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

Sefton Coast Special Area of Conservation (SAC)
Site Code: UK0013076

Recently rejuvenated dune slack, Sefton Coast © Margaret Dickinson, Natural England

Date of Publication: 21 March 2019

About this document

This document provides Natural England's supplementary advice about the European Site Conservation Objectives relating to Sefton Coast 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	Sefton Coast Special Area of Conservation (SAC)
Location	Merseyside
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	4,563.97 ha
Designation Changes	N/A
Feature Condition Status	Details of the feature condition assessments made at this site can be found using Natural England's Designated Sites System
Names of component Sites of Special Scientific Interest (SSSIs)	Sefton Coast SSSI The boundaries are broadly coincident except for a few small areas (45 ha in total) where the SSSI includes land that is not within the SAC.
Relationship with other European or International Site designations	3,109 ha of the intertidal frontage of Sefton Coast SAC overlaps with the Ribble and Alt Estuaries SPA. There is more extensive overlap with the Ribble and Alt Estuaries Ramsar, with 4,150 ha of overlap on the intertidal and in some parts of the dunes. Liverpool Bay SPA abuts the western intertidal boundary of the SAC.

Site background and geography

Sefton Coast is a large sand dune system (the fourth largest in Britain, Ratcliffe 1977) in north-west England, stretching over 20 km from Southport in the north (at the mouth of the Ribble estuary) and Crosby in the south (at the mouth of the Mersey). The majority of the dune system site lies within the Sefton Coast National Character Area (NCA 57), but at the southern end its landward margin abuts the Merseyside Conurbation NCA (NCA 58). Ravenmeols Hills LNR also lies within Sefton Coast SAC.

Much of the SAC has public access and includes Ainsdale Sand Dunes and Cabin Hill National Nature Reserves and Ainsdale and Birkdale Sandhills Local Nature Reserves. There are 5 championship golf courses within the SAC and a military training camp at Altcar. The remainder of the land is owned and managed by the Wildlife Trust, the National Trust and one private owner. This means that most of the SAC has either full public access, or is adjacent to public rights of way. The location, adjacent to the Merseyside conurbation, means that there are areas of high public use (around car parks) and the SAC is already at risk from recreational disturbance. This may increase in magnitude as further developments arise.

The site displays both rapid erosion and active shifting dunes. A substantial stretch of the dune system is fronted by shifting dunes. Marram *Ammophila arenaria* usually dominates the mobile dunes, amidst considerable areas of blown sand. Where rates of sand deposition decline, lyme grass *Leymus arenarius*, sea-holly *Eryngium maritimum* and cat's-ear *Hypochaeris radicata* occur, with red fescue *Festuca rubra* and spreading meadow-grass *Poa humilis* present on the more sheltered ridges. Sea spurge *Euphorbia paralias* and the nationally scarce dune fescue *Vulpia fasciculata* are frequent, while

sea bindweed *Calystegia soldanella* is very local. The area of dunes around Formby Point has been eroding since 1906 while areas north and south of this are accreting (where the nature of the coast allows). The rapid erosion is therefore reducing the area of shifting dunes at Formby, and high, steep eroding dunes abut the beach with extensive areas of blown sand immediately inland.

The sequence of habitats from foredunes to dune grassland and dune slack is extensive, and substantial areas of open dune vegetation remain. There are large areas of semi-fixed and fixed dunes with herbaceous vegetation exhibiting considerable variation from calcareous to acidic.

There are extensive dune slacks dominated by creeping willow *Salix repens* ssp. *argentea*; it has been estimated that 99ha, or 43% of the total English resource of the main dune slack community dominated by creeping willow occurs at this site. The species also dominates areas of free-draining dune grassland to a much greater extent than at most other UK sites. Despite some urban and recreational development, both successional and geomorphological processes are still active and the structure and function of the site as a whole is still well-conserved. Pools in the hollows and slacks amongst the more fixed dunes are the habitat of a large population of great crested newts *Triturus cristatus*.

Some active formation can still be seen and a variety of successional stages are represented. The sequence from foredunes to dune grassland and dune slack is extensive. The site also contributes to the range and variation of humid dune slack vegetation, being a large and representative base-rich system towards the northern limit for some humid dune slack communities along the west coast of Britain.

A large population of petalwort *Petalophyllum ralfsii* occurs at this site. The plant was first recorded on the Sefton Coast at Ainsdale in 1861 and it is still found within the dune system between Southport and Ainsdale. It seems to prefer damp ground around the edges of dune slacks of fairly recent origin, with the largest populations found in slacks of less than 25 years old. The plant is often found in association with footpaths, where light trampling keeps the ground vegetation sparse; infrequently-used paths or less-trampled edges of pathways seem to be favoured. Although the preferred habitat is short damp turf with plenty of bare patches, populations have been found growing amongst dense marram *Ammophila arenaria* with few other associated species.

Recreational disturbance; fouling and disturbance by dogs; climate change and natural processes are recurring themes that have an impact on many of the attributes. It should, however be noted that each attribute should be assessed against its specific indicators and on a case-by-case basis. The Sefton – Ribble Site Improvement Plan covers the threats to the SAC and Natural England can also offer bespoke advice where it is needed.

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:

- **H2110 Embryonic shifting dunes**

Embryonic shifting dune vegetation exists in a highly dynamic state and is dependent on the continued operation of physical processes at the dune/beach interface. It is the first type of vegetation to colonise areas of incipient dune formation at the top of a beach. On a prograding dune system this vegetation may be the precursor to the main dune-building vegetation dominated by marram *Ammophila arenaria*. In most cases **Embryonic shifting dunes** are transient and will either be displaced by marram-dominated vegetation as the dunes develop (**2120 Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes")**) or will be washed away by storms. The continued supply of new sand from the beach plain into the dune system is therefore vital to the continued existence of this community, even if this sand is derived from within the same system. The habitat type is of exceptional importance as an indicator of the general structural and functional 'health' of a dune system. Creation of new dune habitat, and indeed the long-term survival of the dune system at which it occurs, is often dependent upon the survival of this habitat type.

Embryonic shifting dunes are inherently species-poor and have a limited range of floristic variation. The predominant plants are strandline species such as sea rocket *Cakile maritima* and the two salt-tolerant, sand-binding grasses: lyme-grass *Leymus arenarius* and sand couch *Elytrigia juncea*. These grasses generally occur slightly higher up the beach profile than the true strandline species. There is some geographical variation, even within this very simple vegetation type. While both dune-binding grasses have a wide geographical range, lyme-grass is more abundant in the north and east of Britain and sand couch is more abundant in the south and west. Marram *Ammophila arenaria* is a common constituent of the habitat type throughout its range.

In the UK the majority of vegetation which conforms to this type belongs to NVC type SD4 *Elymus farctus* ssp. *boreali-atlanticus* foredune community, but certain stands of SD2 *Honkenya peploides – Cakile maritima* strandline community (on sand) and SD5 *Leymus arenarius* mobile dune community may also be referable to this Annex I type when they occur in close association with the *Elymus* community.

By their very nature **Embryonic shifting dunes** are restricted in the area they can occupy. They are made even scarcer by the fact that only a relatively small number of dunes are actively prograding, the condition under which this habitat type develops best. **Embryonic shifting dunes** are also particularly vulnerable to trampling by beach users and to mechanical cleaning of beaches, and this may well be a significant factor in limiting their extent.

This habitat type rarely occurs in isolation, because it may initiate dune succession, and it is invariably one of several Annex I habitat types to be found on a dune system.

This habitat type has a wide European distribution, and has been recorded from coasts in the Atlantic, Mediterranean, Continental and Boreal Regions. Embryonic shifting dunes are a rare habitat type in the UK, covering much less than 1,000 ha.

The Sefton Coast in north-west England displays both rapid erosion and active progradation. Embryonic shifting dunes are mainly dominated by sand couch *Elymus junceiformis* in SD4 *Elymus farctus* ssp.*boreali-atlantcus* foredune (Rodwell, 2000). Foredunes supporting mainly lyme-grass *Leymus arenarius* (SD5 *Leymus arenarius* mobile dune community) also occur but are more sporadic and can occasionally be found a little way inland, as at Crosby Coastal Park and on the golf courses. Gateley and Michell (2004) noted a 72% decline in SD5 from 1988/89 to 2003/04.

- **H2120 Shifting dunes along the shoreline with *Ammophila arenaria* (`white dunes`)**

Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes") encompasses most of the vegetation of unstable dunes where there is active sand movement. Under these conditions sand-binding marram *Ammophila arenaria* is always a prominent feature of the vegetation and is usually dominant. In the UK the majority of such vegetation falls within NVC type SD6 *Ammophila arenaria* mobile dune community. This is a dynamic vegetation type maintained only by change. It can occur on both accreting and eroding dunes, but will rapidly change and disappear if stability is imposed. It rarely occurs in isolation because of its dynamic nature and because it is successionally related to other dune habitats. The habitat type excludes the low, embryonic dunes where occasional exposure to saltwater flooding constrains the growth of marram and where plants of the strandline mingle with salt-tolerant, sand-binding grasses; such vegetation is referable to Annex I type **2110 Embryonic shifting dunes**.

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 *A. arenaria*. As rates of sand deposition decline the marram is joined by more species, first by other specialised dune plants, then by less specialised grasses, drought-tolerant annuals and a restricted number of specialised bryophytes such as the moss *Tortula ruralis* ssp. *ruraliformis*. This moss plays an important part in completing the stabilisation of the sand surface. Towards the seaward edge of the zone of shifting dunes, salt-tolerant plants such as sea sandwort *Honckenya peploides* may be prominent, along with the sand-binding sand couch *Elytrigia juncea*. Further inland these species are rarely prominent.

There is also geographical variation in the floristic composition of the habitat type. A number of typical shifting dune plants such as Portland spurge *Euphorbia portlandica* and sea-holly *Eryngium maritimum* are mostly confined to the south of the UK, while lyme-grass *Leymus arenarius* is much more abundant in the northern half of Britain, where the vegetation may fall within the NVC type SD5 *Leymus arenarius* mobile dune community.

Shifting dunes along the shoreline with *Ammophila arenaria* are found throughout the coastal zone of the EU. This habitat type is geographically widespread around the UK coastline, although in many places it is restricted to a narrow strip.

A substantial stretch of the Sefton Coast dune system in north-west England is fronted by about 163 ha of shifting dunes. Marram *Ammophila arenaria* usually dominates the mobile dunes, amidst much reduced areas of blown sand. Where rates of sand deposition decline, lyme grass *Leymus arenarius*, sea-holly *Eryngium maritimum* and cat's-ear *Hypochaeris radicata* occur, with red fescue *Festuca rubra* and spreading meadow-grass *Poa humilis* present on the more sheltered ridges. Sea spurge *Euphorbia paralias* and the nationally scarce dune fescue *Vulpia fasciculata* are frequent, while sea bindweed *Calystegia soldanella* is very local. Formby Point is the hinge point between two coastal sub-cells. The zone around the Point has been eroding since 1906 while areas north and south of this zone are accreting (where the nature of the coast allows). The rapid erosion is therefore reducing the area of shifting dunes at Formby, and the high, steep eroding dunes near the beach. This has left extensive areas of blown sand immediately inland where there is heavy recreational pressure.

- **H2130 Fixed dunes with herbaceous vegetation (`grey dunes`) * Priority feature**

Fixed dune vegetation occurs mainly on the largest dune systems, being those that have the width to allow it to develop. It typically occurs inland of the zone dominated by marram *Ammophila arenaria* on coastal dunes, and represents the vegetation that replaces marram as the dune stabilises and the organic content of the sand increases. In the UK the vegetation corresponds to the following NVC types:

- SD7 *Ammophila arenaria – Festuca rubra* semi-fixed dune community
- SD8 *Festuca rubra – Galium verum* fixed dune grassland
- SD9b *Ammophila arenaria – Arrhenatherum elatius* dune grassland, *Geranium sanguineum* sub-community
- SD11 *Carex arenaria – Cornicularia aculeata* dune community

- SD12 Carex *arenaria – Festuca ovina – Agrostis capillaris* dune grassland.

Some examples of SD9a *Ammophila arenaria – Arrhenatherum elatius* dune grassland, typical sub-community, can also be referable to this vegetation type. Inland stands of SD11 *Carex – Cornicularia* community and SD12 *Carex – Festuca – Agrostis* dune grassland are referable to Annex I type **2330 Inland dunes with open *Corynephorus* and *Agrostis* grasslands**.

Fixed dunes are an extremely complex habitat type. For the purposes of the Habitats Directive, Fixed dunes with herbaceous vegetation ("grey dunes") has been divided into a series of sub-types (European Commission DG Environment 1999). The UK is particularly important for Atlantic dune (*Mesobromion*) grasslands.

The herbaceous vegetation of fixed dunes in the UK exhibits considerable variation. The most widespread type is Atlantic dune grassland, consisting of a short sward characterised by red fescue *Festuca rubra* and lady's bedstraw *Galium verum* and typically rich in species of calcareous substrates. The vegetation shows considerable variation both from north to south and from east to west.

This Annex I type is widely distributed throughout the EU. Fixed dunes with herbaceous vegetation occur widely around the coasts of the UK and are a major component of many sand dune systems.

Sefton Coast is a large area of predominantly calcareous dune vegetation in north-west England. The sequence of habitats from foredunes to dune grassland and dune slackis extensive but there have been substantial recent losses to coarse neutral grassland, scrub and secondary woodland. A 91% reduction in species-rich SD8 *Festuca rubra-Galium verum* fixed dune grassland between 1988/89 and 2003/04 was reported by Gateley and Michell (2004). In many cases, SD8 had been replaced by taller swards of SD9: *Ammophila arenaria-Arrhenatherum elatius* dune grassland and MG1: *Arrhenatherum elatius* coarse grassland, suggesting nutrient enrichment. There are large areas of semi-fixed and fixed dunes with herbaceous vegetation exhibiting considerable variation from calcareous to acidic. In the calcareous areas common restharrow *Ononis repens* is prominent. There are small but significant areas of decalcified sand with grey hair-grass *Corynephorus canescens*, a species more characteristic of decalcified fixed dunes in the east of England and around the Baltic. This species occurs on Southport and Ainsdale Golf Club and and has also been recorded on one adjacent site outside the SAC boundary.

- **H2150 <u>Atlantic decalcified fixed dunes (Calluno-Ulicetea) * Priority feature</u>**

This habitat type occurs on mature, stable dunes where the initial calcium carbonate content of the dune sand is low. The surface soil layers rapidly lose their remaining calcium carbonate through leaching, and become acidified.

The most characteristic community is dune heath in which heather *Calluna vulgaris* is found in combination with sand sedge *Carex arenaria*. The main species present vary considerably throughout the UK. Bell heather *Erica cinerea* is abundant in dune heath on west coast sites, but much scarcer in the east, where heather *Calluna vulgaris* predominates. Associated with the heathland in drier conditions, and forming transitions with it, is acidic dune grassland. This is often a precursor to heath development and in these drier conditions is usually characterised by a combination of the fine-leaved grasses such as sheep's-fescue *Festuca ovina* and common bent *Agrostis capillaris*, with sand sedge *Carex arenaria*. On very nutrient-poor sand that is also subject to severe drought the heath tends to be dominated by lichens, which form a continuous grey carpet over the ground. In the UK this Annex I type corresponds to the following NVC types:

- H1d *Calluna vulgaris – Festuca ovina* heath, *Carex arenaria* sub-community
- H11a *Calluna vulgaris – Carex arenaria* heath, *Erica cinerea* sub-community
- H11c *Calluna vulgaris – Carex arenaria* heath, species-poor sub-community

Other dry heath types occurring on coastal sand dunes may also be referable to this Annex I type.

At most sites at which **Atlantic decalcified fixed dunes (*Calluno-Ulicetea*)** vegetation occurs, it forms a mosaic with other Annex I habitat types. Fixed dune vegetation tends to occur on the larger dune systems, which have the width to allow it to develop.

Atlantic decalcified fixed dunes (*Calluno-Ulicetea*) are widespread in Europe, and the UK lies at the centre of the north – south range of this habitat type. They are well represented in the UK and there is considerable variation in the vegetation of this habitat type, both between northern and southern sites and between sites on the east and west coasts. A large proportion of the area of the national resource occurs on a relatively small number of sites.

At Sefton, inland sections of the dune system support large, fragmented areas of dune heath. On Formby, Formby Ladies and Southport and Ainsdale Golf Clubs, it can be found in the rough and semi-rough areas, often as a mosaic with areas of acid dune grassland and calcifugous grassland. Due to being frequently mown, the stands are often even-aged. Outside the golf courses, older more mature stands can be found, especially on Freshfield Dune Heath Nature Reserve, Montagu Road Triangle and Larkhill. The dune heath is dominated by heather *Calluna vulgaris*, with sand sedge *Carex arenaria*, sheep's fescue *Festuca ovina*, common bent *Agrostis capillaris*, wavy hair-grass *Deschampsia flexuosa* and mat-grass *Nardus stricta* less frequent. Wetter areas contain heath rush *Juncus squarrosus*, broad buckler fern *Dryopteris dilatata* and narrow buckler fern *D. carthusiana.* Large patches of gorse *Ulex europaeus* are present, particularly within more mature stands (Gateley, 1995; Smith and Small, 2009)

- **H2170 Dunes with *Salix repens* ssp. *argentea* (*Salicion arenaria*)**

This habitat type comprises dunes or parts of dunes where creeping willow *Salix repens* ssp. *argentea* is dominant, forming prominent, low scrubby growth. Creeping willow is found on dunes throughout the UK. It grows predominantly in and around dune slacks, though on some sites it may spread up the drier ridges.

This type of vegetation marks the mature phase in the life cycle of calcareous dune slacks. When found with other wetland and dry dune vegetation it indicates that successional processes are still active and that the structure and function of the dune system are well-conserved. On most of the highest-quality sites this habitat type occurs alongside a number of others, particularly **2190 Humid dune slacks**, calcareous and acidic fixed dune vegetation and, locally, dune heath.

Creeping willow is often found in dune slack vegetation, and the boundaries between **Dunes with *Salix repens* ssp. *argentea*** and **2190 Humid dune slacks** are often diffuse and difficult to define on the ground. The examples which have been selected to represent the former habitat type in the UK sites series are those where creeping willow is dominant and forming prominent, low, scrubby growth, sometimes referred to as 'hedgehog dunes'. Much of this habitat corresponds to NVC type SD16 *Salix repens – Holcus lanatus* dune slack community, although not all examples of SD16 are referable to this Annex I type. This type of vegetation tends to occur in and around mature slacks where there has been little or no sand movement for some time and where grazing is light. Creeping willow tends to grow most vigorously at the drier end of the spectrum of slack vegetation types and it is also mainly associated with calcareous dune sites.

