NPWS

The Murrough Wetlands SAC (site code: 002249)

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 2006-2008 (SMP 2007-2008) and the Saltmarsh Monitoring Project 2017-2018 (SMP 2017-2018) 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 (2021) Conservation Objectives: The Murrough Wetlands SAC 002249. Version 1.0. National Parks and Wildlife Service, Department of Housing, Local Government and Heritage.

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 Communities, 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.

The Murrough Wetlands SAC (site code: 002249) is a complex coastal system comprising both freshwater and coastal wetlands, as well as terrestrial coastal habitats. It is selected for shingle beaches, saltmarshes, annual vegetation of drift lines, *Cladium* fen and alkaline fen. The following four Annex I coastal habitats are included in the list of Qualifying Interests for the SAC:

1210 Annual vegetation of drift lines
1220 Perennial vegetation of stony banks
1330 Atlantic salt meadows (Glauco-Puccinellietalia maritimae)
1410 Mediterranean salt meadows (Juncetaliea maritimi)

Atlantic salt meadows (ASM) and Mediterranean salt meadows (MSM) are saltmarsh habitats, while the habitat annual vegetation of drift lines is often associated with sand dune systems. Perennial vegetation of stony banks (vegetated shingle) is another coastal habitat. All habitats occur in close association with each other.

The mapped distribution of perennial vegetation of stony banks and annual vegetation of drift lines within The Murrough Wetlands SAC is presented in Appendix I and the mapped distribution of the saltmarsh habitats within the SAC are presented in Appendix II and III.

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 four coastal habitats listed above in The Murrough Wetlands SAC, which are defined by a list of parameters, attributes and targets. The main parameters are (a) Area (b) Range 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 attributes and targets set for **perennial vegetation of stony banks (vegetated shingle)** are based in part on the findings of the Vegetated Shingle Monitoring Project (VSM; Martin *et al*., 2017), which was carried out in 2016 on behalf of the National Parks and Wildlife Service (NPWS). This document should be consulted for further details on the attributes and targets.

The site-specific conservation objective for perennial vegetation of stony banks in The Murrough Wetlands SAC is based on the findings of the Murrough Sand Dunes Assessment (Martin, 2019) carried out in 2019 on behalf of Wicklow County Council. This document should be read in conjunction with that report.

Vegetated shingle within The Murrough Wetlands SAC had previously been recorded during the National Shingle Beach Survey (NSBS), which was carried out in 1999 on behalf of NPWS (Moore and Wilson, 1999), with the beach referred to as a vegetated shingle ridge and classified as a fringing beach following Chapman (1976).

The NSBS (Moore and Wilson, 1999) ranked each surveyed site as either High, Medium or Low interest, based on site representativity, species diversity, habitat diversity and the presence of rare or scarce species. A 'High interest' ranking denoted a site that is of high conservation value and perhaps of interest botanically or geomorphologically (Moore and Wilson, 1999). The shingle beach in The Murrough Wetlands SAC was ranked as being a site of 'High interest' due to the presence of yellow horned-poppy (*Glaucium flavum*).

The vegetated shingle habitat was resurveyed, mapped and assessed in 2016 by the VSM project (Martin *et al*., 2017) at the sub-site The Murrough (VSM site code 025), and yellow horned-poppy (*G. flavum*) was refound along with *s*ea kale (*Crambe maritima*), a species rare in Ireland. Both of these species are classified as *Near Threatened* on the Irish Red List of Vascular Plants (Wyse Jackson *et al*., 2016).

In 2019, the habitat maps for shingle and sand dunes were updated (Martin, 2019) and the data from these updated maps are presented in Appendix I.

The attribute and targets set for **saltmarsh habitats** are based primarily on the results of the Saltmarsh Monitoring Project 2017-2018 (SMP 2017-2018; Brophy *et al*., 2019) which was carried out on behalf of NPWS. This document should be read in conjunction with that report.

The site-specific conservation objectives for the saltmarsh habitats (ASM and MSM) in The Murrough Wetlands SAC are based on the findings of the SMP 2017-2018 (Brophy *et al*., 2019), during which the sub-site Broad Lough (site code SMP0135), located north of Wicklow town, was surveyed, mapped and assessed.

The saltmarsh habitats from Greystones to Wicklow Town were surveyed, mapped and assessed during the Saltmarsh Monitoring Project 2006-2008 (SMP 2006-2008; McCorry, 2006; McCorry and Ryle, 2009) at the sub-site Kilcoole (site code SMP0036) by McCorry and Ryle (2009).

The distribution of ASM, based on Brophy *et al*. (2019) and McCorry and Ryle (2009), and that of MSM, based on Brophy *et al*. (2019), in the SAC are presented in Appendix II and III respectively.

As part of the SMP 2017-2018 (Brophy *et al*., 2019), a detailed individual site report and habitat map were produced for the Broad Lough sub-site and these are included in Appendix IV.

As part of the SMP 2006-2018 (McCorry and Ryle, 2009), a detailed individual site report and habitat maps were produced for the Kilcoole sub-site and these are included in Appendix V. Please note that the habitat assessment criteria have since been updated by Brophy *et al*. (2019).

The attributes and targets set for **sand dune habitats** are based primarily on the results of the Coastal Monitoring Project (CMP; Ryle *et al*., 2009) and the Sand Dunes Monitoring Project (SDM; Delaney *et al*., 2013), combined with the results of Gaynor (2008). These documents should be consulted for further details on the attributes and targets.

The site-specific conservation objective for Annual vegetation of drift lines in The Murrough Wetlands SAC is based on the findings of Martin (2019).

Previously, sand dune habitats in The Murrough Wetlands SAC had been surveyed by the CMP (Ryle *et al*., 2009). The CMP was a comprehensive national baseline survey of all known sand dune systems in Ireland. Two sub-sites associated with The Murrough Wetlands SAC were surveyed, mapped and assessed:

1. Ballybla (Site code: 014)
2. Kilcoole (site code: 013)

Annual vegetation of drift lines was found to be present in the Ballybla sub-site at that time, but not in the Kilcoole sub-site (Ryle *et al*., 2009).

Martin (2019) resurveyed vegetated shingle and sand dune habitats at The Murrough Wetlands SAC, including Annual vegetation of drift lines, and updated the habitat maps. The data from these updated maps are presented in Appendix I.

The coastal habitats in The Murrough Wetlands SAC have been thoroughly explored and mapped over the course of the surveys cited above, but it should be noted that due to natural coastal processes, these habitats are dynamic and so their area and distribution are subject to change from year to year.

3 Perennial vegetation of stony banks

The following definition of perennial vegetation of stony banks habitat in Ireland is based on the data collected during the VSM (Martin *et al*., 2017) and is an adaptation of the definitions used in European Commission (2013) and NPWS (2013).

Perennial vegetation of stony banks occurs along the coast where shingle (cobbles, pebbles, and gravel ≥2mm) has accumulated to form elevated ridges or banks above the high tide mark. The majority of the rocky material should be between 2mm and 256mm in diameter to be considered in this habitat category. On the upper beach, the pioneer community can be characterised by perennial species such as sea beet (*Beta vulgaris* subsp. *maritima*), sea-kale (*Crambe maritima*), rock samphire (*Crithmum maritimum*), cleavers (*Galium aparine*), yellow-horned poppy (*Glaucium flavum*), sea pea (*Lathyrus japonicus*), wild radish (*Raphanus raphanistrum* subsp. *maritimus*), curled dock (*Rumex crispus*), sea campion (*Silene uniflora*), perennial sow-thistle (*Sonchus arvensis*) and sea mayweed (*Tripleurospermum maritimum*). The majority of the area within this pioneer community is usually bare shingle. At the top of the beach, and moving inland, a wider range of vegetation types can be found at larger shingle sites including a lichen-rich community and coastal forms of grassland, heath and scrub. The grassland community can be characterised by grass species such as common bent-grass (*Agrostis capillaris*), creeping bent-grass (*A. stolonifera*), false oat-grass (*Arrhenatherum elatius*), cock's-foot (*Dactylis glomerata*), spreading meadow-grass (*Poa humilis*), sand couch (*Elytrigia repens*), red fescue (*Festuca rubra*), Yorkshire fog (*Holcus lanatus*) and crested hair-grass (*Koeleria macrantha*), field wood-rush (*Luzula campestris*), and broadleaf herbs such as yarrow (*Achillea millefolium*), thrift (*Armeria maritima*), common mouse-ear (*Cerastium fontanum*), wild carrot (*Daucus carota*), autumn hawkbit (*Leontodon autumnalis*), common bird's-foot trefoil (*Lotus corniculatus*), buck's-horn plantain

(*Plantago coronopus*), ribwort plantain (*P. lanceolata*), silverweed (*Potentilla anserina*), common sorrel (*Rumex acetosa*), dandelion (*Taraxacum officinale* agg.), lady's bedstraw (*Galium verum*), red clover (*Trifolium pratense*) and white clover (*T. repens*). The scrub community can be characterised by the woody species honeysuckle (*Lonicera periclymenum*), blackthorn (*Prunus spinosa*), bramble (*Rubus fruticosus* agg.), gorse (*Ulex europaeus*) and the climber hedge bindweed (*Calystegia sepium*). These more inland communities have less bare shingle and vegetative cover usually dominates. The majority of the grassland and scrub communities are rooted within soil, whereas the pioneer community is usually rooted in gravel, sand or organic matter (e.g. decomposing seaweed and other plant material). Once the soil layer on top of the shingle is more than 30cm deep, the community is no longer defined as perennial vegetation of stony banks.

