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Appendices

Appendix 1

Design Drawings

List of Design Drawings

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12-160-261	Broadmeadow Way Cycle Route Layout	Sheet 10 of 17
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12-160-264	Broadmeadow Way Cycle Route Layout	Sheet 13 of 17
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SADS-16-BROAD-PRE-002	Proposed Broadmeadow Way Footbridge Construction Sequence Stage 2 of 4.	
SADS-16-BROAD-PRE-003	Proposed Broadmeadow Way Footbridge Construction Sequence Stage 3 of 4.	
SADS-16-BROAD-PRE-004	Proposed Broadmeadow Way Footbridge Construction Sequence Stage 4 of 4.	

Appendix 2

Conservation Objectives – Malahide Estuary SPA

National Parks and Wildlife Service

Conservation Objectives Series

Malahide Estuary SPA 004025



An Roinn
Ealaíon, Oidhreachta agus Gaeltachta

Department of
Arts, Heritage and the Gaeltacht



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The overall aim of the Habitats Directive is to maintain or restore the favourable conservation status of habitats and species of community interest. These habitats and species are listed in the Habitats and Birds Directives and Special Areas of Conservation and Special Protection Areas are designated to afford protection to the most vulnerable of them. These two designations are collectively known as the Natura 2000 network.

European and national legislation places a collective obligation on Ireland and its citizens to maintain habitats and species in the Natura 2000 network at favourable conservation condition. The Government and its agencies are responsible for the implementation and enforcement of regulations that will ensure the ecological integrity of these sites.

A site-specific conservation objective aims to define favourable conservation condition for a particular habitat or species at that site.

The maintenance of habitats and species within Natura 2000 sites at favourable conservation condition will contribute to the overall maintenance of favourable conservation status of those habitats and species at a national level.

Favourable conservation status of a habitat is achieved when:

- its natural range, and area it covers within that range, are stable or increasing, and
- the specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future, and
- the conservation status of its typical species is favourable.

The favourable conservation status of a species is achieved when:

- population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats, and
- the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and
- there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.

Notes/Guidelines:

1. The targets given in these conservation objectives are based on best available information at the time of writing. As more information becomes available, targets for attributes may change. These will be updated periodically, as necessary.
2. An appropriate assessment based on these conservation objectives will remain valid even if the targets are subsequently updated, providing they were the most recent objectives available when the assessment was carried out. It is essential that the date and version are included when objectives are cited.
3. Assessments cannot consider an attribute in isolation from the others listed for that habitat or species, or for other habitats and species listed for that site. A plan or project with an apparently small impact on one attribute may have a significant impact on another.
4. Please note that the maps included in this document do not necessarily show the entire extent of the habitats and species for which the site is listed. This should be borne in mind when appropriate assessments are being carried out.
5. When using these objectives, it is essential that the relevant backing/supporting documents are consulted, particularly where instructed in the targets or notes for a particular attribute.

Qualifying Interests

* indicates a priority habitat under the Habitats Directive

004025	Malahide Estuary SPA
A005	Great Crested Grebe <i>Podiceps cristatus</i>
A046	Brent Goose <i>Branta bernicla hrota</i>
A048	Shelduck <i>Tadorna tadorna</i>
A054	Pintail <i>Anas acuta</i>
A067	Goldeneye <i>Bucephala clangula</i>
A069	Red-breasted Merganser <i>Mergus serrator</i>
A130	Oystercatcher <i>Haematopus ostralegus</i>
A140	Golden Plover <i>Pluvialis apricaria</i>
A141	Grey Plover <i>Pluvialis squatarola</i>
A143	Knot <i>Calidris canutus</i>
A149	Dunlin <i>Calidris alpina alpina</i>
A156	Black-tailed Godwit <i>Limosa limosa</i>
A157	Bar-tailed Godwit <i>Limosa lapponica</i>
A162	Redshank <i>Tringa totanus</i>
A999	Wetlands

Please note that this SPA overlaps with Malahide Estuary SAC (000205). See map 2. The conservation objectives for this site should be used in conjunction with those for the overlapping site as appropriate.