Dunes with *Salix repens* ssp. *argentea* are widespread on the coasts of northern and western Europe. In the UK **Dunes with *Salix repens* ssp. *argentea*** are widespread but rare, being estimated to cover much less than 1,000 ha. The habitat type is best-developed in the southern half of the UK.

At Sefton Coast on the north-west coast of England there are extensive dune slacks dominated by creeping willow *Salix repens* ssp. *argentea*, making this site particularly important for **Dunes with *Salix repens* ssp. *argentea***. Radley (1994) estimated that 99 ha, or 43% of the total English resource of the main dune slack community dominated by creeping willow occurred here. The species also dominates areas of free-draining dune grassland to a much greater extent than at most other UK sites. Despite some urban and recreational development, both successional and geomorphological processes are still active and the structure and function of the site as a whole is still well-conserved. The coastal woodlands are managed subject to the Sefton Coast Woodland Forest Plan, with the exception of the Ainsdale Frontal Woodlands. A public consultation exercise is planned to help inform future management of the frontal woodland at Ainsdale by 2024.

- **H2190 <u>Humid dune slacks</u>**

Dune slacks are low-lying areas within dune systems that are seasonally flooded and where nutrient levels are low. They occur primarily on the larger dune systems in the UK, especially in the west and north, where the wetter climate favours their development when compared with the generally warmer and/or drier dune systems of continental Europe. The range of communities found is considerable and depends on the structure of the dune system, the successional stage of the dune slack, the chemical composition of the dune sand, and the prevailing climatic conditions.

Creeping willow is often found in dune slack vegetation and the boundaries between **Humid dune slacks** and **2170 Dunes with *Salix repens* var. *argentea*** are often diffuse and difficult to define on the ground. While **Humid dune slacks** include creeping willow, the Annex I type excludes those sites where the species is dominant. It is variously associated with Yorkshire-fog *Holcus lanatus* and the bryophytes *Campylium stellatum* and *Calliergonella cuspidata*. A further community is typified by silverweed *Potentilla anserina* and common sedge *Carex nigra.* In the UK the predominant NVC types include:

- SD13 *Sagina nodosa – Bryum pseudotriquetrum* dune-slack community,
- SD14 *Salix repens – Campylium stellatum* dune-slack community,
- SD15 *Salix repens – Calliergon cuspidatum* dune-slack community,
- SD16 *Salix repens – Holcus lanatus* dune-slack community,
- SD17 *Potentilla anserina – Carex nigra* dune-slack community

True dune slacks are fed mainly by rain water and are characterised by a pattern of pronounced annual fluctuation of the water table, related to the landform of the dune system as well as climate and the nature of the underlying sediment – whether porous shingle or impervious clay. Variations in the extent and duration of flooding of the dune surface are very important in determining the vegetation and influence the breeding of aquatic species, including the rare natterjack toad *Epidalea calamita*. Humid dune slacks occur on calcareous sand, where the slack vegetation is similar to that of small sedge mires (mires with low-growing sedges), or on acidic dunes where the vegetation may have affinities to wet heath.

A range of other wetland types, especially swamp, mire and tall herb fen communities, occur on some dunes. These communities are not confined to dunes, although they comprise an important part of the mosaic of vegetation characteristic of dune slack and are dominant at a few dune sites, and can be included in the Annex I type. Some stands of the SD14 *Salix – Campylium* and SD15 *Salix – Calliergon* dune-slack communities are charcterised by the prominence of great fen sedge *Cladium mariscus*, and may be referable to Annex I type **7210 Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae***.

Dune slacks are often rich in plant species, particularly rare and local species. Several species, such as the Annex II **1395 Petalwort *Petalophyllum ralfsii***, **1903 Fen orchid *Liparis loeselii***, and round-leaved wintergreen *Pyrola rotundifolia*, are found mainly in this habitat type.

Humid dune slacks are widely but locally distributed throughout the coastal zone of the EU. Mainly owing to the cool wet climate of the UK, Humid dune slacks are a more prominent feature of dunes in the UK than in many other European countries, and the UK has a significant proportion of the EU resource. Dune slacks are widespread but local in the UK and the habitat type exhibits considerable ecological variation.

Sefton Coast is a large area of predominantly calcareous dune vegetation, containing extensive areas representative of **Humid dune slacks** in north-west England. Some limited active slack formation can still be seen and a variety of successional stages are represented. The sequence from foredunes to dune grassland and dune slack is extensive. The site contributes to the range and variation of humid dune slack vegetation, being a large and representative base-rich system towards the northern limit for some humid dune slack communities along the west coast of Britain.

Qualifying Species:

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

The great crested newt *Triturus cristatus* is the largest native British newt, reaching up to around 17 cm length. It has a granular skin texture (caused by glands which contain toxins making it unpalatable to predators), and in the terrestrial phase is dark grey, brown or black over most of the body, with a bright yellow/orange and black belly pattern. Adult males have jagged crests running along the body and tail. Newts require aquatic habitats for breeding. Eggs are laid singly on pond vegetation in spring, and larvae develop over summer to emerge in August – October, normally taking 2–4 years to reach maturity. Juveniles spend most time on land, and all terrestrial phases may range a considerable distance from breeding sites.

Breeding sites are mainly medium-sized ponds, though ditches and other waterbody types may also be used less frequently. Ponds with ample aquatic vegetation (which is used for egg-laying) seem to be favoured. Great crested newts do not require very high water quality, but are normally found in ponds with a circum-neutral pH. Broad habitat type varies greatly, the most frequent being pastoral and arable farmland, woodland, scrub, and grassland. There are also populations in coastal dunes and shingle structures. Great crested newts can be found in rural, urban and post-industrial settings, with populations less able to thrive where there are high degrees of fragmentation. The connectivity of the landscape is important, since great crested newts often occur in metapopulations that encompass a cluster of several or many ponds. This helps ensure the survival of populations even if sub-populations are affected by, for example, pond desiccation or fish introductions. Climate may influence the range edge at the north of its distribution in Scotland, but other ecological or landscape factors such as pond density are probably more important in determining distribution across the main part of its British range.

The great crested newt *Triturus cristatus* is found widely throughout northern Europe. Populations are thought to have declined dramatically throughout the species' European range. It is widespread throughout much of England and Wales, but occurs only sparsely in south-west England, mid Wales and Scotland. It is absent from Northern Ireland. The total UK population is relatively large and is distributed over sites that vary greatly in their ecological character. One estimate has put the national population at around 400,000 animals in 18,000 breeding sites. Many of the largest populations are centred on disused mineral-extraction sites, but lowland farmland forms the majority of great crested newt habitat in the UK.

The dune system at Sefton supports a large population of great crested newts, within Ainsdale Sand Dunes NNR and Ainsdale Sandhills LNR which are used for breeding.

- **S1395 Petalwort *Petalophyllum ralfsii***

Petalwort *Petalophyllum ralfsii* is a pale green thalloid liverwort with erect lamellae on its upper surface that grows in open, damp, calcareous dune slacks, often on low hummocks rather than on the very wet ground, on compacted sandy/muddy bryophyte-rich turf. Most localities are referable to Annex I type **2190 Humid dune slacks**. It has occasionally been recorded in other coastal grassland where conditions are similar. Closely associated species may include the mosses *Barbula convoluta*, *Bryum* spp., *Didymodon tophaceus*, *Ditrichum flexicaule* (*sensu lato*), *Hypnum lacunosum*, glaucous sedge *Carex flacca*, the grasses common bent *Agrostis capillaris*, red fescue *Festuca rubra* and Yorkshire-fog *Holcus lanatus*, and buck's-horn plantain *Plantago coronopus*. At some sites, it appears to be increasing as a result of trampling and soil compaction. At one site, the area where *P. ralfsii* grows is used by vehicles and it can be found on the sides of paths. It does not grow in water-filled slacks or in slacks where willow *Salix* spp. scrub predominates.

Although it occurs throughout western Europe, *Petalophyllum ralfsii* has a predominantly Mediterranean distribution. It is infrequent and declining throughout its range, being rather closely confined to dune slacks of a certain kind, which are under threat in many areas, and the species is classed as Vulnerable. The UK and Ireland may now be its stronghold.

Petalophyllum ralfsii has always been widely but sparsely distributed in the UK. A high proportion of the known localities are in south-west England and Wales. Many of the sites support large populations but in some parts of the species' range only small populations occur. All the sites are large dune systems with extensive dune slack habitat. Petalwort is classed as Lower risk (Nationally scarce) in Britain.

A large population of **petalwort *Petalophyllum ralfsii*** occurs at Sefton Coast, the only site chosen for this species in north-west England. The plant was first recorded on the Sefton Coast at Ainsdale in 1861 and it is still found within the dune system between Southport and Ainsdale. It seems to prefer damp ground around the edges of dune slacks of fairly recent origin, with the largest populations found in slacks of less than 25 years old. The plant is often found in association with footpaths, where light trampling keeps the ground vegetation sparse; infrequently-used paths or less-trampled edges of pathways seem to be favoured. The preferred habitat is short damp turf with plenty of bare patches.

Having been first recorded at Ainsdale in 1861, the previously large population of petalwort at this site has seriously declined. Callaghan (2016) described a population reduction, this being attributed to vegetation succession and a decline in rabbit grazing. However, new colonies have recently been discovered in the Ainsdale-Birkdale frontal dunes on damp ground around the edges of young slacks and on informal footpaths, where light trampling maintains short, sparse vegetation.

Table 1: Supplementary Advice for Qualifying Features: H2110. Embryonic shifting dunes

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Extent and distribution of the feature	**Extent of the feature within the site**	Restore the total extent of the feature to at least 13.59ha of H2110 Embryonic shifting dunes. This target may change in the future once the long term objective for the extent of woodland on the site has been agreed.	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. This is the most dynamic, naturally changing, zone of the dune system. Its extent may vary seasonally and through the years. This natural functioning is critically dependent on no interruption of sand movement to and from the foredunes and the beach. Where beaches are narrow or prevailing winds not onshore, this Annex 1 habitat may be limited in extent. Evidence of natural changes to extent should not justify further loss to development. Target set to Restore because some stands of H2110 embryonic shifting dunes have been damaged by coastal defences, dumped waste, forestry plantations and scrub encroachment. These factors are also the main restrictions on sediment transport and coastal dynamism on the site (Natural England 2018), which has limited the movement and development of embryonic shifting dunes. In particular forestry plantations are preventing embryonic shifting dunes from rolling-back around Formby where the coast is currently rapidly	This attribute will be periodically monitored as part of Natural England's site condition assessments. Edmondson *et al*. (1989) Environment Agency (2017) Gateley & Michell, (2004) Mersey Forest (2013) Natural England (2014) Natural England (2018) Smith (2009) Worsley *et al.* (2010)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			eroding. In some areas recreational and/or vehicular access are disrupting embryo dune formation. The site was mapped during the National Sand Dune Survey in 1988/1989 (Edmondson *et al*. 1989). There is currently (2015) estimated to be 13.59 ha of embryonic shifting dunes in the site (derived from analysis of CASI imagery, see Environment Agency 2017 and Annex 1). This area target may change once the long term objective for the extent of woodland on site has been developed (Mersey Forest 2013, Natural England 2018).	
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 zone of shifting dunes occurs between the beach plane and the usually more stable and fully vegetated older dunes. Communities may be dynamic in their distribution and are linked the sedimentary processes operating at the site. See Annex 1 for the current (2015) distribution of H2110 embryonic shifting dunes across the site (Environment Agency 2017). Target set to Restore because some stands of embryonic shifting dunes have been lost under infrastructure/forestry. In addition, the distribution of embryonic shifting dunes is being limited by restricted coastal dynamism and recreation/vehicle access. See comments in 'Extent of feature' attribute above.	This attribute will be periodically monitored as part of Natural England's site condition assessments. Environment Agency (2017) Mersey Forest (2013) Natural England (2014) Natural England (2018)
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	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. This ability depends on a continuing linkage between the beach and this Annex 1 habitat, together with the ability of dune building grasses to respond in periods of net sand input.	Environment Agency (2017) Mersey Forest (2013) Natural England (2014) Natural England (2018)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			Target set to Restore because a number of factors are limiting coastal dynamism on the site, principally coastal defences, forestry plantations and scrub encroachment (Natural England 2018). In addition recreational and/or vehicular access are disrupting embryo dune formation in some areas. See comments in 'Extent of feature' attribute above.	
Structure and function (including its typical species)	**Dune topography**	Restore a natural dune topography, and allow natural change that is wind driven (some change may be necessary to maintain the continuity of slacks).	Dune topography in this zone can change seasonally and through the years due to wind and tidal events. Accumulations of driftline organic material are important for trapping sand and initiating dune formation. See also 'Functional connectivity with wider coastal sedimentary system' attribute. Target set to Restore because a number of factors are limiting coastal dynamism on the site, principally coastal defences, forestry plantations and scrub encroachment (Natural England 2018). This restricts the movement of sediment and hence changes in dune topography. Some areas of the site have also had their dune topography artificially modified and recreational and/or vehicular access are also disrupting embryo dune formation.	This attribute will be periodically monitored as part of Natural England's site condition assessments. Environment Agency (2017) Mersey Forest (2013) Natural England (2014) Natural England (2018)
Structure and function (including its typical species)	**Presence of unvegetated surfaces**	Maintain an extent of bare sand of varying sizes in a mosaic with the vegetation (up to 50% of the feature extent)	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 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.	
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 *Elymus farctus* ssp. *boreali-atlanticus* [*Elytrigia juncea*] foredune community Some stands of SD5 *Leymus arenarius* mobile dune community	This habitat feature will comprise a number of associated semi-natural vegetation types and their transitional zones, reflecting the geographical location of the site, altitude, aspect, soil conditions (especially base-status and drainage) and vegetation management. In the UK these have been categorised by the National Vegetation Classification (NVC). Maintaining or restoring these characteristic and distinctive vegetation types, and the range of types as appropriate, will be important to sustaining the overall habitat feature. 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).	This attribute will be periodically monitored as part of Natural England's site condition assessments.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Structure and function (including its typical species)	**Vegetation structure: zonation of dune vegetation**	Restore the cover of this feature at or to 95% of the wider dune frontage.	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. On some sites there may be specific natural factors that limit continuous coverage, related to broader scale sediment budgets. Where *Leymus arenarius* is present, there can be a continuous floristic transition to marram dominated mobile dunes (Shifting dunes along the shoreline with *Ammophila arenaria*). Target set to Restore because the extent of embryonic shifting dunes is limited by direct loss, lack of coastal dynamism and recreational/vehicular access. See comments in 'Extent of feature' attribute above.	This attribute will be periodically monitored as part of Natural England's site condition assessments. Natural England (2014)
Structure and function (including its typical species)	**Vegetation composition: trees and scrub**	Ensure scrub and tree cover is absent or rare.	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. Sea buckthorn is not native to the Sefton Coast and should be treated as an invasive.	This attribute will be periodically monitored as part of Natural England's site condition assessments. Natural England (2014)
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. Invasive non-native species no more than rare. Other undesirable species should be no more than frequent throughout the sward, or singly or together their cover should be no more than 5%.	Two types of negative species can occur: invasive non-natives, or species indicative of poor condition (e.g. nettle or creeping thistle). The native species listed are natural components of a range of vegetation types within the SAC and many are beneficial to a range of invertebrates and other species. However, in certain circumstances (such as when they encroach on stands of rare plants) they can be undesirable and/or indicate negative pressures on the site. The main issues that are likely to result in increases in these species are eutrophication, and disturbance (e.g. from fire). Sea buckthorn is not considered to be native on the site. Undesirable species include: *Arrhenatherum elatius* False oat-grass; *Cirsium arvense* Creeping thistle; *Cirsium vulgare* Spear	This attribute will be periodically monitored as part of Natural England's site condition assessments. Natural England (2014)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			thistle; *Lolium perenne* Perennial rye grass;; *Urtica dioica* Common nettle. Target set to Restore because white poplar *Populus alba*, sea buckthorn *Hippophae rhamnoides* and Japanese rose *Rosa rugosa* are encroaching stands of H2110 embryonic shifting dunes.	
Structure and function (including its typical species)	**Soils, substrate and nutrient cycling**	Restore the properties of the underlying soil types, including structure, bulk density, total carbon, pH, soil nutrient status and fungal: bacterial ratio, to within typical values for the habitat.	Soil is the foundation of basic ecosystem function and a vital part of the natural environment. Its properties strongly influence the colonisation, growth and distribution of those plant species which together form vegetation types, and therefore provides a habitat used by a wide range of organisms. Soil biodiversity has a vital role to recycle organic matter. Changes to natural soil properties may therefore affect the ecological structure, function and processes associated with this Annex I feature. This Annex 1 habitat has essentially raw soils with little humus and low nutrient status. Target set to Restore because recreational use is causing sand/soil erosion and dog-fouling is resulting in nutrient enrichment in localised areas, specifically, adjacent to car parks at Weld Road and Ainsdale Promenade, as well as alongside public footpaths e.g. Montagu Road, Freshfield, adjacent to SSSI Unit 29 (The Triangle).	
Structure and function (including its typical species)	**Key structural, influential and/or distinctive species**	Maintain the abundance of the species listed to enable each of them to be a viable component of the Annex I habitat feature: The constant and preferential species of the SD4 and SD5 dune NVC communities that form a special component of the H2110 feature at this site. Sandhill rustic *Luperina nickerlii*	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	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			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.	
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 moderate, taking into account the sensitivity, fragmentation, topography and management of its habitats/supporting habitats. This means that this site is considered to be vulnerable overall but moderately so. This means that some adaptation action for specific issues may be required, 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.	Environment Agency (2017) Lymbery & Newton (2010) Mersey Forest (2013) Natural England (2014) Natural England (2018) Smith (2009) Worsley *et al.* (2010)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			Target set to Restore because a number of factors are limiting coastal dynamism on the site, principally coastal defences, forestry plantations and scrub encroachment (Natural England 2018). In addition recreational and/or vehicular access are disrupting embryo dune formation in some areas. See comments in 'Extent of feature' attribute above.	
Supporting processes (on which the feature relies)	**Functional connectivity with wider coastal sedimentary system**	Restore adequate movement of sediment from all key sediment sources (directly from the beach, indirectly from offshore, eroding cliffs etc).	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 outside of the designated site boundary which are either important for the continuous supply of sediment (such as soft eroding cliffs, dunes, offshore sand banks) or 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. This Annex 1 habitat is an integral element of the 'coastal foredune' (the beach-dune sand-sharing system). However, it is also important that sediment transport that feeds the beach from offshore is also not interrupted. In some cases sand may come from marram-dominated dunes landward (Shifting dunes along the shore with *Ammophila arenaria*). Target set to Restore because a number of factors are limiting sediment movement on the site, principally coastal defences, forestry plantations and scrub encroachment (Natural England 2018). The current dredging regime in the Mersey Estuary also affects the availability of sediment to refresh the dunes. See comments for 'Extent of feature' attribute above.	Environment Agency (2017) Mersey Forest (2013) Natural England (2014) Natural England (2018)
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. Blow-throughs are a natural element of the dynamics of this zone. However, excessive recreational pressure can inhibit vegetation growth in sand building phases.	Natural England (2014) Natural England (2018)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			Target set to Restore because a number of factors are limiting sediment movement on the site, principally coastal defences, forestry plantations and scrub encroachment (Natural England 2018). See comments for 'Extent of feature' attribute above.	
Supporting processes (on which the feature relies)	**Hydrology**	At a site, unit and/or 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. 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. On a few sites, the development of new Embryonic shifting dunes can lead to new primary dune slacks forming. The hydrology of the dune system is not fully understood. Some investigations have been undertaken, but these have only examined limited areas e.g. Clarke & Sanitwong na Ayutthaya (2010). A detailed investigation of the hydrology of the whole site is required. Target set to Restore because forestry plantations are disrupting natural hydrological processes by reducing water input to the dune system. In addition there are a number of water abstractions in the surrounding area and it is not known whether they are affecting the groundwater levels in the site. There is also extensive agricultural drainage in the wider Alt / Crossens catchment. Dog-fouling may be resulting in nutrient enrichment in some areas.	Clarke & Sanitwong na Ayutthaya (2010) Natural England (2014)
Supporting processes (on which the feature relies)	**Water quality**	Where the feature is dependent on surface water and/or groundwater, maintain water quality and quantity to a standard which provides the necessary conditions to support the feature.	For many SAC features which are dependent on wetland habitats supported by surface and/or ground water, maintaining the quality and quantity of water supply will be critical, especially at certain times of year. Poor water quality and inadequate quantities of water can adversely affect the structure and function of this habitat type. Typically, meeting the surface water and groundwater environmental standards set out by the Water Framework Directive (WFD 2000/60/EC) will also be sufficient to support	Clarke & Sanitwong na Ayutthaya (2010) Natural England (2014)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			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. See comments for the 'Hydrology' attribute, above. Target set to Restore because forestry plantations are reducing water input to the dune system. In addition there are a number of water abstractions in the surrounding area and extensive agricultural drainage in the wider Alt / Crossens catchment, which may be affecting water supply to the dunes.	
Supporting processes (on which the feature relies)	**Air quality**	Restore as necessary, the concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System (www.apis.ac.uk).	This habitat type is considered sensitive to changes in air quality. Exceedance of these critical values for air pollutants may modify the chemical status of its substrate, accelerating or damaging plant growth, altering its vegetation structure and composition and causing the loss of sensitive typical species associated with it. Critical Loads and Levels are recognised thresholds below which such harmful effects on sensitive UK habitats will not occur to a significant level, according to current levels of scientific understanding. There are critical levels for ammonia (NH_3), oxides of nitrogen (NO_x) and sulphur dioxide (SO_2), 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. Target set to Restore because current nitrogen deposition exceeds the critical load for embryonic shifting dunes.	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	**Conservation measures**	Restore the management measures (either within and/or	Active and ongoing conservation management is needed to protect, maintain or restore this feature at this site. Further	English Nature (2005)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
(on which the feature relies)		outside the site boundary as appropriate) which are necessary to restore the structure, functions and supporting processes associated with the feature	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. For this feature, direct habitat and species management is not expected to take place in this zone. However, excessive recreational activity can be damaging and may well need to be managed. Target set to Restore because large scale management is required to return coastal dynamism to the site. In particular, large areas of forestry plantation need to be felled and removed. In some areas access management is required to reduce anthropogenic erosion of embryonic shifting dunes.	Natural England (2014) Natural England (2018)
Version Control Advice last updated: **14th February 2019** following stakeholder feedback. Ragwort *Senecio jacobaea* (now *Jacobaea vulgaris*) deleted from list of species in **Undesirable species** attribute as ragwort is important foodplant and nectar source for a range of specialized dune invertebrates on the Dunes.				
Variations from national feature-framework of integrity-guidance: N/A				