3.1 Overall Objective

The overall objective for 'Perennial vegetation of stony banks' in The Murrough Wetlands SAC is to '*restore the favourable conservation condition'*.

This objective is based on an assessment of the recorded condition of the 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 for favourable condition is that there is no decrease from the established baseline. Bearing in mind that coastal systems are naturally dynamic and subject to change, even within a season, this target is assessed subject to natural processes, including erosion and succession.

According to the most recent survey, the area of Perennial vegetation of stony banks in The Murrough Wetlands SAC is c. 13ha (Martin, 2019). No decline in area due to human activities has been recorded.

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

3.3 Range

3.3.1 Habitat distribution

The recorded location of the surveyed vegetated shingle site in The Murrough Wetlands SAC, as mapped by Martin (2019), is presented in Appendix I. The habitat in the SAC runs approximately north to south and provides a barrier between the wetlands to the west and the sea to the east.

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

3.4 Structure and Functions

A fundamental aim of shingle conservation is to facilitate natural mobility. Shingle beaches are naturally dynamic systems, making them of geomorphological interest, as well as ecological interest. They are constantly changing and shingle features are rarely stable in the long-term.

3.4.1 Physical structure: functionality and sediment supply

The health and on-going development of the habitat relies on a continuing supply of shingle sediment. This may occur sporadically as a response to storm events rather than continuously. Interference with the natural coastal processes, through offshore (or onshore) extraction or coastal defence structures in particular, can interrupt the supply of sediment and lead to beach starvation.

The most common vegetation community of the shingle habitat at The Murrough Wetlands SAC is a relatively stable grassland community. Here, gravel (2mm diameter) particles form the majority (>60%) of the substrate from a depth of approximately 10cm. Closer to the shore, a pioneer community is found on coarser substrate. The presence of rock armour erected since designation has affected the mobility of the shingle substrate in the SAC (Martin, 2019).

The target for this SAC is to restore, the natural circulation of sediment and organic matter, without any physical obstructions.

3.4.2 Physical structure: disturbance

Damage to the habitat due to disturbance was assessed as a negative indicator by Martin *et al*. (2017). Disturbance can include damage from heavy trampling, vehicle damage and removal of substrate.

No damage due to disturbance was noted in this habitat during surveys by Martin *et al*. (2017) or Martin (2019).

The target is that no more than 20% of the habitat is affected by disturbance.

3.4.3 Vegetation structure: zonation

Ecological variation within this habitat type depends on stability, the amount of fine material accumulating between the pebbles, climatic conditions, width of the foreshore and past management of the site. The ridges and lows also influence the vegetation patterns, resulting in characteristic communities and zonations of bare and vegetated shingle. In the frontal, less stable areas of shingle, the vegetation tends to be dominated by short-lived salt-tolerant perennials (pioneer community). Where the shingle is more stable, it becomes more vegetated and may include grassland, heathland and scrub communities, depending on the exact nature of the site. The presence of lichens indicates long-term stability of the shingle structure. Further information on the communities of perennial vegetation of stony banks is found in Martin *et al*. (2017).

Martin (2019) recorded three communities of perennial vegetation of stony banks at The Murrough Wetlands SAC: a pioneer community, a scrub community and a grassland community**.** The most abundant community was the grassland community.

Vegetated shingle is part of a naturally dynamic coastal system. In order to ensure the ecological functioning of all of the vegetated shingle communities present, it is vital to maintain the zonations and transitions to other habitats, including lagoon, saltmarsh and sand dune habitats.

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

3.4.4 Vegetation composition: communities and typical species

The degree of exposure, as well as the coarseness and stability of the substrate, determines species diversity. Typical species lists for the three main vegetated shingle communities (pioneer, grassland and scrub) are presented in Martin *et al*. (2017).

As mentioned earlier, the shingle habitat in The Murrough Wetlands SAC includes three communities of perennial vegetation of stony banks that were recorded by Martin (2019) – a pioneer, a shrub and a grassland community. The grassland community is most extensive and the pioneer community is found close to the shore (Martin, 2019), while the grassland and scrub communities are located on the more stable and sheltered parts of the shingle bank to the west. Between 11 and 15 native species were found in seven of the eight monitoring stops recorded by Martin (2019), and although only five species were found at the remaining stop, as this was located in the pioneer community, a sparse community is considered acceptable. Both yellow-horned poppy (*Glaucium flavum*) and sea kale (*Crambe maritima*) were present.

The target for this attribute is to ensure that the occurrence of typical species within the range of vegetated shingle communities is maintained.

3.4.5 Vegetation composition: native negative indicator species

Native negative indicator species can include species indicative of changes in nutrient status e.g. nettle (*Urtica dioica*), and species not considered to be typical of the habitat, e.g. bracken (*Pteridium aquilinum*). The list of negative indicator species commonly found in the habitat is presented in Appendix I of Martin *et al*. (2017).

Negative indicators spear thistle (*Cirsium vulgare*) and ragwort (*Senecio jacobaea*) were present in low numbers, but the cover of perennial rye-grass (*Lolium perenne*) was excessive at a single monitoring stop (50% cover) recorded by Martin (2019).

The target for negative indicator species is that no species is present in more than 60% of stops and the combined cover in any individual stop is 25% or less.

3.4.6 Vegetation composition: non-native species

Non-native species can be invasive and have deleterious effects on native vegetation. Low targets are set as non-native species can spread rapidly and are most easily dealt with when still at lower abundances.

Martin (2019) did not record any non-native species within the vegetated shingle habitat in The Murrough Wetlands SAC.

The target for non-native species is that no species is present in more than 20% of stops, the combined cover in any individual stop is 1% or less, and the cover across the whole site 1% or less. At a site level, if a non-native species has been under-recorded, or not recorded, via the stops the percentage cover for the species across the site should be recorded and assessed.

4 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 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)

Two saltmarsh habitats, Atlantic salt meadows (ASM) and Mediterranean salt meadows (MSM), indicated in **bold** above, are listed as Qualifying Interests for The Murrough Wetlands SAC. The last habitat on the list is restricted in its distribution to sites in the south-east of the country.

The SMP 2017-2018 (Brophy *et al*., 2019) surveyed, mapped and assessed the following saltmarsh sub-site associated with The Murrough Wetlands SAC: Broad Lough, site code SMP0135. Both Atlantic salt meadows (Glauco-Puccinellietalia maritimae) and Mediterranean salt meadows (Juncetalia maritimi) were recorded. *Salicornia* and other annuals colonising mud and sand was also recorded and assessed, but this habitat is not a Qualifying Interest for this particular SAC.

The SMP 2006-2008 (McCorry and Ryle, 2009) surveyed, mapped and assessed the following saltmarsh sub-site associated with The Murrough Wetlands SAC: Kilcoole, site code SMP0036. A small area of Atlantic salt meadows (Glauco-Puccinellietalia maritimae) was recorded within the boundary of the SAC during this survey.

4.1 Overall objectives

The overall objective for 'Atlantic salt meadows' in The Murrough Wetlands SAC is to '*restore the favourable conservation condition*'.

The overall objective for 'Mediterranean salt meadows' in The Murrough Wetlands SAC is to '*restore the favourable conservation condition*'.

This objectives are based on an assessment of the recorded condition of the 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.

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.

The total area of ASM within The Murrough Wetlands SAC is estimated to be 16.64ha. Most of this area (16.57ha) was recorded during the SMP 2017-2018 (Brophy *et al*., 2019) at the Broad Lough sub-site (SMP 0135). The remainder was recorded during the SMP 2006-2008 (McCorry and Ryle, 2009), within the northern part of the SAC in the sub-site Kilcoole (SMP0036), of which 0.07ha of the habitat lies within the SAC boundary.

Brophy *et al*. (2019) noted loss of 0.035ha (equal to 0.021% of the original area) of ASM as the result of construction of a track associated with drainage works.

Mediterranean salt meadows are also primarily located in the southern part of the SAC, and an area of 5.17ha was recorded during the SMP 2017-2018 (Brophy *et al*., 2019).

The general target is that the area of should be stable or increasing. 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.

4.3 Range

4.3.1 Habitat distribution

The Atlantic salt meadows and Mediterranean salt meadows are primarily found in the southern part of The Murrough Wetlands SAC in the Broad Lough sub-site (SMP0135) surveyed by the SMP 2017-2018 (Brophy *et al*., 2019), although much smaller areas of ASM also occur in the northern part of the SAC, as recorded by the SMP 2006-2008 (McCorry and Ryle, 2009). There has been no recorded reduction in the distribution of the habitats since designation.

The general target is that there should be no decline in the distribution of the saltmarsh 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 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 The Murrough Wetlands SAC in terms of its structure and functions depends on a range of attributes for which targets have been set as outlined below.

4.4.1 Physical structure: hydrology

The movement of fresh groundwater and tidal sea water is important for the functioning of saltmarsh habitats and underpins species distributions. Alterations of the drainage, e.g. by altering channels, compromises those natural hydrological processes.

Drainage works were noted in the ASM habitat in The Murrough Wetlands SAC in the sub-site Broad Lough (site code SMP0135) by Brophy *et al*. (2019).

