site	A contraction in the range, or geographic spread, of the feature (and its component vegetation and typical species, plus transitional communities) across the site will reduce its overall area, the local diversity and variations in its structure and composition, and may undermine its resilience to adapt to future environmental changes. This may also reduce and break up the continuity of a habitat within a site and how well its typical species are able to move around the site to occupy and use habitat. Such fragmentation can impact on their viability and the wider ecological composition of the Annex I habitat. Smaller fragments of habitat can typically support smaller and more isolated populations which are more vulnerable to extinction. These fragments also have a greater amount of open edge habitat which will differ in the amount of light, temperature, wind, and even noise that it receives compared to its interior. These conditions may not be suitable for some of the typical and more specialist species associated with the Annex I habitat feature. In the short term, dune wetland features are fixed in space determined by dune topography and hydrology. However, in a naturally functioning dune system topography can change leading to localised losses and gains in dune wetlands, including Humid dune slacks.	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			The target of maintenance of the current distribution and configuration needs to be considered within the context of likely major changes to the site within the next 20 to 50 years (see geomorphology explanatory notes).	
Extent and distribution of the feature	**Future extent of habitat within the site and ability to respond to seasonal changes**	Restore the ability to absorb seasonal and periodic fluctuations in the extent of the habitat Maintain the spatial integrity supporting natural hydrological function which ideally is considered at the catchment scale	This recognises the need to allow for natural fluctuations in the extent and the distribution of this habitat feature, often during particular seasons and usually as a result of natural coastal processes. Humid dune slacks are buffered from short term natural variations in hydrology including dry seasons. However, artificial drainage or a longer series of dry years with lowered water table will lead to early succession away to non-dune wetland habitat. In the medium term, a degree of dune dynamics is required to create new dune slacks. The majority of the dune slack habitat lies within the Greenland Lake area, which is susceptible to inundation by the sea as the landform changes (see explanatory notes on geomorphology). The artificially fixed nature of the site limits the formation of new habitat by natural processes.	
Structure and function (including its typical species)	**Presence of unvegetated surfaces**	Restore an extent of bare ground or sand which is no more than 20% of the total dune slack area.	Patches of bare sand are essential for a wide range of dune invertebrates and colonisation by some bryophytes.	This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments
Structure and function (including its typical species)	**Vegetation community composition**	Restore the component vegetation communities and associated transitions, allowing for successional changes in response to natural processes. SD15c. *Salix repens* Creeping willow – *Calliergon cuspidatum* moss with *Carex flacca* – *Pulicaria dysenterica* sub-community Other dune slack communities are absent or very limited in extent. The SD15c grades to	This habitat feature will comprise a number of associated semi-natural vegetation types and their transitional zones, reflecting the geographical location of the site, altitude, aspect, soil conditions (especially base-status and drainage) and vegetation management. In the UK these have been categorised by the National Vegetation Classification (NVC). Maintaining or restoring these characteristic and distinctive vegetation types, and the range of types as appropriate, will be important to sustaining the overall habitat feature. This will also help to conserve their typical plant species (i.e. the constant and preferential species of a community), and therefore that of the SAC feature, at appropriate levels (recognising natural fluctuations).	Wheeler BR & Wilson PJ (2012) Botanical survey of Dawlish Warren NNR