Table 2: 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**	Restore the total extent of the feature to at least 97.36ha of H2120 shifting dunes This target may change in the future once the long term objective for the extent of woodland on the site has been agreed.	See the 'Supporting and explanatory notes' for this attribute above in Table 1 Target set to Restore because some stands of H2120 shifting dunes with marram have been damaged by coastal defences, dumped waste, forestry plantations and scrub encroachment. These factors are also the main restrictions on sediment transport and coastal dynamism on the site (Natural England 2018), which has limited the movement and development of shifting dunes. In particular forestry plantations are preventing the dunes from rolling-back around Formby where the coast is currently rapidly eroding. In some areas recreational and/or vehicular access are disrupting shifting dunes with marram. The site was mapped during the National Sand Dune Survey in 1988/1989 (Edmondson *et al*. 1989). There is currently (2015) estimated to be 97.36 ha of H2120 embryonic shifting dunes in the site (derived from analysis of CASI imagery, see Environment Agency 2017 and Annex 1). This area target may change once the long term objective for the extent of woodland on site has been developed (Mersey Forest 2013, Natural England 2018).	This attribute will be periodically monitored as part of Natural England's site condition assessments. Edmondson *et al*. (1989) Environment Agency (2017) Gateley & Michell (2004) Mersey Forest (2013) Natural England (2014) Natural England (2018)
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	This attribute will be periodically monitored as part of Natural England's site condition assessments. Environment Agency (2017) Mersey Forest (2013) Natural England (2014) Natural England (2018)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			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. Annex 1 habitat to be present where relevant sedimentary and wind conditions occur. See Annex 1 for the current (2015) distribution of H2120 shifting dunes with marram across the site (Environment Agency 2017). Target set to Restore because some areas of shifting dunes have been damaged by coastal defences, dumped waste, forestry plantations and scrub encroachment. In addition, the distribution of shifting dunes is being limited by restricted coastal dynamism and recreation/vehicle access. See comments in 'Extent of feature' attribute above.	
Structure and function (including its typical species)	**Vegetation community composition**	Ensure the component vegetation communities of the feature are referable to and characterised by the following National Vegetation Classification type: SD6 *Ammophila arenaria* mobile dune 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).	This attribute will be periodically monitored as part of Natural England's site condition assessments. Gateley & Michell (2004)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			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.	
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. Invasive non-native species no more than rare. Other undesirable species should be no more than frequent throughout the sward, or singly or together their cover should be no more than 5%.	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). 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. Undesirable non-woody and woody vascular plants species may require active management to avert an unwanted succession to a different and less desirable state. Often they may be indicative of a negative trend relating to another aspect of a site's structure and function. These species will vary depending on the nature of the particular feature, and in some cases these species may be natural/acceptable components or even dominants. The native species listed are natural components of a range of vegetation types within the SAC and many are beneficial to a range of invertebrates and other species. However, in certain circumstances (such as when they encroach on stands of rare plants) they can be undesirable and/or indicate negative pressures on the site. The main issues that are likely to result in increases in these species are eutrophication, and disturbance (e.g. from fire). Sea buckthorn *Hippophae rhamnoides* is not considered to be	This attribute will be periodically monitored as part of Natural England's site condition assessments. Gateley & Michell (2004) Natural England (2014)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			native on the site. Undesirable species include: *Arrhenatherum elatius* False oat-grass; *Cirsium arvense* Creeping thistle; *Cirsium vulgare* Spear thistle; *Lolium perenne* Perennial rye grass;; *Urtica dioica* Common nettle. Target set to Restore because white poplar *Populus alba*, sea buckthorn and Japanese rose *Rosa rugosa* are encroaching stands of H2120 shifting dunes with marram.	
Structure and function (including its typical species)	**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 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. Target set to Restore because dune vegetation and transitions between different types have been lost/truncated through direct loss, restricted coastal dynamism and recreational/vehicular access. See comments in 'Extent of feature' attribute above.	This attribute will be periodically monitored as part of Natural England's site condition assessments. Edmondson *et al*. (1989) Environment Agency (2017) Gateley & Michell (2004) Mersey Forest (2013) Natural England (2014) Natural England (2018)
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. Target set to Restore because a number of factors are limiting coastal dynamism on the site, principally coastal defences,	This attribute will be periodically monitored as part of Natural England's site condition assessments. Environment Agency (2017) Mersey Forest (2013) Natural England (2014) Natural England (2018)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			forestry plantations and scrub encroachment (Natural England 2018). This restricts the movement of sediment and hence changes in dune topography. Some areas of the site have also had their dune topography artificially modified and recreational and/or vehicular access are also damaging stands of shifting dunes.	
Structure and function (including its typical species)	**Presence of unvegetated surfaces**	Maintain the extent of bare sand which typically covers up to 50% of the feature extent, of varying sizes, in a mosaic with the vegetation.	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 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.	
Structure and function (including its typical species)	**Key structural, influential and/or distinctive species**	Maintain the abundance of the species listed to enable each of them to be a viable component of the Annex I habitat feature: The constant and preferential plant species of the SD6 dune NVC community which comprise the H2120 feature on this site. Northern dune tiger-beetle *Cicindela hybrida* Sand lizard *Lacerta agilis* Dune fescue *Vulpia fasciculate*	See the 'Supporting and Explanatory Notes' for this attribute above in Table 1.	
Structure and function (including its typical species)	**Supporting off-site habitat**	Restore the extent, quality and spatial configuration of land or habitat surrounding or adjacent to the site which is known to support the feature.	The structure and function of the qualifying habitat, including its typical species, may rely upon the continued presence of areas which surround and are outside of the designated site boundary. Changes in surrounding land-use may adversely (directly/indirectly) affect the functioning of the feature and its component species. This supporting habitat may be critical to the typical species of the feature to 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. Sefton Coast SAC covers a large part of the Sefton Coast	Natural England (2018)

<table>
<tr><th colspan="2">Attributes</th><th>Targets</th><th>Supporting and Explanatory Notes</th><th>Sources of site-based evidence (where available)</th></tr>
<tr><td></td><td></td><td></td><td>‘sand field’, but there are also significant areas of semi-natural dune habitats that are outside of the site, but adjacent or close to it. The Table below summarises these sites (Natural England 2018):

<table><tr><th>Site</th><th>Feature(s)</th></tr><tr><td>Marine Lake dunes</td><td>Mobile dunes</td></tr><tr><td>Birkdale Common</td><td>Fixed dune grassland</td></tr><tr><td>RAF Woodvale</td><td>Dune heath</td></tr><tr><td>Cloven-le-Dale farm</td><td>Dune heath</td></tr><tr><td>Blundellsands Key Park</td><td>Mobile and fixed dunes</td></tr><tr><td>Sandfield Farm</td><td>Former asparagus fields</td></tr><tr><td>Crosby Costal Park</td><td>Mobile and fixed dunes</td></tr><tr><td>Dunes between Hall Road and Hightown</td><td>Mobile dunes</td></tr><tr><td>West Lancashire Golf Club</td><td>Fixed dunes and ponds</td></tr><tr><td>Ainsdale Recreation Ground</td><td>Acid grassland</td></tr><tr><td>Queen’s Jubilee Nature Trail</td><td>Fixed dunes, Humid dune slacks</td></tr><tr><td>Falklands Way dunes</td><td>Fixed dunes</td></tr><tr><td>Kenilworth Road dunes</td><td>Fixed dunes</td></tr><tr><td>Hope School (Ainsdale) playing fields</td><td>Fixed dune grassland</td></tr></table>
Target set to Restore because management is required to improve the condition of many of these sites, in particular scrub removal.</td><td></td></tr>
<tr><td>Structure and function (including its typical species)</td><td>Functional connectivity with wider landscape</td><td>Restore the overall extent, quality and function of any supporting features within the local landscape which provide a critical functional connection with the site.</td><td>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</td><td>Natural England (2018)</td></tr>
</table>

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			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. There are significant areas of semi-natural dune habitats on the Sefton 'sand field' that are adjacent or close to the SAC. See comments for 'Supporting off-site habitat' attribute, above. Target set to Restore because these patches of semi-natural vegetation are fragmented by unsuitable habitat, such as built development and amenity grassland.	
Structure and function (including its typical species)	**Adaptation and resilience**	Restore the feature's ability, and that of its supporting processes, to adapt or evolve to wider environmental change, either within or external to the site	See the 'Supporting and Explanatory Notes' for this attribute above in Table 1. Target set to Restore because a number of factors are limiting coastal dynamism on the site, principally coastal defences, forestry plantations and scrub encroachment (Natural England 2018). In addition recreational and/or vehicular access are eroding the shifting dunes in some areas. See comments in 'Extent of feature' attribute above.	Environment Agency (2017) Lymbery & Newton (2010) Mersey Forest (2013) Natural England (2014) Natural England (2018)
Structure and function (including its typical species)	**Soils, substrate and nutrient cycling**	Restore the properties of the underlying soil types, including structure, bulk density, total carbon, pH, soil nutrient status and fungal: bacterial ratio, to within typical values for the habitat.	Soil is the foundation of basic ecosystem function and a vital part of the natural environment. Its properties strongly influence the colonisation, growth and distribution of those plant species which together form vegetation types, and therefore provides a habitat used by a wide range of organisms. Soil biodiversity has a vital role to recycle organic matter. Changes to natural soil properties may therefore affect the ecological structure, function and processes associated with this Annex I feature. This Annex 1 habitat has essentially raw soils with little humus and low nutrient status. Target set to Restore because recreational use is causing sand/soil erosion and dog-fouling is resulting in nutrient enrichment.	
Supporting processes (on which the feature relies)	**Conservation measures**	Restore the management measures (either within and/or outside the site boundary as appropriate) which are necessary	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	English Nature (2005) Natural England (2014)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		to Restore the structure, functions and supporting processes associated with the feature	information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, Site Management Strategies or Plans, the Views about Management Statement for the underpinning SSSI and/or management agreements. Management should consider the structure and function of the site as a whole. Target set to Restore because large scale management is required to return coastal dynamism to the site. In particular, large areas of forestry plantation need to be felled and removed. In some areas access management is required to reduce anthropogenic erosion of shifting dunes with marram.	Natural England (2018)
Supporting processes (on which the feature relies)	**Air quality**	Restore as necessary, the concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System (www.apis.ac.uk).	This habitat type is considered sensitive to changes in air quality. Exceedance of these critical values for air pollutants may modify the chemical status of its substrate, accelerating or damaging plant growth, altering its vegetation structure and composition and causing the loss of sensitive typical species associated with it. Critical Loads and Levels are recognised thresholds below which such harmful effects on sensitive UK habitats will not occur to a significant level, according to current levels of scientific understanding. There are critical levels for ammonia (NH_3), oxides of nitrogen (NO_x) and sulphur dioxide (SO_2), 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. Target set to Restore because current nitrogen deposition exceeds the critical load for shifting dunes with marram.	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)	**Water quality**	Where the feature is dependent on surface water and/or groundwater, Restore water quality and quantity to a standard which provides the necessary	For many SAC features which are dependent on wetland habitats supported by surface and/or ground water, maintaining the quality and quantity of water supply will be critical, especially at certain times of year. Poor water quality and inadequate quantities of water can adversely affect the	Clarke & Sanitwong na Ayutthaya (2010) Natural England (2014)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		conditions to support the feature.	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. The hydrology of the dune system is not fully understood. Some investigations have been undertaken, but these have only examined limited areas e.g. Clarke & Sanitwong na Ayutthaya (2010). A detailed investigation of the hydrology of the whole site is required. Target set to Restore because forestry plantations are disrupting natural hydrological processes by reducing water input to the dune system. In addition there are a number of water abstractions in the surrounding area and it is not known whether they are affecting the groundwater levels in the site. There is also extensive agricultural drainage in the wider Alt / Crossens catchment. Dog-fouling may be resulting in nutrient enrichment in some areas.	
Supporting processes (on which the feature relies)	**Hydrology**	At a site, unit and/or catchment level (as necessary, Restore the natural hydrological regime to provide the conditions necessary to sustain the feature within the site.	Defining and maintaining the appropriate hydrological regime is a key step in moving towards achieving the conservation objectives for this site and sustaining this feature. Changes in source, depth, duration, frequency, magnitude and timing of water supply can have significant implications for the assemblage of characteristic plants and animals present. This target is generic and further site-specific investigations may be required to fully inform conservation measures and/or the likelihood of impacts. See comments for the 'Water quality' attribute, above. Target set to Restore because forestry plantations are reducing water input to the dune system. In addition there are a number of water abstractions in the surrounding area and extensive agricultural drainage in the wider Alt / Crossens catchment, which may be affecting water supply to the dunes.	Clarke & Sanitwong na Ayutthaya (2010) Natural England (2014)
Supporting processes	**Aeolian (wind-blow)**	Restore the ability of wind-blow processes to transport sand from	Allowing natural wind-blow (or 'aeolian') processes to shape the topography of this habitat feature is important to its long-term	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
(on which the feature relies)	**processes**	the beach plain to the foredune.	conservation. The beach plain needs to be dry to allow sand to be transported into the dune system.	
Version Control Advice last updated: **14th February 2019** following stakeholder feedback. Ragwort *Senecio jacobaea* (now *Jacobaea vulgaris*) deleted from list of species in **Undesirable species** attribute as ragwort is important foodplant and nectar source for a range of specialized dune invertebrates on the Dunes. Further locations and habitats added within **Supporting off-site habitat** attribute.				
Variations from national feature-framework of integrity-guidance: N/A				

Table 3: Supplementary Advice for Qualifying Features: H2130. Fixed dunes with herbaceous vegetation ("grey dunes"); Dune grassland *Priority feature