No alterations to the hydrology were noted as affecting the MSM habitat by Brophy *et al*. (2019).

The target is that there should be no human disturbance to hydrology (including impacts on creeks and pans).

4.4.2 Vegetation structure: plant height

This attribute is only relevant to Atlantic salt meadows, and not to Mediterranean salt meadows. Under optimal conditions, the vegetation height in saltmarsh is variable, depending on the plant community and external factors such as grazing. This small-scale variability is beneficial for biodiversity. Intensive grazing or abandonment of light grazing can result in a more uniform sward height. Standard deviation provides a measure of variability in sward height between monitoring stops.

The standard deviation for sward height in Atlantic salt meadows at the sub-site Broad Lough (site code SMP0135), was greater than 5 according to Brophy *et al*. (2019).

The target for this attribute is that the standard deviation of median of maximum leaf height from four quadrants of a representative number of 2m x 2m monitoring plots is greater than 5.

4.4.3 Vegetation structure: disturbed ground

Disturbed ground is the result of activities that break the vegetation cover and result in bare marsh substrate. While a small component of disturbed ground can be beneficial for pioneer species and overall habitat diversity, a large component of disturbed ground can compromise the integrity of the saltmarsh.

Disturbed ground occupied less than 5% of the total area of both Atlantic salt meadows and Mediterranean salt meadows at Broad Lough (site code SMP0135) (Brophy *et al*., 2019).

The target for this attribute is that disturbed ground should be below 5% in a representative number of 2m x 2m monitoring stops.

4.4.4 Vegetation structure: zonation

Zonation in Atlantic salt meadows is assessed as variability of plant communities associated with different characteristics in the saltmarsh. The plant communities associated with Irish saltmarsh habitats, e.g. SM2, SM3, etc., are described in the Irish Vegetation Classification (details available here: https://biodiversityireland.ie/projects/ivc-classification-explorer/) and listed in Brophy *et al*. (2019). While discernible zonation of vegetation is considered a sign of good saltmarsh functioning, it can be

limited naturally under certain circumstances (Devaney and Perrin, 2015). The assessment criteria for zonation is therefore set depending on the geographical type of saltmarsh present. The attribute does not apply to Mediterranean salt meadows.

Zonation was considered adequate in the Atlantic Salt meadows at Broad Lough (site code SMP0135) (Brophy *et al*., 2019).

The target for this attribute is for Atlantic salt meadows to have an adequate number of zones that cover 1% or more of the 1330 area, depending on the geographical type of saltmarsh present.

4.4.5 Vegetation structure: transitions

Intact transitions from saltmarsh habitats to surrounding habitats (e.g. sand dunes, freshwater marsh) are an important aspect of saltmarsh functioning and support biodiversity.

No losses of habitat transitions were recorded in Atlantic salt meadows or Mediterranean salt meadows at Broad Lough (site code SMP0135) (Brophy *et al*., 2019).

The target for this attribute is that no loss of natural transitions to semi-natural terrestrial habitats on landward margin should have occurred.

4.4.6 Vegetation composition: typical species

The plant communities of saltmarsh habitat vary according to the habitat zonation, but certain species are commonly found in saltmarsh habitats and are indicative of saltmarsh functioning. These differ between saltmarsh types, and the typical species that are listed for Atlantic salt meadows (1330) and Mediterranean salt meadows (1410) are presented in Brophy *et al*. (2019) and in Table 1 below.

Table 1: Typical species lists in the Structure and functions assessment of Atlantic salt meadows (1330) and Mediterranean salt meadows (1410) from Brophy *et al*. (2019).

Atlantic salt meadows (1330)		**Mediterranean salt meadows (1410)**
Agrostis stolonifera	*Spergularia marina*	*Aster tripolium*
Armeria maritima	*Spergularia media*	*Cochlearia* spp.
Aster tripolium	*Suaeda maritima*	*Glaux maritima*
Atriplex littoralis	*Triglochin maritimum*	*Juncus acutus*
Atriplex portulacoides	*Tripleurospermum maritimum*	*Juncus gerardii*
Atriplex prostrata		*Juncus maritimus*
Beta vulgaris		*Leontodon autumnalis*
Carex extensa		*Oenanthe lachenalii*
Cochlearia spp.		*Plantago maritima*
Elytrigia atherica		*Triglochin maritimum*
Elytrigia repens		
Festuca rubra		
Glaux maritima		
Juncus gerardii		
Limonium humile		
Plantago maritima		
Puccinellia maritima		
Salicornia agg.		

More than twelve typical species were recorded in Atlantic salt meadows, and more than six in Mediterranean salt meadows in the Broad Lough sub-site by Brophy *et al*. (2019). Two or more typical species were recorded in each of the Mediterranean salt meadow monitoring plots in the sub-site (Brophy *et al*., 2019).

The target for this attribute in Atlantic salt meadows is that a minimum of twelve typical species should be recorded across all 2m x 2m monitoring plots. For Mediterranean salt meadows, the target is that a minimum of six typical species be recorded across all plots; and for there to be at least two typical species present in more than 25% of plots (excluding *Juncus maritimus*).

4.4.7 Vegetation composition: negative species

Common cordgrass (*Spartina anglica*) is a non-native species capable of colonising saltmarsh and mudflats rapidly, and can pose a threat to native plant communities. It is therefore considered a negative species in saltmarsh habitats, and spread of the species is monitored. Monitoring occurs both at the habitat level (i.e. new occurrence of common cordgrass (*S. anglica*) at a site where it was previously absent from the habitat) and also at the stop level (the percentage cover within 5m of a monitoring plot).

Common cordgrass (*S. anglica*) was not recorded in either ASM or MSM according to Brophy *et al*. (2019), nor in ASM habitat in the Kilcoole sub-site (McCorry and Ryle, 2009).

The target is for *Spartina* spp. to be absent from the saltmarsh habitat, or, where previously recorded, for there to be no increase in the distribution or cover of *Spartina* spp. since the SMP 2006-2008 (McCorry, 2007; McCorry and Ryle, 2009).

4.4.8 Other negative indicators

Other negative indicators is a broad category for a range of damaging activities affecting the functioning of saltmarsh habitat. These may include, but are not limited to, infilling, land claim, turf-cutting and pollution.

Both the Atlantic salt meadows and the Mediterranean salt meadows at Broad Lough (sub-site SMP0135) were affected by disturbance through the use of a digger and deposition of dredged materials in 2018 (Brophy *et al*., 2019).

The target is that no negative indicators, such as signs of infilling, reclamation, turf-cutting or pollution, should be recorded in the saltmarsh habitat.

4.4.9 Indicators of local distinctiveness

At some sites, species of conservation interest that are not noted elsewhere in the monitoring assessment occur, and it is desirable to maintain these populations. Such species often have restricted distributions or are widespread but scarce nationally. In many cases they are strongly associated with coastal habitats and saltmarsh in particular. Examples include saltmarsh flat-sedge (*Blysmus rufus*), hard-grass (*Parapholis strigose*), sea couch (*Elytrigia atherica*), meadow barley (*Hordeum secalinum*), ditch-grasses (*Ruppia* spp.) and sea wormwood (*Seriphidium maritimum*).

Sea couch (*Elytrigia atherica*) was found in the Atlantic salt meadow habitat at Broad Lough (sub-site SMP0135) in 2018 (Brophy *et al*., 2019). There were no indicators of local distinctiveness recorded from Mediterranean salt meadows at the sub-site (Brophy *et al*., 2019).

The target for this attribute is that there should be no decline in distribution or population sizes of rare, threatened or scarce species associated with the habitat.

5 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) *

One sand dune habitat, indicated in **bold** above, is listed as a Qualifying Interest for The Murrough Wetlands SAC. Three further sand dune habitats (2110, 2120 and 2130*) were recorded in the SAC during both the Coastal Monitoring Project (Ryle *et al*., 2009) and by Martin (2019), but these habitats are not listed as Qualifying Interests for The Murrough Wetlands SAC. These habitats include mobile areas at the front as well as more stabilised parts of dune systems.

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

leaved orache (*Atriplex prostrata*), frosted orache (*A. laciniata*), sea rocket (*Cakile maritima*), sea sandwort (*Honckenya peploides*) and prickly saltwort (*Salsola kali*).

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.

5.1 Overall objective

The overall objective for 'Annual vegetation of drift lines' in The Murrough Wetlands SAC is to '*restore the favourable conservation condition*'.

This objective is based on an assessment of the recorded condition of the 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.

5.2 Area

5.2.1 Habitat area

Habitat extent is a basic attribute to be assessed when determining the condition of a particular habitat.

Annual vegetation of drift lines covered a total area of c. 5.2ha when surveyed in 2019 (Martin, 2019), an increase since the previously recorded area of 0.11ha made during the Coastal Monitoring Project (Ryle *et al*., 2009). Much of the difference in area can be ascribed to differences in mapping and interpretation methodologies. No loss of habitat due to human activities was recorded in 2019. The most recent habitat maps for the sand dune and shingle habitats are shown in Appendix I, and full details of that survey are provided in Martin (2019), a report written for Wicklow County Council.

The general target for this attribute is that the area of the habitat 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.

5.3 Range

5.3.1 Habitat distribution

Annual vegetation of drift lines occurs on the upper part of beaches, seaward of dune and shingle habitats. The distribution of Annual vegetation of drift lines at The Murrough Wetlands SAC is presented in Appendix I. No reduction of the distribution of the habitat due to human activities has been recorded in the SAC.

