NPWS

Inagh River Estuary SAC
(site code: 000036)

Conservation objectives supporting document- Coastal habitats

Version 1

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Contents

Please note that the opinions expressed in the site reports from the Saltmarsh Monitoring Project (SMP) and Coastal Monitoring Project (CMP) 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 (2017) Conservation Objectives: Inagh River Estuary SAC 000036. Version 1.0. National Parks and Wildlife Service, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs.

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 (European Commission, 2013). 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.

Inagh River Estuary SAC includes the estuaries of both the Inagh and Dealagh Rivers, extending from Ennistimon town westwards to the sea at Liscannor Bay, in south-west Co. Clare. These estuarine channels meander through a wide, flat valley, which is sheltered from the sea by an extensive sand dune system. The soils vary from gleys to peats (NPWS, 2013).

A range of habitats occurs within the SAC, from coastal sand dunes, estuarine channels and associated saltmarsh habitat, to freshwater and terrestrial habitats further inland. Two small areas of deciduous woodland are found further inland towards Ennistimon; a wet woodland and a narrow band of dry deciduous woodland (NPWS, 2013).

Sand dune systems occur on both sides of the mouth of the Inagh Estuary. The most extensive area of sand dune occurs on the southern side of the estuary, overlying a sand spit that partially encloses the estuary (Ryle *et al*., 2009).

Inagh River Estuary SAC (site code: 000036) is selected for saltmarsh and sand dune habitats. The following five coastal habitats are included in the list of Qualifying Interests for the SAC (* denotes a priority habitat):

1310	*Salicornia* and other annuals colonising mud and sand
1330	Atlantic salt meadows (Glauco-Puccinellietalia maritimae)
1410	Mediterranean salt meadows (Juncetaliea maritimi)
2120	Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes)
2130	Fixed coastal dunes with herbaceous vegetation (grey dunes)*

The first three habitats are saltmarsh habitats and the last two occur within sand dune systems. All five of these habitats are usually found in close association with each other.

The distribution of saltmarsh habitats within Inagh River Estuary SAC is presented in Appendix I and that of sand dune habitats in Appendix II.

2 Conservation Objectives

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

This supporting document sets out the conservation objectives for the five coastal habitats listed above in Inagh River Estuary SAC, which are 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 **saltmarsh habitats** are based primarily on the results of the Saltmarsh Monitoring Project (McCorry, 2007; McCorry and Ryle, 2009) and this document should be read in conjunction with those reports.

The Saltmarsh Monitoring Project (SMP) surveyed, mapped and assessed a single sub-site associated with Inagh River Estuary SAC (McCorry, 2007):

Lahinch (SMP site ID: SMP0008)

The distribution of saltmarsh habitats within Inagh River Estuary SAC is presented in Appendix I. As part of the SMP, a detailed individual report and habitat maps were produced for each sub-site surveyed and those produced for Lahinch are included in Appendix III.

The conservation objectives for the saltmarsh habitats in Inagh River Estuary SAC are based primarily on the findings of the SMP at this sub-site. Almost the entire Lahinch saltmarsh habitat is located within Inagh River Estuary SAC. It is important to note however, that further unsurveyed areas may be present within the SAC.

The targets set for the **sand dune habitats** are based primarily on the results of the Coastal Monitoring Project (Ryle *et al*., 2009) and this document should be read in conjunction with that report.

The Coastal Monitoring Project (CMP) surveyed, mapped and assessed a single sub-site associated with Inagh River Estuary SAC (Ryle *et al*., 2009):

Lahinch (CMP site ID: 085)

The distribution of sand dune habitats within Inagh River Estuary SAC is presented in Appendix II. As part of the CMP, a detailed individual report and habitat map were produced for the Lahinch sub-site and these are included in Appendix IV at the end of this document.

The conservation objectives for the sand dune habitats in Inagh River Estuary SAC are based on the findings of the CMP, combined with the results of Gaynor (2008). It is thought that the sub-site as surveyed by the CMP represents the entire area of sand dunes within Inagh River Estuary SAC.

3 Saltmarsh habitats

Saltmarshes are stands of vegetation that occur along sheltered coasts, mainly on mud or sand, and are flooded periodically by the sea. They are restricted to the area between mid-neap tide level and high water spring tide level. In Ireland, there are four saltmarsh habitats listed under Annex I of the EU Habitats Directive (92/43/EEC):

- ***Salicornia* and other annuals colonising mud and sand (1310)**
- **Atlantic salt meadows (Glauco-Puccinellietalia maritimae) (1330)**
- **Mediterranean salt meadows (Juncetalia maritimi) (1410)**
- Mediterranean and thermo-Atlantic halophilous scrubs (Sarcocornetea fruticosi) (1420)

The first three habitats, indicated in bold, are listed as Qualifying Interests for Inagh River Estuary SAC. The last habitat is restricted in its distribution to sites in the south-east of the country.

The SMP surveyed, mapped and assessed the following saltmarsh sub-site associated with Inagh River Estuary SAC (McCorry, 2007):

Lahinch (SMP site ID: SMP0008; see Appendix III)

This sub-site supports estuary type saltmarsh that is underlain by mud and sand (McCorry, 2007). Saltmarsh occurs along the tidal section of the Inagh River valley. The dominant type of saltmarsh present is Mediterranean Salt Meadows (MSM) with Atlantic Salt Meadows (ASM) also frequent. *Salicornia* mud and sandflats also occur in places, with glassworts (*Salicornia* spp.) extending out onto the intertidal sands.

The distribution of saltmarsh habitats within Inagh River Estuary SAC is presented in Appendix I.

3.1 Overall Objectives

The overall objective for '*Salicornia* and other annuals colonising mud and sand' in Inagh River Estuary SAC is to '*restore the favourable conservation condition*'.

The overall objective for **'**Atlantic salt meadows (Glauco-Puccinellietalia maritimae)' in Inagh River Estuary SAC is to '*restore the favourable conservation condition*'.

The overall objective for 'Mediterranean salt meadows (Juncetalia maritimi)' in Inagh River Estuary 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 area

Habitat extent is a basic attribute to be assessed when determining the condition of a particular habitat. The target is that there is no decrease from the baseline which was established by McCorry (2007). Bearing in mind that coastal systems are naturally dynamic and subject to change, this target is assessed subject to natural processes, including erosion and succession.

Saltmarsh is mainly situated along the two river channels with the largest sections occurring between Lahinch Golf Course and the Inagh River, and in the south-west of the central section between the two river channels (McCorry, 2007).

A baseline habitat map of all known saltmarsh in the Lahinch sub-site was produced based on the findings of the SMP (McCorry, 2007) and is presented in Appendix III**.** A total of 113.84ha of saltmarsh habitat was mapped by the SMP within the boundary of Inagh River Estuary SAC.

The total areas of each saltmarsh habitat within the Lahinch sub-site and the total area of each habitat within Inagh River Estuary SAC as mapped by the SMP are presented in the following tables. When calculating the areas, where a polygon was identified as a mosaic of ASM and MSM habitats, the area was divided 50:50 between each habitat.

There are a number of differences in the figures below. Most of the differences can be explained by the fact that the SMP mapped the total saltmarsh resource and not all of the saltmarsh mapped is contained within the SAC boundary. In addition, the total area within the SAC can be greater than that given in the SMP as the area figures were subsequently checked and adjusted to take into account some overlapping polygons and mapping anomalies.

Sub-site	**Total area (ha) of *Salicornia* mudflats (including mosaics) from SMP**	**Total area (ha) of *Salicornia* mudflats within SAC boundary (including mosaics)**
Lahinch	0.21	0.22

The actual area of *Salicornia* mudflats habitat may be underestimated somewhat as not all the salt pans that contained this habitat were mapped. Many of these were quite small but cumulatively may cover 0.1-0.5ha (McCorry, 2007).

Sub-site	**Total area (ha) of ASM (including mosaics) from SMP**	**Total area (ha) of ASM within SAC boundary (including mosaics)**
Lahinch	49.97	49.47

Sub-site	**Total area (ha) of MSM (including mosaics) from SMP**	**Total area (ha) of MSM within SAC boundary (including mosaics)**
Lahinch	56.71	64.15

The target is that the area of each saltmarsh habitat should be stable or increasing, subject to natural processes, including erosion and succession.

3.3 Range

3.3.1 Habitat distribution

Saltmarsh occurs along tidal sections of the river channels. The saltmarsh is likely to have been more extensive in the past. The 6 inch map indicates that the tide flows much higher upstream than the extent of the saltmarsh recorded during the SMP (McCorry, 2007).

Salicornia mudflats habitat is located on the western side of the Inagh River channel. The SMP noted that this area was in transition as there had been fairly recent shifts in the river channel at the time of the survey. An old channel was silted up and was dry. The SMP concluded that with further accretion this habitat was likely to disappear in the near future as it transitioned to lower saltmarsh vegetation dominated by common saltmarsh-grass (*Puccinellia maritima*). A similar area was present further south, but saltmarsh succession was more progressed (McCorry, 2007).

The SMP noted that the extent of *Salicornia* mud and sandflats habitat is transient, with patches of *Salicornia* appearing for several years in recently accreted areas and then disappearing due to succession to lower saltmarsh vegetation. Patches of *Salicornia* mud and sandflats habitat were also present in some of the salt pans of the ASM (McCorry, 2007).

The Atlantic salt meadows habitat is mainly situated along the two river channels with the largest sections between the Lahinch Golf Course and the Inagh River and in the south-west of the central section between the two river channels (McCorry, 2007).

There are large expanses of MSM habitat in the north-east part of the site that are quite uniform, with a very dense cover (up to 100%) of sea rush (*Juncus maritimus*). In other areas, the cover of sea rush is lower and the vegetation is more diverse with other species, particularly grasses and white clover (*Trifolium repens*) becoming more abundant. In the south-west area, there is a mosaic between the ASM and MSM. This area contains assorted clumps of sea rush interspersed with ASM vegetation (McCorry, 2007).

The distribution of each saltmarsh habitat within Inagh River Estuary SAC can be found in Appendix I.

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

3.4 Structure and Functions

The location, character and dynamic behaviour of saltmarshes are governed by sediment supply, tidal regime, wind-wave climate and sea level change. The slope of the saltmarsh allows the development of several ecological gradients such as tidal submergence and salinity, and this influences the development of distinctive zones of halophytic and salt-tolerant plant communities.

Maintaining the favourable conservation condition of the saltmarsh habitat in Inagh River Estuary SAC in terms of its structure and functions depends on a range of attributes for which targets have been set as outlined below.

3.4.1 Physical structure: sediment supply

Accretion and erosion are natural elements of saltmarsh systems. Maintaining the sediment supply is vital for the continued development and natural functioning of a saltmarsh system. Interruption to the sediment circulation through physical structures can starve the system and lead to accelerated erosion rates.

Natural erosion and accretion is occurring along the Inagh River. The main channel has shifted its position, particularly in the north-west section where it joins the Dealagh River. Minor channels that cut off parts of the saltmarsh and created islands in the channel have also changed significantly between 1930-2006 when comparing the 6 inch map and the 2000 aerial photos. Several old 'islands' are now connected to the main saltmarsh and the channels are in-filled or are becoming smaller and now act as creeks. Erosion and accretion is dependent on whether the saltmarsh is situated on inside (accretion) or the outside (erosion) of a meander in the river. During the SMP, accretion was recorded as occurring on the eastern side of the channel in the southwest section. There is some re-colonisation along an older saltmarsh cliff. The western side is being eroded. Accretion then switches to the western side further north as the channel changes direction. Natural erosion and accretion in the channels are generally in balance (McCorry, 2007).

The target is to maintain, or where necessary restore, the natural circulation of sediment and organic matter, without any physical obstructions.

3.4.2 Physical structure: creeks and pans

Saltmarshes can contain a distinctive topography with an intricate network of creeks and pans occurring on medium to large-sized sites. Creek density is influenced by vegetation cover, sediment supply and tidal influence. Creeks absorb tidal energy and assist with delivery of sediment into the saltmarsh. The efficiency of this process depends on creek pattern. Creeks allow pioneer vegetation to become established along their banks higher up into the saltmarsh system. Major erosion of saltmarsh is indicated by internal dissection and enlargement of the drainage network, ultimately leading to the creation of mud basins.

