

**Carrowmore Dunes SAC (site code 2250)
Conservation objectives supporting document
-coastal habitats**

NPWS

Version 1

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Please note that the opinions expressed in the site reports from the Coastal Monitoring Project are those of the authors and do not necessarily reflect the opinion or policy of NPWS.

Please note that this document should be read in conjunction with the following report: NPWS (2014). Conservation Objectives: Carrowmore Dunes SAC 002250. Version 1.0. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

1 Introduction

Achieving Favourable Conservation Status (FCS) is the overall objective to be reached for all Annex I habitat types and Annex II species of European Community interest listed in the Habitats Directive 92/43/EEC (Commission of the European Communities, 2007). It is defined in positive terms, such that a habitat type or species must be prospering and have good prospects of continuing to do so.

Carrowmore Dunes (referred to locally as Doonbeg dunes) are situated on the south-western coast of County Clare, approximately midway between Milltown Malbay and Kilkee. They extend from Carrowmore Point in the north to Doonbeg Bay in the south. A fine sandy beach (White Strand) merges into a cobble beach on the seaward side of a sand dune system. Exposed bedrock marks the northern and southern boundaries of the site. On the seaward side, the site extends for 500m from the shore to include the reefs in the shallow marine waters within Doughmore Bay. The geology of the site consists of Upper Carboniferous sandstone and shale.

The beach and bay, along with the areas of sand dunes, form Carrowmore Dunes SAC. Much of the dune system is occupied by a golf course, which is excluded from the designation. The fixed dunes are contained within two blocks of land located in the northwest and southwest sections of the site (see Appendix I). These two areas are connected by a strip of dunes that extends westwards into the sub-tidal zone from Doonbeg Bay in the south to Carrowmore Point in the north. Seaward, the site extends for 500m from the shore to include marine waters (Moorkens & Browne, 2011). The dunes in the SAC are managed as a golf course that was constructed in 2000.

Carrowmore Dunes SAC (site code: 2250) is designated for a range of habitats including sand dunes and reefs. The site has also been selected for the narrow mouthed whorl snail (*Vertigo angustior*), a species listed on Annex II of the EU Habitats Directive. It can be found in the fixed dune grassland and the damp areas around Carrowmore marsh to the east. The following three coastal habitats are included in the qualifying interests for the site (* denotes a priority habitat):

- Embryonic shifting dunes (2110)
- Shifting dunes along the shoreline with *Ammophila arenaria* (2120)
- Fixed coastal dunes with herbaceous vegetation (grey dunes) (2130)*

All of these habitats are associated with sand dune systems and are found in close association with each other. Annual vegetation of driftlines, perennial vegetation of stony banks and dune slacks were also recorded at this SAC site during the Coastal Monitoring Project (CMP) (Ryle *et al.*, 2009) and other surveys (Moorkens & Gaynor, 2000-2002; Moorkens & Browne, 2003; Moorkens, 2004-2011). The distribution of sand dune habitats within Carrowmore Dunes SAC is presented in Appendix I.

As part of the conditions attached to the planning permission for the development of the golf course, measures must be taken to ensure the protection of both the entire area of the SAC, as well as the habitat of the Annex II species, *Vertigo angustior*. Annual monitoring of the habitats and the *Vertigo* population has been on-going since 2000 (Moorkens & Gaynor, 2000-2002; Moorkens & Browne, 2003; Moorkens, 2004-2011). These reports have also been consulted in the development of the conservation objectives for the site.

This backing document sets out the conservation objectives for the three coastal habitats listed above in Carrowmore Dunes SAC, which is defined by a list of parameters, attributes and targets. The main parameters are (a) Range (b) Area and (c) Structure and Functions, the last of which is broken down into a number of attributes, including physical structure, vegetation structure and vegetation composition.

The targets set for the **sand dune habitats** are based primarily on the results of the Coastal Monitoring Project (CMP) (Ryle *et al.*, 2009) and this document should be read in conjunction with that report. As part of the Coastal Monitoring Project (CMP) detailed individual reports and habitat maps were produced for one sub-site (White Strand) and these are included in Appendix II at the end of this document.

The conservation objectives for the sand dune habitats in Carrowmore Dunes are based on the findings of the CMP, combined with the results of Gaynor (2008), as well as annual monitoring reports from the site (Moorkens & Gaynor, 2000-2002; Moorkens & Browne, 2003; Moorkens, 2004-2011).

It should be noted that Carrowmore Dunes are sometimes referred to in the literature as Doonbeg Dunes or White Strand Dunes.

2 Conservation Objectives

The conservation objective aims to define the favourable conservation condition of a habitat or species at a particular site. Implementation of these objectives will help to ensure that the habitat or species achieves favourable conservation status at a national level.

3 Sand dune habitats

Sand dunes are hills of wind blown sand that have become progressively more stabilised by a cover of vegetation. In general, most sites display a progression through strandline, foredunes, mobile dunes and fixed dunes. Where the sandy substrate is decalcified, fixed dunes may give way to dune heath. Wet hollows, or dune slacks, occur where the dunes have been eroded down to the level of the water-table. Machair is a specialised form of dune system that is only found on the northwest coasts of Ireland and Scotland. Transitional communities can occur between dune habitats and they may also form mosaics with each other. Dune systems are in a constant state of change and maintaining this natural dynamism is essential to ensure that all of the habitats present at a site achieve favourable conservation condition.

In Ireland, there are nine sand dune habitats (including annual vegetation of drift lines) listed under Annex I of the EU Habitats Directive (92/43/EEC) (* denotes a priority habitat):

- Annual vegetation of drift lines (1210)
- **Embryonic shifting dunes (2110)**
- **Shifting dunes along the shoreline with *Ammophila arenaria* (2120)**
- **Fixed coastal dunes with herbaceous vegetation (grey dunes) (2130) ***
- Decalcified dunes with *Empetrum nigrum* (2140) *
- Decalcified dune heath (2150) *
- Dunes with *Salix repens* (2170)
- Humid dune slacks (2190)
- Machair (21AO) *

Five dune habitats were recorded by Ryle *et al.* (2009) but only the three habitats indicated in bold above are listed as Qualifying Interests for Carrowmore Dunes SAC. These habitats include mobile areas at the front, as well as more stabilised parts of dune systems. Humid dune slacks and annual vegetation of driftlines were also recorded at the Whitestrand sub-site.