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		drier SD12 and SD11 grassland.	For this feature it is unlikely that all slack communities will be represented in a single slack. It is more usual for individual slacks to be at different stages in vegetation succession, and to have slightly different hydrological regimes. The target relates to the humid dune slack resource across the whole site.	
Structure and function (including its typical species)	**Vegetation structure: zonation of dune vegetation**	Restore succession of dune slack stages (early, middle and later). All humid slack communities should be present – from embryonic dune slacks with a high % of bare ground to those with more closed vegetation and up to 33% cover of *Salix repens*. Early dune slack successional stages at least occasional.	The coastal sand dune ecosystem has a characteristic range of natural features, representing different stages of natural succession. The full representation of these stages should be maintained or where appropriate restored. The target relates to the humid dune slack resource across the whole site. Not all slack communities will be represented in a single slack. It is more usual for individual slacks to be at different stages in vegetation succession, and to have slightly different hydrological regimes. A mosaic of other wetland vegetation communities are frequently present within dunes (swamp/ mire/tall herb fen). These are all important elements of the dune system and may have hydrological connectivity with the dune slack habitats.	
Structure and function (including its typical species)	**Vegetation composition: trees and scrub**	Maintain scrub and tree cover of locally native species to less than 5%, scattered and in small groups. Cover of Salix repens not more than 33%.	Dense cover of trees and shrubs can smother and shade out smaller and more characteristic vegetation of this habitat feature, and interrupt naturally occurring dune processes. Usually active management is required to reduce or contain its cover across this habitat feature. Apart from sea buckthorn (where it is native), other trees and shrubs would usually indicate an artificially stabilised system. The 'humid dune slack' community requires soil to be wet enough and not too dominated by creeping willow *Salix repens* for a diverse range of forbs and some grasses to be also present. The target relates to the humid dune slack resource across the whole site.	This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments
Structure and function (including its typical	**Vegetation composition: forb/grass ratio**	Maintain a typically low vegetation sward with >30% cover of forbs and <50% cover of grasses, and occasional	Low swards are required by some species. Drying and eutrophication of the slack can be indicated by increase in 'grassiness'.	This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
species)		bryophytes e.g. *Calliergon cuspidatum, Campylium stellatum*.		
Structure and function (including its typical species)	**Vegetation: undesirable species**	Maintain 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.	*Urtica dioica, Cirsium arvense* and *C. vulgare* species are indicative of poor condition. Other thistles should not be included as negative indicators. *Lolium perenne* is indicative of agricultural improvement. *Senecio jacobaea* is a natural constituent of dune vegetation. However, in dune slacks an abundance of *Senecio jacobaea* indicates over-stocking. If Salix repens covers more than 33% it is potentially indicative of drying out, and this should trigger further investigation to determine why this might be shifting to a different Annex I habitat.	This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments
Structure and function (including its typical species)	**Key structural, influential and/or distinctive species**	Maintain the abundance of the typical species listed below to enable each of them to be a viable component of the Annex 1 habitat. • Constant and preferential plant species SD15c dune NVC vegetation types which comprise the H2190 feature within this SAC • Petalwort *Petalophyllum ralfsii* • Important invertebrate assemblage typical of sand dune systems	Some plant or animal species (or related groups of such species) make a particularly important contribution to the necessary structure, function and/or quality of an Annex I habitat feature at a particular site. These species will include; • **Structural** species which form a key part of the Annex I habitat's structure or help to define that habitat on a particular SAC (see also the attribute for 'vegetation community composition'). • **Influential** species which are likely to have a key role affecting the structure and function of the habitat (such as bioturbators (mixers of soil/sediment), grazers, surface borers, predators or other species with a significant functional role linked to the habitat) • **Site-distinctive** species which are considered to be a particularly special and distinguishing component of an Annex I habitat on a particular SAC. There may be natural fluctuations in the frequency and cover of each of these species. The relative contribution made by them	This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments Species lists for Dawlish Warren are published by the Dawlish Warren Recording Group on their website www.dawlishwarren.co.uk