Parts of the recorded saltmarsh area at Inagh River Estuary SAC have been subject to drainage and land improvement activity, particularly the north-eastern section and south of the Inagh River channel in Dough Townland. These activities occurred before the 1930s and are likely to have had a significant impact on the saltmarsh habitats, particularly on the creek structure and functions. This drainage is still probably having a residual impact on the saltmarsh, but it has recovered to some extent and the functionality of the creeks is recovering. Some of the deeper drains are likely to have been cleaned or deepened during the intervening period (McCorry, 2007).

The salt pan structure is relatively well-developed and some of the pans contain patches of pioneer glassworts (*Salicornia* spp.) that can be classed as mudflats (McCorry, 2007).

The ASM generally has a complicated topography and the creeks and salt pans are well-developed, although some creeks have been modified or affected by old drainage works. Some of these creeks are recovering their function. The creeks are quite meandering. Some of the salt pans are quite large. Some of the pans are bare and contain exposed muddy sediment. Some of the pans contain lower saltmarsh plant communities dominated by common saltmarsh-grass (*Puccinellia maritima*). There are also frequent low mounds and wide shallow hollows, and some old banks on the ASM probably relate to old river channels (McCorry, 2007).

There is also a well-developed creek and pan structure in the MSM habitat. This habitat is situated in the area significantly affected by the old drainage works in the north-east section. These drains cut across the creeks and pans that originally were in the saltmarsh. Many of the creeks have recovered and are functioning again. However, some of them have in-filled as the larger drains are still functional. Some of the drains have also partly in-filled with MSM vegetation. The remaining open parts of drains act as salt pans and pools. Parallel groups of pans and pools are visible on the aerial photograph (McCorry, 2007).

The target is to maintain creek and pan networks where they exist and to restore areas that have been altered.

3.4.3 Physical structure: flooding regime

The regular ebb and flow of the tide brings salinity, but also nutrients, organic matter and sediment, which are central to the development, growth and indeed survival of saltmarshes. Saltmarsh vegetation consists of a limited number of halophytic (salt-tolerant) species that are adapted to regular immersion by the tides. Species in the lowest part of the saltmarsh require regular inundation, while those higher up on the marsh can only tolerate occasional inundation.

Two areas upstream on both sides of the Inagh River (in Dough and Lissaturna) were embanked with attempts at land improvement in association with drainage. The embankments have since been breached and are eroding. Both these areas now contain a range of brackish, freshwater marsh, wet grassland and dry grassland habitats but were likely to have contained some saltmarsh in the past (McCorry, 2007).

As mentioned previously, much of the MSM saltmarsh has been modified in the past by drainage works.

The target is to maintain a flooding regime whereby the lowest levels of the saltmarsh are flooded daily, while the upper levels are flooded occasionally (e.g. highest spring tides).

3.4.4 Vegetation structure: zonation

Saltmarshes are naturally dynamic coastal systems. In order to ensure the ecological functioning of all of the saltmarsh habitats, it is vital to maintain the zonations and transitions to other habitats, including intertidal, shingle and sand dune habitats.

Thin bands of lower zone saltmarsh are situated on the eastern side of the Inagh River on more recently accreted sediment banks. There are also frequent low mounds and wide shallow hollows, and some old banks on the ASM probably related to old river channels (McCorry, 2007).

The ASM area to the west of the Inagh River has a more complicated structure with lower shallow hollows containing saltmarsh vegetation and transitioning into dry coastal grassland that develops on higher mounds. Some of these smaller patches of dry coastal grassland may be mapped within the ASM area due to the complicated topography (McCorry, 2007).

Several different ASM vegetation communities are present and zonation is present depending on elevation. The most notable transitions of ASM to other habitats are the transitions to fixed dune or disturbed coastal grassland. There is also internal zonation of saltmarsh plant communities along the edges of the creeks and pans. Bands of ASM are present along the creeks in the MSM dominated areas (McCorry, 2007).

Species such as long-bracted sedge (*Carex extensa*), autumn hawkbit (*Leontodon autumnalis*) and white clover (*Trifolium repens*) appear in the upper saltmarsh zones, particularly in the transition from ASM to dry coastal grassland and in the mosaic areas with MSM. This transition is dominated by species such as silverweed (*Potentilla anserina*) and creeping bent-grass (*Agrostis stolonifera*). The relative abundance of white clover may be an indicator of agricultural enrichment probably from long-term cattle grazing. This area is not likely to have been fertilised (McCorry, 2007).

There is also significant internal zonation of saltmarsh vegetation along the edges of creeks and salt pans. Bands of pioneer and lower saltmarsh vegetation are situated along these creeks and pans. These zones generally contain the most badly poached areas. An interesting mosaic of mid and mid-upper saltmarsh zones is situated to the west of the Inagh River channel. This area contains small mounds with upper saltmarsh vegetation (saltmarsh rush (*Juncus gerardii*)/red fescue (*Festuca rubra*) dominated) interspersed between shallow hollows containing the mid-saltmarsh vegetation (sea pink (*Armeria maritima*)/sea plantain (*Plantago maritima*) dominated). Atlantic salt meadow is also present in ASM/MSM mosaic areas. These areas have clumps of sea rush (*Juncus maritimus*) scattered through the ASM and either habitat may be dominant (McCorry, 2007).

Different vegetation zones are not particularly evident in the MSM habitat, as it is generally defined by the presence of sea rush (*Juncus maritimus*). However, plant community zonation is evident where the MSM transitions to terrestrial habitats along slopes. Here narrow strips of ASM vegetation, characterised by the absence of sea rush and dominated by the grasses, are positioned alongside the creeks and drains (McCorry, 2007).

The central area contains more elevated land where terrestrial habitats have developed (wet grassland, dry acid grassland, wet heath and gorse (*Ulex europaea*) scrub). These areas were formerly enclosures. This has led to the development of interesting mosaics of MSM and terrestrial vegetation. Thin bands of MSM are situated in lower drainage channels between some of these higher patches of land. There are transitions from MSM to wet grassland dominated by purple moor-grass (*Molinia caerulea*), with frequent tufted hair-grass (*Deschampsia caespitosia*), devil's-bit scabious (*Succisa pratensis*), tormentil (*Potentilla erecta*) and sweet vernal-grass (*Anthoxanthum odoratum*). An interesting transitional habitat co-dominated by purple moor-grass and sea rush (*Juncus maritimus*), which also contains occasional marsh pennywort (*Hydrocotyle vulgaris*) and frequent parsley water-dropwort (*Oenanthe lachenalii*), is present (McCorry, 2007).

Common reed (*Phragmites australis*) appears in some places, particularly along some of the larger drains in the north-east section. One hypothesis put forward is that much of MSM habitat containing

these transitional species is situated at an elevation that only allows several tidal inundations a year (perhaps less inundation on this habitat compared to other sites) (McCorry, 2007).

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

3.4.5 Vegetation structure: vegetation height

A varied vegetation structure is important for maintaining species diversity and is particularly important for invertebrates and birds. Grazing is often used as a tool for maintaining structural diversity in the sward but stocking levels need to be appropriate. Overgrazing can lead to loss of species and destruction of the vegetation cover, while undergrazing can lead to a loss of plant diversity due to competitive exclusion.

At the time of survey, the sward height of the ASM was generally low (1-2cm) due to cattle grazing. However, there were patches within the ASM/MSM mosaic and in the MSM dominated areas that had a higher general sward height (5-10cm) (McCorry, 2007).

The grazing is generally low in the MSM habitat, although cattle do graze in these areas and sometimes cause some heavy localised poaching (McCorry, 2007).

The target is to maintain structural variation within the sward. A general guideline is that there should be a sward ratio of 30% tall: 70% short across the entire saltmarsh.

3.4.6 Vegetation structure: vegetation cover

Vegetation cover can have a major effect on saltmarsh development by reducing the velocity of the tide and thereby enhancing the deposition of sediment. Excessive bare mud, however, is often a sign of overuse by livestock or humans and can lead to destabilisation and accelerated erosion of the system.

As mentioned above, cattle graze both the ASM and MSM at Lahinch. They also cross the river and graze the saltmarsh to the west and south-west of the Inagh River. Grazing levels are variable and are generally low-moderate (McCorry, 2007). Cattle are causing some poaching of the saltmarsh. There are small local areas of heavy poaching at some locations in both habitats. Some enclosures on the saltmarsh are moderately-heavily poached and the MSM is tussocky (McCorry, 2007).

The lower saltmarsh zone, which is situated around the edge of creeks and pans, is dominated by common saltmarsh-grass and is generally the most damaged from poaching (this is particularly seen in the ASM to the west of the Inagh River) (McCorry, 2007).

At the time of the SMP, the recorded stocking rates and management practises were causing poaching damage in some of the ASM and MSM but the damaged areas only affected between 10-20% of the habitat extent (McCorry, 2007).

While poaching may help the development of pioneer species by disturbance of the mud basins, after the glassworts (*Salicornia* spp.) and other species have grown, cattle trample the plants and poaching disturbs this habitat and uproots the glassworts (*Salicornia* spp.) (McCorry, 2007).

The target is to maintain 90% of the area outside of the creeks vegetated.

3.4.7 Vegetation composition: typical species and sub-communities

Saltmarshes contain several distinct zones that are related to elevation and frequency of flooding. The lowest part along the tidal zone is generally dominated by the most halophytic (salt-tolerant) species including common saltmarsh-grass (*Puccinellia maritima*) and species more usually associated with *Salicornia* muds. The mid-marsh zone is generally characterised by thrift (*Armeria maritima*), sea plantain (*Plantago maritima*) and sea aster (*Aster tripolium*). This mid-zone vegetation generally grades into an herbaceous community in the upper marsh, dominated by red fescue (*Festuca rubra*), sea milkwort (*Glaux maritima*) and saltmarsh rush (*Juncus gerardii*).

Below are lists of typical species for the different saltmarsh zones, although some of these species have a restricted distribution nationally and may not occur in the Inagh River Estuary SAC area.

Typical species

Lower marsh	Low-mid marsh	Mid-upper marsh
Salicornia spp.	*Puccinellia maritima*	*Festuca rubra*
Suaeda maritima	*Triglochin maritima*	*Juncus gerardii*
Puccinellia maritima	*Plantago maritima*	*Armeria maritima*
Aster tripolium	*Atriplex portulacoides*	*Agrostis stolonifera*
	Aster tripolium	*Limonium humile*
	Spergularia spp.	*Glaux maritima*
	Suaeda maritima	*Seriphidium maritimum*
	Salicornia spp.	*Juncus maritimus*
	Glaux maritima	*Triglochin maritima*
	Turf fucoids	*Blysmus rufus*
		Eleocharis uniglumis
		Leontodon autumnalis
		Carex flacca
		Carex extensa
		Turf fucoids

In Inagh River Estuary SAC, the central part of the *Salicornia* mudflats area is colonised by glassworts (*Salicornia* spp.) on muddy sand. There is occasional annual sea-blite (*Suaeda maritima*) and common saltmarsh-grass (*Puccinellia maritima*) plants in these areas (McCorry, 2007).

The lower saltmarsh community is dominated by common saltmarsh-grass (*Puccinellia maritima*) and contains frequent sea milkwort (*Glaux maritima*), sea-spurrey species (*Spergularia* spp.) and glassworts (*Salicornia* spp.), as well as occasional thrift (*Armeria maritima*) and annual sea-blite (*Suaeda maritima*). This is a good example of how transient the *Salicornia*-dominated habitat is and how quickly it transitions to other saltmarsh habitats (McCorry, 2007).

The vegetation of ASM areas consists of mid and mid-upper saltmarsh plant communities. The mid-upper saltmarsh is dominated by saltmarsh rush (*Juncus gerardii*) and red fescue (*Festuca rubra*), with frequent sea plantain (*Plantago maritima*). Common scurvygrass (*Cochlearia officinalis*) is also

present. Clumps of sea rush (*Juncus maritimus*) are occasionally present and may be locally frequent (McCorry, 2007).