Annual vegetation of drift lines is found on beaches along the high tide mark, where tidal litter accumulates. It is dominated by a small number of annual species (i.e. plants that complete their life-cycle within a single season). Tidal litter contains the remains of marine algal and faunal material, as well as a quantity of seeds. Decaying detritus in the tidal litter releases nutrients into what would otherwise be a nutrient-poor environment. The habitat is often represented as patchy, fragmented stands of vegetation that are short-lived and subject to frequent re-working of the sediment. The vegetation is limited to a small number of highly specialised species that are capable of coping with salinity, wind exposure, an unstable substrate and lack of soil moisture. Typical species include spear-leaved orache (*Atriplex prostrata*), frosted orache (*A. laciniata*), sea rocket (*Cakile maritima*), sea sandwort (*Honckenya peploides*) and prickly saltwort (*Salsola kali*).

Embryonic dunes are low accumulations of sand that form above the strandline. They are sometimes referred to as foredunes, pioneer dunes or embryo dunes, as they can represent the primary stage of dune formation. They are characterised by the presence of the salt-tolerant dune grasses sand couch (*Elytrigia juncea*) and lyme grass (*Leymus arenarius*), which act as an impediment to airborne sand. Strandline species can remain a persistent element of the vegetation.

Where sand accumulation is more rapid, marram grass (*Ammophila arenaria*) invades, initiating the transition to mobile dunes (Shifting dunes along the shoreline with *Ammophila arenaria*). Marram growth is actively stimulated by sand accumulation. These unstable and mobile areas are sometimes referred to as 'yellow dunes' (or white dunes in some European countries), owing to the areas of bare sand visible between the tussocks of marram.

Fixed dunes refers to the more stabilised area of dune systems, generally located in the shelter of the mobile dune ridges, where the wind speed is reduced and the vegetation is removed from the influence of tidal inundation and salt spray. This leads to the development of a more or less closed or 'fixed' carpet of vegetation dominated by a range of sand-binding species (Gaynor, 2008).

All of the dune habitats indicated above occur as part of a complex mosaic of constantly changing and evolving vegetation communities. They are inextricably linked in terms of their ecological functioning and should be regarded as single geomorphological units. As such, no dune habitat should be considered in isolation from the other dune habitats present at a site, or the adjoining semi-natural habitats with which they often form important transitional communities.

The CMP surveyed one sub-site within Carrowmore Dunes SAC:

1. White Strand

Detailed descriptions from the Coastal Monitoring Project (CMP) (Ryle *et al.*, 2009) of each sand dune habitat found at White Strand are presented in Appendix II. The sub-site as surveyed by the CMP represents the total area of sand dunes within Carrowmore Dunes SAC.

3.1 Overall objectives

The overall objective for 'Embryonic shifting dunes' in Carrowmore Dunes SAC is to 'restore the favourable conservation condition'.

The overall objective for 'Shifting dunes along the shoreline with *Ammophila arenaria*' in Carrowmore Dunes SAC is to 'restore the favourable conservation condition'.

The overall objective for 'Fixed coastal dunes with herbaceous vegetation' in Carrowmore Dunes SAC is to 'restore the favourable conservation condition'.

These objectives are based on an assessment of the recorded condition of each habitat under a range of attributes and targets. The assessment is divided into three main headings (a) Area (b) Range and (c) Structure and Functions.

3.2 Area

3.2.1 Habitat extent

Habitat extent is a basic attribute to be assessed when determining the condition of a particular habitat. A baseline habitat map was produced for the sand dune habitats at the White Strand sub-site during the Coastal Monitoring Project (CMP) (Ryle *et al.*, 2009). This map is included with the individual site report in Appendix II.

The extent of the mobile dune habitat at White Strand was rated as unfavourable-inadequate during the CMP, as this habitat had eroded along much of the coastline (Ryle *et al.* 2009). However, as erosion is considered a natural process, it should have been assessed as a neutral impact rather than a negative one.

The extent of fixed dunes at White Strand was rated as unfavourable-bad by the CMP, owing to erosion that was compounded by removal of beach material in the past. However, this activity has not occurred at the site since 2000 (Ryle *et al.*, 2009; Moorkens & Gaynor, 2000-2002; Moorkens & Browne, 2003; Moorkens, 2004-2011) and erosion is a natural process, so the situation should not have been assessed so negatively for this attribute.

The total area of each sand dune habitat within Carrowmore (White Strand) Dunes, as estimated by Ryle *et al.* (2009), is presented in the first column of the following table. These figures were subsequently checked and adjusted to take into account some overlapping polygons and mapping errors. In addition, the CMP mapped the total dune resource at each sub-site and not all of the area mapped is contained within the SAC boundary. The adjusted figure for the total area as mapped by the CMP within the SAC is presented in the final column.

Habitat	Total area (ha) of habitat from CMP	Total area (ha) of habitat within SAC boundary
Embryonic shifting dunes	0.187	0.19
Shifting dunes along the shoreline with <i>Ammophila arenaria</i>	2.151	2.15
Fixed coastal dunes with herbaceous vegetation	12.005	10.46
Total	14.343	12.80

The general target for this attribute in the case of each habitat is that the area should be stable, or increasing. Bearing in mind that coastal systems are naturally dynamic and subject to change, this target is always assessed subject to natural processes, including erosion and succession.

3.3 Range

3.3.1 Habitat distribution

The distribution of sand dune habitats within Carrowmore Dunes SAC is presented in Appendix I.

There are two blocks of sand dune within the White Strand sub-site., one located in the northeast section of the site, the other in the southeast section of the site.

Embryonic dunes are present along the seaward side of the dune system, at the foot of tall *Ammophilla arenaria* shifting dunes. Due to the high exposure and retreating conditions of the west coast, typically these embryonic dunes are poorly developed.

Shifting dunes along the shoreline with *Ammophilla arenaria*, or marram dunes, occur on the seaward steeper slopes of the dunes above the beach and at the edges of blowouts.

Fixed dune habitat with herbaceous vegetation occupies the largest area within the dune system.

The target is that there should be no decline or change in the distribution of these habitats, unless it is the result of natural processes, including erosion, and succession.

3.4 Structure and Functions

The location, character and dynamic behaviour of sand dunes are governed by a combination of geographic, climatic, edaphic and anthropogenic factors. Sand dunes are highly complex, dynamic systems, where the habitats occur in a complex and constantly evolving and changing mosaic. They function as systems in terms of geomorphology and hydrology and maintaining the favourable conservation condition of the habitats present depends on allowing these processes to continue unhindered. Maintaining the favourable conservation condition of all of the sand dune habitats in Carrowmore Dunes SAC in terms of structure and functions depends on a range of attributes for which targets have been set as outlined below.