Supporting documents, relevant reports & publications

Supporting documents, NPWS reports and publications are available for download from: www.npws.ie/Publications

NPWS Documents

Year : 2013
Title : Malahide Estuary SPA (site code 4025) Conservation objectives supporting document V1
Author : NPWS
Series : Conservation objectives supporting document

A005 Great Crested Grebe *Podiceps cristatus*

To maintain the favourable conservation condition of Great Crested Grebe in Malahide Estuary SPA, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Population trend	Percentage change	Long term population trend stable or increasing	Waterbird population trends are presented in part four of the conservation objectives supporting document
Distribution	Range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by great crested grebe, other than that occurring from natural patterns of variation	Waterbird distribution from the 2011/2012 waterbird survey programme is discussed in part five of the conservation objectives supporting document

A046 **Brent Goose *Branta bernicla hrota***

To maintain the favourable conservation condition of Light-bellied Brent Goose in Malahide Estuary SPA, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Population trend	Percentage change	Long term population trend stable or increasing	Waterbird population trends are presented in part four of the conservation objectives supporting document
Distribution	Range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by light-bellied brent goose, other than that occurring from natural patterns of variation	Waterbird distribution from the 2011/2012 waterbird survey programme is discussed in part five of the conservation objectives supporting document

A048 *Shelduck Tadorna tadorna*

To maintain the favourable conservation condition of Shelduck in Malahide Estuary SPA, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Population trend	Percentage change	Long term population trend stable or increasing	Waterbird population trends are presented in part four of the conservation objectives supporting document
Distribution	Range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by shelduck, other than that occurring from natural patterns of variation	Waterbird distribution from the 2011/2012 waterbird survey programme is discussed in part five of the conservation objectives supporting document

Conservation Objectives for : Malahide Estuary SPA [004025]

A054 Pintail *Anas acuta*

To maintain the favourable conservation condition of Pintail in Malahide Estuary SPA, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Population trend	Percentage change	Long term population trend stable or increasing	Waterbird population trends are presented in part four of the conservation objectives supporting document
Distribution	Range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by pintail, other than that occurring from natural patterns of variation	Waterbird distribution from the 2011/2012 waterbird survey programme is discussed in part five of the conservation objectives supporting document

A067 Goldeneye *Bucephala clangula*

To maintain the favourable conservation condition of Goldeneye in Malahide Estuary SPA, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Population trend	Percentage change	Long term population trend stable or increasing	Waterbird population trends are presented in part four of the conservation objectives supporting document
Distribution	Range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by goldeneye, other than that occurring from natural patterns of variation	Waterbird distribution from the 2011/2012 waterbird survey programme is discussed in part five of the conservation objectives supporting document

A069 Red-breasted Merganser *Mergus serrator*

To maintain the favourable conservation condition of Red-breasted Merganser in Malahide Estuary SPA, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Population trend	Percentage change	Long term population trend stable or increasing	Waterbird population trends are presented in part four of the conservation objectives supporting document
Distribution	Range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by red-breasted merganser, other than that occurring from natural patterns of variation	Waterbird distribution from the 2011/2012 waterbird survey programme is discussed in part five of the conservation objectives supporting document

A130 **Oystercatcher *Haematopus ostralegus***

To maintain the favourable conservation condition of Oystercatcher in Malahide Estuary SPA, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Population trend	Percentage change	Long term population trend stable or increasing	Population trends are presented in part four of the conservation objectives supporting document
Distribution	Range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by oystercatcher, other than that occurring from natural patterns of variation	Waterbird distribution from the 2011/2012 waterbird survey programme is discussed in part four of the conservation objectives supporting document

A140 Golden Plover *Pluvialis apricaria*

To maintain the favourable conservation condition of Golden Plover in Malahide Estuary SPA, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Population trend	Percentage change	Long term population trend stable or increasing	Population trends are presented in part four of the conservation objectives supporting document
Distribution	Range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by golden plover, other than that occurring from natural patterns of variation	Waterbird distribution from the 2011/2012 waterbird survey programme is discussed in part five of the conservation objectives supporting document