A mid-marsh zone is dominated by a typical low sward community of thrift (*Armeria maritima*) and sea plantain (*Plantago maritima*) with sea milkwort (*Glaux maritima*), sea arrowgrass (*Triglochin maritimum*), red fescue (*Festuca rubra*) and sea aster (*Aster tripolium*) (McCorry, 2007).

Species such as long-bracted sedge (*Carex extensa*), autumn hawkbit (*Leontodon autumnalis*) and white clover (*Trifolium repens*) appear in the upper saltmarsh zones, particularly in the transition to dry coastal grassland and in the mosaic areas with MSM. This transition is dominated by species such as silverweed (*Potentilla anserina*) and creeping bent-grass (*Agrostis stolonifera*) (McCorry, 2007).

While not found during the SMP, there is a previous record for lax-flowered sea lavender (*Limonium humile*) at this site, which is not found very often along the Irish west coast (Preston *et al*., 2002).

The MSM habitat is generally dominated by a dense cover of sea rush (*Juncus maritimus*). Other species typically present include creeping bent-grass (*Agrostis stolonifera*), red fescue (*Festuca rubra*), saltmarsh rush (*Juncus gerardii*), white clover (*Trifolium repens*), sea plantain (*Plantago maritima*), autumn hawkbit (*Leontodon autumnalis*), sea arrowgrass (*Triglochin maritimum*), common scurvygrass (*Cochlearia officinalis*), sea aster (*Aster tripolium*), thrift (*Armeria maritima*), sea milkwort (*Glaux maritima*), silverweed (*Potentilla anserina*) and parsley water-dropwort (*Oenanthe lachenalii*). Spear-leaved orache (*Atriplex prostrata*) is present in some of the pans (McCorry, 2007).

There are also several patches of sea club-rush (*Bolboschoenus maritimus*), grey club-rush (*Schoenoplectus tabernaemontani*) and common reed (*Phragmites australis*) positioned in several pools, at the end of some long meandering creeks. These indicate a transition to more brackish conditions or up-welling of freshwater at these locations. Patches of yellow flag (*Iris pseudacorus*) and purple loosestrife (*Lythrum salicaria*) occur along parts of the terrestrial boundary south of the track through the central section (McCorry, 2007).

The target for this attribute is to ensure that a typical flora of saltmarshes is maintained, as are the range of sub-communities within the different zones.

3.4.8 Vegetation composition: negative indicator species

The only invasive and non-native species recorded on saltmarshes during the SMP was common cordgrass (*Spartina anglica*) (McCorry, 2007; McCorry and Ryle, 2009).

Common cordgrass (*Spartina anglica*) was not recorded at this site during the SMP (McCorry, 2007).

The aim is that negative indicators, such as common cordgrass (*Spartina anglica*), should be absent or under control. The current target for this particular SAC is that common cordgrass should not be allowed to establish.

4 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. 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* (white dunes) (2120)**
- **Fixed coastal dunes with herbaceous vegetation (grey dunes) (2130) ***
- Decalcified dunes with *Empetrum nigrum* (2140) *
- Atlantic decalcified fixed dune (Calluno-Ulicetea) (2150) *
- Dunes with *Salix repens* ssp. *argentea* (Salix arenariae) (2170)
- Humid dune slacks (2190)
- Machairs (21A0) *

Four sand dune habitats were recorded by Ryle *et al*. (2009) at Inagh River Estuary SAC, two of which, indicated in **bold** above, are listed as Qualifying Interests for the SAC. The other two sand dune habitats recorded were annual vegetation of drift lines and embryonic shifting dunes, but these habitats are not selected as Qualifying Interests for this particular SAC. These habitats include mobile areas at the front as well as more stabilised parts of dune systems. The Annex I coastal habitat perennial vegetation of stony banks was also recorded by the CMP, but again this habitat is not a Qualifying Interest for the SAC.

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 strands 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 than in the embryonic dunes, 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 refer 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 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.

Detailed descriptions from the Coastal Monitoring Project (Ryle *et al*., 2009) of each sand dune habitat found at the Lahinch sub-site (CMP site ID: 085) are presented in Appendix IV**.** A total of 17.19ha of sand dune habitats was mapped within the Inagh River Estuary SAC, 16.78ha (97.6%) of which represents habitats that are listed as Qualifying Interests for this particular SAC.

4.1 Overall objectives

The overall objective for 'Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes)' in Inagh River Estuary SAC is to '*restore the favourable conservation condition*'.

The overall objective for 'Fixed coastal dunes with herbaceous vegetation (grey dunes)' in Inagh River Estuary 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.

It should be noted that given the small area of white dune (mobile dune) habitat present, a conservation assessment was not carried out by the CMP (Ryle *et al*., 2009).

4.2 Area

4.2.1 Habitat area

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 in the Lahinch sub-site during the Coastal Monitoring Project (CMP) (Ryle *et al*., 2009). This map is included with the individual site report in Appendix IV at the end of this document.

The total areas of both Qualifying Interest (QI) sand dune habitats within the Lahinch sub-site as estimated by Ryle *et al*. (2009) are presented in the second column of the following table. The figures for the total area of both QI sand dune habitats within Inagh River Estuary SAC are presented in the third column.

Habitat	**Total area (ha) of habitat from CMP: Lahinch**	**Total area (ha) of habitat within SAC boundary**
Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) (2120)	0.14	0.001
Fixed coastal dunes with herbaceous vegetation (grey dunes) (2130)*	17.67	16.78
Totals	**17.81**	**16.78**

The general target for this attribute in the case of both habitats 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.

4.3 Range

4.3.1 Habitat distribution

The distribution of sand dune habitats within Inagh River Estuary SAC, as mapped by Ryle *et al.* (2009), is presented in Appendix II.

Owing to golf course development, only a small area of intact sand dunes remains within the SAC.

A narrow band of mobile marram (*Ammophila arenaria*) dunes edges the northern part of the golf course and extend towards the tip of the sandy peninsula near O'Brien's Bridge (Ryle *et al*., 2009).

A small pocket of fixed dunes habitat lies outside of Lahinch golf course on the eastern side of O'Brien's Bridge where the ruins of Dough Castle are situated (Ryle *et al*., 2009). A small area of fixed dune is located on the north-east edge of Lahinch golf course and is semi-improved and grazed by cattle. Another larger area of fixed dune is located next to Sandfield Pitch and Putt club on the northern side of the mouth of Inagh River estuary and is grazed by cattle (Ryle *et al*., 2009).

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

4.4 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 Inagh River Estuary SAC in terms of structure and functions depends on a range of attributes for which targets have been set as outlined below.

4.4.1 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, thus 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.

The main activities impacting on the sand dune sediment supply at Lahinch are recreational and coastal protection activities. Recreational activities in the form of the golf course and pitch and putt course have greatly altered the sand dunes. Coastal protection has been installed (in the form of rock armour and gabions) in an effort to protect the golf course from natural erosion (Ryle *et al*., 2009).

The coastal protection has restricted sand movement and has halted the natural development of foredunes, which are now largely absent from the site (Ryle *et al*., 2009).

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.

4.4.2 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, including those to the saltmarsh communities.

A diverse mosaic of coastal habitats occurs within Inagh River Estuary SAC, ranging from the sand dune system to estuarine channels and associated saltmarsh habitats (Ryle *et al*., 2009).

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

4.4.3 Vegetation structure: bare ground

This target applies to the fixed dunes. It does not apply to the other habitats present in the SAC where high levels of bare sand are a natural component of the habitat. In the fixed 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.

At Lahinch, the condition of the fixed dune habitat was reported as poor due to the presence of large blowouts caused by sand extraction, which are exacerbated by trampling by cattle (Ryle *et al*., 2009).

The target not to exceed 10% bare sand. This target is assessed subject to natural processes.

4.4.4 Vegetation structure: sward height

This attribute applies to the fixed dune habitat 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).

According to the CMP, agricultural activities dominate the fixed dunes of Inagh River Estuary SAC. Overall, they are affected by cattle grazing with some areas overgrazed and in poor condition. Poaching and trampling were apparent with many bare areas visible throughout the dunes. The area of fixed dune on the eastern side of O'Brien's Bridge was lightly grazed by cattle (Ryle *et al*., 2009).

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

4.4.5 Vegetation composition: plant health of dune grasses

This attribute applies to the mobile dunes, where blown sand is a natural feature. The health of the dune grasses (particularly *Ammophila arenaria*) 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.

4.4.6 Vegetation composition: typical species and 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* spp.) are also present. The fixed, more stable dune vegetation includes lady's bedstraw (*Galium verum*), common bird's-foot trefoil (*Lotus corniculatus*), wild thyme (*Thymus polytrichus*), kidney vetch (*Anthyllis vulneraria*), wild pansy (*Viola tricolor*) and biting stonecrop (*Sedum acre*).

The mobile dunes in the Lahinch sub-site are composed of the typical species marram grass (*Ammophila arenaria*) with other species such as sand couch (*Elytrigia juncea*) also present (Ryle *et al*., 2009).

The typical species found in the fixed dunes include kidney vetch (*Anthyllis vulneraria*), sand sedge (*Carex arenaria*), glaucous sedge (*C. flacca*), moth hawk's-beard (*Crepis capillaris*), eyebright (*Euphrasia officinalis* agg.), red fescue (*Festuca rubra*), lady's bedstraw (*Galium verum*), cat's ear (*Hypochaeris radicata*), common bird's-foot trefoil (*Lotus corniculatus*), red bartsia (*Odontites verna*), ribwort plantain (*Plantago lanceolata*), biting stonecrop (*Sedum acre*), white clover (*Trifolium repens*), germander speedwell (*Veronica chamaedrys*) and the mosses *Rhytidiadelphus squarrosus* and *Syntrichia ruralis* subsp. *ruraliformis* (Ryle *et al*., 2009).

Other species recorded in the fixed dunes are creeping bent (*Agrostis stolonifera*), marram (*Ammophila arenaria*), squinancywort (*Asperula cynanchica*), daisy (*Bellis perennis*), common knapweed (*Centaurea nigra*), cock's-foot (*Dactylis glomerata*), wild carrot (*Daucus carota*), Yorkshire fog (*Holcus lanatus*), autumn hawkbit (*Leontodon autumnalis*), buck's-horn plantain (*Plantago coronopus*), smooth sow-thistle (*Sonchus oleraceus*), dandelion (*Taraxacum* agg.), red clover (*Trifolium pratense*) and the moss *Homalothecium lutescens* (Ryle *et al*., 2009).

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

4.4.7 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 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 sea buckthorn, which can form dense impenetrable thickets.

Negative indicators recorded in the fixed dunes at Lahinch include creeping thistle (*Cirsium arvense*), bramble (*Rubus fruticosus* agg.), common ragwort (*Senecio jacobaea*) and common nettle (*Urtica dioica*) (Ryle *et al*., 2009).

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

4.4.8 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.