3.4.1 Physical structure: functionality and sediment supply

Coastlines naturally undergo a constant cycle of erosion and accretion. There are two main causes of erosion: (a) those resulting from natural causes and (b) those resulting from human interference. Natural causes include the continual tendency towards a state of equilibrium between coasts and environmental forces, climatic change (particularly an increase in the frequency of storms or a shift in storm tracks), relative sea level rise and natural changes in the sediment supply. Human interference is usually associated with changes in the sediment budget, either directly, through the removal of beach or inshore sediment, or indirectly, by impeding or altering sediment movement. It is important to recognise that the process of coastal erosion is part of a natural tendency towards equilibrium. Natural shorelines attempt to absorb the energy entering the coastal zone by redistributing sediment.

Dunes are naturally dynamic systems that require continuous supply and circulation of sand. Sediment supply is especially important in the embryonic dunes and mobile dunes, as well as the strandline communities where accumulation of organic matter in tidal litter is essential for trapping sand and initiating dune formation. The construction of physical barriers such as sea defences can interrupt longshore drift, leading to beach starvation and increased rates of erosion. Sediment circulation and erosion also has a role to play in the more stabilised dune habitats. Cycles of erosion and stabilisation are part of a naturally functioning dune system, where the creation of new bare areas allows pioneer species and vegetation communities to develop, increasing biodiversity. The construction of physical barriers can interfere with the sediment circulation by cutting the dunes off from the beach resulting in fossilisation or over-stabilisation of dunes.

Soft protection measures have been installed over the years with various degrees of success. The first 'soft' erosion protection measures were implemented at Doonbeg Golf Club in 2001 and consisted of two rows of sand trap fencing at the toe (bottom) of the dunes. These were washed away by a storm within weeks of completion. Since then a series of soft coastal protection measures have been installed along parts of the dunes in front of areas of the golf course that are prone to erosion. These measures have been effective along the southern end of the beach where embryo dune development has occurred. However, along the central part of the beach they have been largely ineffective from protecting the dunes from damage by average annual storms and significant storm events. Soft protection measures are absent from the front of the north and south high dune sections within the SAC. There are plans in place for more effective protection from storm activity, but these have yet to be implemented (Moorkens, 2011).

The target for this attribute is to maintain the natural circulation of sediment and organic matter throughout the entire dune system, without any physical obstructions.

3.4.2 Vegetation structure: zonation

The range of vegetation zones on a dune system should be maintained. Gaynor (2008) highlights the highly transitional nature of much of the vegetation; therefore, it is important that the transitional communities are also conserved.

Carrowmore Dunes supports a range of dune habitats including dune slacks and annual vegetation of driftlines in addition to the qualifying interests of fixed dunes, mobile dunes and embryo dunes. Carrowmore Dunes is also intrinsically connected to a significant wetland zone known as Carrowmore Marsh, which is located to the east of the site, inland from the golf course.

The target is to maintain the range of coastal habitats, including transitional zones, subject to natural processes, including erosion and succession.

3.4.3 Vegetation structure: bare ground

This target only applies to fixed dunes. It does not apply to the other habitats present where high levels of bare sand are a natural component of the habitat (e.g. mobile dunes). In the fixed and slack areas some degree of instability is vital. Constant cycles of erosion and stabilisation provide the necessary conditions for the establishment of pioneer species and species that favour open conditions including invertebrates, helping to increase biodiversity.

The target is to achieve up to 10% bare sand. This target is assessed subject to natural processes.

3.4.4 Vegetation structure: vegetation height

This attribute applies to the fixed dunes, where a varied vegetation structure is important for maintaining species diversity and is particularly important for invertebrates and birds. The ecological benefits of moderate levels of grazing on dunes have been well documented (Gaynor, 2008). Moderate grazing regimes lead to the development of a species-rich vegetation cover. The animals increase biodiversity by creating micro-habitats through their grazing, dunging and trampling activities. Grazing slows down successional processes and in some cases reverses them, helping to achieve a diverse and dynamic landscape. The effects of trampling assist the internal movement of sand through the development of small-scale blowouts, while dunging can eutrophicate those dune habitats whose nutrient-poor status is crucial for the survival of certain vegetation types. Many species, from plants to invertebrates, benefit immensely from the open and diverse system created by a sustainable grazing regime. Many dune species are small in size and have relatively low competitive ability. Consequently, the maintenance of high species diversity on a dune system is dependent on the existence of some control to limit the growth of rank coarse vegetation (Gaynor, 2008).

Prior to 2000, the dunes at White Strand had been damaged by summer and winter grazing, as well as the introduction of supplementary feed over the winter period (Bleasdale, 1998). A controlled annual grazing regime was re-introduced in 2002, whereby cattle are allowed on site for a short period in the spring and autumn only. This moderate grazing regime includes feeding protein nuts to the cattle to encourage them to seek out more roughage and hence undertake more widespread grazing.

The target for this attribute is to maintain structural variation within the sward.

3.4.5 Vegetation composition: plant health of dune grasses

This attribute applies to foredunes and mobile dunes, where blowing sand is a natural feature. The health of the dune grasses (particularly *Ammophila arenaria* and *Elytrigia juncea*) is assessed by the plant parts above the ground (they should be green) and the presence of flowering heads. This gives a clear indication of the status of the supply of blown sand, which is required for these species to thrive.

The target for this attribute is that more than 95% of the dune grasses should be healthy.

3.4.6 Vegetation composition: typical species & sub-communities

Species diversity and plant distribution in dunes is strongly controlled by a range of factors, including mobility of the substrate, grazing intensities, moisture gradients, nutrient gradients and human disturbance. In the younger, more mobile dunes, marram (*Ammophila arenaria*) is common, while groundsel (*Senecio vulgaris*), sea rocket (*Cakile maritima*) and dandelion (*Taraxacum* sp.) are also present. The fixed, more stable dune vegetation includes lady's bedstraw (*Galium verum*), common birdsfoot trefoil (*Lotus corniculatus*), wild thyme (*Thymus praecox*), kidney vetch (*Anthyllis vulneraria*), wild pansy (*Viola tricolor*) and biting stonecrop (*Sedum acre*). The White Strand sub-site supports a characteristic dune flora, details of which can be found in the site report from the CMP (Ryle *et al.*, 2009) (which is included in Appendix II) as well as other reports (Moorkens & Gaynor, 2000-2002; Moorkens & Browne, 2003; Moorkens, 2004-2011).