A141 **Grey Plover *Pluvialis squatarola***

To maintain the favourable conservation condition of Grey Plover in Malahide Estuary SPA, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Population trend	Percentage change	Long term population trend stable or increasing	Population trends are presented in part four of the conservation objectives supporting document
Distribution	Range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by grey plover, other than that occurring from natural patterns of variation	Waterbird distribution from the 2011/2012 waterbird survey programme is discussed in part five of the conservation objectives supporting document

A143 **Knot *Calidris canutus***

To maintain the favourable conservation condition of Knot in Malahide Estuary SPA, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Population trend	Percentage change	Long term population trend stable or increasing	Waterbird population trends are presented in part four of the conservation objectives supporting document
Distribution	Range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by knot, other than that occurring from natural patterns of variation	Waterbird distribution from the 2011/2012 waterbird survey programme is discussed in part five of the conservation objectives supporting document

A149 **Dunlin *Calidris alpina alpina***

To maintain the favourable conservation condition of Dunlin in Malahide Estuary SPA, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Population trend	Percentage change	Long term population trend stable or increasing	Population trends are presented in part four of the conservation objectives supporting document
Distribution	Range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by dunlin, other than that occurring from natural patterns of variation	Waterbird distribution from the 2011/2012 waterbird survey programme is discussed in part five of the conservation objectives supporting document

A156 **Black-tailed Godwit *Limosa limosa***

To maintain the favourable conservation condition of Black-tailed Godwit in Malahide Estuary SPA, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Population trend	Percentage change	Long term population trend stable or increasing	Population trends are presented in part four of the conservation objectives supporting document
Distribution	Range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by black-tailed godwit, other than that occurring from natural patterns of variation	Waterbird distribution from the 2011/2012 waterbird survey programme is discussed in part five of the conservation objectives supporting document

Conservation Objectives for : Malahide Estuary SPA [004025]

A157 Bar-tailed Godwit *Limosa lapponica*

To maintain the favourable conservation condition of Bar-tailed Godwit in Malahide Estuary SPA, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Population trend	Percentage change	Long term population trend stable or increasing	Population trends are presented in part four of the conservation objectives supporting document
Distribution	Range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by bar-tailed godwit, other than that occurring from natural patterns of variation	Waterbird distribution from the 2011/2012 waterbird survey programme is discussed in part five of the conservation objectives supporting document