5 References

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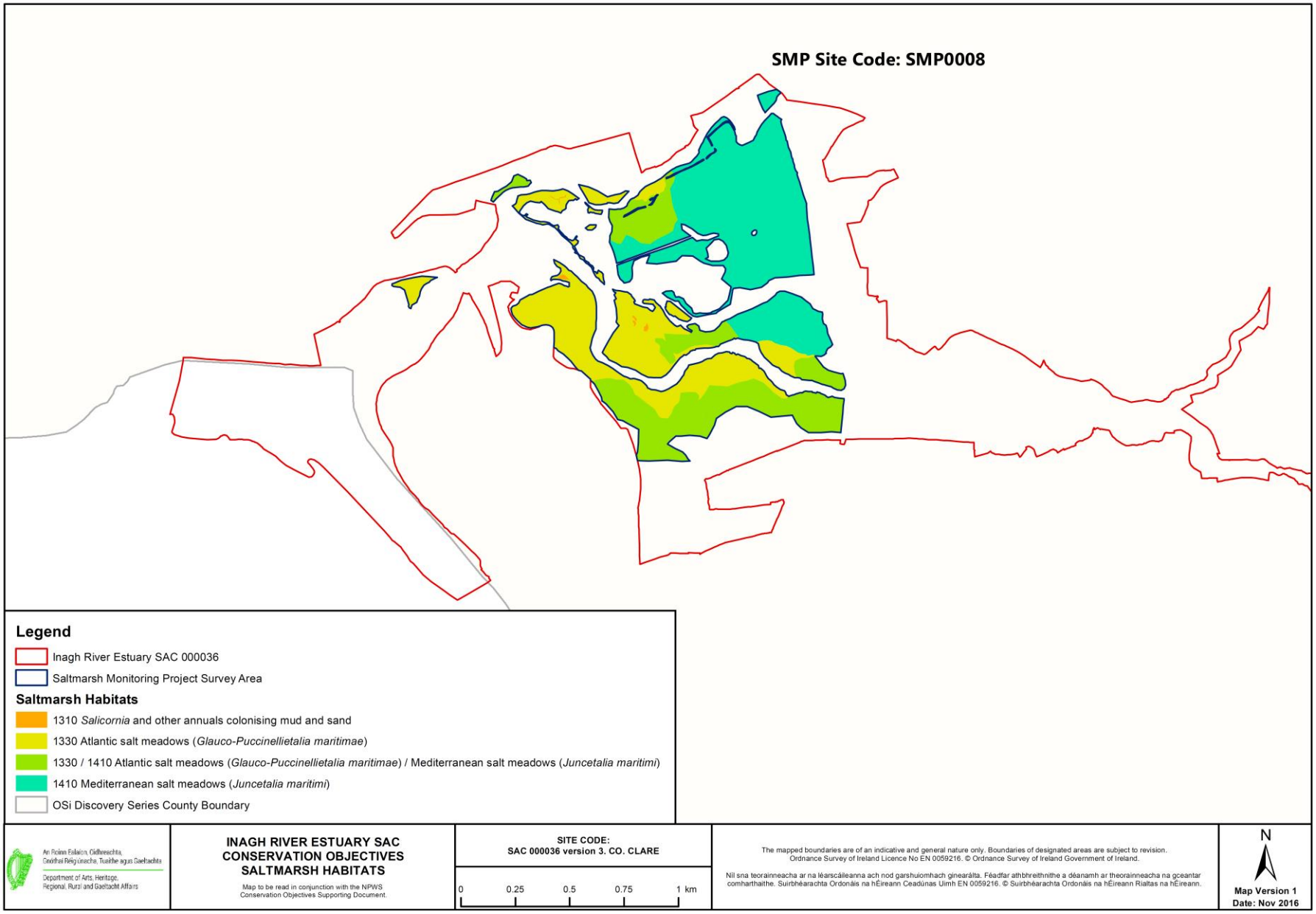
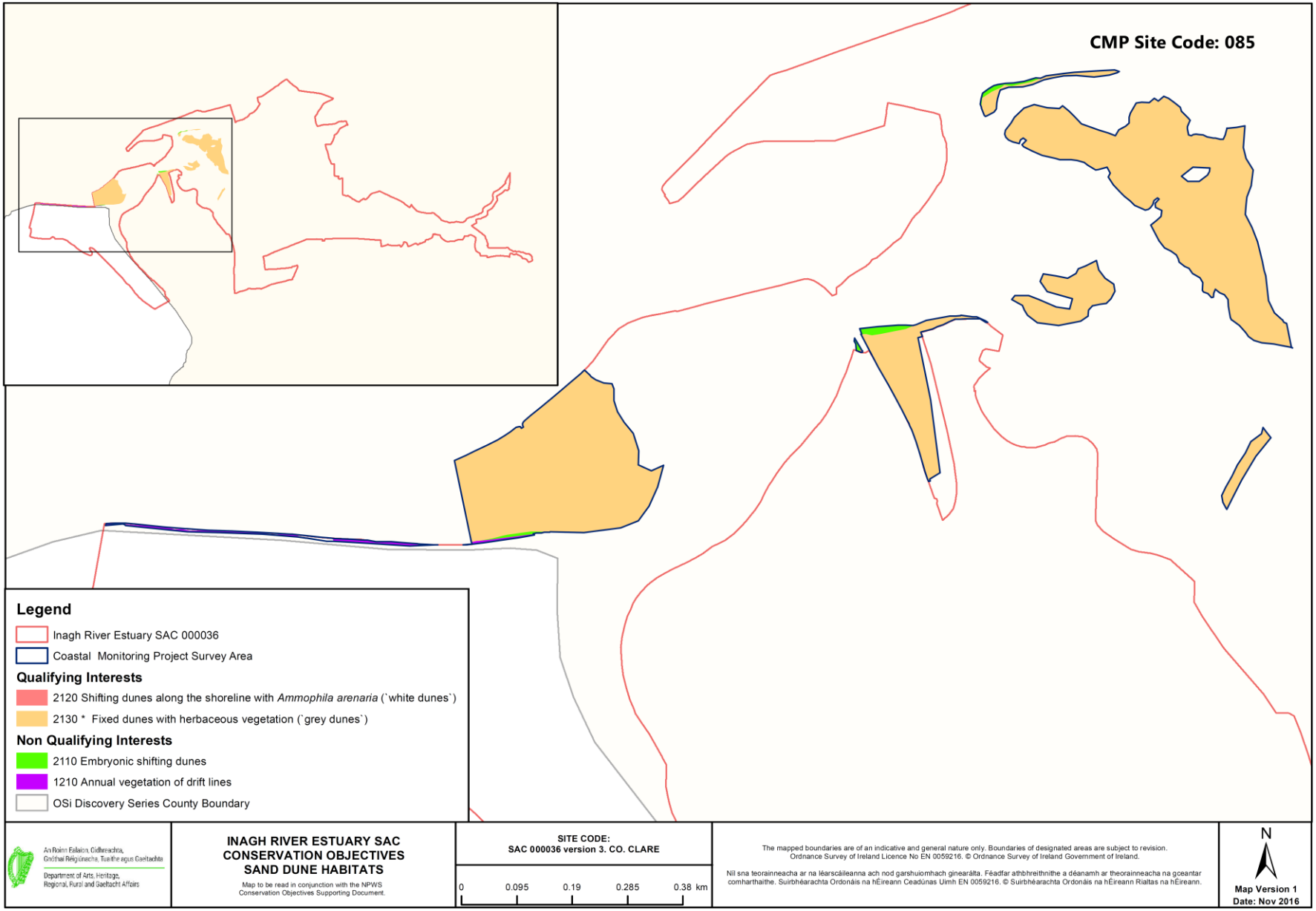
Appendix I – Distribution map of saltmarsh habitats within Inagh River Estuary SAC



Appendix II – Distribution map of sand dune habitats within Inagh River Estuary SAC



Appendix III – Lahinch site report and habitat map from the Saltmarsh Monitoring Project (McCorry, 2007)

1 SITE DETAILS

SMP site name: Lahinch	**SMP site code:** SMP0008
Site name (Curtis list): Lahinch	**CMP site code:** 85
	Site No: (Curtis list): 132
NPWS Site Name: Inagh River Estuary	**Dates of site visit:** 26-27/07/2006
NPWS designation **cSAC:** 000036	**MPSU Plan:** none
pNHA: 000036	
Wildfowl Sanctuary: IE05, Inagh River	
County: Clare	**Discovery Map:** 51/57 **Grid Ref:** 110180, 189260
6 inch Map No: Cl015	**Aerial photos (2000 series):** 04024-d, 04083-a, 04083-b, 04083-c, 04083-d

Annex I habitats currently designated for Inagh River Estuary cSAC:

Salicornia and other annuals colonizing mud and sand (1310)
Atlantic salt meadows (Glauco-Puccinellietalia maritimae) (1330)
Mediterranean salt meadows (Juncetalia maritimi) (1410)

Saltmarsh type: Estuary **Substrate type:** Mud, Sand

2 SITE DESCRIPTION

Lahinch saltmarsh is located along the coast of Co. Clare in Liscannor Bay. The saltmarsh is sheltered from the sea by an extensive sand-dune system now containing Lahinch Golf Course. Lahinch Town is located to the south-west of the saltmarsh. The saltmarsh is situated in a flat flood plain in a wide valley with undulating hills on both sides and towards the back of the saltmarsh. The flood plain is tidal and is the estuary of two rivers, the Inagh River and the Dealagh River. The Inagh River channel is located along the southern side of the estuary and meanders towards the north-west. Here it joins the Dealagh River, which flows along the northern side of the valley. One main channel flows past the northern end of the sand-dune system and enters Liscannor Bay. The valley narrows upstream along the Inagh River and there is further saltmarsh development along the channel.

Three Annex I habitats, *Salicornia* flats (1310), Atlantic salt meadows (ASM) (1330), Mediterranean salt meadows (MSM) (1410), are present at this site. All of these habitats are listed as qualifying interests for the Inagh River Estuary cSAC. Nearly the entire Lahinch saltmarsh habitat is located within the Inagh River Estuary cSAC. There are small minor areas of saltmarsh outside the cSAC boundary on Lahinch Golf Course and upstream of New Bridge, Ballingaddy Townland. The main part of this site can be accessed from a farm at Lissatunna after getting the landowners permission. Saltmarsh to the west of the Inagh River can be accessed via O'Briens Bridge. The area on the southern side of the Inagh River further upstream in Dough and Cloonaveige Townlands was not surveyed. No permission could be obtained to cross farmland to access this area. This area has potential for saltmarsh habitats. Aerial photos and views from distance were not clear as this area could be wet grassland dominated by soft rush (*Juncus effusus*) or may be Mediterranean salt meadow dominated by sea rush (*J. maritimus*).

3 HABITATS

3.1 General description

Saltmarsh is mainly situated between the two river channels (Inagh River and the Dealagh River) occupying the flat central plain. This area is dominated by Mediterranean salt meadows (MSM) (Table 3.1). Atlantic salt meadow (ASM) habitat is mainly situated along the west side of this area and along the banks of both the river channels. MSM saltmarsh seems to be distributed landward of the ASM, which is mainly distributed closer to the river channels. MSM saltmarsh extends to the east, where several fields on the plain have developed brackish habitats and wet grassland. The land then becomes sloped and improved agricultural grassland is present.

Interesting mosaics with transitions from saltmarsh to brackish habitats, wet grassland, dry coastal grassland, dry acid grassland, dry heath and scrub have developed due to the topography of the section and these other habitats cover a significant area, mainly in the central section. This also made mapping difficult at this site. Dry coastal grassland with affinities to fixed dune is situated in the north-west section. The topography of the area has been modified somewhat and tracks have been laid down on infill. There are other long narrow banks where material taken from adjacent drains has been dumped and these elevated banks have developed terrestrial vegetation. Some of the tracks are now grassy (wet and dry grassland).

Atlantic salt meadow is also situated along the western side of the Inagh River channel, between the channel and Lahinch Golf Course (dry coastal grassland). ASM saltmarsh continues along the southern side of the Inagh River with MSM developing further landward to the south. The MSM and ASM form a mosaic in this area. At the landward (southern) side of the saltmarsh mosaic there are patches of wet grassland and common reed beds. Saltmarsh continues along the Inagh River upstream towards the eastern side of Lissatunna and Dough Townlands. It eventually transitions to brackish and freshwater habitats that become more common along the river.

There are only small patches of saltmarsh along the northern side of the Dealagh River with both ASM and MSM being present. A small patch of saltmarsh is situated in the outer estuary, west of the sand-dune system and the O'Briens road bridge. Most of the saltmarsh along the Dealagh River is situated west of a road bridge at New Bridge, Ballingaddy Townland. There is only a small strip of saltmarsh upstream of this bridge and transitional brackish habitats with common reedbeds become more prevalent.

There are small amounts of *Salicornia*-dominated habitat that can be classified as 1310. These patches of glasswort (*Salicornia* sp.) are generally situated in old salt pans or in recently accreted patches of sand/mud. The overall area of this habitat is quite small (Table 3.1) and is probably under-estimated somewhat. Smaller salt pans containing this habitat were not mapped.