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Extent and distribution of the feature	**Extent of the feature within the site**	Restore the total extent of the feature to at least 469.67ha of H2130 “grey dunes”. This target may change in the future once the long term objective for the extent of woodland on the site has been agreed.	See the ‘Supporting and Explanatory Notes’ for this attribute above in Table 1. Target set to Restore because some stands of H2130 grey dunes have been damaged by forestry plantations and scrub encroachment. These factors are also the main restrictions on sediment transport and coastal dynamism on the site (Natural England 2018), which has limited sand rain onto the grey dunes and movement of dune features. In particular forestry plantations are preventing the grey dunes from rolling-back around Formby where the coast is currently rapidly eroding. In some areas recreational and/or vehicular access are eroding grey dunes. However, controlled destabilisation and remobilisation of grey dunes can be beneficial. The site was mapped during the National Sand Dune Survey in 1988/1989 (Edmondson *et al*. 1989). There is currently (2015) estimated to be 469.67 ha of H2130 fixed dunes with herbaceous vegetation in the site (derived from analysis of CASI imagery, see Environment Agency 2017 and Annex 1). This area target may change once the long term objective for the extent of woodland on site has been developed (Mersey Forest 2013, Natural England 2018).	This attribute will be periodically monitored as part of Natural England’s site condition assessments. Edmondson *et al*. (1989) Environment Agency (2017) Gateley & Michell (2004) Mersey Forest (2013) Natural England (2014) Natural England (2018) Smith (2009) Worsley *et al.* (2010)
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	This attribute will be periodically monitored as part of Natural England’s site condition assessments. Environment Agency (2017) Mersey Forest (2013) Natural England (2014)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			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 it is also important to maintain transitions between fixed/semi-fixed dunes and other dune/terrestrial habitats to seaward or landward. See Annex 1 for the current (2015) distribution of H2130 grey dunes across the site (Environment Agency 2017). Target set to Restore because some areas of grey dunes have been damaged by plantation forestry. In addition, the distribution of grey dunes is being limited by restricted coastal dynamism. See comments in 'Extent of feature' attribute, above.	Natural England (2018)
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 - Festuca rubra* semi-fixed dune community SD8 *Festuca rubra - Galium verum* fixed dune grassland SD9 *Ammophila arenaria - Arrhenatherum elatius* dune grassland SD11 *Carex arenaria - Cornicularia aculeata* dune community	This habitat feature will comprise a number of associated semi-natural vegetation types and their transitional zones, reflecting the geographical location of the site, altitude, aspect, soil conditions (especially base-status and drainage) and vegetation management. In the UK these have been categorised by the National Vegetation Classification (NVC). Maintaining or restoring these characteristic and distinctive vegetation types, and the range of types as appropriate, will be important to sustaining the overall habitat feature. 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).	This attribute will be periodically monitored as part of Natural England's site condition assessments.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		SD12 *Carex arenaria - Festuca ovina - Agrostis capillaris* dune grassland SD19: *Phleum arenarium-Arenaria serpyllifolia* dune annual community		
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: Invasive non-native species no more than rare. Other undesirable species should be no more than frequent throughout the sward, or singly or together their cover should be no more than 5%.	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). 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. 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. Species such as *Urtica dioica*, *Cirsium arvense* and *C. vulgare* species are indicative of poor condition because of enrichment. The native species listed are natural components of a range of vegetation types within the SAC and many are beneficial to a range of invertebrates and other species. However, in certain circumstances (such as when they encroach on stands of rare plants) they can be undesirable and/or indicate negative pressures on the site. The main issues that are likely to result in increases in these species are eutrophication, and disturbance (e.g. from fire). Sea buckthorn *Hippophae rhamnoides* is not considered to be native on the site.	This attribute will be periodically monitored as part of Natural England's site condition assessments. Natural England (2014)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			Undesirable species include: *Arrhenatherum elatius* False oat-grass (not SD9); *Cirsium arvense* Creeping thistle; *Cirsium vulgare* Spear thistle; *Lolium perenne* Perennial rye grass; *Pteridium aqulinum* Bracken; *Rosa* spp. Roses; *Rubus fruticosus* Bramble; ; *Urtica dioica* Common nettle. Target set to Restore because white poplar *Populus alba*, sea buckthorn and Japanese rose *Rosa rugosa* are encroaching stands of H2130 grey dunes.	
Structure and function (including its typical species)	**Vegetation community transitions (range and zones)**	Restore the patterns of natural zonations / transitions. The full zonation from beach inland to fixed dune should be intact over at least 95% of coastal frontage.	Transitions / zonations between adjacent but different vegetation communities are usually related to naturally-occurring changes in soil, aspect or slope. Such 'ecotones' retain characteristics of each bordering community and can add value in often containing species not found in the adjacent communities. Retaining such transitions can provide further diversity to the habitat feature, and support additional flora and fauna. Some dunes are on naturally sediment-deficit coasts: on these there is likely to be less than 95% frontage of strandline and embryo dunes. Target set to Restore because dune vegetation and transitions between different types have been lost/truncated through direct loss, restricted coastal dynamism and recreational/vehicular access. See comments in 'Extent of feature' attribute above.	This attribute will be periodically monitored as part of Natural England's site condition assessments. Edmondson *et al*. (1989) Environment Agency (2017) Gateley & Michell (2004) Mersey Forest (2013) Natural England (2014) Natural England (2018) Smith (2009) Worsley *et al.* (2010)
Structure and function (including its typical species)	**Vegetation structure diversity**	Restore variation in sward structure, so that typically 30-70% of sward comprises species-rich short turf (between 2-10cm 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.	This attribute will be periodically monitored as part of Natural England's site condition assessments.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			Target set to Restore because some areas of the dune system have become dominated by tall, rank and species-poor swards.	
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. Target set to Restore because a number of factors are limiting coastal dynamism on the site, principally coastal defences, forestry plantations and scrub encroachment (Natural England 2018). This restricts the movement of sediment and hence changes in dune topography. Some areas of the site have also had their dune topography artificially modified and recreational and/or vehicular access are also damaging stands of grey dunes.	This attribute will be periodically monitored as part of Natural England's site condition assessments. Environment Agency (2017) Mersey Forest (2013) Natural England (2014) Natural England (2018)
Structure and function (including its typical species)	**Presence of unvegetated surfaces**	Restore 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. Target set to Restore because some areas of grey dune are heavily vegetated and do not have sufficient bare ground.	This attribute will be periodically monitored as part of Natural England's site condition assessments.
Structure and function (including its typical species)	**Key structural, influential and/or distinctive species**	Restore the abundance of the species listed to enable each of them to be a viable component of the Annex I habitat feature: The constant and preferential species of the SD7, SD8, SD9, SD11 and SD12 and SD19 dune NVC communities that form a special component of the H2130 feature on this site. Vascular plant assemblage including: *Corynephorous*	See the 'Supporting and Explanatory Notes' for this attribute above in Table 1 Target set to Restore because a number of populations of rare species have been reduced/lost.	This attribute will be periodically monitored as part of Natural England's site condition assessments. Gateley & Michell (2004)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		canescens Grey hair-grass; *Epipactis dunensis* Dune helleborine;; *Epipactis phyllanthes* Green flowered helleborine; *Vulpia fasciculate* Dune fescue Northern dune tiger-beetle *Cicindela hybrida* Great-crested newt *Triturus cristatus* Sand lizard *Lacerta agilis*		
Structure and function (including its typical species)	**Functional connectivity with wider landscape**	Restore the overall extent, quality and function of any supporting features within the local landscape which provide a critical functional connection with the site	This recognises the potential need at this site to maintain or restore the connectivity of the site to its wider landscape in order to meet the conservation objectives. These connections may take the form of landscape features, such as habitat patches, hedges, watercourses and verges, outside of the designated site boundary which are either important for the migration, dispersal and genetic exchange of those typical species closely associated with qualifying Annex I habitat features of the site. These features may also be important to the operation of the supporting ecological processes on which the designated site and its features may rely. In most cases increasing actual and functional landscape-scale connectivity would be beneficial. Where there is a lack of detailed knowledge of the connectivity requirements of the qualifying feature, Natural England will advise as to whether these are applicable on a case by case basis. There are significant areas of semi-natural dune habitats on the Sefton 'sand field' that are adjacent or close to the SAC (Natural England 2018). See comments for 'Supporting off-site habitat' attribute in Table 2, above. Target set to Restore because some of these patches of semi-natural vegetation are separated from the site by unsuitable habitat, such as built development and amenity grassland.	Natural England (2018)
Structure and function	**Adaptation and resilience**	Restore the feature's ability, and that of its supporting processes,	See the 'Supporting and Explanatory Notes' for this attribute above in Table 1	Environment Agency (2017)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
(including its typical species)		to adapt or evolve to wider environmental change, either within or external to the site	Target set to Restore because a number of factors are limiting coastal dynamism on the site, principally coastal defences, forestry plantations and scrub encroachment (Natural England 2018). In addition recreational and/or vehicular access are eroding grey dunes in some areas. See comments in 'Extent of feature' attribute above.	Lymbery & Newton (2010) Mersey Forest (2013) Natural England (2014) Natural England (2018)
Structure and function (including its typical species)	**Soils, substrate and nutrient cycling**	Restore 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. Target set to Restore because recreational use is causing sand/soil erosion and dog-fouling is resulting in nutrient enrichment.	
Supporting processes (on which the feature relies)	**Conservation measures**	Restore the management measures (either within and/or outside the site boundary as appropriate) which are necessary to Restore the structure, functions and supporting processes associated with the feature	Active and ongoing conservation management is needed to protect, maintain or restore this feature at this site. Further details about the necessary conservation measures for this site can be provided by contacting Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, Site Management Strategies or Plans, the Views about Management Statement for the underpinning SSSI and/or management agreements. For this feature, 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	English Nature (2005) Natural England (2014) Natural England (2018)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			infrastructure are not comprised. Target set to Restore because large scale management is required to return coastal dynamism to the site. In particular, large areas of forestry plantation need to be felled and removed. In addition, management is required to reduce the extent of scrub and to increase structural diversity and extent of bare ground in the sward (e.g. through grazing or mowing). In some areas access management is required to reduce erosion.	
Supporting processes (on which the feature relies)	**Air quality**	Restore as necessary, the concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System (www.apis.ac.uk).	See the 'supporting and Explanatory Notes' for this attribute above in Table 1. Target set to Restore because current nitrogen deposition exceeds the critical load for grey dunes. Current levels of acid deposition also exceed the critical load for the acid communities of grey dunes.	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)	**Water quality**	Where the feature is dependent on surface water and/or groundwater, Restore water quality and quantity to a standard which provides the necessary conditions to support the feature.	For many SAC features which are dependent on wetland habitats supported by surface and/or ground water, maintaining the quality and quantity of water supply will be critical, especially at certain times of year. Poor water quality and inadequate quantities of water can adversely affect the structure and function of this habitat type. Typically, meeting the surface water and groundwater environmental standards set out by the Water Framework Directive (WFD 2000/60/EC) will also be sufficient to support the achievement of SAC Conservation Objectives but in some cases more stringent standards may be needed. Further site-specific investigations may be required to establish appropriate water quality standards for the SAC. The hydrology of the dune system is not fully understood. Some investigations have been undertaken, but these have only examined limited areas e.g. Clarke & Sanitwong na Ayutthaya (2010). A detailed investigation of the hydrology of the whole site is required. Target set to Restore because forestry plantations are disrupting natural hydrological processes by reducing water	Clarke & Sanitwong na Ayutthaya (2010) Natural England (2014)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			input to the dune system. In addition there are a number of water abstractions in the surrounding area and it is not known whether they are affecting the groundwater levels in the site. There is also extensive agricultural drainage in the wider Alt / Crossens catchment. Dog-fouling may be resulting in nutrient enrichment in some areas.	
Supporting processes (on which the feature relies)	**Hydrology**	At a site, unit and/or catchment level as necessary, Restore natural hydrological processes to provide the conditions necessary to sustain the feature within the site.	Defining and maintaining the appropriate hydrological regime is a key step in moving towards achieving the conservation objectives for this site and sustaining this feature. Changes in source, depth, duration, frequency, magnitude and timing of water supply can have significant implications for the assemblage of characteristic plants and animals present. This target is generic and further site-specific investigations may be required to fully inform conservation measures and/or the likelihood of impacts. For this feature, hydrology can be influenced by dune topography, vegetation, substrate, flow regimes. See comments for the 'Water quality' attribute, above. Target set to Restore because forestry plantations are reducing water input to the dune system. In addition there are a number of water abstractions in the surrounding area and extensive agricultural drainage in the wider Alt / Crossens catchment, which may be affecting water supply to the dunes.	Clarke & Sanitwong na Ayutthaya (2010) Natural England (2014)
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. Target set to Restore because a number of factors are limiting sediment movement on the site, principally coastal defences, forestry plantations and scrub encroachment (Natural England 2018). See comments for 'Extent of feature' attribute above.	Natural England (2014) Natural England (2018)
Version Control Advice last updated: **14th February 2019** following stakeholder feedback. Ragwort *Senecio jacobaea* (now *Jacobaea vulgaris*) deleted from list of species in **Undesirable species** attribute as ragwort is important foodplant and nectar source for a range of specialized dune invertebrates on the Dunes. Further locations and habitats added within **Supporting off-site habitat** attribute. Further, SD19: *Phleum arenarium-Arenaria serpyllifolia* dune annual community added as an NVC community to **Vegetation community composition** attribute and within **Key structural, influential and/or distinctive species**, Seaside centaury, *Centaurium littorale* removed as it is a more of a damp slack plant.				
Variations from national feature-framework of integrity-guidance: N/A				

Table 4: Supplementary Advice for Qualifying Features: H2150. Atlantic decalcified fixed dunes (Calluno-Ulicetea); Coastal dune heathland *Priority feature