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			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. Annual species will vary in population size so only presence and distribution might be relevant.	
Structure and function (including its typical species)	**Soils, substrate and nutrient cycling**	Maintain the properties of the underlying soil types, including structure, bulk density, total carbon, pH, soil nutrient status and fungal: bacterial ratio, to within typical values for the habitat.	Soil is the foundation of basic ecosystem function and a vital part of the natural environment. Its properties strongly influence the colonisation, growth and distribution of those plant species which together form vegetation types, and therefore provides a habitat used by a wide range of organisms. Soil biodiversity has a vital role to recycle organic matter. Changes to natural soil properties may therefore affect the ecological structure, function and processes associated with this Annex I feature. As dune slack vegetation succession progresses, soils develop in structure and nutrient status. The soils under Humid dune slacks represent less to moderately developed natural soils to be found on dunes. Natural England do not routinely monitor soils except for the assessment of extent of bare ground. The geological map indicates the site to be underlain by superficial deposits of Marine Beach Deposits and Tidal Flats. Core samples taken by Ian Farmer Associates for the Environment Agency found generally very little topsoil with predominantly sand to about 0.9 to 2m depth then lower down silt, gravels, cobbles and clays on a weathered mudstone bedrock around 9 to 12m below the surface. The Ian Farmer Associates report also provides a chemical analysis of the core samples. Dune slack areas have developed shallow (less than 0.1m) humic surface layers over more clayey substrates.	British Geological Survey (1976) Sheet No. 339, 'Newton Abbot', solid and drift edition, 1:50000 scale Ian Farmer Associates (2010) Report on Ground Investigation carried out at Dawlish Warren Prepared for Environment Agency
Supporting processes	**Functional connectivity**	Restore adequate movement of sediment from all key sediment	Although Humid dune slacks do not depend in the short term on continued inputs of sand, its medium/long term survival	See references against geomorphology

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
(on which the feature relies)	**with wider coastal sedimentary system, including seed/ propagule dispersal.**	sources (directly from the beach, indirectly from offshore, eroding cliffs etc).	does. Primary slacks can occur on the beach plane with sufficient input of sand. The artificially fixed nature of the site prevents natural movement of sand that might develop new dune slacks – see explanatory notes under geomorphology.	
Supporting processes (on which the feature relies)	**Aeolian (wind-blow) processes**	Restore the natural movement of sand within the site, resulting from wind blow-outs and blow-throughs.	Allowing natural wind-blow (or 'aeolian') processes to operate and to allow active movement of dry sand is important. Current dune topography, including hollows reaching damp sand where slacks occur, has resulted from past within-site dune movement. Although Humid dune slacks does not depend in the short term on new dune mobility, its medium/long term survival does. Secondary slacks are created where overlying sand is blown away down to the water table/wet sand. The site is held artificially to seaward by means of groynes and hard defences. The beach is eroding and is too low to dry out enough to support Aeolian processes over large parts of the site. See further explanatory notes under geomorphology.	See references against geomorphology
Supporting processes (on which the feature relies)	**Hydrology**	At a catchment level restore natural hydrological processes to provide the conditions necessary to sustain the feature within the site	Defining and maintaining the appropriate hydrological regime is a key step in moving towards achieving the conservation objectives for this site and sustaining this feature. It will rarely be possible to alleviate the problems of a single type of slack without addressing the hydrology/hydrochemistry of the dune system in which it is found 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. All dune wetland vegetation communities are influenced by the water table. Each community reflects a particular past and current hydrological regime and any lowering of the water table is not considered desirable, particularly for SD15 vegetation	Devon Wildlife Trust (2017) Inner Warren Nature Reserve Management Plan (Draft) Teignbridge District Council (2018) Dawlish Warren National Nature Reserve Draft Management Plan 2018-2022 Burden R (1997) The Hydrology and Management of the Warren Burden R & Williams A (1995) A Hydrological Investigation of Three Devon Sand Dune Systems Analysis of Hydrological Data for Northam Burrows and Dawlish Warren

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			community Water table monitoring should be present on all sites with dune wetlands. Humid dune-slacks are extremely rich and specialised habitats which are very threatened by the lowering of water tables (Interpretation Manual - EUR28). They require a period of wetting, with inundation to shallow depth in winter and maintenance of moist soils in summer. SD15 vegetation itself is normally representative of mature dune slacks that are kept wet by prolonged flooding. Inundation for much or all of the year is important in maintaining the composition and structure of the vegetation. Permanent pools will sometimes occur in association with dune slacks, and can be hydrologically linked to the humid dune slack feature. There will be a suite of dune slacks within a site, all at different stages in vegetation succession, and although all linked to the same dune aquifer, may have slightly different hydrological regimes due to variations in age, elevation and management. Within the golf course drainage and overall site water levels are controlled artificially by a series of open water ditches, underground piping and culverts together with a diesel pump which pumps water into the estuary from a pond. There are also a series of underground drains and soakaways underneath some of the golf course greens; the purpose of these is to move water away from the green and allow it to soak away on-site. Fairways are irrigated during drought conditions. No surface drainage features exist on the Teignbridge District Council-managed part of the site. There are two ponds that have been excavated on the TDC site (believed to date from the 1980s and early 1990s) and these together with areas of dune slack, show fluctuations in the level in response to both rainfall and the tidal cycle, suggesting ground water levels are perched on saline infiltration. There is anecdotal evidence that the site has been drying up	https://www.gov.uk/government/publications/eco-hydrological-guidelines-for-wet-dune-habitats