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

5.4 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. Restoring the favourable conservation condition of the sand dune habitat in The Murrough Wetlands SAC in terms of structure and functions depends on a range of attributes for which targets have been set as outlined below.

5.4.1 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 installation of rock armour since designation has reduced the mobility of the substrate of the sand dune and shingle habitats at The Murrough Wetlands SAC, including Annual vegetation of drift lines (Martin, 2019).

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.

5.4.2 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.

The natural transitions between Annual vegetation of drift lines, the beach and the more stable dune and shingle habitats to the west have been maintained in The Murrough Wetlands SAC.

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

5.4.3 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.

Annual vegetation of drift lines in The Murrough Wetlands SAC supported typical species including oraches (*Atriplex spp*.), sea rocket (*Cakile maritima*) and sea sandwort (*Honckenya peploides*) as recorded by Martin (2019).

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

5.4.4 Vegetation composition: native negative indicator species

Native negative indicators include species indicative of changes in nutrient status, e.g. nettle (*Urtica dioica*), and species not considered characteristic of the habitat, e.g. bracken (*Pteridium aquilinum*). Native negative indicator species for Annual vegetation of drift lines is found in Appendix I of Delaney *et al*. (2013).

No negative indicator species were recorded in Annual vegetation of drift lines at The Murrough Wetlands SAC in 2019 (Martin, 2019).

The target for native negative indicators is that no species is present in more than 60% of stops and the combined cover of negative indicators throughout any one habitat is 5% or less and the highest cover score within any one stop in 25% or less.

5.4.5 Vegetation composition: non-native species

Non-native species can have a negative impact on sand dune habitats. Sea buckthorn (*Hippophae rhamnoides*) should be absent or effectively controlled.

No non-native species were recorded in the habitat in the SAC in 2019 (Martin, 2019).

The target is that non-native species, such as sea buckthorn (*Hippophae rhamnoides*) or red valerian (*Centranthus ruber*), should not be present in more than 20% of stops.

6 References

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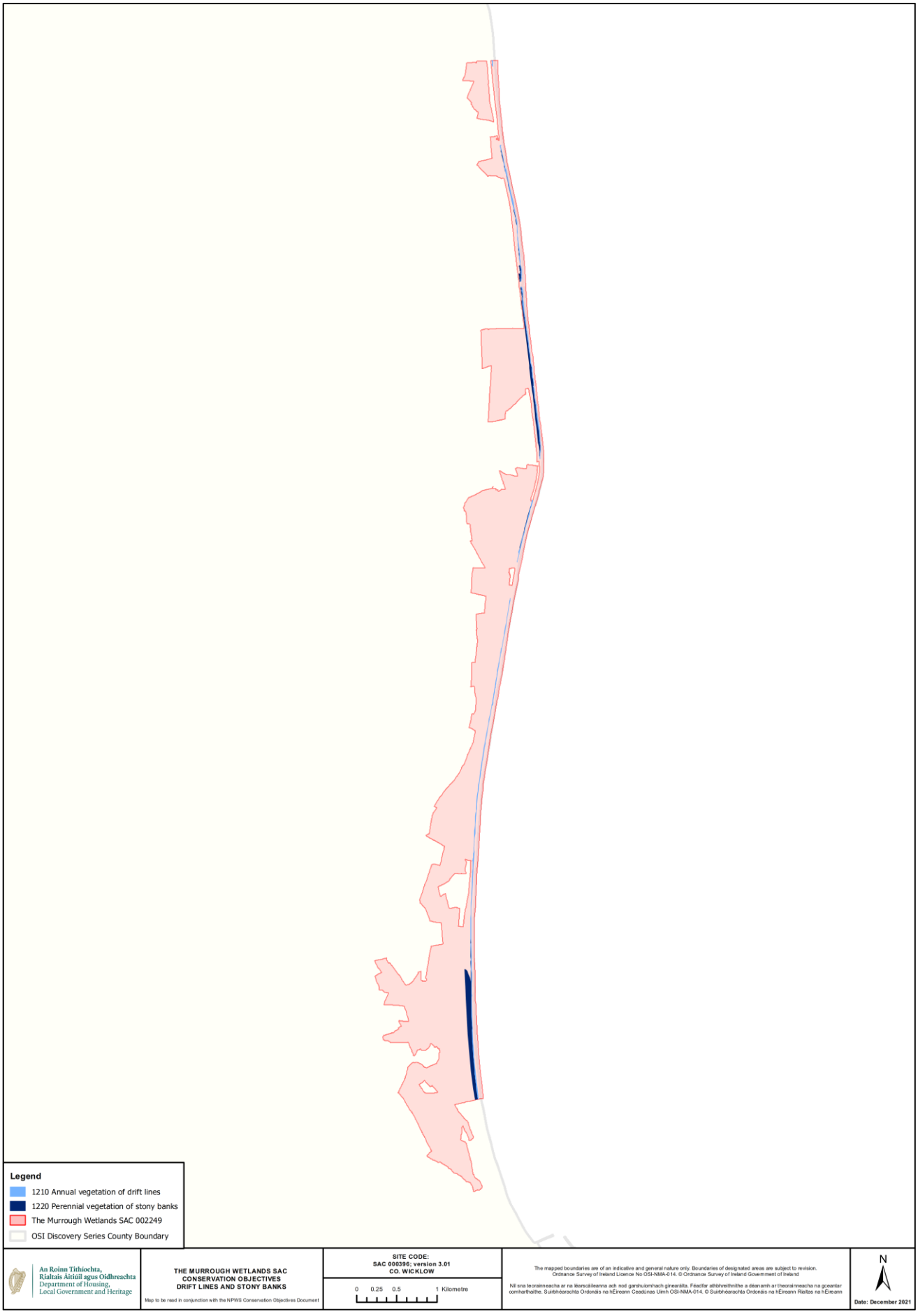
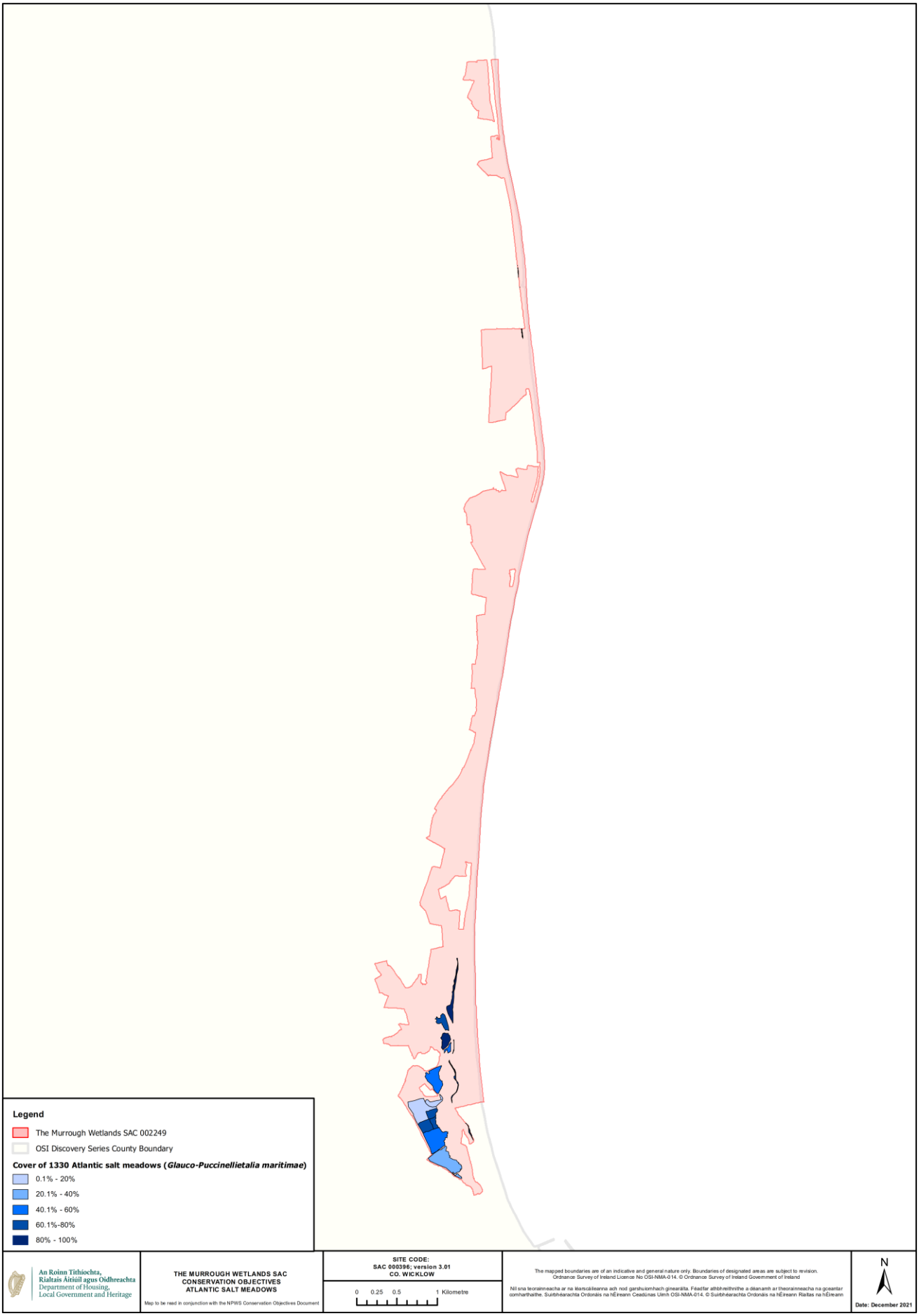
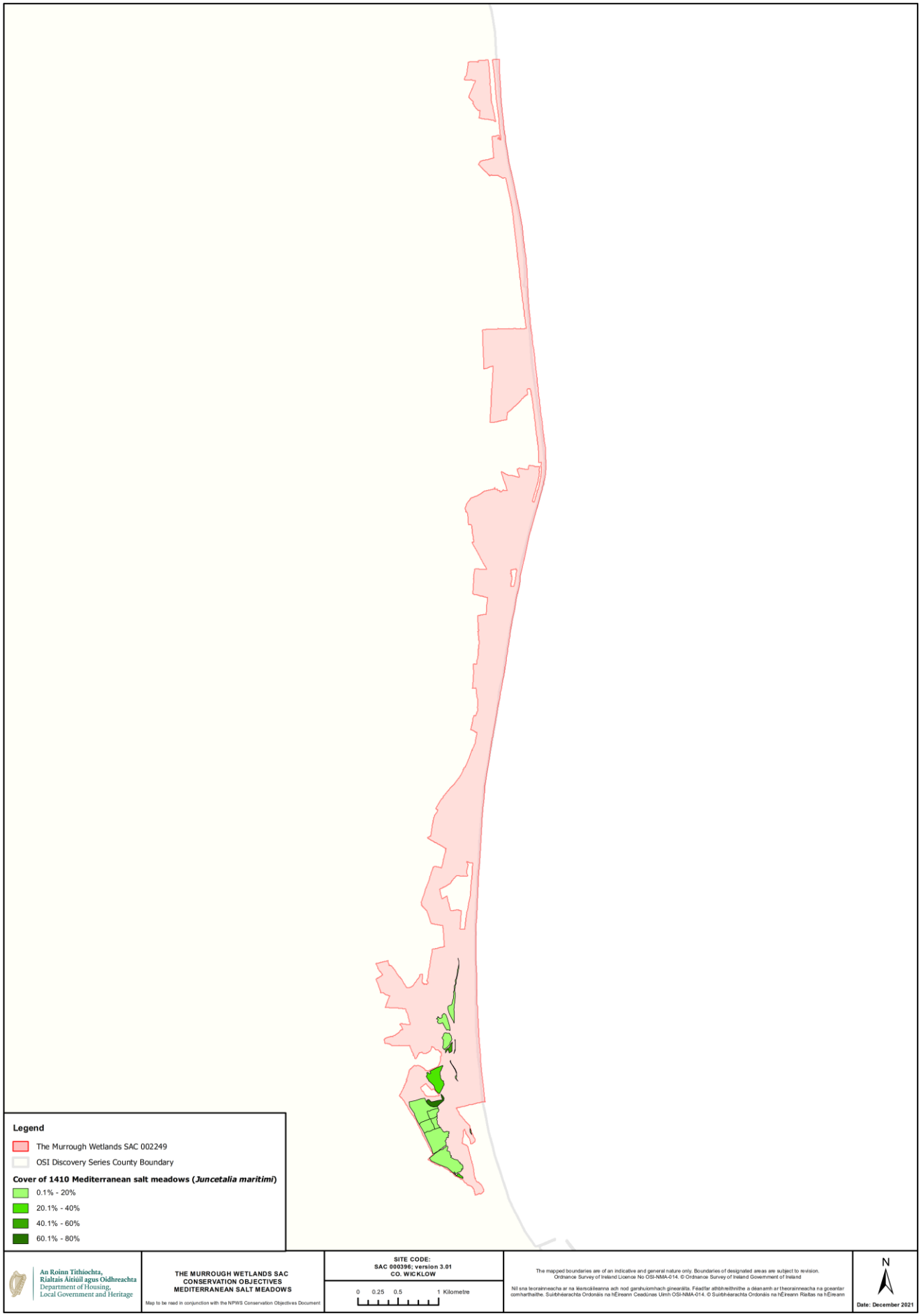
Appendix I – Distribution map of Perennial vegetation of stony banks and Annual vegetation of drift lines in The Murrough Wetlands SAC (002249)