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Extent and distribution of the feature	**Extent of the feature within the site**	Restore the total extent of the feature to at least 13.24 ha of H2150 Atlantic decalcified fixed dunes. This target may change in the future once the long term objective for the extent of woodland on the site has been agreed.	See the 'Supporting and Explanatory Notes' for this attribute above in Table 1. Target set to Restore because some stands of H2150 dune heath have been damaged by forestry plantations and scrub encroachment. In some areas recreational and/or vehicular access are eroding dune heath. The site was mapped during the National Sand Dune Survey in 1988/1989 (Edmondson *et al*. 1989). There is currently (2015) estimated to be 13.24 ha H2150 dune heath in the site (derived from analysis of CASI imagery, see Environment Agency 2017 and Annex 1). This area target may change once the long term objective for the extent of woodland on site has been developed (Mersey Forest 2013, Natural England 2018).	This attribute will be periodically monitored as part of Natural England's site condition assessments. Edmondson *et al*. (1989) Environment Agency (2017) Gateley (1995) Mersey Forest (2013) Natural England (2014) Natural England (2018) Smith (2009) Smith & Small (2009) Worsley *et al.* (2010)
Extent and distribution of the feature	**Spatial distribution of the feature within the site**	Restore the distribution of the dune heath Annex I habitat across the site, and transitions with and between other dune or terrestrial habitats, including fixed dune grassland, acid dune grassland and lowland heath.	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	This attribute will be periodically monitored as part of Natural England's site condition assessments. Environment Agency (2017) Mersey Forest (2013) Natural England (2014) Natural England (2018)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			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. See Annex 1 for the current (2015) distribution of H2150 dune heath across the site (Environment Agency 2017). Target set to Restore because the distribution of dune heath has been reduced by plantation forestry and scrub encroachment. These factors are also the main restrictions on sediment transport and coastal dynamism on the site (Natural England 2018), which is limiting the movement of dune features and in the longer term will truncate transitions to dune heath. In some areas the management of golf courses means that tracts of heath alongside fairways are kept short by mowing; elsewhere on the course, greens staff are encouraged to manage for a mosaic of different age classes of heather.	
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: H1 *Calluna vulgaris - Festuca ovina* heath H9 *Calluna vulgaris - Deschampsia flexuosa* heath H11 *Calluna vulgaris - Carex arenaria* heath	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). Dune heath is found on the Sefton Coast in a mosaic of *Calluna vulgaris*-dominated sward and areas of more typical acid grassland. The SAC and SSSI descriptions of Grey / Fixed dune includes reference to acid grassland too, making it difficult to establish whether some areas should be managed as fixed dune, or as part of the acid grassland – dune heath matrix. Advice should be taken on a case-by-case basis from Natural	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			England.	
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. Invasive non-native species no more than rare. Acrocarpous mosses <Occasional. Other undesirable species <1%.	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. The native species listed are natural components of a range of vegetation types within the SAC and many are beneficial to a range of invertebrates and other species. However, in certain circumstances (such as when they encroach on stands of rare plants) they can be undesirable and/or indicate negative pressures on the site. The main issues that are likely to result in increases in these species are eutrophication, and disturbance (e.g. from fire). Sea buckthorn *Hippophae rhamnoides* is not considered to be native on the site. Undesirable species include: *Cirsium arvense* Creeping thistle; *Chamerion angustifolium* Rosebay willowherb; *Digitalis purpurea* Foxglove; *Epilobium* spp. Willowherbs (excluding *E. palustre* Marsh willowherb); *Juncus effusus* Soft rush; *Ranunculus* spp. Buttercups; *Rumex obtusifolius* Broad-leaved dock;; *Urtica dioica* Common nettle; 'Coarse' grasses. Target set to Restore because white poplar *Populus alba*, and sea buckthorn as well as birch-dominated scrub are encroaching on stands of H2150 dune heath.	This attribute will be periodically monitored as part of Natural England's site condition assessments. Gateley (1995) Natural England (2014)
Structure and function (including its	**Vegetation community transitions**	Restore the typical patterns of zonations/transitions between the feature and landward to other	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	Natural England (2014) Natural England (2018)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
typical species)	**(range and zones)**	dune habitats or terrestrial and wetland habitats	each bordering community and can add value in often containing species not found in the adjacent communities. Retaining such transitions can provide further diversity to the habitat feature, and support additional flora and fauna. For this habitat, fluctuations in the extent of grasses to dwarf shrubs can occur over time, but there should be evidence on re-colonisation by dwarf shrubs Target set to Restore because some transitions from dune heath to other habitats have been truncated, principally by plantation forestry, scrub encroachment and built development.	
Structure and function (including its typical species)	**Functional connectivity with wider landscape**	Restore the overall extent, quality and function of any supporting features within the local landscape which provide a critical functional connection with the site	This recognises the potential need at this site to maintain or restore the connectivity of the site to its wider landscape in order to meet the conservation objectives. These connections may take the form of landscape features, such as habitat patches, hedges, watercourses and verges, outside of the designated site boundary which are either important for the migration, dispersal and genetic exchange of those typical species closely associated with qualifying Annex I habitat features of the site. These features may also be important to the operation of the supporting ecological processes on which the designated site and its features may rely. In most cases increasing actual and functional landscape-scale connectivity would be beneficial. Where there is a lack of detailed knowledge of the connectivity requirements of the qualifying feature, Natural England will advise as to whether these are applicable on a case by case basis. There are significant areas of semi-natural dune habitats on the Sefton 'sand field' that are adjacent or close to the SAC (Natural England 2018). See comments for 'Supporting off-site habitat' attribute in Table 2, above. Target set to Restore because some of these patches of semi-natural vegetation are separated from the site by unsuitable habitat, such as built development and amenity grassland.	Natural England (2018)
Structure and function (including its typical species)	**Adaptation and resilience**	Restore the feature's ability, and that of its supporting processes, to adapt or evolve to wider environmental change, either within or external to the site	See the 'Supporting and Explanatory Notes' for this attribute above in Table 1 Target set to Restore because a number of factors are limiting coastal dynamism on the site, principally coastal defences,	Environment Agency (2017) Lymbery & Newton (2010) Mersey Forest (2013)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			forestry plantations and scrub encroachment (Natural England 2018), which restrict the movement of dune features and their ability to respond to environmental change. See comments in 'Extent of feature' attribute above.	Natural England (2014) Natural England (2018)
Structure and function (including its typical species)	**Key structural, influential and/or distinctive species**	Restore the abundance of the species listed to enable each of them to be a viable component of the Annex I habitat feature. The constant and preferential species of the H1, H9 and H11 heath NVC communities that form a special component of the H2150 dune heath feature: Sand lizard *Lacerta agilis* *Corynephorous canescens* Grey hair-grass	See the 'Supporting and Explanatory Notes' for this attribute above in Table 1. Target set to Restore because of the threat to dune heath from scrub encroachment and loss of areas of sparse vegetation and bare sand, in particular on south-facing slopes.	This attribute will be periodically monitored as part of Natural England's site condition assessments.
Structure and function (including its typical species)	**Soils, substrate and nutrient cycling**	Restore the properties of the underlying soil types, including structure, bulk density, total carbon, pH, soil nutrient status and fungal: bacterial ratio, to within typical values for the habitat.	Soil is the foundation of basic ecosystem function and a vital part of the natural environment. Its properties strongly influence the colonisation, growth and distribution of those plant species which together form vegetation types, and therefore provides a habitat used by a wide range of organisms. Soil biodiversity has a vital role to recycle organic matter. Changes to natural soil properties may therefore affect the ecological structure, function and processes associated with this Annex I feature. This habitat depends on acidic surface layers which overlie acidic sand or sand deposits that have been subject to long-term leaching. Target set to Restore because dog fouling in localised areas (Larkhill Dune Heath, The Triangle) is causing nutrient enrichment.	
Supporting processes (on which the feature relies)	**Conservation measures**	Restore the management measures (either within and/or outside the site boundary as appropriate) which are necessary	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.	English Nature (2005) Natural England (2014)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		to Restore the structure, functions and supporting processes associated with the feature	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. Dune heath specifically requires stable sand, with no inputs of calcareous sand, surface layers should not be disturbed as these have been leached over long time periods. Target set to Restore because large scale management is required to return coastal dynamism to the site. In particular, large areas of forestry plantation need to be felled and removed. In addition, management is required to reduce the extent of scrub and to increase structural diversity and extent of bare ground in the sward (e.g. through grazing or mowing). In some areas access management is required to reduce erosion from access and vehicles.	Natural England (2018) Smith (2009) Smith & Small (2009) Worsley *et al.* (2010)
Supporting processes (on which the feature relies)	**Air quality**	Restore as necessary, the concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System (www.apis.ac.uk).	See the 'Supporting and Explanatory Notes' for this attribute above in Table 1 Target set to Restore because current levels of nitrogen and acid deposition exceed the critical loads for dune heath.	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)	**Water quality**	Where the feature is dependent on surface water and/or groundwater, Restore water quality and quantity to a standard which provides the necessary conditions to support the feature.	For many SAC features which are dependent on wetland habitats supported by surface and/or ground water, maintaining the quality and quantity of water supply will be critical, especially at certain times of year. Poor water quality and inadequate quantities of water can adversely affect the structure and function of this habitat type. Typically, meeting the surface water and groundwater environmental standards set out by the Water Framework Directive (WFD 2000/60/EC) will also be sufficient to support the achievement of SAC Conservation Objectives but in some cases more stringent standards may be needed. Further site-specific investigations	Clarke & Sanitwong na Ayutthaya (2010) Natural England (2014)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			may be required to establish appropriate water quality standards for the SAC. The hydrology of the dune system is not fully understood. Some investigations have been undertaken, but these have only examined limited areas e.g. Clarke & Sanitwong na Ayutthaya (2010). A detailed investigation of the hydrology of the whole site is required. Target set to Restore because forestry plantations are disrupting natural hydrological processes by reducing water input to the dune system. In addition there are a number of water abstractions in the surrounding area and it is not known whether they are affecting the groundwater levels in the site. There is also extensive agricultural drainage in the wider Alt / Crossens catchment. Dog-fouling may be resulting in nutrient enrichment in some areas.	
Supporting processes (on which the feature relies)	**Hydrology**	At a site, unit and/or catchment level as necessary, Restore natural hydrological processes to provide the conditions necessary to sustain the feature within the site.	Defining and maintaining the appropriate hydrological regime is a key step in moving towards achieving the conservation objectives for this site and sustaining this feature. Changes in source, depth, duration, frequency, magnitude and timing of water supply can have significant implications for the assemblage of characteristic plants and animals present. This target is generic and further site-specific investigations may be required to fully inform conservation measures and/or the likelihood of impacts. See comments for the 'Water quality' attribute, above. Target set to Restore because forestry plantations are reducing water input to the dune system. In addition there are a number of water abstractions in the surrounding area and extensive agricultural drainage in the wider Alt / Crossens catchment, which may be affecting water supply to the dunes.	Clarke & Sanitwong na Ayutthaya (2010) Natural England (2014)
Version Control Advice last updated: **14th February 2019** following stakeholder feedback. Ragwort *Senecio jacobaea* (now *Jacobaea vulgaris*) deleted from list of species in **Undesirable species** attribute as ragwort is important foodplant and nectar source for a range of specialized dune invertebrates on the Dunes. Further heath rush *Juncus squarrosus* deleted from undesirable plants as it is a characteristic species.				
Variations from national feature-framework of integrity-guidance: N/A				

Table 5: Supplementary Advice for Qualifying Features: H2170. Dunes with *Salix repens* ssp. *argentea* (Salicion arenariae); Dunes with creeping willow

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Extent and distribution of the feature	**Extent of the feature within the site**	Restore the total extent of the feature to at least 103.33 ha of H2170 Dunes with *Salix repens*. This target may change in the future once the long term objective for the extent of woodland on the site has been agreed.	See the 'Supporting and Explanatory Notes' for this attribute above in Table 1. Dunes with *Salix repens* is part of a broader dune wetland vegetation community. It is characteristic of older, drier dune slacks. In a naturally functioning dune system some dune slacks will, over time, dry out leading to localised losses of Dunes with *Salix repens*. However new slacks will be created by sand blow (secondary slacks) or by beach development (primary slacks), some of which in time will develop into Dunes with *Salix repens*. Therefore, this Annex 1 habitat needs to be assessed in combination with H2190 Humid dune slacks which 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 Target set to Restore because some stands of H2170 dunes with creeping willow have been damaged by forestry plantations and scrub encroachment. These factors, together with coastal defences, are the main restrictions on sediment transport and coastal dynamism on the site (Natural England 2018), which has limited sand rain and movement of dune features. In particular forestry plantations have prevented dune features from rolling-back around Formby where the coast is currently rapidly eroding. In some areas recreational and/or vehicular access have damaged dune slacks. The site was mapped during the National Sand Dune Survey in 1988/1989 (Edmondson *et al*. 1989). There is currently (2015) estimated to be 103.33 ha of H2170 dunes with creeping willow (40.25 ha in dune slack situations and 63.08 ha of willow scrub developed on fixed dunes) in the	This attribute will be periodically monitored as part of Natural England's site condition assessments. Edmondson *et al*. (1989) Environment Agency (2017) Gateley (1995) Mersey Forest (2013) Natural England (2014) Natural England (2018) Smith (2009) Smith & Small (2009) Worsley *et al.* (2010)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			site (derived from analysis of CASI imagery, see Environment Agency 2017 and Annex 1). This area target may change once the long term objective for the extent of woodland on site has been developed (Mersey Forest 2013, Natural England 2018).	
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. 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 Dunes with *Salix repens*. See Annex 1 for the current (2015) distribution of H2170 dunes with creeping willow across the site (Environment Agency 2017). Target set to Restore because some areas of dunes with creeping willow have been damaged by plantation forestry. In addition, the distribution of dunes with creeping willow is being limited by restricted coastal dynamism and recreation/vehicle access. See comments in 'Extent of feature' attribute above.	This attribute will be periodically monitored as part of Natural England's site condition assessments. Environment Agency (2017) Mersey Forest (2013) Natural England (2014) Natural England (2018)
Extent and distribution	**Future extent of habitat**	Restore the ability to absorb seasonal and periodic	This recognises the need to allow for natural fluctuations in the extent and the distribution of this habitat feature, often during	Environment Agency (2017)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
of the feature	**within the site and ability to respond to seasonal changes**	fluctuations in the extent of the habitat	particular seasons and usually as a result of natural coastal processes. Dunes with *Salix repens* 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, some of which over time will develop into Dunes with *Salix repens*. Target set to Restore because a number of factors are limiting coastal dynamism on the site, principally coastal defences, forestry plantations and scrub encroachment (Natural England 2018). In addition, forestry plantations are reducing water input to the dune system which limits the ability of slacks to withstand periods of drought. There are a number of water abstractions in the surrounding area and extensive agricultural drainage in the wider Alt / Crossens catchment, which may also be affecting water supply to the dunes.	Mersey Forest (2013) Natural England (2014) Natural England (2018)
Structure and function (including its typical species)	**Dune topography**	Restore a natural dune topography, and allow natural change that is wind driven.	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. Target set to Restore because a number of factors are limiting coastal dynamism on the site, principally coastal defences, forestry plantations and scrub encroachment (Natural England 2018). This restricts the movement of sediment and hence changes in dune topography.	This attribute will be periodically monitored as part of Natural England's site condition assessments. Environment Agency (2017) Mersey Forest (2013) Natural England (2014) Natural England (2018)
Structure and function (including its typical species)	**Presence of unvegetated surfaces**	Restore patches of bare sand of varying sizes in a mosaic with the vegetation (5% -10% of the feature extent).	Bare sand is less characteristic of Dunes with *Salix repens* than of Humid dune slacks. Nevertheless some bare sand should be expected even in this late succession community. Its location can change over time in response to localised dune dynamics and rabbit activity. Target set to Restore because there is insufficient bare ground in some of the dune slacks.	This attribute will be periodically monitored as part of Natural England's site condition assessments.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Structure and function (including its typical species)	**Vegetation community composition**	Maintain the species composition of component vegetation communities and associated transitions, allowing for successional changes in response to natural processes.	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). The NVC type SD16 *Salix repens - Holcus lanatus* is a characteristic community of this habitat. Although this vegetation type is dominated by creeping willow and can appear uniform, there is natural variation related to dampness and levels of grazing (including rabbits). H2170 dunes with creeping willow is represented on the site by two main communities: SD16 *Salix repens - Holcus lanatus* dune-slack vegetation and stands of dense *Salix repens* scrub that have developed on fixed dunes.	This attribute will be periodically monitored as part of Natural England's site condition assessments. Gateley (1995)
Structure and function (including its typical species)	**Vegetation structure: zonation of dune vegetation**	Maintain the cover of this Annex 1 habitat to typically comprise between 10% and 50% of the overall dune wetland resource on the site	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. This Annex 1 habitat needs to be considered in combination with Humid dune slacks which 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. There is currently (2015) estimated to be 40.25 ha of H2170 dunes with creeping willow in dune slack situations and 103.2 ha of H2190 humid dune slack (derived from analysis of CASI imagery, see Environment Agency 2017 and Annex 1). Creeping willow slacks represent 28% of the slack resource.	This attribute will be periodically monitored as part of Natural England's site condition assessments. Environment Agency (2017)
Structure and function (including its	**Vegetation composition: trees and**	Restore Scrub and tree cover of locally native species, excluding creeping willow, to less than 5%,	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.	This attribute will be periodically monitored as part of Natural England's site condition

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
typical species)	**scrub**	scattered and in small groups.	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. On some sites it may be appropriate to allow natural succession to native woodland to proceed on a small proportion of the Annex 1 habitat. Target set to Restore because scrub has encroached on some stands of dunes with creeping willow. The site contains some rare willow hybrids (Smith 2000) and so some stands of willow scrub need to be retained.	assessments. Natural England (2014) Smith (2000)
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: Invasive non-native species no more than rare. Other undesirable species should be no more than frequent throughout the sward, or singly or together their cover should be no more than 5%.	Two types of negative species can occur: invasive non-natives (e.g. Michaelmas daisy), or species indicative of poor condition (e.g. nettle or creeping thistle). *Jacobaea vulgaris* is a natural constituent of dune vegetation. However, in dune slacks an abundance indicates over-stocking. The native species listed are natural components of a range of vegetation types within the SAC and many are beneficial to a range of invertebrates and other species. However, in certain circumstances (such as when they encroach on stands of rare plants) they can be undesirable and/or indicate negative pressures on the site. The main issues that are likely to result in increases in these species are eutrophication, and disturbance (e.g. from fire). Sea buckthorn *Hippophae rhamnoides* is not considered to be native on the site. Grey willow *Salix cinerea* is considered as an encroaching species. Undesirable species include: *Cirsium arvense* Creeping thistle; *Cirsium palustre* Marsh thistle; *Cirsium vulgare* Spear thistle; *Lolium perenne* Perennial rye grass; *Pteridium aqulinum* Bracken; *Urtica dioica* Common nettle; Broad-leaved grasses (*Dactylis glomerata*, *Arrhenatherum elatius*) <10% Target set to Restore because Indian balsam *Impatiens glandulifera*, white poplar *Populus alba*, sea buckthorn and Japanese rose *Rosa rugosa* are encroaching stands of H2150	This attribute will be periodically monitored as part of Natural England's site condition assessments. Gateley (1995) Natural England (2014)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			dunes with creeping willow.	
Structure and function (including its typical species)	**Soils, substrate and nutrient cycling**	Restore 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 Dunes with *Salix repens* represent some of the more mature natural soils to be found on dunes. Target set to Restore because recreational use is causing sand/soil erosion and dog-fouling is resulting in nutrient enrichment.	This attribute will be periodically monitored as part of Natural England's site condition assessments. Natural England (2014)
Structure and function (including its typical species)	**Key structural, influential and/or distinctive species**	Restore the abundance of the species listed to enable each of them to be a viable component of the Annex I habitat feature: The constant and preferential species of the SD16 dune NVC community that form a special component of the H2170 dunes with creeping willow feature. Vascular plant assemblage including: *Epipactis dunensis* Dune helleborine; *Epipactis phyllanthes* Green flowered helleborine; *Equisetum variegatum* Variegated horsetail; *Juncus balticus* Baltic rush; *Pyrola rotundifolia* ssp. *maritima* Round-leaved wintergreen; Hybrid willow spp. *Petalophyllum ralfsii* Petalwort	See the 'Supporting and Explanatory Notes' for this attribute above in Table 1 Target set to Restore because a number of populations of rare species have been reduced/lost.	This attribute will be periodically monitored as part of Natural England's site condition assessments. Gateley (1995) Smith (2006b)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		Natterjack toad *Epidalea calamita* Great-crested newt *Triturus cristatus*		
Structure and function (including its typical species)	**Vegetation structural diversity**	Restore a suitable variation in vegetation height across the feature.	Even for a vegetation community dominated by *Salix repens*, a uniform canopy will not be typical. And a wide range of invertebrates in particular depend on both a varied vegetation structure and a succession of flowers and seeds.	
Supporting processes (on which the feature relies)	**Functional connectivity with wider coastal sedimentary system**	Restore adequate movement of sediment from all key sediment sources (directly from the beach, indirectly from offshore, eroding cliffs *etc*).	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 outside of the designated site boundary which are either important for the continuous supply of sediment (such as soft eroding cliffs, dunes, offshore sand banks) or 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. Although Dunes with *Salix repens* does not depend in the short term on continued inputs of sand, its medium/long term survival does. Primary slacks can occur on the beach plane with sufficient input of sand. Target set to Restore because coastal dynamism is restricted, in particular by forestry plantations, scrub encroachment and coastal defences. This is limiting sand rain and movement of dune features. In particular forestry plantations have prevented dune features from rolling-back around Formby where the coast is currently rapidly eroding.	This attribute will be periodically monitored as part of Natural England's site condition assessments. Natural England (2014)
Supporting processes (on which the	**Aeolian (wind-blow) processes**	Restore the natural movement of sand within the site, resulting from wind blow-outs and blow-	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	Natural England (2014) Natural England (2018)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
feature relies)		throughs.	slacks occur, has resulted from past within-site dune movement. Although Dunes with *Salix repens* 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. Target set to Restore because a number of factors are limiting sediment movement on the site, principally coastal defences, forestry plantations and scrub encroachment (Natural England 2018).	
Supporting processes (on which the feature relies)	**Hydrology**	At a site, unit and/or catchment level, as necessary, Restore natural hydrological processes to provide the conditions necessary to sustain the feature within the site.	Defining and maintaining the appropriate hydrological regime is a key step in moving towards achieving the conservation objectives for this site and sustaining this feature. Changes in source, depth, duration, frequency, magnitude and timing of water supply can have significant implications for the assemblage of characteristic plants and animals present. This target is generic and further site-specific investigations may be required to fully inform conservation measures and/or the likelihood of impacts. All dune wetland vegetation communities, including Dunes with *Salix repens*, are influenced by the water table. Each community reflects a particular past and current hydrological regime. Water table monitoring should be present on all sites with dune wetlands. The hydrology of the dune system is not fully understood. Some investigations have been undertaken, but these have only examined limited areas e.g. Clarke & Sanitwong na Ayutthaya (2010). A detailed investigation of the hydrology of the whole site is required. Target set to Restore because forestry plantations are disrupting natural hydrological processes by reducing water input to the dune system. In addition there are a number of water abstractions in the surrounding area and extensive agricultural drainage in the wider Alt / Crossens catchment, which may be affecting water supply to the dunes.	Clarke & Sanitwong na Ayutthaya (2010) Natural England (2014)
Supporting processes (on which the feature relies)	**Water quality**	Where the feature is dependent on surface water and/or groundwater, Restore water quality and quantity to a standard which provides the necessary	For many SAC features which are dependent on wetland habitats supported by surface and/or ground water, maintaining the quality and quantity of water supply will be critical, especially at certain times of year. Poor water quality and inadequate quantities of water can adversely affect the	Clarke & Sanitwong na Ayutthaya (2010) Natural England (2014)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		conditions to support the feature.	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. See comments for the 'Hydrology' attribute, above. Target set to Restore because forestry plantations are reducing water input to the dune system. In addition there are a number of water abstractions in the surrounding area and extensive agricultural drainage in the wider Alt / Crossens catchment, which may be affecting water supply to the dunes. Dog-fouling is resulting in nutrient enrichment in some areas.	
Supporting processes (on which the feature relies)	**Air quality**	Restore as necessary, the concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System (www.apis.ac.uk).	See the 'Supporting and Explanatory Notes' for this attribute above in Table 1 Target set to Restore because current levels of nitrogen and acid deposition exceed the critical loads for dunes with creeping willow.	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**	Restore the management measures (either within and/or outside the site boundary as appropriate) which are necessary to Restore the structure, functions and supporting processes associated with the feature	Active and ongoing conservation management is needed to protect, maintain or restore this feature at this site. Further details about the necessary conservation measures for this site can be provided by contacting Natural England. This information will typically be found within, where applicable, supporting documents such as Natura 2000 Site Improvement Plan, Site Management Strategies or Plans, the Views about Management Statement for the underpinning SSSI and/or management agreements. Although 'natural processes' are given a high priority in sustaining site and feature integrity in dunes, active management (including livestock grazing) is sometimes required. Target set to Restore because large scale management is required to return coastal dynamism to the site to maintain sand rain and to enable new slacks to develop. In particular,	English Nature (2005) Natural England (2014) Natural England (2018) Smith (2006a)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			large areas of forestry plantation need to be felled and removed. In addition, works are required in some slacks to set back succession and create bare ground (to maintain the extent of slacks in the long term), to reduce the extent of scrub and invasive non-natives and to control recreational access and dog-fouling.	
Version Control Advice last updated: **14th February 2019** following stakeholder feedback. Ragwort *Senecio jacobaea* (now *Jacobaea vulgaris*) deleted from list of species in **Undesirable species** attribute as ragwort is important foodplant and nectar source for a range of specialized dune invertebrates on the Dunes. Grey willow *Salix cinerea* added as an encroaching species.				
Variations from national feature-framework of integrity-guidance: N/A				