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			and groundwater levels falling since the 1970s. In response to the perceived problem, a series of dipwells were established in 1993 to gather data on groundwater (Burden & Willams, 1995; Burden, 1997). Dipwell monitoring has continued across the site since but has been sporadic and inconsistent. More data is needed to fully understand the hydrology of the site. There are concerns that the slacks are drying out; water extraction, the presence of ponds exposing ground water to evaporation and the amount of woodland cover may be contributing factors The primary control on water levels in a dune sand aquifer is the balance of precipitation and evapotranspiration leading to rain-fed, freshwater recharge. Even single rainfall events can lead to a rise in water level. In some cases long-term variation in seasonal and annual rainfall over several years can cause long periods of drought or flooding that can have lasting impacts on humid dune slacks. During the 2017 beach recharge water levels found within at least one dune slack were notably higher than in recent years. It is possible that the gradual decline in beach levels has enabled the site to drain more rapidly than in the past, exacerbating the situation. If this has indeed been a contributory factor in the drying out of the slacks, the return to higher water tables is likely to be short-lived, as beach levels are expected to fall again over the next few years. It is predicted that much of the existing dune slack habitat at the Warren will be lost to salt water inundation as the site evolves following the 2017 Beach Management Scheme. The areas west of the 'Flood Wall' that lies north of the second groyne are unlikely to be affected.	
Supporting processes (on which the	**Water quality**	Where the feature is dependent on surface water and/or groundwater, maintain water	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,	Devon Wildlife Trust (2017) Inner Warren Nature Reserve Management Plan (Draft)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
feature relies)		quality and quantity to a standard which provides the necessary conditions to support the feature.	especially at certain times of year. Poor water quality and inadequate quantities of water can adversely affect the structure and function of this habitat type. Typically, meeting the surface water and groundwater environmental standards set out by the Water Framework Directive (WFD 2000/60/EC) will also be sufficient to support the achievement of SAC Conservation Objectives but in some cases more stringent standards may be needed. Further site-specific investigations may be required to establish appropriate water quality standards for the SAC. Dune slacks are nutrient-poor habitats in which the characteristic vegetation is maintained by low levels of nutrient input, particularly of nitrogen (N) and phosphorus (P). Nutrient limitation is a key factor in maintaining stability in such communities and hence delaying potential successional development.	https://www.gov.uk/government/publications/eco-hydrological-guidelines-for-wet-dune-habitats
Supporting processes (on which the feature relies)	**Air quality**	Restore the concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System (www.apis.ac.uk).	See the explanatory notes for this attribute above in Table 1	More information about site-relevant Critical Loads and Levels for this SAC is available by using the 'search by site' tool on the Air Pollution Information System (www.apis.ac.uk).
Supporting processes (on which the feature relies)	**Conservation measures**	Maintain the management measures (either within and/or outside the site boundary as appropriate) which are necessary to restore the structure, functions and supporting processes associated with the feature	Active and ongoing conservation management is needed to protect, maintain or restore this feature at this site. Further details about the necessary conservation measures for this site can be provided by contacting Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, Site Management Strategies or Plans, the Views about Management Statement for the underpinning SSSI and/or management agreements. Although 'natural processes' are given a high priority in sustaining site and feature integrity in dunes, active management (including livestock grazing) is sometimes required. Management includes scrub cutting, mowing, grazing,	Teignbridge District Council (2018) Dawlish Warren National Nature Reserve Draft Management Plan 2018-2022