Appendix II – Distribution map of Atlantic salt meadows in The Murrough Wetlands SAC (002249)



Appendix III – Distribution map of Mediterranean salt meadows in The Murrough Wetlands SAC (002249)



Appendix IV – Broad Lough (SMP0135) site report and habitat map from the Saltmarsh Monitoring Project 2017-2018 (Brophy *et al*., 2019)

Summary site data

WFD water body	Broad Lough		**SMPI**		**SMPII**	
SMP site no.	0135	**HD 1310**	NA ha	NA plot(s)	0.34 ha	0 plot(s)
County	Wicklow	**HD 1330**	NA ha	NA plot(s)	NA ha	17 plot(s)
Discovery map	56	**HD 1410**	NA ha	NA plot(s)	5.17 ha	8 plot(s)
Site source	Desk	**HD 1420**	NA ha	NA plot(s)	NA ha	0 plot(s)
Surveyor(s)	JB, RH, MP	***Spartina***	NA ha		0.00 ha	
Date(s) surveyed	07/07/2017, 10/07/2017 & 14/08/2018					
Notes	*Species of local distinctiveness = Elytrigia atherica (SMPII)*					

Site description

Broad Lough is a medium-sized saltmarsh site covering 57ha, which was not covered by the SMP. It is distributed around Broad Lough, north of Wicklow Town and north of the R999 Bridge, Co. Wicklow. The main saltmarsh habitats are 1330 and 1410, with some 1310 to the southeast. Extensive areas of swamp are also present within the site. The locally distinctive *Elytrigia atherica* occurs at this site.

Past drainage is evident throughout the western part of this site. A road runs through saltmarsh behind Tinakilly Hotel, and this is already evident at OSI 1995 aerial photographs. Large pans in 1330 within the north-western part of the site have been recently drained using a digger and nearby drainage channel has been widened up considerably. A low soil berm has been constructed within 1330 parallel to the channel, extending to the front of the saltmarsh. At the time of the survey, it had recent caterpillar track prints. Footpath continues for most of the western shore within saltmarsh habitat.

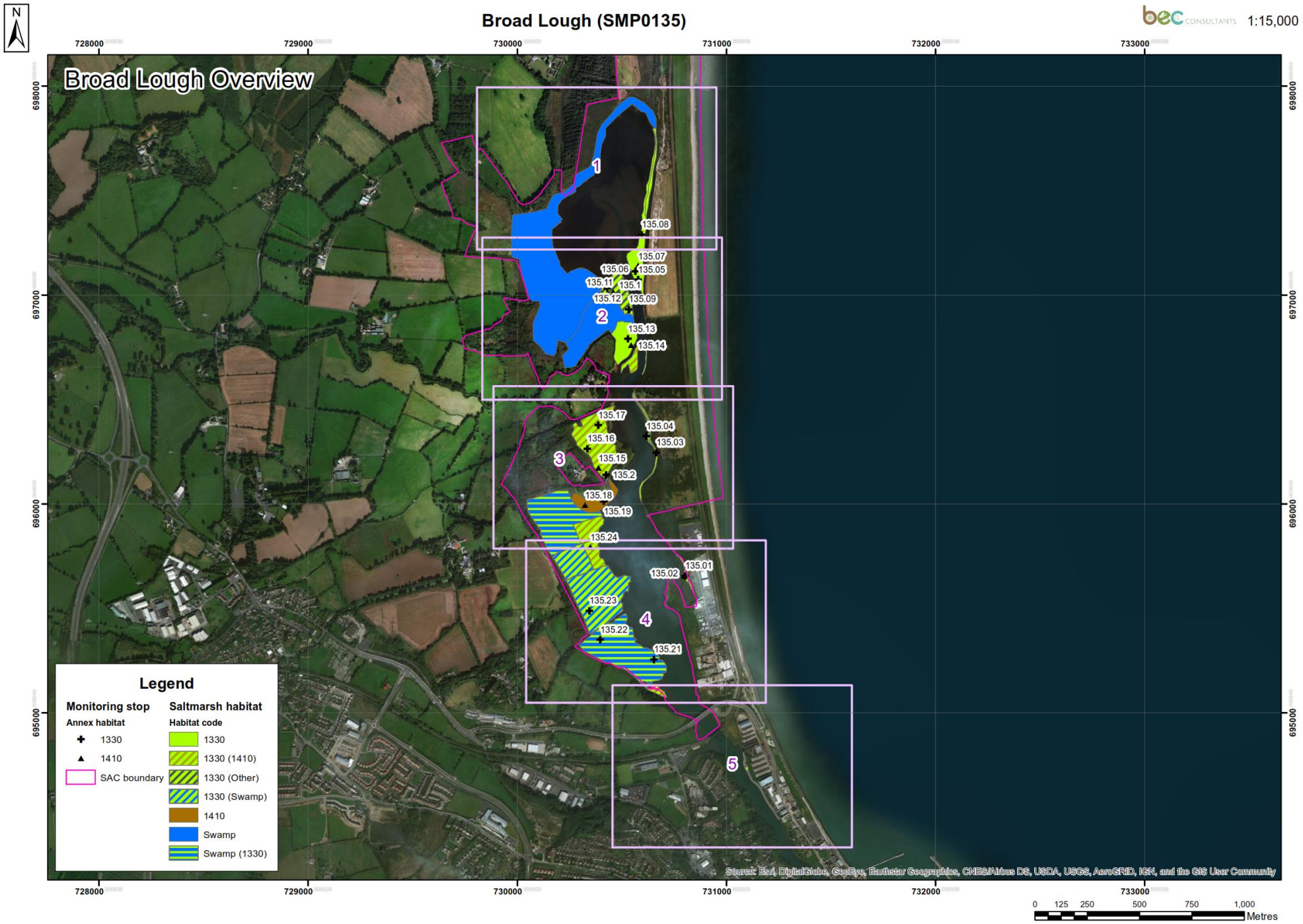
The western shore of this site is accessible from a track behind a wastewater treatment plant. The western part of this site is accessible through Tinakilly Hotel and more northerly sections by crossing the channel from the eastern bank at low tide. This section has a gravely bottom and a depth of approximately 0.3–0.5m at low tide.