Table 6: 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**	Restore the total extent of the feature to at least 103.02ha of H2190 humid dune slacks. This target may change in the future once the long term objective for the extent of woodland on the site has been agreed.	See the 'Supporting and Explanatory Notes' for this attribute above in Table 1 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. H2170 Dunes with *Salix repens* are characteristic of older, drier dune slacks, therefore, this Annex 1 habitat needs to be assessed in combination with it. Target set to Restore because some stands of H2190 humid dune slacks have been damaged by forestry plantations and scrub encroachment. These factors, together with coastal defences, are the main restrictions on sediment transport and coastal dynamism on the site (Natural England 2018), which has limited sand rain and movement of dune features. In particular forestry plantations have prevented dune features from rolling-back around Formby where the coast is currently rapidly eroding. In some areas recreational and/or vehicular access have damaged dune slacks. The site was mapped during the National Sand Dune Survey in 1988/1989 (Edmondson *et al*. 1989). There is currently (2015) estimated to be 103.02 ha of H2190 humid dune slacks in the site in the site (derived from analysis of CASI imagery, see Environment Agency 2017 and Annex 1). This area target may change once the long term objective for	This attribute will be periodically monitored as part of Natural England's site condition assessments. Edmondson *et al*. (1989) Environment Agency (2017) Gateley (1995) Mersey Forest (2013) Natural England (2014) Natural England (2018) Smith (2017)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			the extent of woodland on site has been developed (Mersey Forest 2013, Natural England 2018).	
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. Target set to Restore because a number of factors are limiting coastal dynamism on the site, principally coastal defences, forestry plantations and scrub encroachment (Natural England 2018). This restricts the movement of sediment and hence changes in dune topography.	This attribute will be periodically monitored as part of Natural England's site condition assessments. Environment Agency (2017) Mersey Forest (2013) Natural England (2014) Natural England (2018)
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. 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. See Annex 1 for the current (2015) distribution of H2190 humid dune slacks across the site (Environment Agency 2017).	This attribute will be periodically monitored as part of Natural England's site condition assessments. Environment Agency (2017) Mersey Forest (2013) Natural England (2014) Natural England (2018)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			Target set to Restore because some areas of humid dune slacks have been damaged by plantation forestry. In addition, the distribution of humid dune slacks is being limited by restricted coastal dynamism and recreation/vehicle access. See comments in 'Extent of feature' attribute above.	
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	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. Target set to Restore because a number of factors are limiting coastal dynamism on the site, principally coastal defences, forestry plantations and scrub encroachment (Natural England 2018). In addition, forestry plantations are reducing water input to the dune system which limits the ability of slacks to withstand periods of drought. There are a number of water abstractions in the surrounding area and extensive agricultural drainage in the wider Alt / Crossens catchment, which may also be affecting water supply to the dunes.	Environment Agency (2017) Mersey Forest (2013) Natural England (2014) Natural England (2018) Smith (2009) Worsley *et al.* (2010)
Structure and function (including its typical species)	**Presence of unvegetated surfaces**	Maintain 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 site condition assessments.
Structure and function (including its typical species)	**Vegetation community composition**	Maintain the component vegetation communities and associated transitions, allowing for successional changes in response to natural processes. H2190 humid dune slack is represented on site by: SD13 *Sagina nodosa - Bryum*	This habitat feature will comprise a number of associated semi-natural vegetation types and their transitional zones, reflecting the geographical location of the site, altitude, aspect, soil conditions (especially base-status and drainage) and vegetation management. In the UK these have been categorised by the National Vegetation Classification (NVC). Maintaining or restoring these characteristic and distinctive vegetation types, and the range of types as appropriate, will be important to sustaining the overall habitat feature. This will also	This attribute will be periodically monitored as part of Natural England's site condition assessments.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		pseudotriquetrum dune-slack community SD14 *Salix repens - Campylium stellatum* dune-slack community SD15 *Salix repens - Calliergonella cuspidatum* dune-slack community Some stands of SD16 *Salix repens - Holcus lanatus* dune-slack vegetation SD17 *Potentilla anserina - Carex nigra* dune-slack community	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). 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**	Maintain 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. The latter end of the dune slack succession which is dry dune slack is covered by H2170 Dunes with *Salix repens*. There are different types of dune slacks - pioneer, young/moderate and old, and stages within these: dune slack community sub-types: dune slack pools (permanent water bodies); dune slack pioneer swards; dune slack fens (calcareous, occasionally acidic); dune slack grasslands (humid grasslands and rushbeds); dune slack reedbeds, sedgebeds and canebeds. 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. A number of factors are limiting coastal dynamism on the site, principally coastal defences, forestry plantations and scrub encroachment which will limit the natural creation of dune slacks. There is not currently sufficient early succession dune	This attribute will be periodically monitored as part of Natural England's site condition assessments.

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			slack to maintain the extent of the H2190 humid dune slack in the longer term.	
Structure and function (including its typical species)	**Vegetation composition: trees and scrub**	Restore 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. Target set to Restore because scrub has encroached on some humid dune slacks. The site contains some rare willow hybrids (Smith 2000) and so some stands of willow scrub need to be retained.	This attribute will be periodically monitored as part of Natural England's site condition assessments. Gateley (1995) Natural England (2014) Smith (2000)
Structure and function (including its typical species)	**Vegetation composition: forb/grass ratio**	Maintain a typically low vegetation sward with >30% cover of forbs and <50% cover of grasses, and occasional bryophytes (e.g. *Calliergonella cuspidata*, *Campylium stellatum*).	Low swards are required by species such as fen orchid. 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 site condition assessments.
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: Invasive non-native species no more than rare Other undesirable species should be no more than frequent throughout the sward, or singly or together their cover should be no more than 5%.	Two types of negative species can occur: invasive non-natives (e.g. Michaelmas daisy), or species indicative of poor condition (e.g. nettle or creeping thistle). Other thistles should not be included as negative indicators. *Lolium perenne* is indicative of agricultural improvement. 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. The native species listed are natural components of a range of vegetation types within the SAC and many are beneficial to a range of invertebrates and other species. However, in certain circumstances (such as when they encroach on stands of rare plants) they can be undesirable and/or indicate negative pressures on the site. The main issues that are likely to result	This attribute will be periodically monitored as part of Natural England's site condition assessments. Natural England (2014)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			in increases in these species are eutrophication, and disturbance (e.g. from fire). Sea buckthorn *Hippophae rhamnoides* is not considered to be native on the site. Undesirable species include: *Arrhenatherum elatius* False oat-grass; *Cirsium arvense* Creeping thistle; *Cirsium palustre* Marsh thistle; *Cirsium vulgare* Spear thistle; *Lolium perenne* Perennial rye grass; *Pteridium aqulinum* Bracken;; *Urtica dioica* Common nettle Target set to Restore because Indian balsam *Impatiens glandulifera*, white poplar *Populus alba*, sea buckthorn and Japanese rose *Rosa rugosa* are encroaching H2190 humid dune slacks.	
Structure and function (including its typical species)	**Key structural, influential and/or distinctive species**	Restore the abundance of the species listed to enable each of them to be a viable component of the Annex I habitat feature. The constant and preferential species of the SD13, SD14, SD15, SD16 and SD17 dune NVC communities that form a special component of the H2170 dunes with creeping willow feature. Vascular plant assemblage including: *Epipactis dunensis* Dune helleborine; *Epipactis phyllanthes* Green flowered helleborine; *Equisetum variegatum* Variegated horsetail; *Juncus balticus* Baltic rush; *Pyrola rotundifolia* ssp. *maritima* Round-leaved wintergreen *Petalophyllum ralfsii* Petalwort	See the 'Supporting and Explanatory Notes' for this attribute above in Table 1. Target set to Restore because a number of populations of rare species have been reduced. Disturbance of slacks containing Natterjack spawn by dogs is a problem. Further grey willow *Salix cinerea* is an encroaching species within this habitat.	This attribute will be periodically monitored as part of Natural England's site condition assessments. Gateley (1995) Smith (2017)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		Natterjack toad *Epidalea calamita* Great-crested newt *Triturus cristatus*		
Structure and function (including its typical species)	**Soils, substrate and nutrient cycling**	Restore 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. Target set to Restore because recreational use is causing sand/soil erosion and dog-fouling is resulting in nutrient enrichment.	This attribute will be periodically monitored as part of Natural England's site condition assessments. Natural England (2014)
Supporting processes (on which the feature relies)	**Functional connectivity with wider coastal sedimentary system, including seed/ propagule dispersal.**	Restore adequate movement of sediment from all key sediment sources (directly from the beach, indirectly from offshore, eroding cliffs *etc*).	Although Humid dune slacks do not depend in the short term on continued inputs of sand, its medium/long term survival does. Primary slacks can occur on the beach plane with sufficient input of sand. Target set to Restore because coastal dynamism is restricted, in particular by forestry plantations, scrub encroachment and coastal defences. This is limiting sand rain and movement of dune features. In particular forestry plantations have prevented dune features from rolling-back around Formby where the coast is currently rapidly eroding.	This attribute will be periodically monitored as part of Natural England's site condition assessments. Natural England (2014)
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.	Natural England (2014) Natural England (2018)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			Target set to Restore because a number of factors are limiting sediment movement on the site, principally coastal defences, forestry plantations and scrub encroachment (Natural England 2018).	
Supporting processes (on which the feature relies)	**Hydrology**	At a site, unit and/or catchment level, as necessary, Restore natural hydrological processes to provide the conditions necessary to sustain the feature within the site.	Defining and maintaining the appropriate hydrological regime is a key step in moving towards achieving the conservation objectives for this site and sustaining this feature. Changes in source, depth, duration, frequency, magnitude and timing of water supply can have significant implications for the assemblage of characteristic plants and animals present. This target is generic and further site-specific investigations may be required to fully inform conservation measures and/or the likelihood of impacts. For this feature: All dune wetland vegetation communities are influenced by the water table. Each community reflects a particular past and current hydrological regime. 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 (European Commission 2013). They require a period of wetting, with inundation to shallow depth in winter and dry in summer. 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. The hydrology of the dune system is not fully understood. Some investigations have been undertaken, but these have only examined limited areas e.g. Clarke & Sanitwong na Ayutthaya (2010). A detailed investigation of the hydrology of the whole site is required. Target set to Restore because forestry plantations are disrupting natural hydrological processes by reducing water	Clarke & Sanitwong na Ayutthaya (2010) Natural England (2014) Natural England (2014b)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			input to the dune system. In addition there are a number of water abstractions in the surrounding area and extensive agricultural drainage in the wider Alt / Crossens catchment, which may be affecting water supply to the dunes.	
Supporting processes (on which the feature relies)	**Water quality**	Where the feature is dependent on surface water and/or groundwater, Restore water quality and quantity to a standard which provides the necessary conditions to support the feature.	For many SAC features which are dependent on wetland habitats supported by surface and/or ground water, maintaining the quality and quantity of water supply will be critical, especially at certain times of year. Poor water quality and inadequate quantities of water can adversely affect the structure and function of this habitat type. Typically, meeting the surface water and groundwater environmental standards set out by the Water Framework Directive (WFD 2000/60/EC) will also be sufficient to support the achievement of SAC Conservation Objectives but in some cases more stringent standards may be needed. Further site-specific investigations may be required to establish appropriate water quality standards for the SAC. See comments for the 'Hydrology' attribute, above. Target set to Restore because forestry plantations are reducing water input to the dune system. In addition there are a number of water abstractions in the surrounding area and extensive agricultural drainage in the wider Alt / Crossens catchment, which may be affecting water supply to the dunes. Dog-fouling is resulting in nutrient enrichment in some areas.	Clarke & Sanitwong na Ayutthaya (2010) Natural England (2014)
Supporting processes (on which the feature relies)	**Air quality**	Restore as necessary, the concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System (www.apis.ac.uk).	See the 'Supporting and Explanatory Notes' for this attribute above in Table 1. Target set to Restore because current levels of nitrogen and acid deposition exceed the critical loads for acid communities of humid dune slacks.	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**	Restore the management measures (either within and/or outside the site boundary as appropriate) which are necessary to Restore the structure, functions and supporting	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	Millett & Edmondson (2013) English Nature (2005) Natural England (2014)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		processes associated with the feature.	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, 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. Target set to Restore because large scale management is required to return coastal dynamism to the site to maintain sand rain and to enable new slacks to develop. In particular, large areas of forestry plantation need to be felled and removed. In addition, works are required in some slacks to set back succession and create bare ground (to maintain the extent of slacks in the long term), to reduce the extent of scrub and invasive non-natives and to control recreational access and disturbance by dogs.	Natural England (2018) Smith (2006a) Smith (2009) Worsley *et al.* (2010)
Version Control Advice last updated: **14th February 2019** following stakeholder feedback. Ragwort *Senecio jacobaea* (now *Jacobaea vulgaris*) deleted from list of species in **Undesirable species** attribute as ragwort is important foodplant and nectar source for a range of specialized dune invertebrates on the Dunes. Grey willow *Salix cinerea* added as an encroaching species.				
Variations from national feature-framework of integrity-guidance: N/A				

Table 7: Supplementary Advice for Qualifying Features: S1166. *Triturus cristatus*; Great crested newt

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	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 whether the figures stated are the best available. Estimating the average	This attribute will be periodically monitored as part of Natural England's site condition assessments. Cheshire Ecological Services (2001) Sefton Coast and Countryside Service 2008

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			size of the GCN population will normally be based on the peak count of adults undertaken in the known peak season for the area, and in-year weather conditions; likely to be Mid-April to Mid-May in central areas. The peak count is derived by summing the counts across the site on 'best' night for each season. Considerable natural between-year variation in population counts is frequent. The baseline population size is not known. Cheshire Ecological Services (2001) provides information on presence/absence of eggs/larvae in 35 ponds in Ainsdale Sand Dunes National Nature Reserve (approximately 11% of the SAC area). Great crested newts have also been recorded in Ainsdale and Birkdale Sandhills Local Nature Reserve during natterjack toad surveys (e.g. Sefton Coast and Countryside Service 2008). A full-site great crested newt survey is required.	
Population (of the feature)	**Population viability**	Maintain the presence of great crested newt eggs in breeding ponds at a level which is likely to Maintain the abundance of the population at or above its target level.	A "breeding pond" is defined as a pond in which egg-laying and successful metamorphosis (e.g. the pond doesn't dry up too soon) is likely to occur at least once every three years. The optimum time to survey for eggs is mid-March to mid-May. Presence of eggs can be recorded by day or night visits and surveys should be combined with visits for the adult component. Cheshire Ecological Services (2001) gives information on presence/absence of eggs/larvae in 35 ponds in Ainsdale Sand Dunes National Nature Reserve.	This attribute will be periodically monitored as part of Natural England's site condition assessments. Cheshire Ecological Services (2001)
Population (of the feature)	**Supporting metapopulations**	Restore the connectivity of the SAC population to any associated metapopulations (either within or outside of the site boundary)	Great crested newts often exist in metapopulations. A metapopulation is a group of associated populations made up of newts which breed in, and live around, a cluster of ponds. There will be some interchange of newts between these populations, even though most adults consistently return to the same pond to breed, and so it will be important to avoid the isolation of these populations from each other. A metapopulation associated with a SAC may occur outside of the designated site boundary. The connectivity of the wider local landscape to the SAC may therefore be important as this may help to ensure the survival of the overall population even if sub-populations are temporarily affected by, for example, pond desiccation or fish introductions.	