Much of the MSM saltmarsh has also been modified in the past by drainage. This has occurred north of the track dividing the central area between the two river channels. There are several very deep drains (trenches) criss-crossing this area and dividing it into regular blocks. Some of these blocks have been further drained with smaller regular drains orientated north-south. These smaller drains are now being silted up and most have re-vegetated. The drainage works were super-imposed over the existing saltmarsh creek and salt topography. This distinctive saltmarsh topography is still visible from the aerial photos. Many of these creeks are still active or are becoming functional again.

Drainage works have also occurred to the south of the Inagh River channel in east part of Dough Townland, but this area was not surveyed. It is not known if this area contains MSM or wet grassland. Some saltmarsh or brackish habitats would be likely in this area.

Much of the MSM was classified as wet grassland during the NHA survey (it is rush-dominated). This may have been a simple error in classification as it is difficult to separate wet grassland and MSM saltmarsh from distance. While it could also indicate that there has been transition or restoration back to saltmarsh it is unlikely that dense stands of sea rush would have developed in this period (1993-2006) with no remnants of the previous wet grassland species (soft rush).

Table 3.1. Area of EU Annex I habitats listed at Lahinch.

EU Code	Habitat	Area (ha)
1310	*Salicornia* and other annuals colonizing mud and sand (1310)	0.21
1330	Atlantic salt meadows (Glauco-Puccinellietalia maritimae)	49.97[1]
1410	Mediterranean salt meadows (Juncetalia maritimi)	56.71[1]
	Total	**106.89**

[1]includes 50% of the 1330/1410 mosaic.

3.2 *Salicornia* and other annuals colonizing mud and sand (H1310)

This habitat is located on the western side of the Inagh River in the north-west corner. This area is in transition as there has been fairly recent shifts in the river channel. An old channel has now silted up and is dry. The central part of this area is colonised by a monoculture of glasswort on muddy sand. There is occasional annual sea-blite (*Suaeda maritima*) and common saltmarsh-grass (*Puccinellia maritima*) plants in this area. The monoculture of glasswort transitions to pioneer saltmarsh around the edges, dominated by common saltmarsh-grass and containing frequent glasswort. With further accretion, this habitat is likely to disappear in the near future as it transitions to lower saltmarsh vegetation dominated by common saltmarsh-grass.

A similar area is present further south but saltmarsh succession is more progressed. This area is currently vegetated with a lower saltmarsh community dominated by common saltmarsh-grass and containing frequent sea milkwort (*Glaux maritima*), sea-spurrey sp. (*Spergularia* sp.), glasswort, and occasional sea pink (*Armeria maritima*) and annual sea-blite. This area was unvegetated on the 2000 aerial photo but did have 80-90% plant cover during the survey in 2006. It is likely to have contained *Salicornia*-dominated vegetation around 2000. This is a good example of how transient the *Salicornia*-dominated 1310 habitat is and how quickly it can transition to other habitats.

There are several other large pans in the main area of saltmarsh between the two rivers that were colonised with a dense sward of glasswort and correspond with this habitat. Mosaics have formed with lower saltmarsh vegetation and the pans are in various stages of succession with patches dominated by common saltmarsh-grass and glasswort, and patches dominated by a monoculture of glasswort. Annual sea-blite is occasional in these areas. Some of these are moderately poached by cattle. Disturbance of these pans by cattle may also increase the abundance of *Salicornia*-dominated 1310 by continually keeping the salt pans disturbed and allowing colonisation by these pioneer species.

There are further small patches of this habitat in bands along the eastern side of the Inagh River. These bands can be quite narrow (< 0.5 m wide) and have developed on accreting sandbanks on this side.

3.3 Atlantic salt meadows (H1330)

This habitat is mainly situated along the two river channels with the largest sections between the Lahinch Golf Course and the Inagh River and in the south-west of the central section between the two river channels. The vegetation of these ASM areas is dominated by mid and mid-upper saltmarsh plant communities. The mid-upper saltmarsh is dominated by saltmarsh rush (*Juncus gerardii*) and red fescue (*Festuca rubra*) with frequent sea plantain (*Plantago maritima*). Other species present include common scurvygrass (*Cochlearia officinalis*). Clumps of sea rush are occasionally present and may be locally frequent. Only the larger areas were mapped as MSM or mosaic 1330/1410 areas. Species such as long-bracted sedge (*Carex extensa*), autumn hawkbit (*Leontodon autumnalis*) and white clover (*Trifolium repens*) appear in the upper saltmarsh zones, particularly in the transition to dry coastal grassland and in the mosaic areas with MSM. This transition is dominated by species such as silverweed (*Potentilla anserina*) and creeping bent-grass (*Agrostis stolonifera*). The relative abundance of white clover may be an indicator of agricultural enrichment probably from long-term cattle grazing. This area is not likely to have been fertilised.

A mid-marsh zone is dominated by a typical low sward community of sea pink and sea plantain. This community also contains sea milkwort (*Glaux maritima*), sea arrowgrass (*Triglochin maritimum*), red fescue (*Festuca rubra*) and sea aster (*Aster tripolium*).

Thin bands of lower zone saltmarsh are situated on the eastern side of the Inagh River on more recently accreted sediment banks. These are dominated by common saltmarsh-grass with frequent glasswort and occasional annual sea-blite and greater sea-spurrey (*Spergularia media*). Lesser sea-spurrey (*Spergularia marina*) was also recorded in some vegetated shallow creek beds. There is a layer of tidal debris along the strandline.

The ASM generally has a complicated topography and the creeks and salt pans are well-developed. The creeks are quite meandering. Some of the salt pans are quite large. Some of the pans are bare and contain exposed muddy sediment. Some of the pans contain a monoculture of glasswort and have been classified as 1310 and some pans contain lower saltmarsh plant communities dominated by common saltmarsh-grass. There are also frequent low mounds and wide shallow hollows, and some old banks on the ASM probably relate to old river channels. The ASM area to the west of the Inagh River has a more complicated structure with lower shallow hollows containing saltmarsh vegetation and transitioning into dry coastal grassland that develops on higher mounds. Some of these smaller patches of dry coastal grassland may be mapped within the ASM area due to the complicated topography.

There is also significant internal zonation of saltmarsh vegetation along the edges of creeks and salt pans. Bands of pioneer and lower saltmarsh vegetation are situated along these creeks and pans. These zones generally contain the most badly poached areas. An interesting mosaic of mid and mid-upper saltmarsh zones is situated to the west of the Inagh River channel. This area contains small mounds with upper saltmarsh vegetation (saltmarsh rush/red fescue dominated) interspersed between shallow hollows containing the mid-saltmarsh vegetation (sea pink/sea plantain dominated). Atlantic salt meadow is also present in ASM/MSM mosaic areas. These areas have clumps of Sea Rush scattered through the ASM and either habitat may be dominant.

The sward height of the ASM is generally low due to grazing (1-2 cm). However, there are patches within the ASM/MSM mosaic and in the MSM dominated areas that have a higher general sward height (5-10 cm).

3.4 Mediterranean salt meadows (H1410)

This habitat is generally dominated by a dense cover of Sea Rush. Other species typically present include creeping bent-grass, red fescue, saltmarsh rush, white clover, sea plantain, autumn hawkbit, sea arrowgrass, common scurvygrass, sea aster, sea pink, sea milkwort, silverweed and parsley water-dropwort (*Oenanthe lachenalii*). Spear-leaved orache (*Atriplex prostrata*) is present in some of the pans. There are large expanses of this habitat in the north-east section that are quite uniform, with a very dense cover of sea rush (up to 100%). In other areas the cover of sea rush is lower and the vegetation is more diverse with the other species, particularly the grasses and white clover, becoming more abundant. In the south-west area there is a mosaic between the ASM and MSM. This area contains assorted clumps of sea rush interspersed with ASM vegetation.

Much of this habitat occupies the upper saltmarsh zone. Some of this habitat that is situated in the wide saltmarsh plain may occupy a particular elevation that is flooded by the tide very infrequently. The wide flat saltmarsh plain allows the development of very gradual slopes and therefore wider zones. Therefore, a transitional saltmarsh-terrestrial zone may occupy a larger area at this site. This may be why white clover and silverweed are particularly abundant at some locations in this site. At other sites these two species indicate a transition to terrestrial vegetation. At some sites sea rush also extends higher than the upper tide boundaries, so sea rush-dominated vegetation may not necessarily be saltmarsh but occupy more brackish conditions. An alternative reason for the abundance of white clover is long-term agricultural enrichment due to cattle grazing.

Different vegetation zones are not particularly evident in this habitat, as it is generally defined by the presence of sea rush. However, plant community zonation is evident where the MSM transitions to terrestrial habitats along slopes. Zonation is also evident along the old creeks and some of the newer drains. Here narrow strips of ASM vegetation characterised by the absence of sea rush and dominated by the grasses are positioned alongside the creeks and drains.

The central area contains more elevated land where terrestrial habitats have developed (wet grassland, dry acid grassland, wet heath and gorse (*Ulex europaea*) scrub. These areas were formerly enclosures. This has led to the development of interesting mosaics of MSM and terrestrial vegetation. Thin bands of MSM are situated in lower drainage channels between some of these higher patches of land. There are transitions from MSM to wet grassland dominated by purple moor-grass (*Molinia caerulea*), with frequent tufted hair-grass (*Deschampsia caespitosia*), devil's-bit (*Succisa pratensis*), tormentil (*Potentilla erecta*) and sweet vernal-grass (*Anthoxanthum odoratum*). An interesting transitional habitat co-dominated by purple moor-grass and sea rush, which also contains occasional marsh pennywort (*Hydrocotyle vulgaris*) and frequent parsley water-dropwort is present.

Common reed (*Phragmites australis*) appears in some places, particularly along some of the larger drains in the north-east section. There are also several patches of sea club-rush (*Bolboschoenus maritimus*), grey club-rush (*Schoenoplectus tabernaemontani*) and common reed positioned in several pools, at the end of some long meandering creeks. These indicate a transition to more brackish conditions or up-welling of freshwater at these locations. Patches of yellow flag (*Iris pseudacorus*) and purple loosestrife (*Lythrum salicaria*) occur along parts of the terrestrial boundary south of the track through the central section.

There is also a well-developed creek and pan structure in this habitat. This habitat is situated in the area significantly affected by the old drainage works in the north-east section. These drains cut across the creeks and pans that originally were in the saltmarsh. Many of the creeks have recovered and are

functioning again. However, some of the old creeks have infilled as the larger drains are still functional and are functioning like creeks. Some of the drains have partly infilled with MSM vegetation. The remaining open parts of drains act as salt pans and pools. Parallel groups of pans and pools are visible on the aerial photo.

The grazing is generally low in this habitat although cattle do graze in these areas as opposed to some sites where sheep avoid these areas. The cattle do cause some heavy localised poaching. Some of the MSM south of the track is tussocky and has been damaged by long-term poaching.

4 IMPACTS AND ACTIVITIES

The chief activity on the saltmarsh habitats is grazing by cattle (140) (Table 4.1). The activity codes used in Table 4.1 are given in brackets in the following text. Cattle graze both the ASM and MSM in the central section. They also cross the river and graze the saltmarsh west and south-west of the Inagh River. Grazing levels are variable and are generally low-moderate, creating a typical low sward in the ASM areas. The impact of the cattle grazing can be seen along the ASM/golf course boundary. The golf course is ungrazed while the saltmarsh is grazed.

Cattle are causing some poaching of the saltmarsh (143). There are small local areas of heavy poaching at some locations in both habitats. Some enclosures on the saltmarsh are moderately-heavily poached and the MSM is tussocky. The lower saltmarsh zone, which is situated around the edge of creeks and pans, is dominated by common saltmarsh-grass and is generally the most damaged from poaching (this is particularly seen in the ASM to the west of the Inagh River).