A162 **Redshank *Tringa totanus***

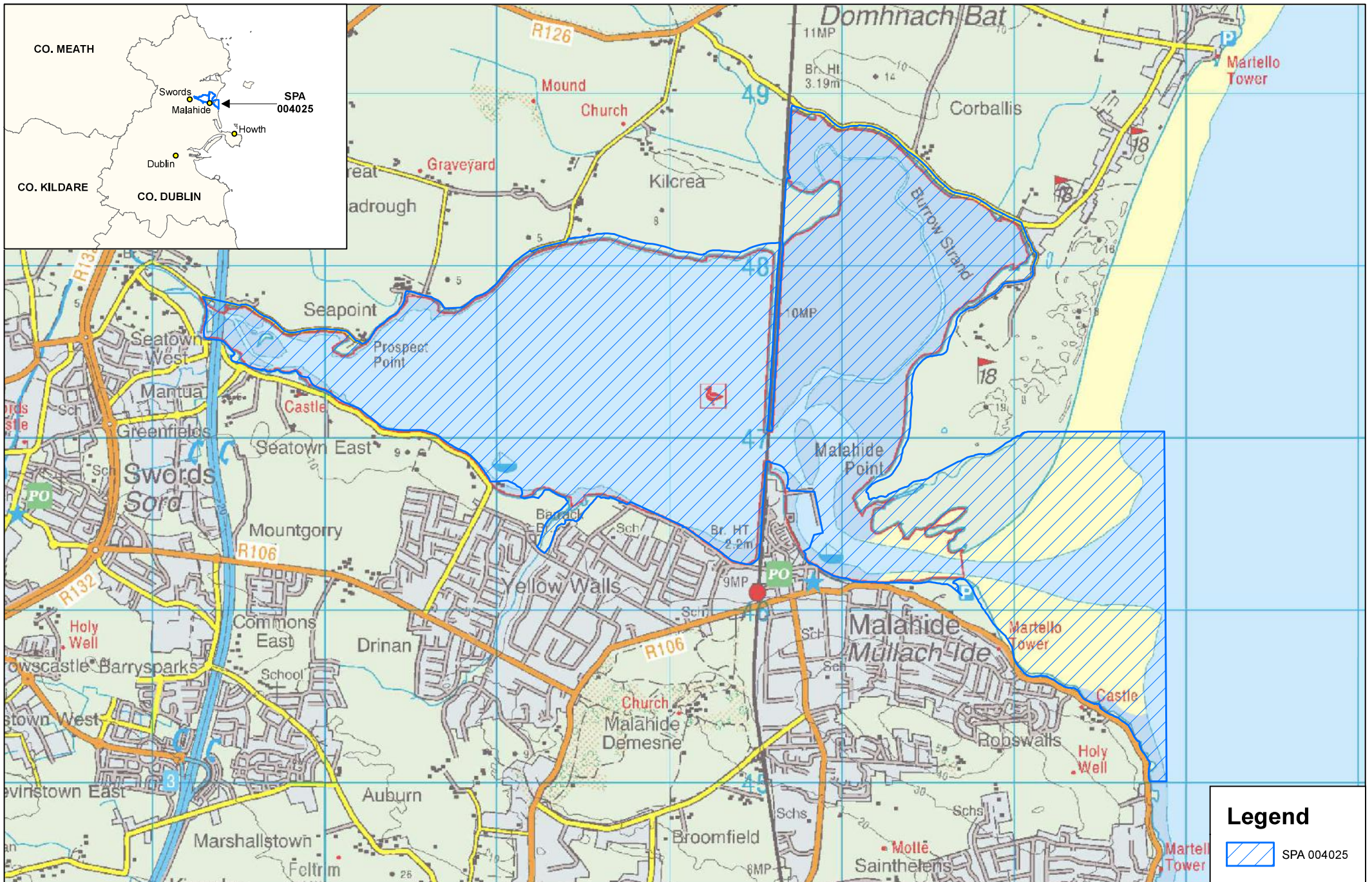
To maintain the favourable conservation condition of Redshank in Malahide Estuary SPA, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Population trend	Percentage change	Long term population trend stable or increasing	Population trends are presented in part four of the conservation objectives supporting document
Distribution	Range, timing and intensity of use of areas	No significant decrease in the range, timing or intensity of use of areas by redshank, other than that occurring from natural patterns of variation	Waterbird distribution from the 2011/2012 waterbird survey programme is discussed in part five of the conservation objectives supporting document

A999 Wetlands

To maintain the favourable conservation condition of the wetland habitat in Malahide Estuary SPA as a resource for the regularly-occurring migratory waterbirds that utilise it. This is defined by the following attribute and target:

Attribute	Measure	Target	Notes
Habitat area	Hectares	The permanent area occupied by the wetland habitat should be stable and not significantly less than the area of 765 hectares, other than that occurring from natural patterns of variation	The wetland habitat area was estimated as 765ha using OSi data and relevant orthophotographs. For further information see part three of the conservation objectives supporting document