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			Sefton Coast SAC covers a large part of the Sefton Coast 'sand field', but there are also significant areas of semi-natural dune habitats that are outside of the site, but adjacent or close to it (see the 'Supporting off-site habitat' attribute in Table 2, above). Target set to Restore because works are required to improve the connectivity between sites, such as scrub and plantation removal.	
Supporting habitat: extent and distribution	**Extent of supporting habitat**	Restore the total extent of the habitats which support the feature.	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. Great crested newts use a wide range of habitats throughout the dune system, including slacks, ponds, dune grassland and scrub. See Annex 1 for the current (2015) distribution of habitats across the site (Environment Agency 2017). Target set to Restore because a significant proportion of the dune system has been damaged by forestry plantations, but an area target has not been set because the long term objective for the extent of woodland on site is still being developed (Mersey Forest 2013, Natural England 2018).	Environment Agency (2017) Mersey Forest (2013) Natural England (2014) Natural England (2018)
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.	Environment Agency (2017) Mersey Forest (2013) Natural England (2014) Natural England (2018)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			Target set to Maintain because great crested newt habitats are not severely affected by plantation forestry. See Annex 1 for the current (2015) distribution of habitats across the site (Environment Agency 2017) and also comments for 'Extent of supporting habitat' attribute, above.	
Supporting habitat: structure/ function	**Cover of macrophytes**	Maintain a high cover of macrophytes, typically between 50-80%, within ponds	Marginal and emergent vegetation are important components of a great crested newt pond as they provide excellent egg-laying sites. Good plants for this purpose include water forget-me-not *Myosotis scorpioides*, flote/sweet grass *Glyceria fluitans* and great hairy willowherb *Epilobium hirsutum*. They are, however, an integral part of the natural successional change of a waterbody and whilst it is preferable to have a good range and area of marginal plants, they should not extend across the entire water surface. In most circumstances it will be desirable to retain a fringe of marginal and emergent vegetation around at least half of a pond's edge. Where the marginal vegetation is particularly invasive, and provides no specific benefit to crested newts, it may be decided that its complete removal is necessary.	This attribute will be periodically monitored as part of Natural England's site condition assessments.
Supporting habitat: structure/ function	**Overall Habitat Suitability Index score**	For this SAC, Maintain an overall Great Crested Newt Habitat Suitability Index score of no less than 0.8.	The Habitat Suitability Index provides a measure of evaluating habitat quality and quantity for Great Crested Newts. The Index score lies between 0 and 1, with 1 representing optimal GCN habitat. In general, the higher the index score the more likely the site is to support great crested newts. The HSI methodology is documented in ARG-UK Advice Note 5 (May 2010). The HSI should not be used as a substitute for more detailed surveys and consideration of other attributes where necessary.	ARG (2010)
Supporting habitat: structure/ function	**Permanence of ponds**	Restore the permanence of water within ponds present within the site	Ponds to include breeding ponds as well as non-breeding ponds, since the latter may be used for foraging or sustaining prey populations. Ponds should have a high degree of permanence (they never or rarely dry out other than though natural drought) and this may be adversely affected by changes in the supply or flow of water (from either surface water and/or groundwater sources) to the ponds. Target set to Restore because forestry plantations are reducing water input to the dune system and consequently the permanence of waterbodies within the dunes. In addition there are a number of water abstractions in the surrounding area and	This attribute will be periodically monitored as part of Natural England's site condition assessments. Clarke & Sanitwong na Ayutthaya (2010) Natural England (2014)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			extensive agricultural drainage in the wider Alt / Crossens catchment, which may be affecting water supply to the dunes.	
Supporting habitat: structure/ function	**Presence of fish and wildfowl**	Ensure fish and wildfowl are rare in all ponds.	At high densities waterfowl (i.e. most water birds such as ducks, geese and swans but excluding moorhen) can remove all aquatic vegetation, adversely affect water quality and create turbid pondwater conditions. Some may also actively hunt adult GCNs and their larvae. Similarly fish can be significant predators of GCN larvae. The presence of waterfowl and fish can reduce habitat suitability. These should be wholly absent form sites which support fewer than 5 ponds.	This attribute will be periodically monitored as part of Natural England's site condition assessments.
Supporting habitat: structure/ function	**Presence of ponds**	Maintain the number or surface area of ponds present within the site.	Ponds to include breeding ponds as well as non-breeding ponds, since the latter may be used for foraging or sustaining prey populations. The surface area of a pond is taken from when water reaches its highest level (excluding flooding events), which will usually be in the spring. The total number of ponds within the site is not known. Cheshire Ecological Services (2001) gives a detailed survey of suitable ponds within Ainsdale Sand Dunes National Nature Reserve (approximately 11% of the SAC area) and Environment Agency (2017) provides a map of current (2015) wetland habitats and standing water across the SAC, but more work is required to fully define the number of great crested newt ponds on site. The majority of all the breeding 'ponds' on site are scrapes that were excavated as breeding sites for natterjack toads *Epidalea calamita.* Some were dug too deep or have become overgrown with age and are now used by the Great crested newts.	This attribute will be periodically monitored as part of Natural England's site condition assessments. Cheshire Ecological Services (2001) Environment Agency (2017)
Supporting habitat: structure/ function	**Shading of ponds**	Ensure pond perimeters are generally free of shade (typically no more than 60% cover of the shoreline)	Shading from trees and/or buildings (not including emergent pond vegetation) can negatively affect the abundance of marginal vegetation in ponds, water temperature and the rate of hatching and development of great crested newt eggs and larvae.	This attribute will be periodically monitored as part of Natural England's site condition assessments.
Supporting habitat: structure/ function	**Soils, substrate and nutrient cycling**	Restore the properties of the underlying soil types, including structure, bulk density, total carbon, pH, soil nutrient status and fungal: bacterial ratio,	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	Natural England (2014)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		within typical values for the supporting habitat	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. Target set to Restore because access management is required to reduce dog-fouling, which is resulting in nutrient enrichment in some slacks. In the long term nutrient enrichment is likely to reduce structural diversity and/or the extent of aquatic plants in breeding ponds.	
Supporting habitat: structure/ function	**Supporting terrestrial habitat**	Restore the quality of terrestrial habitat likely to be utilised by Great Crested Newts, with no fragmentation of habitat by significant barriers to newt dispersal.	Great crested newts need both aquatic and terrestrial habitat. Good quality terrestrial habitat, particularly within 500m of the breeding ponds, provides important sheltering, dispersing and foraging conditions and can include all semi-natural habitat along with meadows, rough tussocky grassland, scrub, woodland, as well as 'brownfield' land or low-intensity farmland. Good quality terrestrial habitat for GCNs has structural diversity which can be provided by features such as hedges, ditches, stone walls, old farm buildings, loose stone/rocks, rabbit burrows and small mammal holes. Good habitat provides a range of invertebrates, such as earthworms, insects, spiders and slugs, on which GCNs are known to feed. Fragmentation refers to significant barriers to GCN movement such as walls and buildings, but not footpaths or tracks. Newts disperse over land to forage for food, and move between ponds. The distances moved during dispersal vary widely according to habitat quality and availability. At most sites, the majority of adults probably stay within around 250m of the breeding pond but may well travel further if there are areas of high quality foraging and refuge habitat extending beyond this range. Great crested newts use a wide range of habitats throughout the dune system, including slacks, ponds, dune grassland and scrub. See Annex 1 for the current (2015) distribution of habitats across the site (Environment Agency 2017). Target set to Restore because a significant proportion of the dune system has been damaged and fragmented by forestry plantations.	Environment Agency (2017) Mersey Forest (2013) Natural England (2014) Natural England (2018)

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)	**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 'Supporting and Explanatory Notes' for this attribute above in Table 1. Target set to Restore because a number of factors are limiting coastal dynamism on the site, principally coastal defences, forestry plantations and scrub encroachment (Natural England 2018), which restrict the movement of dune features and their ability to respond to environmental change.	Environment Agency (2017) Lymbery & Newton (2010) Mersey Forest (2013) Natural England (2014) England (2015) Natural England (2018)
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 'Supporting and Explanatory Notes' for this attribute above in Table 1. Critical loads have not been defined on APIS for great crested newt. However, target set to Restore because critical loads for nitrogen deposition (and for some features also acid deposition) are currently being exceeded in a range of great crested newt supporting habitats, including H2130 grey dunes, H2170 dunes with creeping willow and H2190 humid dune slacks.	More information about site-relevant Critical Loads and Levels for this SAC is available by using the 'search by site' tool on the Air Pollution Information System (www.apis.ac.uk).
Supporting processes (on which the feature and/or its supporting habitat relies)	**Conservation measures**	Restore the management measures (either within and/or outside the site boundary as appropriate) which are necessary to 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. Target set to Restore because fish removal is required in some ponds. In addition, access management is required to reduce disturbance of ponds by dogs. There are also a range of ongoing works that are required to maintain suitable conditions in the ponds for great crested newts, including occasional scrub/tree cover to reduce shading of ponds and herbicide treatment of any patches of New Zealand pygmyweed *Crassula helmsii*.	English Nature (2005) Cheshire Ecological Services (2001) Natural England (2014)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			There is a potential conflict because Natterjacks and Great Crested Newts on site. Natterjacks require shallow water that dries up by mid-summer while the Great Crested Newts need more-or-less permanent ponds. Great Crested Newts can predate Natterjack spawn and tadpoles. Further, the deeper ponds support common toads *Bufo bufo* and common frogs *Rana temporaria*. These can then invade Natterjack breeding scrapes and compete with the rarer amphibian. Any New Great Crested Newt ponds should therefore be situated in older dune areas well away from the younger, more open habitats used by Natterjacks.	
Supporting processes (on which the feature and/or its supporting habitat relies)	**Water quantity/quality**	Where the feature or its supporting habitat is dependent on surface water and/or groundwater, Restore water quality and quantity to a standard which provides the necessary conditions to support the feature.	For many SAC features which are dependent on wetland habitats supported by surface and/or ground water, maintaining the quality and quantity of water supply will be critical, especially at certain times of year. Poor water quality and inadequate quantities of water can adversely affect the structure and function of this habitat type. Typically, meeting the surface water and groundwater environmental standards set out by the Water Framework Directive (WFD 2000/60/EC) will also be sufficient to support the achievement of SAC Conservation Objectives but in some cases more stringent standards may be needed to reflect the ecological needs of the species feature. Further site-specific investigations may be required to establish appropriate water quality standards for the SAC. Great crested newts are dependent on waterbodies for breeding. The hydrology of the dune system is not fully understood. Some investigations have been undertaken, but these have only examined limited areas e.g. Clarke & Sanitwong na Ayutthaya (2010). A detailed investigation of the hydrology of the whole site is required. Target set to Restore because forestry plantations are disrupting natural hydrological processes by reducing water input to the dune system. In addition there are a number of water abstractions in the surrounding area and extensive	Clarke & Sanitwong na Ayutthaya (2010) Natural England (2014)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			agricultural drainage in the wider Alt / Crossens catchment, which may be affecting water supply to the dunes. Dog-fouling may be resulting in nutrient enrichment of the water in some slacks.	
Supporting processes (on which the feature or its supporting habitat relies)	**Water quality**	Maintain the quality of pondwaters within the site as indicated by the presence of an abundant and diverse invertebrate community.	As the clarity and chemical status of water bodies supporting GCNs can be subjective, the presence of an abundant and diverse community of freshwater invertebrates can be indicative of suitable water quality standards. Invertebrate groups present should include groups such as mayfly larvae and water shrimps. This will ensure ponds support a healthy (mainly invertebrate) fauna to provide food for developing GCN larvae and adults.	
Version Control Advice last updated: 14th February 2019 following stakeholder comments Further site information added to Spporting and Explanatory Notes section for **Presence of Ponds** and **Conservation Measure** attributes.				
Variations from national feature-framework of integrity-guidance: N/A				

Table 8: 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**	Restore the abundance of the population to at least 7,887 thalli, whilst allowing no deterioration from current levels. This target may change in the future once the long term objective for the extent of woodland on the site has been agreed.	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 stated are the best available.	Callaghan (2016) Mersey Forest (2013) Natural England (2014) Natural England (2015) Natural England (2018) Sefton Coast Life Project (1997)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			A survey in 1997 estimated a population of 7,887 thalli. This population target may change once the long term objective for the extent of woodland on site (and hence the extent of petalwort supporting habitat) has been developed (Mersey Forest 2013, Natural England 2018). Target set to Restore because significant areas of dune supporting habitat have been damaged by forestry plantations and scrub encroachment.	
Supporting habitat: extent and distribution	**Extent of supporting habitat**	Restore the total extent of the habitats which support the feature	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 occurs in a range of different habitats on the site. Colonies are found on damp sand, in or near slacks at up to 1.5km from the dune front. The majority of the slacks occupied by petalwort are <40 years old, with the largest colonies found in slacks <25 years old. Colonies are also associated with infrequently-used footpaths and an open vegetation structure, on sand with a relatively high organic content. Target set to Restore because significant areas of dune supporting habitat have been damaged by forestry plantations and scrub encroachment. These factors are also the main restrictions on sediment transport and coastal dynamism on the site (Natural England 2018), which is limiting sand rain and movement of dune features. In particular forestry plantations are preventing the dunes from rolling-back around Formby where the coast is currently rapidly eroding. An area target has not been set because the long term objective for the extent of woodland on site is still being developed (Mersey Forest 2013, Natural England 2018).	This attribute will be periodically monitored as part of Natural England's site condition assessments. Environment Agency (2017) Natural England (2014) Sefton Coast Life Project (1997)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			There is currently (2015) estimated to be 103.02 ha of H2190 humid dune slacks in the site (derived from analysis of CASI imagery, see Environment Agency 2017 and Annex 1), but not all of this will be suitable for petalwort and there are also colonies away from dune slacks.	
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 has been recorded from several locations within the SAC (Sefton Coast Life Project 1997). See comments for 'Extent of supporting habitat' attribute, above. Target set to Maintain. Petalwort occurs in a range of different habitats on the site. Colonies are found on damp sand, in or near slacks at up to 1.5km from the dune front. The majority of the slacks occupied by petalwort are <40 years old, with the largest colonies found in slacks <25 years old. Colonies are also associated with infrequently-used footpaths and an open vegetation structure, on sand with a relatively high organic content. This means colonies should be protected by appropriate management of slacks and access routes. Natural England should be consulted where there are records of Petalwort colonies.	This attribute will be periodically monitored as part of Natural England's site condition assessments. Natural England (2014) Sefton Coast Life Project (1997)
Supporting habitat: structure/ function	**Bare Ground and Vegetation Structure**	Ensure areas supporting *P. ralfsii* contain at least 5% bare ground and the height of overall vegetation structure is predominantly short.	*P. ralfsii* tolerates only light shading, and most sites supporting the species have persistently very low vegetation that includes many small perennials, which is maintained by low nutrient levels and often by intense grazing by rabbits, plus on some sites light trampling pressure.	