Mountain pansy (*Viola lutea*) occurs frequently within the fixed dunes at Doonbeg, both within the SAC and in the adjacent golf course and is considered an indicator of local distinctiveness. This species is a perennial herb of grazed grassland on hill slopes and banks and on rock ledges. Although it is usually found on calcareous rocks, it is a mild calcifuge and prefers leached soils, but avoids very acidic sites. It has been recorded at only five sites in the West of Ireland mostly in County Clare and all on coastal dunes (Preston *et al.*, 2002).

The target for this attribute is to maintain a typical flora for the particular sand dune habitat.

3.4.7 Vegetation composition: negative indicator species

Negative indicators include non-native species (e.g. *Hippophae rhamnoides*), species indicative of changes in nutrient status (e.g. *Urtica dioica*) and species not considered characteristic of the habitat. Sea-buckthorn (*Hippophae rhamnoides*) should be absent or effectively controlled.

The main invasive species identified in Gaynor (2008) were bracken (*Pteridium aquilinum*) and sea buckthorn (*Hippophae rhamnoides*). The invasion of non-native species compromises the typical plant community structure. Bracken (*Pteridium aquilinum*) is becoming increasingly dominant, particularly where sites have been abandoned or where grazing levels have been significantly reduced. The vegetation retains many elements of the original vegetation cover, but there is a reduction in biodiversity. As the canopy becomes taller and ranker, many of the low-growing species disappear. In this case, the vegetation is treated as a sub-community of the original community that was invaded. This is always the case unless the original vegetation cover has been completely destroyed, as can happen with *H. rhamnoides*, which can form dense impenetrable thickets.

Neither Bracken (*Pteridium aquilinum*), nor buckthorn (*Hippophae rhamnoides*) has been recorded from the White Strand sub-site (Ryle *et al.*, 2009). The negative indicator species ragwort (*Senecio jacobaea*) occurs occasionally in the fixed dune (Ryle *et al.*, 2009).

The target is that negative indicators (including non-native species) should represent less than 5% of the vegetation cover.

3.4.8 Vegetation composition: scrub/trees

This attribute only applies to the fixed dunes. Scrub encroachment leads to reduction in dune biodiversity and needs to be controlled. The presence of scrub and trees which have deep roots can also lower the groundwater table which can have significant impacts on the slack communities.

The target for this attribute therefore is that the cover of scrub and tree species should be under control or represent no more than 5% of the vegetation cover.

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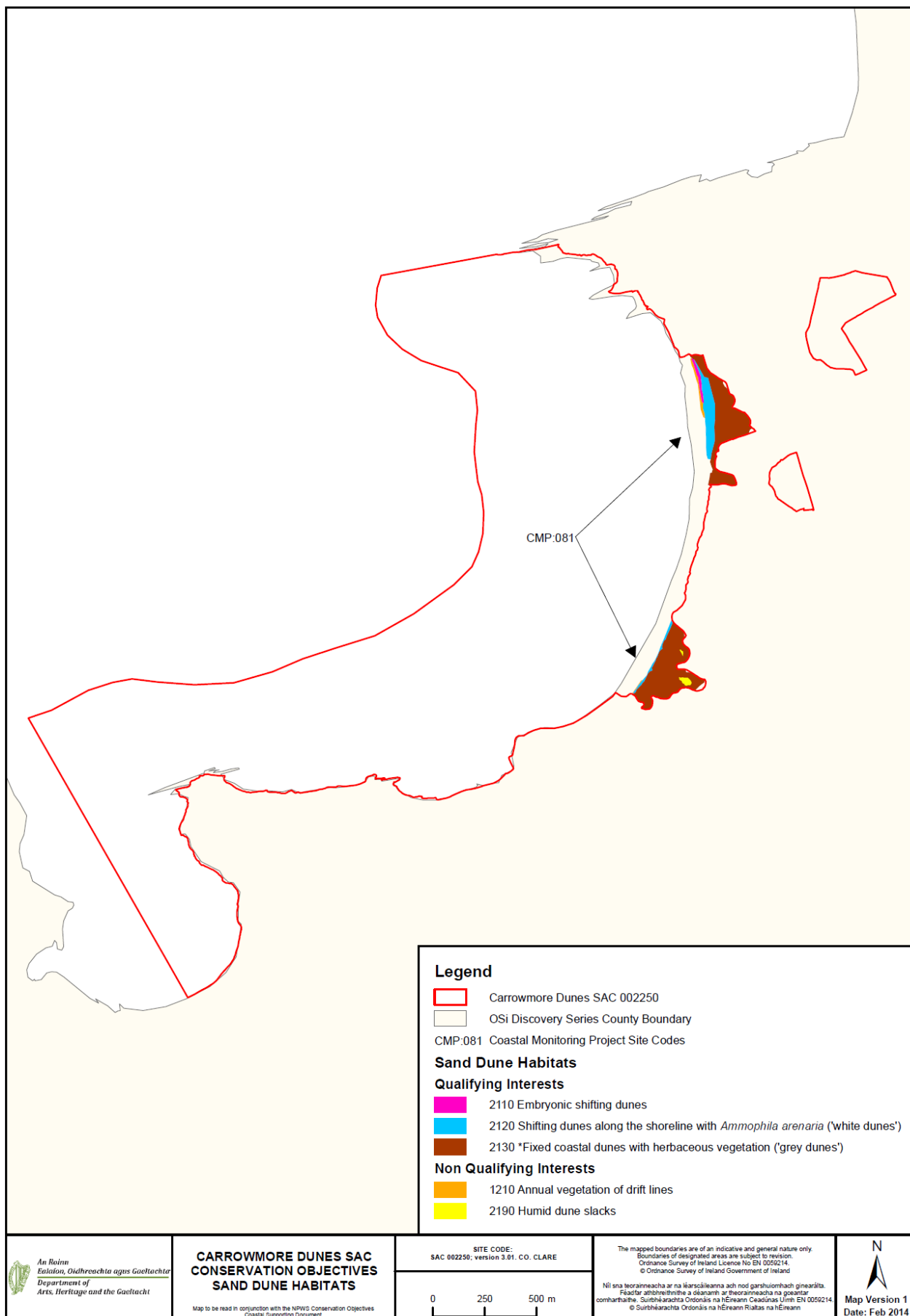
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Appendix I –Distribution map of sand dune habitats within Carrowmore Dunes SAC