Legend

 SPA 004025

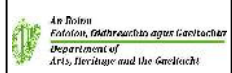
**MAP 1:
MALAHIDE ESTUARY SPA
CONSERVATION OBJECTIVES
SPA DESIGNATION**



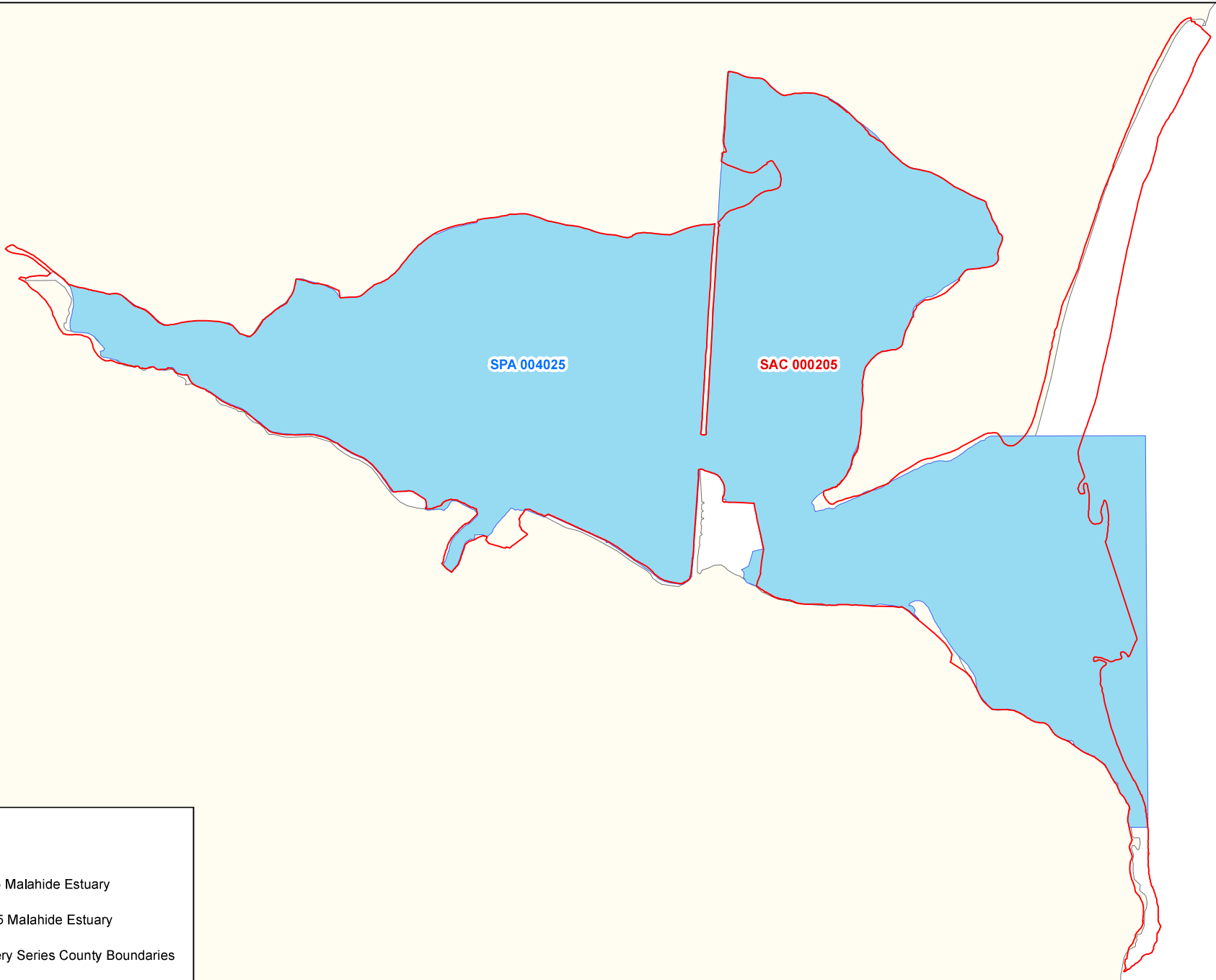
Boundaries of designated areas are subject to revision. Reproduced from Ordnance Survey material by permission of the Government (Permit number EN 0059212).