Saltmarsh is likely to have been more extensive in the past. The 6 inch map indicates that the tide flows much higher upstream than the extent of the current saltmarsh. Historical land improvement and drainage has had a significant impact on the habitats present in the Inagh and Dealagh River estuary inside and outside the current cSAC boundary. These 'historical' activities are not considered during assessment of impacts.

Parts of the current saltmarsh have been subject to old drainage and land improvement activity, particularly in the north-eastern section and south of the Inagh River channel in Dough Townland. These activities occurred before 1930 (6 inch map) and are likely to have had a significant impact on the saltmarsh habitats, particularly on the creek structure and functions. This drainage is still probably having a residual impact on the saltmarsh, but the saltmarsh has recovered to some extent (or the drainage and land improvement failed) and the functionality of the creeks is recovering. Some of the deeper drains are likely to have been cleaned or deepened during the intervening period (1930-2006). Several tracks were laid down in the past and infilled with gravel or hardcore. Two areas upstream on both sides of the Inagh River (in Dough and Lissaturna) were also embanked with attempts at land improvement in association with drainage. The embankments have since been breached and are eroding. Both these areas now contain a range of brackish, freshwater marsh, wet grassland and dry grassland habitats but were likely to have continued some saltmarsh in the past. The remnants of the saltmarsh creek and pan topography are still visible on the aerial photos. Some embankment may have also taken place along the southern edge of the Dealagh River in association with the drainage works.

The saltmarsh has also been used for other historical activities. Part of the site in the south-west section, including the saltmarsh and transitional areas, was used as the site of an old Ennistimon RDC

sewage works. The old Lahinch race course route also passed over the edge of the saltmarsh in the south-west area.

Natural erosion (900) and accretion (910) is occurring along the Inagh River. The main channel has shifted its position, particularly in the north-west section where it joins the Dealagh River. Minor channels that cut off parts of the saltmarsh and created islands in the channel have also changed significantly between 1930-2006 when comparing the 6 inch map and the 2000 aerial photos. Several old 'islands' are now connected to the main saltmarsh and the channels are infilled or are becoming smaller and now act as creeks. Erosion and accretion is dependent on whether the saltmarsh is situated on inside (accretion) or the outside (erosion) of a meander in the river. Accretion is currently occurring on the eastern side of the channel in the south-west section. There is some re-colonisation along an older saltmarsh cliff. The western side is being eroded. Accretion then switches to the western side further north as the channel changes direction. Natural erosion and accretion in the channels are generally in balance.

Accretion and erosion is also affecting the relative abundance of sand-dune habitats, coastal grassland and saltmarsh, although there is no information on the previous extent of these habitats. Sand-dune habitats are currently developing in the north-west section due to accretion and this will probably lead to further development of saltmarsh behind the sand-dunes.

Telegraph lines and poles cross the saltmarsh (511). There are occasional patches with wheel ruts at the edge of the track through the central area and in some other areas (501). The strandline along the Inagh River contains frequent rubbish and litter deposited by the tide (421).

Activities adjacent to the saltmarsh habitats include farming (120, 140), urban areas (400), golf courses (601), caravan parks (608) and roads (502). There is likely to be some water pollution (701) upstream from Ennistimon and from the surrounding valley farming and dwellings.

Table 4.1. Intensity of various activities on saltmarsh habitats at Lahinch.

EU Habitat Code[1]	Activity code[2]	Intensity[3]	Impact[4]	Area affected (ha)	Location of activity[5]
1310	143	A	-1	0.21	Inside
13s	140	B	0	106.89	Inside
1330	143	A	-1	12.5	Inside
1410	143	A	-1	14	Inside
1330	421	C	-1	< 0.1	Inside
13s	501	C	-1	< 0.1	Inside
13s	511	C	-1	< 0.1	Inside
13s	900	C	0	/	Inside
13s	910	C	0	/	Inside
13s	120	C	-1	106.89	Outside
13s	140	C	-1	106.89	Outside
13s	400	C	0	106.89	Outside
13s	502	C	0	106.89	Outside
13s	601	C	0	106.89	Outside
13s	608	C	0	106.89	Outside
13s	701	C	-1	106.89	Outside

[1] EU codes as per Interpretation Manual. Code 13s is an additional code used to signify the entire saltmarsh habitat.
[2] Description of activity codes are found in Appendix III summary report.
[3] Intensity of the influence of an activity is rated as A = high, B = medium, C = low influence and D unknown.
[4] Impact is rated as –2 = irreparable negative influence, -1 = reparable negative influence, 0 = neutral, +1= natural positive influence and +2 = strongly managed positive influence.
[5] Location of activity: Inside = activities recorded within and directly impacting the saltmarsh habitat, outside = activities recorded outside but adjacent to saltmarsh habitat that are impacting the saltmarsh habitat.

5 CONSERVATION STATUS

5.1 Overall Conservation Status

Overall, the conservation status of this site is *unfavourable-bad* (Table 5.1). No conservation plan is available for this cSAC. Cattle-induced poaching is causing some damage to the vegetation ground cover and ground structure. However, this damage is localised and generally affects the lower saltmarsh zones or some enclosures where there has been over-stocking. A significant part of the site was drained in the past but the saltmarsh habitats are recovering. Some of the larger drains are still active and have a significant drainage function. No common cordgrass (*Spartina anglica*) was recorded at this site.

The medium-term future prospects of natural landward saltmarsh migration in response to sea level rise are good. The main part of this site has developed in a low, flat flood plain acting as the estuary of two rivers. There is a significant area between the two river channels and along the southern boundary that contains brackish and terrestrial habitats, but these occur on low mounds or in flat areas with shallow slopes and could easily transition to saltmarsh habitats in response to sea-level rise. Any landward saltmarsh migration upstream along the river channels may be dependent on geomorphological changes as the large sand spit containing Lahinch Golf Course protects the estuary and regulates the tidal levels somewhat. There is some potential for landward migration of saltmarsh habitats upstream along the rivers as there are patches of brackish and freshwater marsh vegetation along the rivers. Some of the land in the river valleys has been improved in the past, although it is reverting naturally back to brackish, freshwater marsh and wet grassland conditions.

Table 5.1. Conservation status of Annex I saltmarsh habitats at Lahinch.

Habitat	**EU Conservation Status Assessment**			
	Favourable	**Unfavourable - inadequate**	**Unfavourable - Bad**	**Overall EU conservation status assessment**
***Salicornia* flats (1310)**	Extent		Structure and functions, Future prospects	**Unfavourable - Bad**
Atlantic salt meadows (1330)	Extent		Structure and functions, Future prospects	**Unfavourable - Bad**
Mediterranean salt meadows (1410)	Extent	Structure and functions, Future prospects		**Unfavourable - inadequate**

5.2 *Salicornia* and other annuals colonizing mud and sand (H1310)

5.2.1 Extent

Overall, the extent of this habitat is assessed as *favourable* in the absence of other information on the previous extent of this habitat. The extent of this habitat is transient with patches within the saltmarsh appearing for several years in recently accreted areas and then disappearing due to succession to lower

saltmarsh vegetation. Patches of this habitat are also present in some of the salt pans of the ASM. Poaching by cattle in some of these pans may be actually increasing the extent of this habitat, as poaching is disturbing the bare mud basins in these salt pans and assisting their colonisation by these pioneer species. Small patches of this habitat also develop within the Inagh River channel on accreted sediments and these also can change shape and shift position in response to geomorphological cycles in the river channel.

The actual area of this habitat may be under-estimated somewhat as not all the salt pans that contained this habitat were mapped. Many of these were quite small but cumulatively may cover 0.1-0.5 ha.

5.2.2 Habitat structure and functions

The structure and functions is assessed as *unfavourable bad*. There were two stops carried out in this habitat with one stop failing. This stop failed due to poaching damage and disturbance by cattle. So while poaching may help the development of pioneer species by disturbance of the mud basins, after the glasswort and other species have grown, cattle trample the plants and poaching disturbs this habitat and uproots the glasswort. As some of these salt pans contain a significant mapped portion of this habitat, the structure and functions has failed as targets for levels of disturbance and negative indicators have been breached.

5.2.3 Future prospects

The future prospects of this habitat are assessed as *unfavourable bad.* This assumes that the current grazing regime is continued and poaching of the glasswort patches in salt pans continues. However, there are no indications that geomorphological cycles have changed to limit the accretion of sediment banks that this habitat favours.

5.3 Atlantic salt meadows (H1330)

5.3.1 Extent

Overall, the extent of this habitat is assessed as *favourable*. There is some information available from the Natura database on extent of this habitat but its accuracy is poor and any comparisons to this data would perhaps indicate false trends. There are no indications that there have been any recent losses in the extent of this habitat due to land reclamation or any other activities. Natural erosion is occurring along the Inagh River channel but this is balanced by accretion on the opposite sides of the meanders of the rivers.

5.3.2 Habitat structure and functions

Overall the structure and functions of this habitat is assessed as *unfavourable-bad*. Twelve stops were carried out and three stops failed (25%). The failed stops did not reach targets for bare ground cover and were quite disturbed from poaching. The lower saltmarsh zones generally had the worst poaching damage and in some areas a network of poached channels is visible amongst less badly damaged low mounds. Grazing has created a low close-cropped sward in much of the ASM but this was not considered overgrazed. The effects of grazing are visible along one of the boundaries where there is no grazing on one side. However, all the other attributes of structure and functions reached their targets. Species diversity was normal with all the typical species appearing. One notable record is the lax-flowered sea lavender (*Limonium humile*), which is not found very often along the west Irish coast and has not been recorded here before (Preston *et al.* 2002).

Several different ASM vegetation communities are present and zonation is present depending on elevation. The most notable transitions of ASM to other habitats is the transition to fixed-dune or disturbed coastal grassland. There is also internal zonation of saltmarsh plant communities along the edges of the creeks and pans. Bands of ASM are present along the creeks in the MSM dominated areas.

The salt pan structure is relatively well-developed and some of the pans contain patches of pioneer *Salicornia* sp. that can be classed as 1310. Some of the pans and the lower saltmarsh zones are more vulnerable to poaching by cattle, as they are inundated by the tide more often. The creek structure is also well developed in this habitat, although some creeks have been modified or affected by old drainage works. Some of these creeks are recovering their function.

5.3.3 Future prospects

The future prospects of this habitat are assessed as *unfavourable-bad*. This assessment assumes that the current management practises and stocking rates continue in the near future. The current stocking rates and management practises are causing poaching damage in some of the ASM but the damaged areas only affect between 10-20% of the habitat extent.

5.4 Mediterranean salt meadows (H1410)

5.4.1 Extent

Overall, the extent of this habitat is assessed as *favourable*. Previous data had under-estimated significantly the area of MSM at this site due to poor habitat classification. There are no indications that there have been any recent losses in the extent of this habitat due to land reclamation or any other activities. Natural erosion and accretion is occurring along the Inagh River channel but this mainly affects the ASM. The actual area of this habitat may be under-estimated somewhat as part of the site was not surveyed and extent in this area was estimated from the aerial photos.

5.4.2 Habitat structure and functions

Overall the structure and functions of this habitat is assessed as *unfavourable-inadequate*. Thirteen stops were carried out in this habitat and eleven stops passed. The remaining two stops failed due to excessive poaching and excessive bare ground cover. Overall, the species diversity is high in this habitat. There are several other typical indicators of good structure and function present including creeks and pans, internal zonation of vegetation communities along the creeks and natural transitions to other terrestrial habitats.

This site has several distinctive features (features of local distinctiveness), particularly the relative abundance of transitional species such as white clover and silverweed amongst more typical saltmarsh vegetation dominated by sea rush, red fescue, creeping bent-grass and saltmarsh rush. One hypothesis put forward is that much of this habitat containing these transitional species is situated at an elevation that only allows several tidal inundations a year (perhaps less inundation on this habitat compared to other sites). A second interesting feature are the transitions to terrestrial habitats on raised land within the wide saltmarsh basin located between the two rivers.

A significant portion of this habitat has been affected in the past by drainage. While the drains may be still having a residual impact, much of this area is recovering, with some of the smaller drains infilling and some of the larger creeks functioning normally.