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			turf-stripping and re-wetting. Mowing can prolong the younger species-rich stage of slack succession but cannot reverse the process. Reverse the fall in water tables (if anthropogenic) and/or removal of trees and scrub combined with follow-up grazing management. Management should focus on creating new successional cycles to provide habitat for early successional species and replace that lost by accelerated succession. Stimulation of germination from the seed bank through management may contribute to the conservation of both characteristic and threatened species typical of dune slacks. (Plassmann et al., 2009) Management practices that remove nutrients (N) from the system can mitigate the effects of N inputs but may damage fragile components. A range of invertebrates and plants require bare sand, usually naturally created by wind blow, but sometimes where it is infrequently disturbed by vehicles or feet. Teignbridge District Council are undertaking a range of management (including scrape creation, grazing and mowing) to maintain existing dune slacks and to restore zonation.	
Version Control Advice last updated: **28 February 2019**. Following stakeholder feedback, more detail added about invertebrate interest to the 'K**ey structural, influential and/or distinctive species'** attribute				
Variations from national feature-framework of integrity-guidance: N/A				

Table 4: Supplementary Advice for Qualifying Features: S1395. *Petalophyllum ralfsii*; Petalwort

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Population (of the feature)	**Population abundance**	Maintain the abundance of the population at a level defined as: • At least ten thalli, including sexually active plants are found in 90% of the known locations at least once in five years; • At least three of the known locations held at least 50 thalli at least once in five years.	This will ensure there is a viable population of the feature which is being maintained at or increased to a level that contributes as appropriate to its Favourable Conservation Status across its natural range in the UK. Due to the dynamic nature of population change, the target-value given for the population size or presence of this feature is considered to be the minimum standard for conservation/restoration measures to achieve. This minimum-value may be revised where there is evidence to show that a population's size or presence has significantly changed as a result of natural factors or management measures and has been stable at or above a new level over a considerable period (generally at least 10 years). The values given here may also be updated in future to reflect any strategic objectives which may be set at a national level for this feature. Given the likely fluctuations in numbers over time, any impact-assessments should focus on the current size of the site's population, as derived from the latest known or estimated level established using the best available data. This advice accords with the obligation to avoid deterioration of the site or significant disturbance of the species for which the site is designated, and seeks to avoid plans or projects that may affect the site giving rise to the risk of deterioration. Similarly, where there is evidence to show that a feature has historically been more abundant than the stated minimum target and its current level, the ongoing capacity of the site to accommodate the feature at such higher levels in future should also be taken into account in any assessment. Unless otherwise stated, the population size or presence will be that measured using standard methods, such as peak mean counts or breeding surveys. This value is also provided recognising there will be inherent variability as a result of natural fluctuations and margins of error during data collection. Whilst we will endeavour to keep these values as up to date as possible, local Natural England staff can advise that the figures	Lansdown R.V. (2012) Survey of *Petalophyllum ralfsii* at Dawlish Warren

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			stated are the best available. Counts of the numbers of thalli have shown wide variations from year-to-year and even week-to-week and have not so far been a useful measure of condition at Dawlish Warren. Lansdown has recommended an alternative approach based on the minimum baseline for a healthy population and based on averaging counts over 5 years.	
Supporting habitat: extent and distribution	**Distribution of supporting habitat**	Maintain the distribution and continuity of the feature and its supporting habitat, including where applicable its component vegetation types and associated transitional vegetation types, across the site	A contraction in the range, or geographic spread, of the feature (and its component vegetation) across the site will reduce its overall area, the local diversity and variations in its structure and composition, and may undermine its resilience to adapt to future environmental changes. Contraction may also reduce and break up the continuity of a habitat within a site and how well the species feature is able to occupy and use habitat within the site. Such fragmentation may have a greater amount of open edge habitat which will differ in the amount of light, temperature, wind, and even noise that it receives compared to its interior. These conditions may not be suitable for this feature and this may affect its viability. Petalwort is associated with the humid dune slack habitat, for explanatory notes on the distribution of this habitat refer to Table 3	Refer to references for habitat distribution of humid dune slacks in Table 3
Supporting habitat: extent and distribution	**Extent of supporting habitat**	Maintain the total extent of the habitat which supports the feature. Petalwort is associated with the humid dune slack habitat – for targets see Table 3.	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. Petalwort is associated with the humid dune slack habitat, for explanatory notes on the extent of this habitat refer to Table 3.	Refer to references for habitat extent of humid dune slacks in Table 3
Supporting habitat:	**Bare Ground and**	Ensure areas supporting *P. ralfsii* contain at least 5% bare ground	*P. ralfsii* tolerates only light shading, and most sites supporting the species have persistently very low vegetation that includes	Cox C & Large R (2017) Condition assessment for