Assessment results

Habitat	Area	Structures and functions	Future prospects	Overall conservation assessment
1310	Favourable	Favourable	Favourable	Favourable
1330	Unfavourable-Inadequate	Unfavourable-Inadequate	Unfavourable-Inadequate	Unfavourable-Inadequate
1410	Favourable	Unfavourable-Inadequate	Unfavourable-Inadequate	Unfavourable-Inadequate
1420	Absent	Absent	Absent	Absent

Justification for assessment

All parameters are Favourable for 1310. Area loss for 1330 attributable to the construction of an access track for a tracked vehicle resulted in an Area assessment of Unfavourable-Inadequate. Structure and functions of 1330 has been negatively affected by drainage impacting on hydrology. Future prospects are Unfavourable-Inadequate, as there is no indication that the situation will be remedied into the future. Structure and functions for 1410 have also been impacted by the earthworks on the site, and this has had a similar effect on Future prospects.


Broad Lough (SMP0135)
bec CONSULTANTS
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Broad Lough Overview
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135.18
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135.24
135.01
135.02
135.23
135.22
135.21
Legend
Monitoring stop
Annex habitat
1330
1410
SAC boundary
Saltmarsh habitat
Habitat code
1330
1330 (1410)
1330 (Other)
1330 (Swamp)
1410
Swamp
Swamp (1330)
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
0 125 250 500 750 1,000
Metres

Appendix V – Kilcoole (SMP0036) site report and habitat maps from the Saltmarsh Monitoring Project 2006-2008 (McCorry and Ryle, 2009)

1 Site Details

SMP site name: **Kilcoole**	SMP site code: **0036**
Dates of site visit: **21/09/2007**	CMP site code: **013**
SM inventory site name: **Kilcoole**	SM inventory site code: **228**
NPWS Site Name: **The Murrough Wetlands**	
NPWS designation SAC: **2249**	MPSU Plan: **Old Format Draft2 Consultation, 2000**
NHA: **730**	SPA: **4186**
County: **Wicklow**	Discovery Map: **56** Grid Ref: **331400, 207000**
Aerial photos (2000 series): **O 3732-B,D; O 3790-B,D; O 3848-B,D; O 3906-B,D; O 3963-B,D; O 4020-B**	6 inch Map No: **Wi 013, 019, 025**
Annex I habitats currently listed as qualifying interests for The Murrough Wetlands SAC:	
H1330 Atlantic salt meadows (Glauco-Puccinellietalia maritimae)	
H1410 Mediterranean salt meadows (Juncetalia maritimi)	
Other SMP sites within this SAC/NHA: **N/A**	
Saltmarsh type: **Lagoon**	Substrate type: **Mud**

2 Site description

Kilcoole marsh is located in Co. Wicklow between Greystones and Wicklow town. This large wetland complex is landlocked by the Dublin–Rosslare railway embankment and various coastal protection works that have been installed over the years on a shingle barrier that forms the shoreline. While there are a number of one-way gates that are used to control the water levels of the marsh, one area known as The Breaches is constantly open to the tides, although owing to the volume of shingle along this coastline, incoming waters must are generally associated with higher tides. The adjacent land forms a low-lying plain that is dominated by farmland. There has also been extensive and ongoing reclamation in this area.

Kilcoole is not a typical saltmarsh; rather it is largely an extensive low-lying wetland area that is situated behind the railway embankment. Part of this area is flooded by the tide flowing from The Breaches. The tide flows into a network of wide shallow intertidal channels. These channels extend into a mosaic of wetland habitats. Much of the wetland complex was altered through drainage in the 1980's and early 1990's (NPWS management plan). Extensive berms have been created along the edges of these channels to enclose a significant amount of wetland, some of which has also been drained and improved to develop agricultural grassland. There are also substantial amounts of brackish Reedbeds dominated by stands of Common Reed (*Phragmites australis*) or Sea Club-rush (*Bolboschoenus maritimus*). These stands have been classified and mapped as CM2 or other Non-Annex saltmarsh vegetation in accordance with the SMP project classification. Wet grassland that forms a mosaic with smaller amounts of scrub is also present. The NPWS management plan notes that there is still some

seepage of saline water into the enclosed area and this has created patches of brackish wetland and pockets of saltmarsh. There is still some more typical saltmarsh developed along the landward side of the shingle embankment near The Breaches and in the northern section of the site (Cooldross Middle and Lower) where the tide has not been excluded.

There are still deep natural drainage channels found behind these berms that are permanently filled and classified as brackish lakes. Oliver (2005) classified the intertidal channels located behind the embankments as artificial lagoons. These three lagoons have a wide salinity range.

The saltmarsh was classified as a 'Lagoon' type marsh by Curtis and Sheehy-Skeffington (1998). This is mainly due to the fact that The Breaches outflow regularly becomes blocked by naturally shifting cobble and shingle. This creates a lagoon in the intertidal channel behind this area and some of the adjoining saltmarsh may be flooded for long periods of time. This outflow is regularly cleared of these blockages to help drainage in this area.

Kilcoole marsh is part of The Murrough Wetlands candidate Special Area of Conservation as well as a Special Protection Area. It contains a number of Annex I habitats such as Alkaline fens, Perennial vegetation of stony banks, and Calcareous fens with *Cladium mariscus* and species of the Caricion davallianae. This coastal wetland complex also has been designated as a Special Protection Area (4186) as it supports nationally important numbers of certain Annex I birds as defined by the Birds Directive. In addition, parts of the site are being developed as bird sanctuaries by Birdwatch Ireland owing to the numbers of migratory birds that have been found there. Three Annex I saltmarsh habitats are listed as qualifying interests for this site, *Salicornia* flats, Atlantic salt meadows (ASM) and Mediterranean salt meadows. Only the latter two habitats were recorded at the site by this survey.

A large part of this wetland complex has been excluded from the SAC. This includes most of the Annex I saltmarsh habitat mapped at this site in Colldross Middle and Lower. This area has been excluded from the SAC in the past due to land reclamation in this area. The current cSAC boundary follows the landward side of the shingle bar in this area.

Accessing the site is complicated by the fact that this long linear area is dissected by many man-made drainage dykes and impenetrable field boundaries. Birdwatch Ireland has the leasehold on a number of plots and are actively developing a wetland marsh in a plot adjacent to Kilcoole Railway. This work was on-going at the time of survey. Access to the bird sanctuary at Kilcoole and information on crossing private land was facilitated by Birdwatch Ireland. The large area behind the berm was not directly surveyed due to time constraints on the survey and the fact that this area was dominated by other wetland habitats and the potential for saltmarsh development was limited.

3 Saltmarsh Habitats

3.1 General description

The saltmarsh at surveyed Kilcoole is found in two main sections. There is minor development of saltmarsh vegetation along the edge of the intertidal channels that flow along the landward side of the

shingle bank. This saltmarsh is dominated by ASM. Saltmarsh vegetation is found on both sides of The Breaches.

The largest area of saltmarsh development to the north of the site is in Cooldross Middle and Lower. This saltmarsh is found in low-lying meadows that have been partially improved and reseeded in the recent past. The main intertidal channel containing soft mud extends through this area and there is saltmarsh development on both sides of the channel and along smaller branches of the channel that connect to drainage ditches. The intertidal channel is bridged by an embankment to allow livestock access to the east side. The saltmarsh is generally found in the low-lying ground on both sides of the channel but in places the topography is variable and some low mounds within the saltmarsh area contain terrestrial grassland that does not get inundated by the brackish water. These mounds contain species like Curled Dock (*Rumex crispus*), Yorkshire Fog (*Holcus lanatus*), Crested Dogstail (*Cynosuros cristatus*) and Perennial Rye-grass (*Lolium perenne*). This area is divided into several fields by ditches and hedges. There are transitions to wet grassland and improved grassland along the upper landward boundary of this saltmarsh. This saltmarsh is dominated by ASM (Table 3.1) with a small amount of MSM development at one location.

Table 3.1. Area of saltmarsh habitats mapped at Kilcoole.