Féadfar athbheithniú a déanamh ar theorainneacha na gceantar comharthaithe. Macasamhail d'ábhar na Suirbhéarachta Ordoanáis le chead ón Rialtas (Ceadunas Uimh. EN 0059212)

Site Code
SPA 004025
Version: 1.03
Map Version 1
Date: March 2013

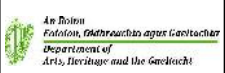


Map to be read in conjunction with the NPWS Conservation Objectives Document.



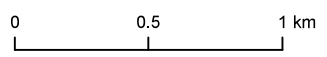
Legend

- SPA 004025 Malahide Estuary
- SAC 000205 Malahide Estuary
- OSi Discovery Series County Boundaries



MAP 2:
MALAHIDE ESTUARY SPA
CONSERVATION OBJECTIVES
ADJOINING / OVERLAPPING
DESIGNATIONS

Map to be read in conjunction with the NPWS Conservation Objectives Document.



Boundaries of designated areas are subject to revision. Reproduced from Ordnance Survey material by permission of the Government (Permit number EN 0059212).
Féadfar athbheithníthe a déanamh ar theorainneacha na gceantar comharthaithe. Macasamhail d'ábhar na Suirbhéarachta Ordonáis le chead ón Rialtas (Ceadunas Uimh. EN 0059212)

Site Code
SPA 004025 version 1.03
SAC 000205 version 1.02
Map Version 1
Date: March 2013

Appendix 3

Conservation Objectives – Malahide Estuary SAC

National Parks and Wildlife Service

Conservation Objectives Series

Malahide Estuary SAC 000205



An Roinn
Ealaíon, Oidhreachta agus Gaeltachta

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Arts, Heritage and the Gaeltacht



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Introduction

The overall aim of the Habitats Directive is to maintain or restore the favourable conservation status of habitats and species of community interest. These habitats and species are listed in the Habitats and Birds Directives and Special Areas of Conservation and Special Protection Areas are designated to afford protection to the most vulnerable of them. These two designations are collectively known as the Natura 2000 network.

European and national legislation places a collective obligation on Ireland and its citizens to maintain habitats and species in the Natura 2000 network at favourable conservation condition. The Government and its agencies are responsible for the implementation and enforcement of regulations that will ensure the ecological integrity of these sites.

A site-specific conservation objective aims to define favourable conservation condition for a particular habitat or species at that site.

The maintenance of habitats and species within Natura 2000 sites at favourable conservation condition will contribute to the overall maintenance of favourable conservation status of those habitats and species at a national level.

Favourable conservation status of a habitat is achieved when:

- its natural range, and area it covers within that range, are stable or increasing, and
- the specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future, and
- the conservation status of its typical species is favourable.

The favourable conservation status of a species is achieved when:

- population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats, and
- the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and
- there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.

Notes/Guidelines:

1. The targets given in these conservation objectives are based on best available information at the time of writing. As more information becomes available, targets for attributes may change. These will be updated periodically, as necessary.
2. An appropriate assessment based on these conservation objectives will remain valid even if the targets are subsequently updated, providing they were the most recent objectives available when the assessment was carried out. It is essential that the date and version are included when objectives are cited.
3. Assessments cannot consider an attribute in isolation from the others listed for that habitat or species, or for other habitats and species listed for that site. A plan or project with an apparently small impact on one attribute may have a significant impact on another.
4. Please note that the maps included in this document do not necessarily show the entire extent of the habitats and species for which the site is listed. This should be borne in mind when appropriate assessments are being carried out.
5. When using these objectives, it is essential that the relevant backing/supporting documents are consulted, particularly where instructed in the targets or notes for a particular attribute.

Qualifying Interests

* indicates a priority habitat under the Habitats Directive

000205 Malahide Estuary SAC

- 1140 Mudflats and sandflats not covered by seawater at low tide
- 1310 *Salicornia* and other annuals colonising mud and sand
- 1320 *Spartina* swards (*Spartinion maritimae*)
- 1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)
- 1410 Mediterranean salt meadows (*Juncetalia maritimi*)
- 2120 Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes)
- 2130 Fixed coastal dunes with herbaceous vegetation (grey dunes)*

Please note that this SAC overlaps with Malahide Estuary SPA (004025). See map 2. The conservation objectives for this site should be used in conjunction with those for the overlapping site as appropriate.