5.4.3 Future prospects

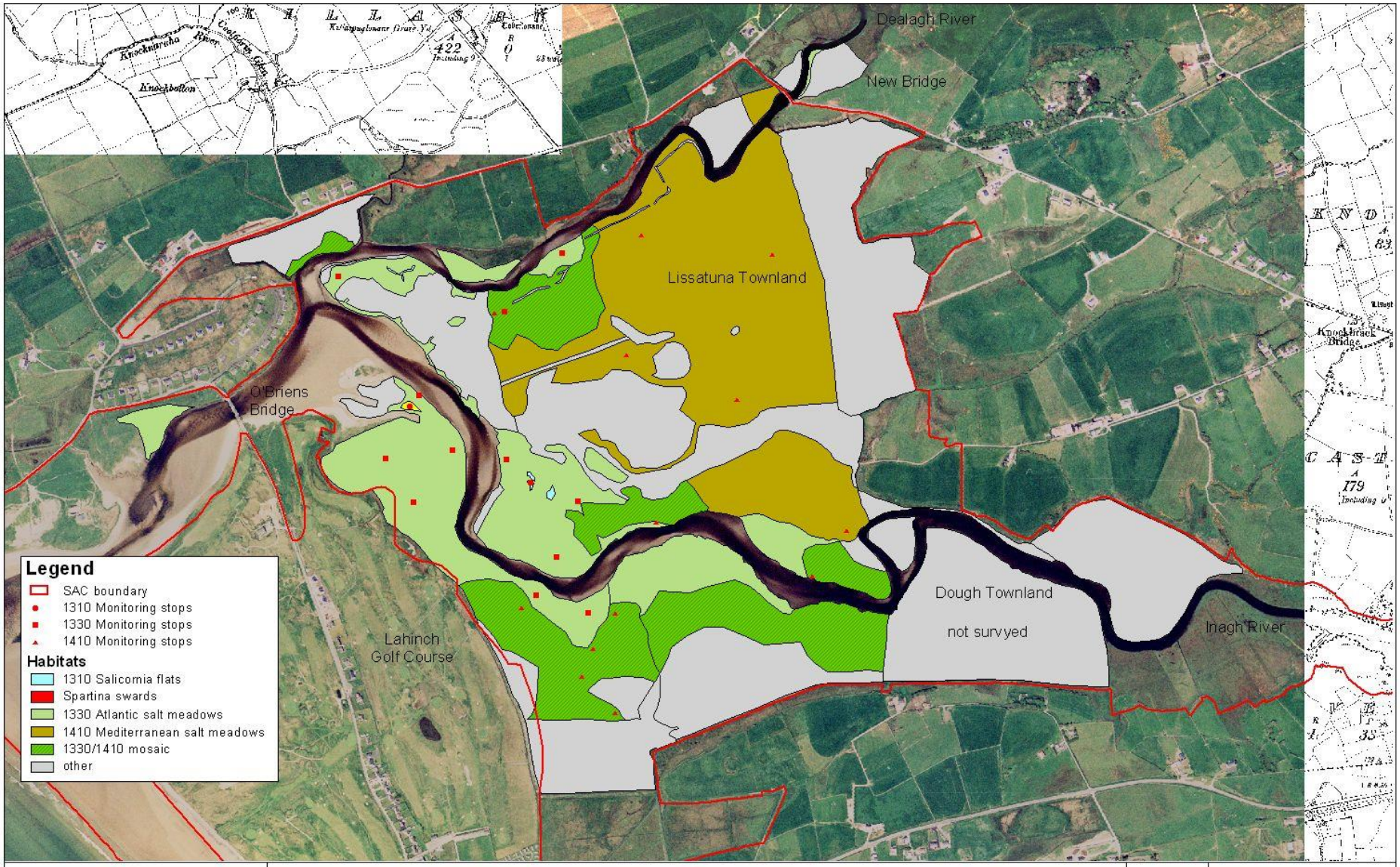
The future prospects of this habitat are assessed as *unfavourable-inadequate*. This assessment assumes that the current management practises and stocking rates continue in the near future. The current stocking rates and management practises are causing poaching damage in some of the MSM, but the damaged areas only affect between 10-20% of the habitat extent.

6 MANAGEMENT RECOMMENDATIONS

Some reduction in grazing pressure on parts of the site is required to enhance the overall conservation status of the site. Monitoring of the site is also required, as the site may be vulnerable to drainage works in the future. Some current drains, draining land adjacent to the saltmarsh may be cleaned or deepened in the future.

7 REFERENCES

Preston, C.D. Pearman, A. and Dines, D. (2002) New atlas of the British and Irish Flora. Oxford University Press.



Saltmarsh Monitoring Project

Lahinch

SMP Code: SMP0008

Map produced by: SMP 2006

Map Version: 1

The mapped boundaries are of an indicative and general nature only. Boundaries of designated areas are subject to revision. Reproduced from Ordnance Survey material by permission of the Government. (Permit number 8953)

Inagh River Estuary cSAC (000036)

0 200 400 600 800 Meters

Scale: 1:9449

N

Appendix IV – Lahinch site report and habitat map from the Coastal Monitoring Project (Ryle *et al.*, 2009)

LAHINCH

SITE DETAILS

CMP06 site name: Lahinch **CMP06 site code:** 085 **CMP Map No.:** 83

County: Clare **Discovery map:** 57 **Grid Reference:** R 090 881

6 inch Map No.: Cl 14 & 15 & 22 & 23

Aerial photographs (2000 series): O 4081 C & D; O 4082 B,C & D; O 4083 A & C; O 4141 B; O 4142 A

NPWS Site Name: Inagh River Estuary

NPWS designation: **pNHA:** 000036 **cSAC:** 000036 **SPA:** 004005 (adjacent)

Blue Flag 2005: Lahinch

Ranger Area: Clare

MPSU Plan: None

Report Author: Anne Murray

SITE DESCRIPTION

Lahinch sand dune system is part of Inagh River Estuary cSAC in the southwest of County Clare. The cSAC includes the estuaries of both the Inagh and Dealagh Rivers.

A diverse mosaic of habitats occurs within this cSAC including sand dunes, estuaries and associated saltmarsh habitat, deciduous woodland and low-lying wet grasslands. The Annex I habitats for which it is designated are *Salicornia* and other annuals colonizing mud and sand, Atlantic salt meadows, Mediterranean salt meadows, fixed dunes and mobile dunes

The cSAC holds a range of waterfowl species. A small flock of white-fronted goose (*Anser albifrons flavirostris*) formerly used the the cSAC during winter months and it still holds regionally important numbers of golden plover (*Pluvialis apricaria*). Both of these are Annex I bird species.

Lahinch sand dune system occurs on both sides of the mouth of the Inagh Estuary. The most extensive area of sand dune occurs on the southern side of the estuary, overlying a sand spit that partially encloses the estuary. On the more sheltered landward side of the spit, the dune system grades into saltmarsh and mudflats which are described in the NPWS Saltmarsh report by McCorry (2007). Most of the dune system has been developed as a golf course and is excluded from the cSAC except for a small pocket of fixed dunes habitat that lies outside of Lahinch golf course on the eastern side of O'Brien's Bridge where the ruins of Dough Castle are situated. This area of fixed dune is improved and lightly grazed by cattle.

Another area of sand dune edges the northern side of the mouth of the estuary. The sand dune system comprises tall ridges of fixed dunes that slope eastwards to a low-lying area of saltmarsh. The dunes here have been taken over by Sandfield Pitch and Putt course which is excluded from the cSAC, the

remaining fixed dunes next to the saltmarsh are fenced into fields and grazed by cattle. The dunes are edged by vegetated cobble with patches of strandline eastward. The total area of sand dune is 18.441ha (excluding the golf course and pitch, putt course and other developments).

Table 85A Areas of EU Annex I habitats mapped at Lahinch

EU Code	EU Habitat	Area (ha)
H1210	Annual vegetation of drift lines	0.249
H1220	Perennial vegetation of stony banks	0.138
H2110	Embryonic shifting dunes	0.251
H2120	Shifting dunes along the shoreline with *Ammophila arenaria*	0.138
H2130	Fixed coastal dunes with herbaceous vegetation	17.665
	Total sand dune excluding developments/modifications	**18.441**
	Total sand dune including developments/modifications	**140.9**

Fixed Dunes (H2130)

A number of developments now occupy the best part of the fixed dunes including- 30ha of residential and summer holiday homes, 89ha of golf course and 3ha of Pitch and Putt course. The remaining fixed dune is fragmented and under pressure from agricultural activities.

The typical species found in the fixed dune include *Anthyllis vulneraria* (kidney vetch), *Carex arenaria* (sand sedge), *Carex flacca* (glaucous sedge), *Crepis capillaris* (smooth hawk's beard), *Euphrasia officinalis agg.* (eyebright), *Festuca rubra* (red fescue), *Galium verum* (lady's bedstraw), *Hypochaeris radicata* (cat's ear), *Lotus corniculatus* (common bird's-foot trefoil), *Odontites verna* (red bartsia), *Plantago lanceolata* (ribwort plantain), *Sedum acre* (biting stonecrop), *Trifolium repens* (white clover), *Veronica chamaedrys* (Germander speedwell) and the mosses - *Rhytidiadelphus squarrosus* and *Tortula ruraliformis.*

Other species recorded in the fixed dune are, *Agrostis stolonifera* (creeping bent), *Ammophila arenaria* (marram), *Asperula cynanchica* (squinancywort), *Bellis perennis* (daisy), *Centaurea nigra* (common knapweed), *Dactylis glomerata* (cock's-foot), *Daucus carota* (wild carrot), *Holcus lanatus* (Yorkshire-fog), *Leontodon autumnalis* (autumn hawkbit), *Plantago coronopus* (buck's-horn plantain), *Sonchus oleraceus* (smooth sow-thistle), *Taraxacum* agg. (dandelion), *Trifolium pratense* (red clover) and the moss *Homalothecium lutescens*.

The negative indicators recorded include *Cirsium arvense* (creeping thistle), *Rubus fruticosus* (bramble), *Senecio jacobaea* (common ragwort) and *Urtica dioica* (common nettle)

Mobile Dunes (H2120)

There is very little mobile dune habitat at Lahinch. The mobile dunes have been altered by coastal protection works carried out by Lahinch golf course. The golf course is edged by rock armour for the most part. A narrow band of mobile dunes edge the northern part of the golf course towards O'Brien's Bridge and comprises a total area of 0.138ha. The mobile dunes are composed of the typical species *Ammophila arenaria* (marram grass), with other species such as *Elytrigia juncea* (sand couch) also present.

There are no negative indicator species present in the habitat.

Embryonic Dunes (H2110)

A narrow band of embryonic dunes fronts the mobile dunes on the northern edge of the golf course. Another small band edges the eroding fixed dunes on the northern side of the estuary where it occurs in association with annual strandline habitat. The total area of embryonic dunes is 0.251ha. The typical species of the embryonic dunes *Elytrigia juncea* (sand couch) dominates with the annual strandline species *Atriplex laciniata* (frosted orache) also present.

There were no negative indicators recorded in the habitat.

Perennial Vegetation of Stony Banks (H1220)

The perennial vegetation habitat comprises 0.138ha of the total sand dune habitat at Lahinch (Table 85A). Perennial vegetation extends the length of the fixed dunes on the northern edge of the estuary. This habitat is undisturbed due to its inaccessibility and is currently in good condition.

The typical species recorded in this habitat include *Beta vulgaris* ssp. *maritima* (sea beet), *Honckenya peploides* (sea sandwort), *Rumex crispus* (curled dock) and *Tripleurospermum maritimum* (sea mayweed) along with other species *Atriplex prostrata* (spear-leaved orache), *Atriplex laciniata* (frosted orache), *Elytrigia juncea* (sand couch), *Potentilla anserina* (silverweed) and *Plantago maritima* (sea plantain).

Negative indicators recorded in the habitat include *Senecio jacobaea* (common ragwort) and *Cirsium arvense* (creeping thistle) but these were not common.