EU Code	Habitat	Area (ha)
H1330	Atlantic salt meadows (Glauco-Puccinellietalia maritimae)	13.058
H1410	Mediterranean salt meadows (Juncetalia maritimi)	0.216
	Total	**13.274**

*note that saltmarsh habitat may continue outside the mapped area

3.2 Atlantic salt meadows (H1330)

The ASM at this site is mainly found in two sections. The saltmarsh near The Breaches is more typical of marine situations and is obviously inundated by the tide more frequently. Saltmarsh has developed on a narrow band of low-lying land along the landward side of the shingle embankment and adjacent to the wide intertidal channels. There are moderate to steep slopes along this embankment which has created some distinctive zones within the saltmarsh vegetation. There are also a small saltmarsh 'island' that is isolated within the intertidal channel that is dominated by low marsh vegetation. The lower zone is dominated by a band of dense Sea Purslane (*Atriplex portulacoides*) with small amounts of Common Saltmarsh-grass (*Puccinellia martima*), Common Scurry-grass (*Cochlearia officinalis*), Sea Plantain (*Plantago maritima*) and Sea Milkwort (*Glaux maritima*). There is some development of a mid-upper marsh zone dominated by Red Fescue (*Festuca rubra*) and also containing more frequent Sea Plantain, and small amounts of Sea Purslane, Sea Aster (*Aster tripolium*), Sea Pink (*Armeria maritima*) and Creeping Bent-grass (*Agrostis stolonifera*). The saltmarsh structure is poorly developed as it is quite small and it has also been modified by arterial drainage works in the past. There is a gradual landward transition to coastal grassland also dominated by Red Fescue in places but containing species such as Birdsfoot (*Lotus corniculatus*), Curled Dock and Sea Beet (*Beta maritima*). Creeping Bent also

forms a narrow band of saltmarsh vegetation along the upper boundary in places. There are also some landward transitions to Twitch (*Elymus repens*)-dominated grassland along the back of this embankment.

The largest area of ASM occurs in the low-lying area on either side of the brackish lagoon at the northern end of the site. Much of the land is heavily poached and in places bared of vegetation. This area contains several ASM vegetation communities including some communities not recorded at any other sites during the SMP survey. Some zonation is present and is related to the variable micro topography over the surface of the saltmarsh area. Low-lying shallow depressions and zones along the channels contain low marsh vegetation. Much of this vegetation is dominated by Lesser Sea-spurrey (*Spergularia marina*) and contains patches dominated by Reflexed Saltmarsh-grass (*Puccinellia distans*). Common Saltmarsh-grass is also present and there are small amounts of other species like Glasswort, Greater Sea-spurrey, Sea Plantain, Creeping Bent, Frosted Orache (*Atriplex lacinata*), Saltmarsh Rush (*Juncus gerardii*), and Sea Milkwort. Some areas contain frequent amount of Kneed Foxtail (*Alopecurus geniculatus*), indicating the brackish influence and prolonged flooding on this site, rather than regular tidal inundation. Much of this vegetation seems quite disturbed, possibly from prolonged flooding, and is more typical of pioneer saltmarsh with bare substrate dominant and containing frequent Glasswort (*Salicornia* sp.).

Adjacent low mounds contain differently-zoned vegetation with more frequent Red Fescue or Creeping Bent in places. Some of these mounds contain terrestrial grassland. There are small amounts of Sea Club-rush scattered in hollows over the site and along the margins of the intertidal channel/lagoon.

An unusual vegetation community has developed at the northern end of the site in an area that was reseeded recently. This area is dominated by Lesser Sea-spurrey (*Spergularia marina*) and also contains Creeping Bent, Common Saltmarsh-grass, Reflexed Saltmarsh-grass, Sea Milkwort, Sea Plantain, Spear-leaved Orache (*Atriplex prostrata*) and Kneed Foxtail. There is also frequent bare substrate cover. This community is in transition.

There is a transition from the upper saltmarsh vegetation to agricultural grassland at the upper boundary.

3.3 Mediterranean salt meadows (H1410)

Mediterranean salt meadows habitat is poorly developed at this site. Two small patches were mapped in the northern section that represents less than 1% of the total saltmarsh area. The largest patch is found along the edges of one of the smaller channels that connect to the main intertidal channel. Both areas are characterised by the presence of Sea Rush (*Juncus maritimus*). This habitat is distinctive as it is much taller than the surrounding vegetation. Other species found in association with the Sea Rush clumps include Greater Sea-spurrey, Common Saltmarsh-grass, Red Fescue and Saltmarsh Rush. The habitat is badly poached in places and is in poor condition with frequent bare substrate cover.

4 Impacts and Activities

This site is affected by several impacts and activities (Table 4.1). The majority of the salt marsh is in private ownership and not readily accessible. The main impact on the remaining saltmarsh is grazing. Poaching and associated impacts are noticeable at this Kilcoole with large area of the ASM heavily poached (143), indeed bare of vegetation in places. There are also tracks across that marsh (501) created by livestock. However, this may also be related to excessive flooding and is typical in a lagoon with variable water levels. Some of this saltmarsh has actually been improved in the recent past and was re-seeded but has since reverted back to saltmarsh vegetation due to tidal inundation and brackish flooding (802). This is clearly seen on the OSI 2005 series aerial photographs where part of the current saltmarsh was cut for silage and was improved grassland. The saltmarsh located closer to The Breaches is not grazed.

This site is also likely to be quite dynamic (990). The development of saltmarsh is usually dependent on regular tidal inundation. However, inundation at this site is not regular so periods with prolonged phases of brackish flooding when The Breaches is blocked is likely to increase saline influence over a wider area. In contrast, periods when The Breaches is kept open may restrict saltmarsh development to areas with tidal inundation during spring tides. Prolonged flooding promotes grazing and poaching damage.

The greatest impacts affecting the overall site are all associated with human management of the site and include the construction of coastal protection works, management of the drainage pattern of the low-lying marshland and reclamation of flooded ground for agricultural purposes. More recently the development, in parts of the marsh of a bird sanctuary includes the construction of large ponds for the purposes of waterfowl and nesting birds. These activities have affected land at Leabeg Lower and Leamore Lower. This area was likely to have contained saltmarsh habitat in the past but this area has been significantly modified. While it was not surveyed, the area behind the berms is not likely to contain any extensive saltmarsh and is most likely to be a mosaic of brackish habitats and other wetland habitats. Therefore extensive saltmarsh habitat has been destroyed. This reclamation has largely occurred prior to the start of the current monitoring period (1995) although there have been ongoing works after this period.

The NPWS management plan states that some of this land may revert back to saltmarsh due to saline seepage and infrequent tidal inundation and flooding. This is likely to happen at this site as it is quite dynamic.

Natural erosion (900) is not a significant impact as this area is quite sheltered by the shingle barrier.

Impacts and activities adjacent to the site are mainly related to farming (100, 102, 120, 140). Wicklow County Council also undertake coastal protection works on the seaward side of the shingle embankment. These activities have little or no measurable impact on the saltmarsh habitats other than those already assessed.

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

EU Habitat Code	Activity code	Intensity	Impact	Area affected (ha)	Location of activity
H1330	143	A	-1	12.5	Inside
H1330	501	C	-1	0.5	Inside
H1330	802	A	-1	1.2	Inside
H1330	990	B	-1	12.5	Inside
H1410	143	C	-1	0.216	Inside
H1410	990	C	0	0.216	Inside

[1] EU codes as per Interpretation Manual.

[2] Description of activity codes are found in Appendix III, Summary Report 2007-2008.

[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

The conservation status of a site is assessed on the condition of the site and on baseline information. The main source of baseline information for this site is the NHA survey, the NPWS management plan, the 1995, 2000 and 2005 OSI aerial photo series. The baseline information from the NHA survey is generally limited to some descriptions of saltmarsh habitat and does not record the specific condition of this area during the survey at this site. There are more detailed descriptions of the saltmarsh habitat within the NPWS management plan.

Kilcoole is not a typical saltmarsh and has several notable features. The development of the site has created unusual lagoon-like conditions where the saltmarsh is influenced by prolonged flooding when the tidal connection to the sea is blocked. This has influenced the vegetation of the site with species like Reflexed Saltmarsh-grass and Sea-spurrey dominated significant parts of the vegetation, which is unusual.

A large part of this wetland complex has been modified by reclamation works and former saltmarsh habitat has been enclosed by berms. Some of this land has been reclaimed and some still is dominated by wetland habitats. This reclamation is not considered by this assessment as it largely occurred outside the current monitoring period.

The overall conservation status of the remaining saltmarsh at Kilcoole is *unfavourable-bad* (Table 5.1). The saltmarsh is in poor condition due to a combination of heavy grazing levels and prolonged flooding. Large sections are damaged by excessive poaching and are bared of vegetation. The conservation status of the lagoons at this site has also been assessed as part of an overall assessment of conservation status of lagoons in Ireland (NPWS 2007). The status of the lagoons has been assessed

as *unfavourable-inadequate* mainly due to eutrophication, modification of drainage and poaching by cattle.

This site is located within The Murrough Wetlands SAC. An old format NPWS management plan is available for this SAC but is now out of date.