Appendix II – White Strand site report and habitat map from the CMP (Ryle *et al.* 2009)

SITE DETAILS

CMP06 site name: **White Strand** CMP06 site code: **081** CMP Map No.: **80**

County: **Clare** Discovery map: **57** Grid Reference: **Q 991 684**

6 inch Map No.: **Cl 38 & 47**

Aerial photographs (2000 series): **O 4429D;O 4488B,C,D**

NPWS Site Name: **Carrowmore Dunes**

NPWS designation: pNHA: **1040** cSAC: **1040**

Other Designation: **Blue Flag 2006**

Ranger Area: **South**

MPSU Plan: **Draft II – 2000**

Report Author: **Anne Murray**

SITE DESCRIPTION

Carrowmore dunes cSAC is located at White Strand in Doughmore Bay, approximately three kilometres northeast of Doonbeg village, County Clare. The site is also known locally as Doonbeg. The EU Annex I sand dune habitats for which the site is designated are Fixed dunes (priority habitat), Mobile dunes and Embryonic dunes. The site has been described in the Conservation Plan as the best sand dune system in Clare. The SAC is also designated for Reefs. Other habitats within the site are freshwater marsh and reedbeds. This SAC is designated for the Annex II species of snail – *Vertigo angustior*.

The EU Annex I sand dune habitats recorded at Carrowmore dunes during this survey include Fixed dunes (priority habitat), Dune slack, Mobile dunes, Embryonic dunes and Annual vegetation of driftlines. A total area of 15ha of sand dune habitat was mapped at White Strand.

The fixed dunes have been subject to agricultural pressure in the past and more recently have been modified by the development of a golf course and associated amenities by Irish National Golf Club Ltd. The golf course occupies approximately 50ha of sand dune habitat (Table 81A). Two areas of fixed dunes remain within the cSAC.

Table 81A Areas of EU Annex I habitats mapped at Whitestrand

<i>EU Code</i>	<i>EU Habitat</i>	Area (ha)
H1210	Annual vegetation of driftlines	0.288
H2110	Embryonic shifting dunes	0.187
H2120	Shifting dunes along the shoreline with <i>Ammophila arenaria</i>	2.151
H2130	Fixed coastal dunes with herbaceous vegetation	12.005
H2190	Humid Dune Slacks	0.234
	1.1.1 Total Sand dune	14.865

Fixed Dunes (H2130)

The remaining fixed dune habitat (excluding the golf course) comprises 12ha of the total sand dune habitat at White Strand. Overall the fixed dunes are rank and dominated by *Ammophila arenaria* (Marram grass) and *Festuca rubra* (Red fescue) in the north of the site as this area consists of high ridges of predominantly semi-fixed dune habitat. The area of fixed dune in the south is generally a short sward that is lightly grazed.

The typical fixed dune species include the following: *Anthyllis vulneraria* (Kidney vetch), *Arrhenatherum elatius* (False oat-grass), *Carex arenaria* (Sand sedge), *Cerastium fontanum* (Common mouse-ear), *Daucus carota* (Wild carrot), *Festuca rubra* (Red fescue), *Galium verum* (Lady's bedstraw), *Hypochaeris radicata* (Cat's ear), *Linum catharticum* (Fairy flax), *Luzula campestris* (Field wood-rush), *Lotus corniculatus* (Bird's-foot trefoil), *Odontites verna* (Red bartsia), *Plantago lanceolata* (Ribwort plantain), *Poa pratensis* (Smooth meadow-grass), *Taraxacum* agg. (Dandelion), *Trifolium repens* (White clover) and the moss *Rhytidiadelphus squarrosus*.

Other species present in the fixed dune are: *Achillea millefolium* (Yarrow), *Ammophila arenaria* (Marram grass), *Angelica sylvestris* (Wild angelica), and mosses *Eurhynchium praelongum*, *Calliergonella cuspidata* and *Brachythecium* spp.

The negative indicator species *Senecio jacobaea* (Common ragwort) occurs in the fixed dune but is rare.

The fixed dune habitat was described in a study to assess the scientific interest of the dunes at White Strand (Bleasdale, 1998). Quadrats were placed along four transects that traversed the dunes perpendicular to the coastline. Overall, the results indicated that the diversity of species was poor at the site. This was attributed to agricultural intensification and sand extraction -

large areas of the dunes have been removed from the site to provide flat areas of grassland for grazing. The central part of the dune system was identified as the area most damaged by agricultural activities. In 1999 a large part of the dune system was excluded from the cSAC due to its poor condition. The possibility of restoring the damaged areas was investigated by NPWS and it was concluded that this was not feasible and would probably fail.

The excluded area was developed as a golf course in 2000. In order to try to ensure that the management of the golf course does not adversely impact on the cSAC, NPWS secured binding conditions in the planning permission, as granted by Clare County Council. This included the implementation of a monitoring programme to ensure that the activities of the golf course would not adversely affect the population of *Vertigo angustior* and the fixed dunes.

The physical presence of the golf course has impacted negatively on the functioning of the sand dune as an entire system and replaced the historical negative impacts of the agricultural management of the excluded part of this system. This is most notable at the centre of the system where the golf course extends right out to the frontline. Given the fact that this system is retreating the golf course should have been located well back from the seaward edge.

As part of the conservation management of the dunes it was recommended that cattle graze the dunes within the cSAC from August to January. Currently they are grazed for two weeks of the year. An electric fence runs along the top of the mobile dunes to limit the livestock during grazing periods. The vegetation is trimmed either side of this fence to ensure that the fence is not earthed. However, the presence and maintenance of this fenceline on the mobile ridge may impact negatively on the integrity of this habitat. It may be prudent to position the fence further back from the mobile area on to a more stable and sheltered part of the dunes and resort to non- electric fencing to avoid trimming of vegetation.

Dune Slacks (H2190)

Two dune slacks covering 0.2ha in area are located in the southern part of the cSAC. The larger dune slack has a high cover of fixed dune grasses and this may be a result of undergrazing. These wet dune slacks are dominated by *Carex nigra* (Common sedge).

However, a dune slack comprising 2ha in area located in the north of White Strand outside the cSAC, has been modified by the golf course.