Annual vegetation of drift lines (H1210)

An area of annual strandline vegetation fronts the embryonic dunes on the northern side of the estuary and comprises a total area of 0.249ha.

The typical species recorded in the habitat include: *Cakile maritima* (sea rocket), *Atriplex* spp. (orache spp.) and *Honckenya peploides* (sea sandwort) along with the embryonic species *Elytrigia juncea* (sand couch).

The negative indicator species *Cirsium arvense* (creeping thistle) occurs in this habitat but is rare.

IMPACTS

The main activities impacting on the sand dune habitats at Lahinch are given in Table 85B. Recreational activities in the form of the golf course and pitch and putt course (code 601) have greatly altered the sand dunes. Coastal protection (code 871) has been installed (in the form of rock armour and gabions) in an effort to protect the golf course from natural erosion (code 900). The coastal protection has restricted sand movement and halted the natural development of foredunes, that are largely absent from the site. Residential and holiday dwellings/houses (Code 150) are permanently located on the dunes and have also modified some of the fixed dune area. These developments are outside of the designated cSAC.

Agricultural activities dominate the remaining fixed dune of the cSAC. As access was denied to the larger area of remaining fixed dunes next to the pitch and putt club, the impacts were observed from

the fenceline. Overall, the fixed dunes are affected by grazing (code 140) by cattle with some areas overgrazed (code 143). Poaching and trampling (code 720) is apparent with many bare areas visible throughout the dunes. Agricultural weeds (code 954) are common throughout the fixed dune area.

The perennial vegetation of stony banks and annual strandline habitats are fenced off from the pitch and putt course with no impacts apparent.

Table 85B Intensity and impact of various activities on sand dune habitats at Lahinch

EU Habitat Code[1]	Activity Code[2]	Intensity[3]	Impact[4]	Area affected (ha)	Location of Activity[5]
H2130	140	A	+1	5	Inside
H2130	143	A	-1	5	Inside
H2130	150	A	-1	10	Inside
H2130	171	C	-1	1	Inside
H2130	601	A	-1	Unknown	Outside
H2130	622	B	-1	2	Inside
H2130	720	B	-1	2	Inside
H2130	871	A	-2	Unknown	Inside
H2120	871	A	-2	Unknown	Inside
H2110	871	A	-2	Unknown	Inside
H2130	900	B	0	Unknown	Inside
H2120	900	B	0	Unknown	Inside
H2110	900	B	0	Unknown	Inside

[1] EU Codes as per Interpretation Manual. Code 21BB is an additional code used to signify the entire dune habitat.
[2] Description of activity codes are found in Appendix 3
[3] Intensity of the influence of an activity is rated as: A= high, B = medium, C = low influence and D = unknown.
[4] Impact is rated as: -2 = irreparable negative influence, -1 = repairable negative influence, 0 = neutral, +1 = natural positive influence and +2 = strongly managed positive influence
[5] Location of activity: Inside = activities recorded within and directly impacting the cSAC. Outside = activities recorded outside but adjacent to sand dune habitat that are impacting the cSAC.

CONSERVATION STATUS

The conservation status of a site is assessed on the current condition of the site and on baseline information. The main source of baseline information for this site was from the ASI survey and the NATURA 2000 survey.

The method of assessment of conservation status differed in NATURA 2000. Therefore, only broad comparisons between the conservation status of the two surveys was possible. A complete survey of the sand dunes at Lahinch was not possible due to denied access and therefore best scientific judgement is used in the absence of survey data, such as monitoring stops etc. The conservation status of the Annex I sand dune habitats at Lahinch are given in Table 85C.

Fixed Dunes (H2130)

A small area of fixed dune is located on the northeast edge of Lahinch golf course and is semi improved and grazed by cattle. Another larger area of fixed dune is located next to Sandfield Pitch and Putt club on the northern side of the mouth of Inagh Estuary and is grazed by cattle. On the day of the survey the landowner was present on site and permission to gain access to his land was requested. Permission was denied by the landowner due to the presence of a bull and therefore the assessment is based on best scientific judgement.

The extent of the fixed dunes is rated as *unfavourable-bad*. This is attributable to the presence of large blowouts caused by sand extraction and exacerbated by trampling by cattle. There is also an animal house located on the dunes.

Table 85C Conservation status of Annex I sand dune habitats of the subsites at Lahinch

Habitat[1]	EU Conservation Status Assessment				
	Favourable	**Unfavourable - Inadequate**	**Unfavourable - Bad**	**Overall EU conservation status assessment**	**Proposed Irish conservation status system[2]**
Fixed Dunes (H2130)		Structure & Functions	Extent, Future prospects	**Unfavourable -Bad**	**Unfavourable - declining**
Perennial vegetation of stony banks (H1220)	Extent, Structure & Functions, Future prospects			**Favourable**	**Favourable - maintained**
Annual vegetation of drift lines (H1210)	Extent, Structure & Functions, Future prospects			**Favourable**	

[1] EU Codes as per Interpretation Manual
[2] Ratings are Favourable (Enhanced, Maintained, Recovered, Declining), Unfavourable (Recovering, Unchanged, Declining) and Destroyed (Partially destroyed, Completely destroyed and Unknown)

Table 85D Pass/Fail results of monitoring stops for Annex I sand dune habitats at Lahinch

	Monitoring stops		
Habitat	**Pass**	**Fail**	**Conservation status**
Fixed Dunes (H2130)	1	0	**Favourable**

The structure and functions is rated as *unfavourable-inadequate*. This is based on best scientific judgement. One monitoring stop was placed in the fixed dunes and this passed. However, high cover of bare ground and agricultural weeds was apparent from visual observations of areas where access was denied. The sward appeared overgrazed and in poor condition.

The future prospects are rated *unfavourable-bad*. The threats from intensive agricultural management of the remaining fixed dunes and threats from activities of the golf course and pitch and putt course are on-going.

The overall EU conservation status is rated as *unfavourable-bad*. The Irish conservation rating is *unfavourable-declining*.

Mobile Dunes (H2120)
Given the small area of Mobile dune habitat a conservation assessment is not required.

Embryonic Dunes (H2110)
Given the small area of Embryonic dune habitat a conservation assessment is not required.

Perennial Shingle (H1220)
The extent of this habitat is rated as *favourable*. A band of perennial vegetation occurs over shingle along the edge of the Pitch and Putt course (Table 85A). The assessment is based on best scientific judgement as the extent of this habitat has not been previously mapped.

The structure and functions parameter is rated as *favourable* (Table 85D). No monitoring stops were placed in the habitat due to restricted access on the day of survey. However, an overall assessment is made on the presence of a good diversity of typical species and the absence of negative indicators, such as, man-made structures.

The future prospects of this habitat are considered *favourable.* There are currently no threats to this habitat. It is situated in a remote and inaccessible part of the site which is tidal.

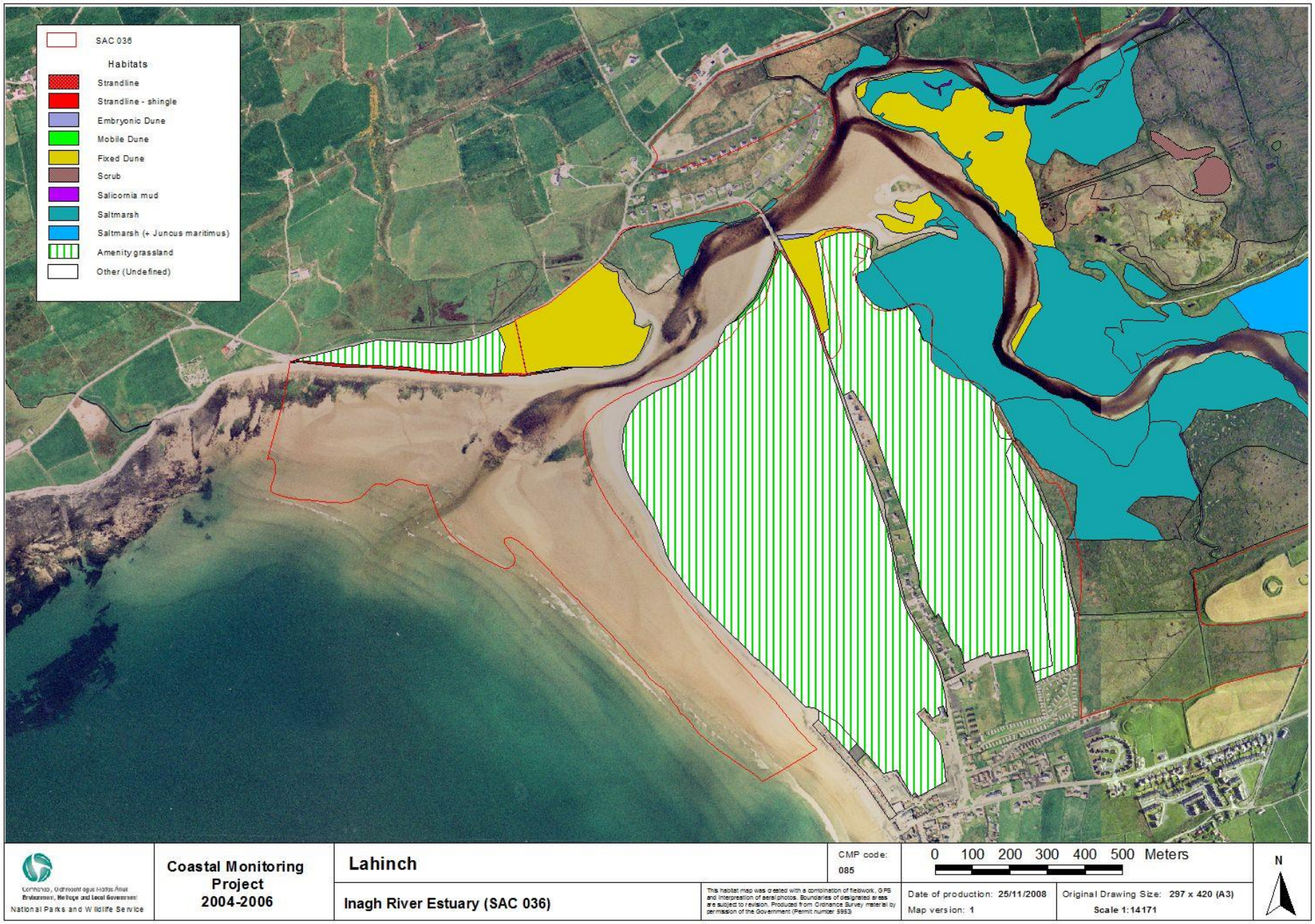
The overall EU conservation assessment is considered *favourable* and the Irish conservation status is *favourable-maintained.*

Annual Strandline (H1210)
The extent of this habitat is rated as *favourable*. A band of annual vegetation occurs along the edge of the Pitch and Putt course (Table 85A). The assessment is based on best scientific judgement as the extent of this habitat has not been previously mapped.

The structure and functions parameter is rated as *favourable* (Table 85D). No monitoring stops were placed in the habitat due to restricted access on the day of survey. As with the perennial shingle vegetation, an overall assessment is made on the presence of a good diversity of typical species and the low occurrence of negative indicator species.

The future prospects of this habitat are considered *favourable.* There are currently no threats to this habitat. It is situated in a remote and inaccessible part of the site which is tidal.

The overall EU conservation assessment is considered *favourable* and the Irish conservation status is *favourable-maintained.*


SAC 036
Habitats
Strandline
Strandline - shingle
Embryonic Dune
Mobile Dune
Fixed Dune
Scrub
Salicornia mud
Saltmarsh
Saltmarsh (+ Juncus maritimus)
Amenity grassland
Other (Undefined)
Coastal Monitoring Project 2004-2006
Lahinch
Inagh River Estuary (SAC 036)
CMP code: 085
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 5953)
0 100 200 300 400 500 Meters
Date of production: 25/11/2008
Map version: 1
Original Drawing Size: 297 x 420 (A3)
Scale 1:14171
N
National Parks and Wildlife Service