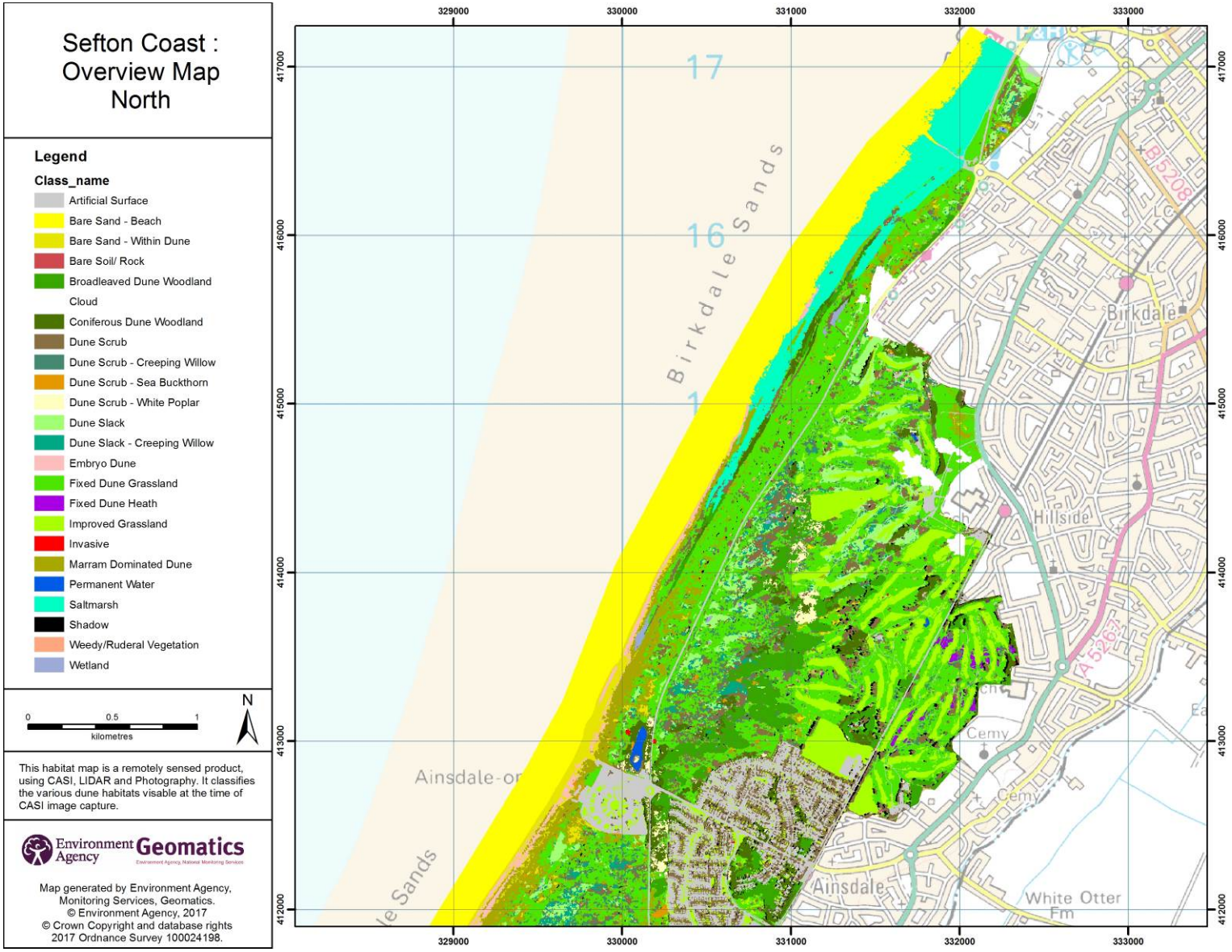
Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			Most sites also have at least some bare ground, commonly 10-50% bare sandy ground amongst low vegetation, although *P. ralfsii* can grow in a very thin low cover of grasses and low herbs. Grazing 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.	
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, in particular Natterjack Toads, 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. Target set to Restore because forestry plantations, scrub and potentially also wider water abstraction and agricultural drainage are reducing water input to the dune system. See also comments for 'Water quantity/quality' attribute, below.	Clarke & Sanitwong na Ayutthaya (2010) Natural England (2014)
Supporting habitat: structure/ function	**Nutrient status**	Restore 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. Target set to Restore because dog-fouling is resulting in nutrient enrichment of dune grassland and slacks.	Natural England (2014)
Supporting habitat: structure/ function	**Scrub and tree cover**	Restore 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 supporting *P. ralfsii*.	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*. Target set to Restore because scrub has encroached a number of dune slacks.	Natural England (2014)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
Supporting habitat: structure/ function	**Soils, substrate and nutrient cycling**	Restore the properties of the underlying soil types, including structure, bulk density, total carbon, pH, soil nutrient status and fungal: bacterial ratio, within typical values for the supporting habitat.	Soil supports basic ecosystem function and is a vital part of the natural environment. Its properties strongly influence the colonisation, growth and distribution of those plant species which together form vegetation types, and therefore provides a habitat used by a wide range of organisms. Soil biodiversity has a vital role to recycle organic matter. Changes to natural soil properties may therefore affect the ecological structure, function and processes associated with the supporting habitat of this Annex II feature. Petalwort requires sparsely vegetated substrates with few competitors. Target set to Restore because dog-fouling is resulting in nutrient enrichment which encourages the vigorous growth of bulky vascular plants.	Plantlife (2006)
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 'Supporting and Explanatory Notes' for this attribute above in Table 1. Target set to Restore because a number of factors are limiting coastal dynamism on the site, principally coastal defences, forestry plantations and scrub encroachment (Natural England 2018), which restrict the movement of dune features and their ability to respond to environmental change.	Environment Agency (2017) Lymbery & Newton (2010) Mersey Forest (2013) Natural England (2014) Natural England (2015) Natural England (2018)
Supporting processes (on which the feature and/or its supporting habitat relies)	**Air quality**	Maintain or, where necessary, restore concentrations and deposition of air pollutants to at or below the site-relevant Critical Load or Level values given for this feature of the site on the Air Pollution Information System (www.apis.ac.uk).	See the 'Supporting and Explanatory Notes' for this attribute above in Table 1. Target set to Restore because current nitrogen exceeds the critical load for the 'moist to wet dune slacks' petalwort supporting habitat.	More information about site-relevant Critical Loads and Levels for this SAC is available by using the 'search by site' tool on the Air Pollution Information System (www.apis.ac.uk).
Supporting processes (on which the feature and/or its supporting habitat relies)	**Conservation measures**	Restore the management measures (either within and/or outside the site boundary as appropriate) which are necessary to Restore the structure, functions and supporting processes associated with the feature and/or its supporting	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	This attribute will be periodically monitored as part of Natural England's site condition assessments. English Nature (2005) Natural England (2014)

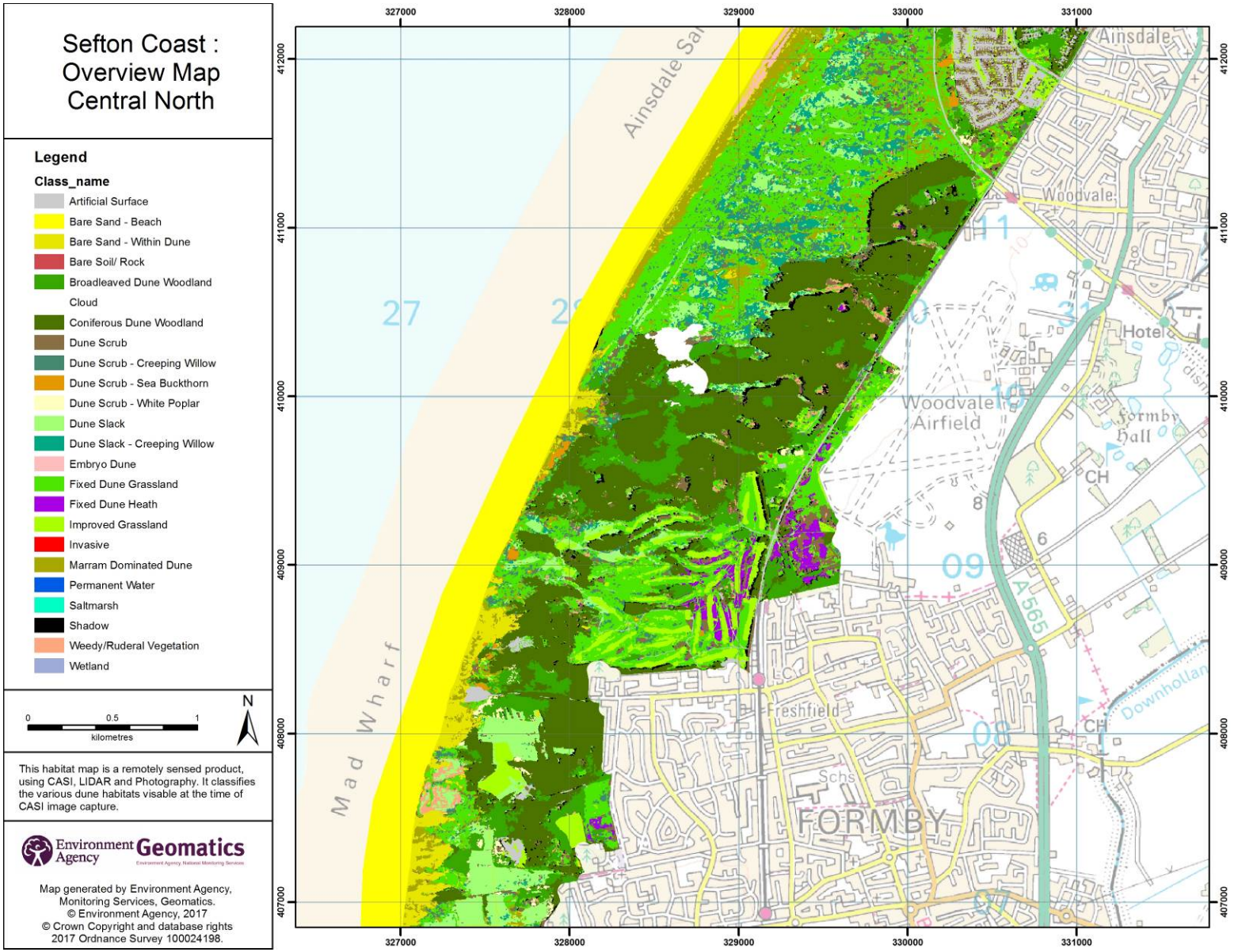
Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
		habitats.	management agreements. Mowing is currently used to prolong the length of time that early succession dune slacks provide suitable habitat for petalwort. Grazing is also used in some parts of the dunes to maintain open conditions and create small areas of bare ground. However, target set to Restore because slacks cannot be maintained in early successional states in the long term by cutting/grazing and more active intervention is required. A number of factors are limiting coastal dynamism on the site, principally coastal defences, forestry plantations and scrub encroachment (Natural England 2018), which restricts sand rain and movement of sediments. Both natural mechanisms of slack development (primary and secondary slacks) require significant sand movement. Digging/scraping can also be used to create new slacks or set back the succession in more mature slacks and is likely to be required to maintain the extent of early succession slack habitat at Sefton in the long term. The current levels of recreational use appear to be creating/maintaining suitable habitat for petalwort in some areas and may be spreading propagules around the site. However, disturbance can quickly become excessive and destroy petalwort habitat Access management may be required to maintain optimum levels on routes with important petalwort populations. Management measures are required to control dog fouling which is increasing nutrient levels on the site.	Plantlife (2016) Sefton Coast Life Project (1997)
Supporting processes (on which the feature and/or its supporting habitat relies)	**Disturbance from human activity**	Restore 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.	Natural England (2014)

Attributes		Targets	Supporting and Explanatory Notes	Sources of site-based evidence (where available)
			Recreational access is providing suitable habitat for petalwort in some areas. However, target set to Restore because dogs running/swimming in slacks are causing significant disturbance.	
Supporting processes (on which the feature and/or its supporting habitat relies)	**Water quantity/ quality**	Where the feature or its supporting habitat is dependent on surface water and/or groundwater, Restore water quality and quantity to a standard which provides the necessary conditions to support the feature.	For many SAC features which are dependent on wetland habitats supported by surface and/or ground water, maintaining the quality and quantity of water supply will be critical, especially at certain times of year. Poor water quality and inadequate quantities of water can adversely affect the structure and function of this habitat type. Typically, meeting the surface water and groundwater environmental standards set out by the Water Framework Directive (WFD 2000/60/EC) will also be sufficient to support the achievement of SAC Conservation Objectives but in some cases more stringent standards may be needed to reflect the ecological needs of the species feature. Further site-specific investigations may be required to establish appropriate water quality standards for the SAC. Most petalwort colonies are present in early succession slacks (Sefton Coast Life Project 1997). The hydrology of the dune system is not fully understood. Some investigations have been undertaken, but these have only examined limited areas e.g. Clarke & Sanitwong na Ayutthaya (2010). A detailed investigation of the hydrology of the whole site is required. Target set to Restore because forestry plantations are reducing water input to the dune system. In addition there are a number of water abstractions in the surrounding area and extensive agricultural drainage in the wider Alt / Crossens catchment, which may be affecting water supply to the dunes. Dog-fouling may be resulting in nutrient enrichment of the water in some slacks.	Clarke & Sanitwong na Ayutthaya (2010) Natural England (2014) Sefton Coast Life Project (1997)
Version Control Advice last updated: N/A				
Variations from national feature-framework of integrity-guidance: N/A				

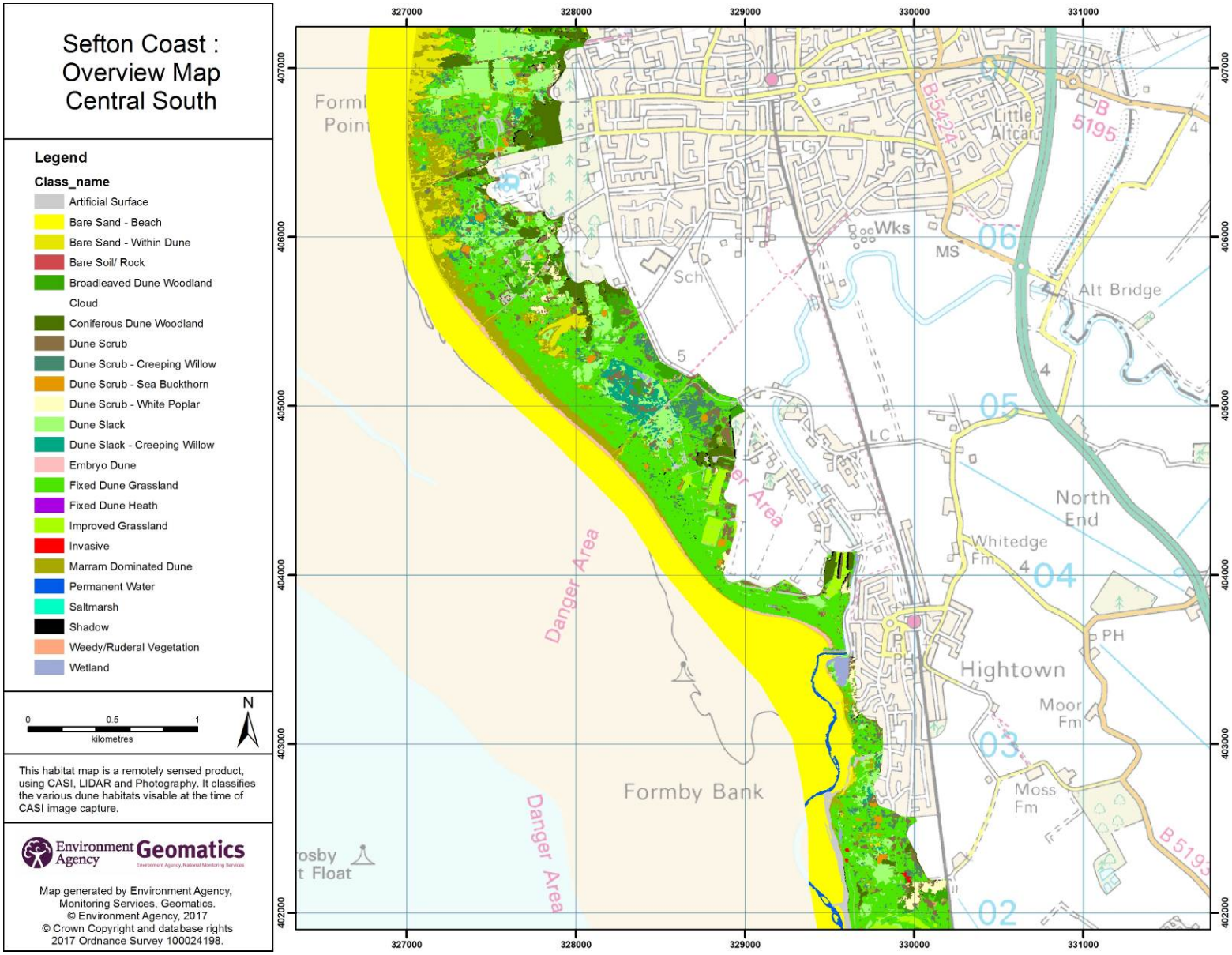
Annex 1: Habitat map of Sefton Coast derived from CASI imagery (Environment Agency 2017). The site is split across four separate maps running north to south. (Map 1 of 4)



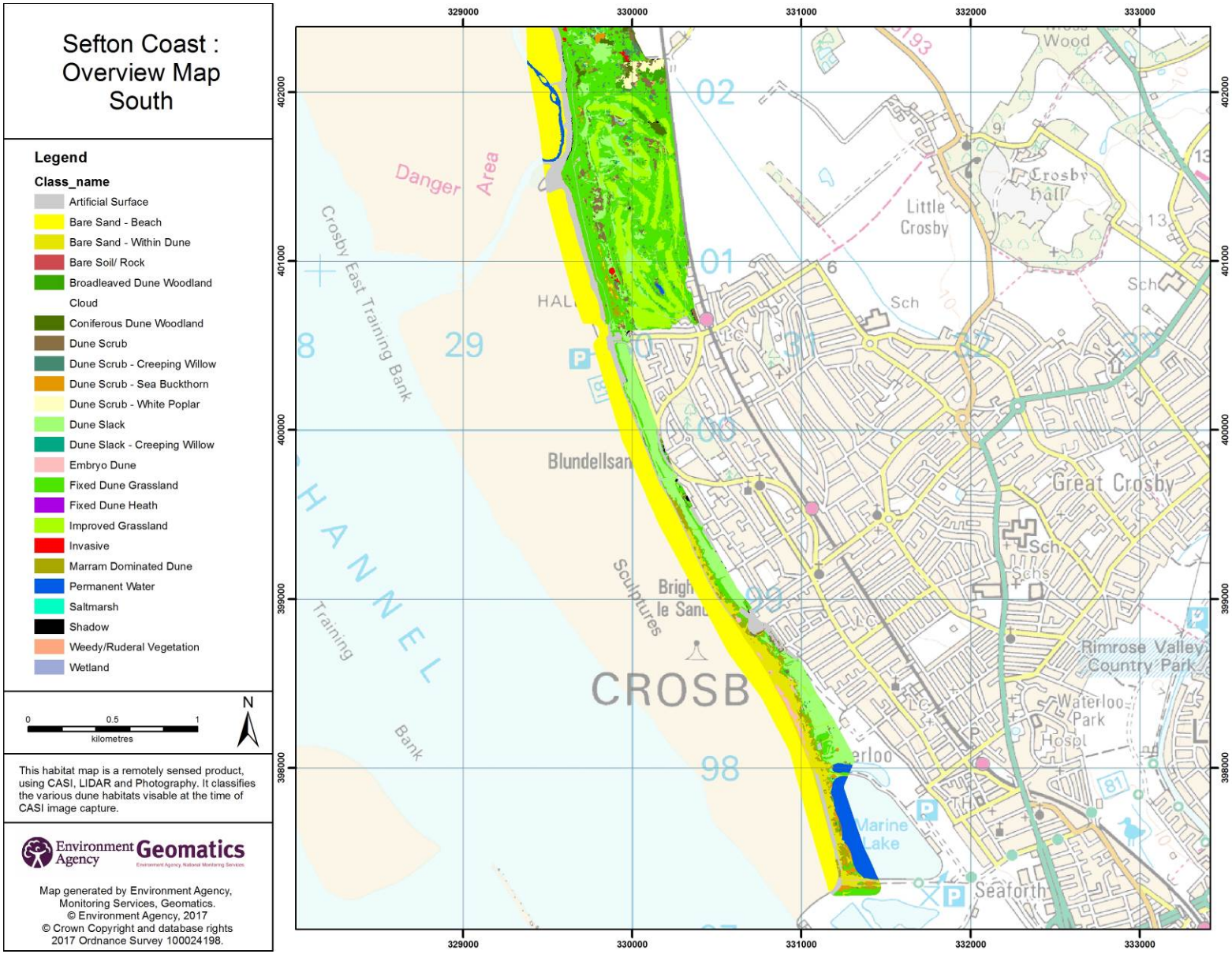
Annex 1: Habitat map of Sefton Coast derived from CASI imagery (Environment Agency 2017). The site is split across four separate maps running north to south. (Map 2 of 4)



Annex 1: **Habitat map of Sefton Coast derived from CASI imagery (Environment Agency 2017). The site is split across four separate maps running north to south. (Map 3 of 4)**



Annex 1: Habitat map of Sefton Coast derived from CASI imagery (Environment Agency 2017). The site is split across four separate maps running north to south. (Map 4 of 4)



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