The typical species that occur in the slacks are: *Carex arenaria* (Sand sedge), *Carex nigra* (Common sedge), *Hydrocotyle vulgaris* (Marsh pennywort), *Juncus articulatus* (Jointed rush), *Potentilla anserina* (Silverweed), *Prunella vulgaris* (Selfheal) and *Calliergonella cuspidata*. Other species present in the slacks include: *Agrostis stolonifera* (Creeping bent), *Arrhenatherum elatius* (False oat-grass), *Carex flacca* (Glaucous sedge), *Festuca rubra* (Red fescue), *Poa pratensis* (Smooth meadow-grass), *Potentilla palustris* (Marsh cinquefoil) and *Trifolium repens* (White clover). There were no negative indicator species present in the dune slacks during this survey.

Mobile Dunes (H2120)

The mobile dune habitat occurs as a narrow band fronting the fixed dune and comprises just over 2ha in area (Table 81A). It is confined to the northern end of the site where there is a small area of building dune from recycled sand. There is very little mobile dune remaining along the centre and southern end where the sand dunes are eroding. The mobile dunes have been impacted historically by agricultural activities and currently by ongoing natural erosion. The remaining mobile dune habitat may be impacted in the future by the activities of the golf course, if the installation of hard coastal protection is permitted in the area outside of, but adjacent to the cSAC.

The typical species *Ammophila arenaria* (Marram grass) dominates with *Elytrigia juncea* (Sand couch) and *Tussilago farfara* (Colt's-foot) also present in the mobile dunes. There were no negative indicator species present.

Embryonic Dunes (H2110)

This habitat fronts the mobile dunes in the northern part of the site. The total area of embryonic dunes is just under 0.2ha (Table 81A). The typical species *Elytrigia juncea* (Sand couch) dominates and *Cakile maritima* (Sea rocket) is also present. No negative indicator species were recorded in the embryonic dunes.

Annual Strandline (H1210)

The annual strandline comprises a very small area 0.3ha of the sand dune habitat (Table 81A). This habitat occurs along a limited area of accretion in the north of the site. The dominant typical species is *Cakile maritima* (Sea rocket) with some *Elytrigia juncea* (Sand couch). There were no negative indicator species in the strandline.

IMPACTS

The main activities impacting on the sand dunes at White Strand are given in Table 81B. The impact of low-level grazing (code 140), as part of the implementation of the conservation plan for the golf course, has generally been positive throughout the dunes. According to the Annual conservation report for the golf course (Moorkens and Gaynor, 2002), there appears to be an increase in species diversity in the fixed dunes. However, maintenance of the electric fencing installed to contain livestock is posing a threat to the mobile dunes. Damage to the vegetation by mechanical trimming and the inappropriate positioning of the fencing within the mobile dunes can be addressed, as discussed earlier.

Table 81B Intensity and impact of various activities on sand dune habitats at White Strand

<i>EU Habitat Code</i> ¹	<i>Activity Code</i> ²	<i>Intensity</i> ³	<i>Impact</i> ⁴	<i>Area affected/ha</i>	<i>Location of Activity</i> ⁵
H2130	140	B	+1	9	Inside
H2130	601	A	-2	50	Outside
H2190	601	B	-2	2	Outside
H2130	720	C	-1	0.2	Inside
H2130	871	A	-1	Unknown	Inside/Outside
H2130	900	C	0	5	Inside
H2120	900	C	0	2	Inside
H2110	900	C	0	0.2	Inside
H1210	900	C	0	0.2	Inside

¹EU Codes as per Interpretation Manual. Code 21BB is an additional code used to signify the entire dune habitat.

²Description of activity codes are found in Appendix 3

³Intensity of the influence of an activity is rated as: A= high, B = medium, C = low influence and D = unknown.

⁴Impact is rated as: -2 = irreparable negative influence, -1 = repairable negative influence, 0 = neutral, +1 = natural positive influence and +2 = strongly managed positive influence

⁵Location of activity: Inside = activities recorded within and directly impacting the sand dune habitat. Outside = activities recorded outside but adjacent to sand dune habitat that are impacting

Historically the site has been heavily impacted by agricultural activities and the areas most affected have been excluded from the cSAC. This excluded area has been developed as a golf course and the activities of the course are concentrated outside of the designated site. However, the coastal protection works (code 871) along the frontline of the golf course may be affecting the dynamics of this sand dune system. While the soft protection works such as

the chestnut paling may be helping to accrete sand in front of the golf course it may be starving other areas of the frontline of the limited sediment circulating within the system, most notably the mobile habitat in the south of the cSAC. Therefore, although the coastal protection is positioned outside of the site, the impact of the activity is considered to be occurring both inside and outside of the site. The area of sand dune habitat affected is unknown as the protection works have been installed recently.

Dune contouring and Marram planting was noted fronting the 14th green, this green has been unwisely positioned on a high dune ridge that is currently eroding. The efforts to protect this have failed and the sea has taken most of the Marram and undermined the underlying structure of the rock/cobble. It is likely that this area will continue to erode as the coastline retreats.

There is evidence of natural erosion (code 900) along the seaward edge of the sand dunes caused by winter storms. This has affected the mobile and fixed dunes.

Recreational use of the beach and sand dunes has not been considered a problem at White Strand in previous reports. The sea here is known to be dangerous for swimmers and the access points are few and unsigned. It is a popular surfing beach. However, with the development of the golf course, hotel and holiday homes adjacent to the site, it is likely that recreational pressure on the beach and dunes will increase. Locals have commented recently on the impact of recreational use, especially ‘dune surfing’ (code 720) on blowouts in the fixed dune adjacent to the car park and access point in the southern part of the site.

It is difficult to determine the impacts on the small area of annual strandline and embryonic dune, as the former is ephemeral and the embryonic habitat naturally contains a high percentage of bare sand. It is apparent that natural erosion (code 900) is affecting these habitats, this is implied by the absence of these habitats along most of the frontline.

2 CONSERVATION STATUS

The conservation status of a site is assessed on the condition of the site and on baseline information. The main sources of baseline information for this site are the ASI and NATURA

2000 surveys. The quadrat information from the study of White Strand by Bleasdale (1998) and the annual conservation reports for the golf course (Moorkens and Gaynor) are also used.

The method of assessment of conservation status differed in NATURA 2000 and so no direct comparisons between the conservation status of the two surveys is possible. The conservation status of the Annex I sand dune habitats in White Strand are given in Table 81C.