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
structure/function	**Vegetation Structure**	and the height of overall vegetation structure is predominantly short.	many small perennials, which is maintained by low nutrient levels and often by intense grazing by rabbits, plus on some sites light trampling pressure. Most sites also have at least some bare ground, commonly 10-50% bare sandy ground amongst low vegetation, although P. ralfsii can grow in a very thin low cover of grasses and low herbs. Grazing by rabbits is often important in the maintenance of this low structure. If such grazing becomes reduced or is not sufficient, then periodic clearance of tall vegetation and scrub with removal of arisings may be required	Petalwort *Petalophyllum ralfsii* at Dawlish Warren (Available from Natural England on request) This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments
Supporting habitat: structure/function	**Hydrological regime**	*Restore* water levels at sites supporting *P. ralfsii* at or to a level sufficient to support the species, in particular water tables should not be lowered and should be allowed to naturally fluctuate. Water tables in dune slack sites should be at or above the ground surface during the majority of the winter months.	*P. ralfsii* favours damp sites with the water table at or near the surface. Most sites are dry for parts of a normal summer and wet or flooded during at least some winters. Ponds dug or deepened in dune slacks for conservation purposes for amphibians should be sited far enough away from *P. ralfsii* populations to prevent the damage that might be caused directly or e.g. by increasing trampling levels nearby. There is anecdotal evidence that water table on the site has lowered but the evidence is inconclusive. Shallow winter flooding still occurs on site despite these concerns. Also see explanatory notes on hydrology within Table 3.	See Table 3
Supporting habitat: structure/function	**Nutrient status**	Maintain the nutrient status to naturally expected levels, avoiding pollution and activities that increase nutrient levels which promote algal growth in dune slacks, or an increase in species such as common nettle and rye grass.	This feature is particularly sensitive to small-scale changes in its supporting habitat's structure. Raised nutrient levels through pollution is likely to be damaging, and increased nutrient levels will promote the growth of other vegetation that will out-compete and shade out the diminutive *P. ralfsii*. Excessive algal growth in dune slacks and an increase in species such as common nettle and rye grass are likely to be indicative of raised nutrient levels.	Cox C & Large R (2017) Condition assessment for Petalwort *Petalophyllum ralfsii* at Dawlish Warren This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments
Supporting habitat: structure/function	**Scrub and tree cover**	Maintain the cover of scrub and trees within dune slacks and other sandy ground supporting *P. ralfsii* at less than 5%, and absent from the primary areas	Invasive scrub is very harmful to *P. ralfsii*, which tolerates only light shading. Scrub species that can be a particular problem in dune slacks include sea buckthorn, bramble and birch, and excessive creeping willow is also undesirable with regard to *P. ralfsii.*	Cox C & Large R (2017) Condition assessment for Petalwort *Petalophyllum ralfsii* at Dawlish Warren