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

Habitat	**EU Conservation Status Assessment**			
	Favourable	**Unfavourable - Inadequate**	**Unfavourable - Bad**	**Overall EU conservation status assessment**
Atlantic salt meadows (H1330)	Extent		Structure and functions Future prospects	**Unfavourable-bad**
Mediterranean salt meadows (H1410)	Extent		Structure and functions Future prospects	**Unfavourable - Bad**

5.2 Atlantic salt meadows (H1330)

5.2.1 Extent

The extent of the ASM is assessed as *favourable*. A large portion of the marsh occurs on the low-lying ground surrounding the lagoon. The remaining marsh occurs as a narrow fringe along creeks and drainage channels. Part of this saltmarsh was improved and reseeded during the current monitoring period but this area has since reverted back to ASM vegetation.

This assessment does not consider reclamation to enclose a large area of former saltmarsh habitat in the southern part of the site. This area was largely reclaimed prior to the current monitoring period.

5.2.2 Habitat structure and functions

The structure and functions for ASM are assessed as *unfavourable-bad*. Ten monitoring stops were carried throughout the ASM habitat, four of which failed to reach the target criteria. While all stops passed on the presence of typical species, the level of poaching/ damage resulted in a homogenously low vegetation height and areas of that have been badly damaged. The saltmarsh is in poor condition at present and seems to be in a state of transition. Prolonged flooding is having a significant impact on the vegetation at this site. However, this has also created a suite of conditions that has resulted in the development of more unusual ASM communities. Vegetation with frequent Reflexed Saltmarsh-grass was not encountered at any other site during the SMP survey. The saltmarsh structure has also been significantly modified in the past with modifications to the drainage of this area.

5.2.3 Future prospects

The future prospects of the habitat are rated as *unfavourable-bad*. This assessment assumes that the current management activities and level of impacts such as grazing continue in the near future. High grazing levels have damaged the sward surface at this site in association with prolonged flooding and these impacts are likely to continue in the future. There are few prospects for grazing management in this area as it is excluded from the SAC.

5.3 Mediterranean salt meadows (H1410)

5.3.1 Extent

Although not widespread in its distribution or extent, the extent of the Mediterranean salt meadows at Kilcoole is assessed as *favourable*. There are no indications that this habitat was more extensive in the past. There are no indications of any loss of habitat due to land-use changes or erosion within the current monitoring period.

5.3.2 Habitat structure and functions

Given the limited extent of the MSM, monitoring stops were not carried out. Hence the assessment of the structure and functions of the habitat are based solely on a visual assessment and is assessed as *unfavourable-bad*. This vegetation is also damaged by heavy grazing levels and there is excessive poaching in places.

5.3.3 Future prospects

The future prospects of the habitat are rated as *unfavourable-bad*. This assessment assumes that the current management activities and level of impacts such as grazing continue in the near future. High grazing levels have damaged the MSM at this site in association with prolonged flooding and these impacts are likely to continue in the future.

6 Management Recommendations

A considerable portion of the saltmarsh has been damaged through agricultural management, which would benefit from a reduction in livestock pressure. However, as the saltmarsh largely occurs outside the cSAC designation, this recommendation may not be easily introduced. Periods of prolonged flooding at the site should be considered as part of the overall natural environmental process that affects the site. This is a dynamic site and natural transition due to prolonged flooding should be allowed to continue.

7 References

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Appendix I

Table 8.1. Areas of SMP habitats mapped using GIS.

SM Habitat code	**SM habitat description**	**Mapped Area (ha)**	**Area (ha)**				
			H1310	H1330	H1410	H1420	*Spartina* swards
1	1310 *Salicornia* flats						
2	*Spartina* swards						
3	1330 Atlantic salt meadow	13.058					
4	1410 Mediterranean salt meadow	0.216					
5	ASM/MSM mosaic (50/50)						
6	ASM/*Spartina* mosaic						
7	1330/other SM (CM2) mosaic						
8	1330/coastal grassland mosaic						
9	Other (non saltmarsh)	74.719					
10	*Spartina* clump/mudflat mosaic (50/50)						
11	Isolated *Spartina* clumps on mud (5%)						
12	pioneer 1330/1310/*Spartina* mosaic						
13	1410/other SM (CM2) mosaic						
14	*Spartina* sward dominated, with some ASM						
15	1310/*Spartina* mosaic						
16	ASM dominated with some *Spartina*						
17	1330/sand dune mosaic						
18	Other SM (CM2)	15.091					
19	1330/rocky shore mosaic						
20	1420 Mediterranean scrub						
21	1310/1330 mosaic						


Legend
SAC Boundary
1330 Atlantic salt meadows
1410 Mediterranean salt meadows
Other Saltmarsh (CM2)
other
1330 monitoring stops
Environment, Heritage and Local Government
National Parks and Wildlife Service
Saltmarsh Monitoring Project 2007-2008
Kilcoole (Map 1 of 3)
The Murrough SAC (002249)
SMP code: SMP0036
This habitat map was created with a combination of fieldwork, GPS and interpreation 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 80 160 240 320 400 Meters
Date of production: 22/02/2009
Map version: 1
Original Drawing Size: 297 x 420 (A3)
Scale 1:5000
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Oifigeach, Oidhreacht agus Rialtas Áitiúil
Environment, Heritage and Local Government
National Parks and Wildlife Service

Saltmarsh Monitoring Project 2007-2008

Kilcoole (Map 2 of 3)

The Murrough SAC (002249)

SMP code: SMP0036

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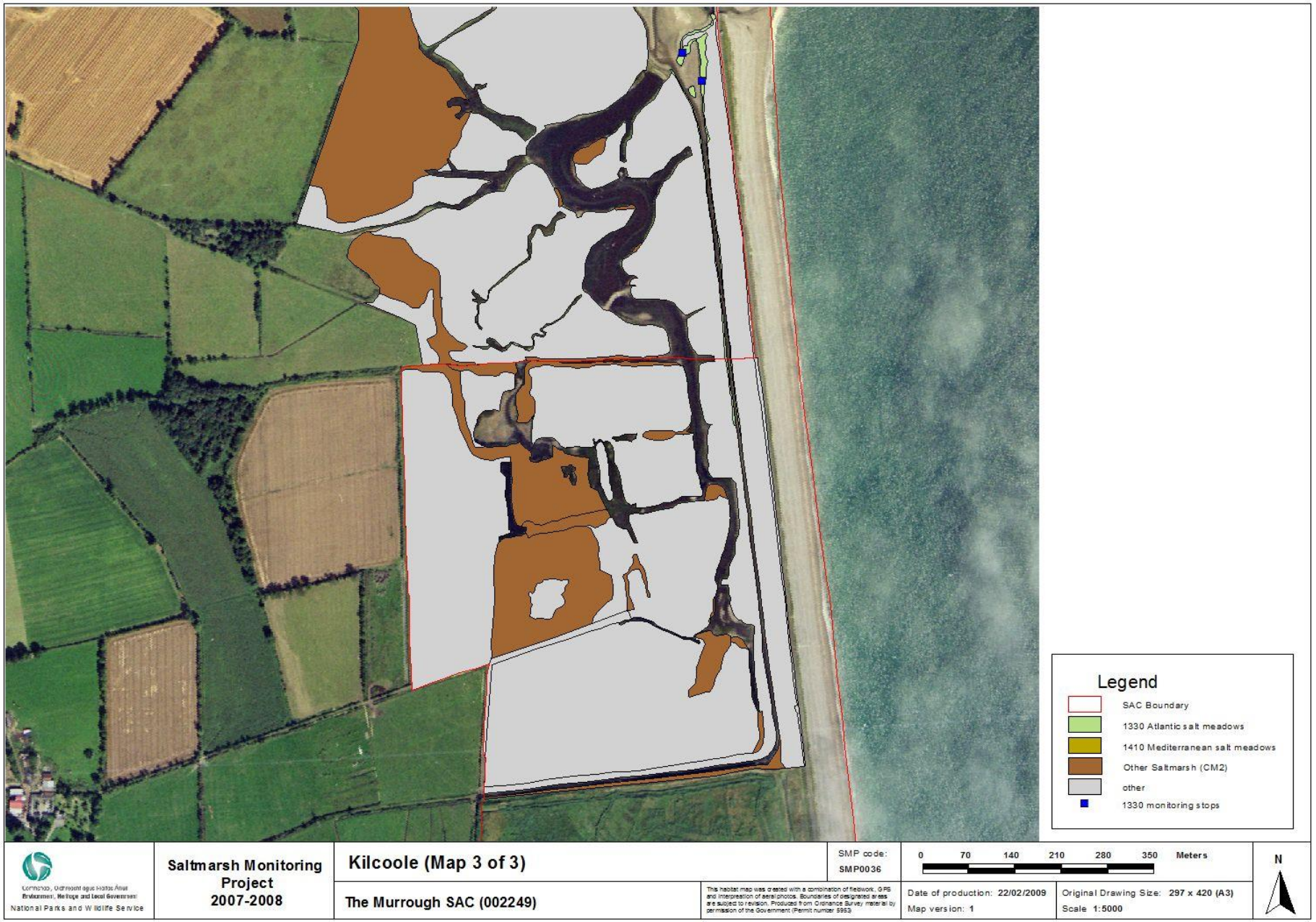
Date of production: 22/02/2009
Map version: 1

Original Drawing Size: 297 x 420 (A3)
Scale 1:5000



Comhshaol, Oidhreacht agus Rialtas Áitiúil
Environment, Heritage and Local Government
National Parks and Wildlife Service

Saltmarsh Monitoring Project 2007-2008

Kilcoole (Map 3 of 3)

The Murrough SAC (002249)

SMP code: SMP0036

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