Fixed Dunes (H2130)

The extent of fixed dunes is rated as *unfavourable-bad* (Table 81C). This is attributed to the recent loss of a large area of fixed dunes through the development of the golf course (1997) at White Strand. The golf course covers approximately 50ha of fixed dune. This rating is also attributable to the erosion of the fixed dunes mainly towards the southern part of the site, as a result of the removal of beach material in the past.

TABLE 81C CONSERVATION STATUS OF ANNEX I SAND DUNE HABITATS AT WHITE STRAND

HABITAT ¹	EU Conservation Status Assessment			Overall EU conservation status assessment	Proposed Irish conservation status system ²
	FAVOURABLE	Unfavourable - Inadequate	Unfavourable - Bad		
FIXED DUNES (H2130)	Future prospects	Structure and functions	Extent	Unfavourable - bad	Partially destroyed
DUNE SLACK (H2190)	Structure and functions/	Future prospects	Extent	Unfavourable - bad	Partially destroyed
MOBILE DUNES (H2120)		Extent/ Structure and functions	Future prospects	Unfavourable - inadequate	Unfavourable-unchanged
ANNUAL VEGETATION OF STRANGLINES (H1210)	Extent/ Structure and functions/ Future prospects			Favourable	Favourable - maintained

¹EU Codes as per Interpretation Manual

²Ratings are Favourable (Enhanced, Maintained, Recovered, Declining), Unfavourable (Recovering, Unchanged, Declining) and Destroyed (Partially destroyed, Completely destroyed and Unknown)

TABLE 81D PASS/FAIL RESULTS OF MONITORING STOPS FOR ANNEX I SAND DUNE HABITATS AT WHITE STRAND

HABITAT	Monitoring stops		Conservation status
	Pass	Fail	
FIXED DUNES (H2130)	7	1	Unfavourable-inadequate
MOBILE DUNES (H2120)	4	1	Unfavourable-inadequate
ANNUAL VEGETATION OF DRIFTLINES (H1210)	2	0	Favourable

The structure and functions parameter is rated as *unfavourable-inadequate*. A total of 8 monitoring stops were placed in the fixed dunes and one of these failed (Table 81D). The stop that failed is located in an area near the golf course at the centre of the site. The stop failed due to lack of typical species and the tall sward dominated by *Ammophila arenaria* (Marram grass). The assessment criteria used for the monitoring stops of this survey were applied to the data contained in eight relevés located in the cSAC as part of the annual conservation monitoring program 2002. All of these relevés passed the monitoring stop assessment. The attribute of sward height failed to reach its target in two of these in the southern part of the cSAC, reflecting the need for grazing. Comparisons between this annual report and previous ones indicate that the habitat is not declining in condition and this is reaffirmed in this current survey. Overall, considering the history of damaging agricultural activities at this site, the remaining fixed dune habitat is functioning well. A review of the grazing regime especially in the southern section of the site would be advisable.

The future prospects for this site are considered *favourable* on the basis that the site is currently managed for the conservation of the dunes and the rare snail *Vertigo angustior*. An annual conservation report is produced by NPWS as part of the binding conditions of the planning permission for the golf course. This may help to highlight any changes and management issues in the future. The main threat to the future of the habitat is the natural retreat of the coastline and the way in which this is managed by the golf course. It is unlikely that a 'do nothing' strategy will be adopted by the golf course.

The conservation status of the fixed dune was described as *excellent* in the NATURA 2000 survey. The current overall EU conservation status of fixed dunes at White Strand is *unfavourable-bad* (Table 81C). This reflects the damaging activities of the recent past that has resulted in some loss of extent and poor quality of this habitat. However, with management plans in place, this situation should improve at the next reporting cycle.

The Irish conservation status is rated as *partially destroyed*.

Dune Slacks (H2190)

The extent is rated as *unfavourable-bad*. This poor rating is due to the loss of dune slack habitat (2ha) through the development of the golf course. The remaining dune slacks occur in the southern part of the site. These slacks appear intact overall.

The structure and functions parameter is rated as *favourable*. Two monitoring stops were placed in dune slacks and both passed (Table 81D). One monitoring stop was placed in each dune slack. The monitoring stop in the larger of the slacks failed to pass two of its attributes - typical species and the ratio of forbs to grasses. This is attributable to past agricultural impacts in the past and to the current lack of grazing of this habitat.

The future prospects for dune slack are considered *unfavourable-inadequate*. Although, the site is currently managed for the conservation of the dunes and the rare snail *Vertigo angustior*, the dune slacks are declining in quality. The results of this survey indicate that grazing is required, in order, to conserve the dune slacks. An annual conservation report is produced by NPWS as part of the binding conditions of the planning permission for the golf course. The aim of this report is to indicate any changes in habitat condition and aid appropriate conservation management of the habitat.

The conservation status of this habitat was not assessed in the NATURA 2000 survey. The current overall EU conservation status of dune slack at White Strand is *unfavourable-bad* (Table 81C).

The Irish conservation status is rated as *partially destroyed*.

Mobile Dunes (H2120)

The extent is rated as *unfavourable-inadequate* (Table 81C). This is based on best scientific judgement as there is no previous information on the extent of this habitat. The mobile dunes have been eroded away along much of the coastline at White Strand and even though it is largely attributable to natural erosion it has been compounded by the removal of beach material. This damaging activity has left the mobile dunes exposed to winter storms.

The structure and functions parameter is rated as *unfavourable-inadequate*. A total of 5 monitoring stops were placed in the mobile dunes and one of these failed (Table 81D). This stop is located in the southern part of the cSAC. The mobile habitat in the northern part of the site is more intact and functioning well. There is no mobile dune habitat along the seaward edge of the golf course.

The future prospects for this site are considered *unfavourable-inadequate*. The remaining mobile dune habitat is very fragmented and susceptible to increasing natural erosion. If the golf course continues to attempt to shift the dynamics of the sediment circulation to protect their sections of the frontline, the mobile habitat of the cSAC may suffer.

The conservation status of the mobile dunes was described as *good* in the NATURA 2000 survey. Currently, the overall EU conservation status of mobile dunes at White Strand is *unfavourable-inadequate* (Table 81C). This rating is attributable to natural coastal erosion compounded by human activities at this site.

The Irish conservation status is rated as *unfavourable-unchanged*.