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		supporting P. ralfsii.		This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments
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. There is speculation that Petalwort was introduced to Dawlish Warren and that its existence depends on the pH of the soil being artificially raised by stone having being brought into the site. However, Lansdown (2012) suggests that the soil pH over most of the locations where Petalwort occurs could be natural and that the plant was present and more widely distributed in the past but had not been identified. The relationship between Petalwort and the soils that support it therefore does not appear to be clearly understood. For further explanatory notes on soils, substrate and nutrient cycling, see Table 1.	See Table 1 Lansdown R.V. (2012) Survey of *Petalophyllum ralfsii* at Dawlish Warren
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	See the explanatory notes for this attribute above in Table 1' Petalwort is associated with the humid dune slack habitat, most of which is located in an area that is likely to be lost to inundation by the sea within the next 20-50 years. The Dawlish Warren sand spit has limited ability to adapt to changes in sediment supply and climate change due to its artificially fixed position. (See explanatory notes with Table 3). The water table height can vary, along with number of *Petalwort thalli* recorded, Lansdown has recommended creating scrapes that a closer to the water table to make the population more resilient to dry periods.	Refer to references for adaptation and resilience of humid dune slacks in Table. Lansdown R.V. (2012) Survey of *Petalophyllum ralfsii* at Dawlish Warren

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**	Restore concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System (www.apis.ac.uk).	See the explanatory notes for this attribute above in Table 1	More information about site-relevant Critical Loads and Levels for this SAC is available by using the 'search by site' tool on the Air Pollution Information System (www.apis.ac.uk).
Supporting processes (on which the feature and/or its supporting habitat relies)	**Conservation measures**	Maintain the management measures within the site boundary which are necessary to restore the structure, functions and supporting processes associated with the feature and/or its supporting habitats.	Active and ongoing conservation management is needed to protect, maintain or restore this feature at this site. Further details about the necessary conservation measures for this site can be provided by contacting Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, site management strategies or plans, the Views about Management Statement for the underpinning SSSI and/or management agreements. Petalwort appears to be associated with short vegetation and at least 50% bare ground. This is being achieved by artificial scrape creation, trampling and grazing. Teignbridge District Council, in association with Natural England, are experimenting to establish how to create the best ground conditions to increase the distribution of the species within the site.	Cox C & Large R (2017) Condition assessment for Petalwort *Petalophyllum ralfsii* at Dawlish Warren Lansdown R.V. (2012) Survey of *Petalophyllum ralfsii* at Dawlish Warren Holyoak, D.T. (2003) Status and conservation of petalwort (*Petalophyllum ralfsii*) at Dawlish Warren NNR, South Devon. Unpublished report to Teignbridge District Council
Supporting processes (on which the feature and/or its supporting habitat relies)	**Disturbance from human activity**	Maintain levels of light to moderate trampling which benefit the feature	*P. ralfsii* requires firm or compacted substrates and avoids very loose or mobile sand, thus excessive disturbance will be harmful. There is a narrow zone of disturbance intensity that provides the right conditions for *P. ralfsii* - too much and the ground remains too unstable for establishment, whilst too little and the ground may become overgrown by a closed turf. There should be no excessive disturbance to dune slacks or other sandy ground supporting *P. ralfsii*, for example caused by excessive trampling or jogging, or the use of vehicles or scrambler motorbikes.	Cox C & Large R (2017) Condition assessment for Petalwort *Petalophyllum ralfsii* at Dawlish Warren This attribute will be periodically monitored as part of Natural England's SSSI Condition Assessments
Supporting processes	**Water quantity/**	Where the feature or its supporting habitat is dependent	For many SAC features which are dependent on wetland habitats supported by surface and/or ground water, maintaining	This attribute will be periodically monitored as part of Natural

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
(on which the feature and/or its supporting habitat relies)	**quality**	on surface water and/or groundwater, maintain water quantity to a standard which provides the necessary conditions to support the feature. The water table should be at or above the surface of the slack for prolonged period during winter months.	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. No specific standards have been set by Natural England for water quality. However, indicators that would show artificially raised nutrient levels may include excessive nettle growth for example. The water table height can vary, along with number of Petalwort thalli recorded - see further explanatory notes against hydrology in Table 3.	England's SSSI Condition Assessments
Version Control Advice last updated: N/A				
Variations from national feature-framework of integrity-guidance: N/A				