Embryonic Dunes (H2110)

The habitat is not differentiated from the mobile dunes on the cSAC map for this site. The conservation status of the embryonic dunes is described as *good* in the NATURA 2000 survey which estimates an area of 2.4ha for embryonic dunes.

Although it is typical in the west for embryonic dunes not to develop to a significant extent there is only a fragmented patch of the embryonic dune in the northern part of the site, 0.2ha in area. Therefore, there is no conservation status assessment for this habitat at this site.

Annual Strandline (H1210)








The extent is rated as *favourable*. Although the habitat is absent along most of the coastline this is mainly due to the unstable beach environment caused by current natural erosion that is not considered unfavourable. There is a small stretch of strandline vegetation in the northern part of the site. This assessment is based on best scientific judgement as this habitat is ephemeral. There is no information is available from previous reports.

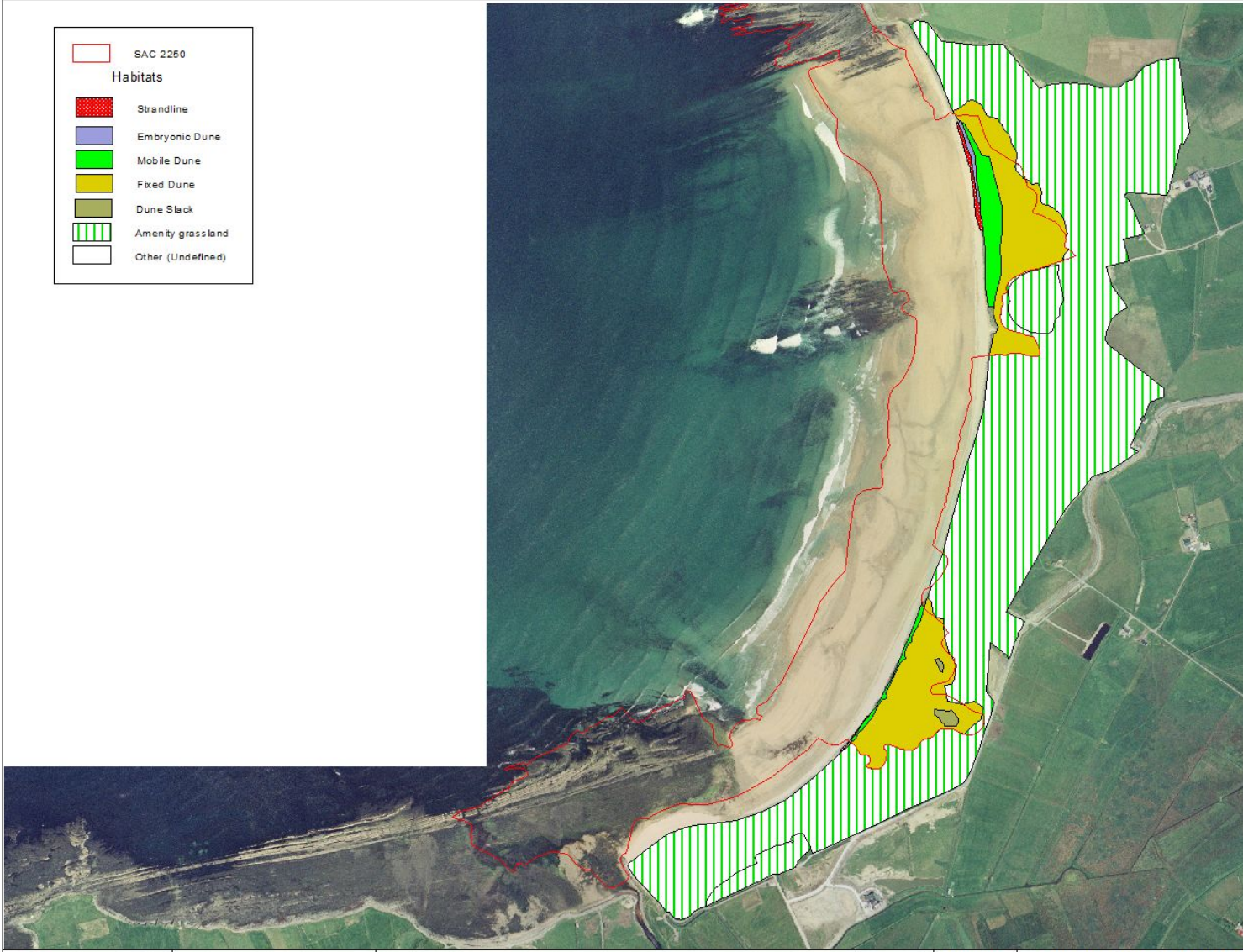
The structure and functions parameter is rated as *favourable* (Table 81D). Two monitoring stops were placed in the narrow band of strandline and these passed based upon the presence of the annual species *Cakile maritima* (Sea rocket).

The future prospects for this habitat is considered *favourable*. The strandline habitat is very fragmented and susceptible to increasing natural erosion but there are no activities affecting the habitat. The beach is cleaned manually which is a good management strategy for the strandline as mechanical cleaning would adversely affect this habitat.

The conservation status of the annual strandline habitat was not assessed in the NATURA 2000 survey. The assessment of the EU conservation status of a habitat that is ephemeral in nature is not exact. The total area of the strandline will vary from year to year and its location may also shift in response to coastal processes. However, it is apparent that the habitat is affected by natural erosion. The overall EU conservation assessment is considered *favourable*.

The Irish conservation status is *favourable-maintained*.

- SAC 2250
- Habitats
-  Strandline
 -  Embryonic Dune
 -  Mobile Dune
 -  Fixed Dune
 -  Dune Slack
 -  Amenity grassland
 -  Other (Undefined)



 <p>Comhaltas, Oifigeann agus Foireas Árainn Buidéanna, Heidege agus Teall Gúineanna National Parks and Wildlife Service</p>	<p>Coastal Monitoring Project 2004-2006</p>	<p>Whitestrاند</p>	<p>CMP code: 081</p>	<p>0 100 200 300 400 500 Meters</p> 	<p>Date of production: 25/11/2008 Map version: 1</p>	<p>Original Drawing Size: 297 x 420 (A3) Scale 1:16644</p>	
		<p>Carrowmore Dunes (SAC 2250)</p>	<p><small>This habitat map was created with a combination of fieldwork, GPS and interpretation of aerial photos. Boundaries of designated areas are subject to revision. Produced from Ordnance Survey material by permission of the Government (Permit number 5963)</small></p>				