Supporting documents, relevant reports & publications

Supporting documents, NPWS reports and publications are available for download from: www.npws.ie/Publications

NPWS Documents

Year :	2007
Title :	Saltmarsh Monitoring Project 2006
Author :	McCorry, M.
Series :	Unpublished report to NPWS
Year :	2009
Title :	Coastal Monitoring Project 2004-2006
Author :	Ryle, T.; Murray, A.; Connolly, C.; Swann, M.
Series :	Unpublished report to NPWS
Year :	2009
Title :	Saltmarsh monitoring project 2007-2008
Author :	McCorry, M; Ryle, T.
Series :	Unpublished report to NPWS
Year :	2013
Title :	Malahide Estuary SAC (site code 205) Conservation objectives supporting document- coastal habitats V1
Author :	NPWS
Series :	Conservation objectives supporting document
Year :	2013
Title :	Malahide Estuary SAC (site code 205) Conservation objectives supporting document- marine habitats V1
Author :	NPWS
Series :	Conservation objectives supporting document

Other References

Year :	2002
Title :	New atlas of the British and Irish flora
Author :	Preston, C.D.; Pearman, D.A.; Dines, T.D.
Series :	Oxford University Press, Oxford
Year :	2003
Title :	<i>Spartina</i> in Ireland. In: Wetlands in Ireland
Author :	McCorry, M.J.; Curtis, T.G.F.; Otte, M.L.
Series :	UCD Press, Dublin
Year :	2008
Title :	The phytosociology and conservation value of Irish sand dunes
Author :	Gaynor, K.
Series :	Unpublished PhD thesis, National University of Ireland, Dublin
Year :	2011
Title :	A survey of mudflats and sandflats in Ireland. An intertidal soft sediment survey of Malahide Estuary
Author :	ASU
Series :	Unpublished report to the Marine Institute and NPWS

Spatial data sources

Year :	Interpolated 2012
Title :	2010 intertidal survey
GIS Operations :	Polygon feature classes from marine community types base data sub-divided based on interpolation of marine survey data. Expert opinion used as necessary to resolve any issues arising
Used For :	1140, marine community types (maps 3 and 4)
Year :	2005
Title :	OSi Discovery series vector data
GIS Operations :	High water mark (HWM) and low water mark (LWM) polyline feature classes converted into polygon feature classes and combined; EU Annex I Saltmarsh and Coastal data erased out if present
Used For :	Marine community types base data (map 4)
Year :	Revision 2010
Title :	Saltmarsh Monitoring Project 2007-2008. Version 1
GIS Operations :	QIs selected; clipped to SAC boundary; overlapping regions with Coastal CO data investigated and resolved with expert opinion used
Used For :	1310, 1330, 1410 (map 5)
Year :	2009
Title :	Coastal Monitoring Project 2004-2006. Version 1
GIS Operations :	QIs selected; clipped to SAC boundary; overlapping regions with Saltmarsh CO data investigated and resolved with expert opinion used
Used For :	2120, 2130 (map 6)

1140 Mudflats and sandflats not covered by seawater at low tide

To maintain the favourable conservation condition of Mudflats and sandflats not covered by seawater at low tide in Malahide Estuary SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	The permanent habitat area is stable or increasing, subject to natural processes. See map 3	Habitat area was estimated using OSi data as 311ha
Community extent	Hectares	Maintain the extent of the <i>Zostera</i> -dominated community and the <i>Mytilus edulis</i> -dominated community complex, subject to natural processes. See map 4	Based on intertidal surveys undertaken in 2010 and 2011 (ASU, 2011). See marine supporting document for further information
Community structure: <i>Zostera</i> density	Shoots/m ²	Conserve the high quality of the <i>Zostera</i> -dominated community, subject to natural processes	Estimated by the EPA during 2011 intertidal survey. See marine supporting document for further details
Community structure: <i>Mytilus edulis</i> density	Individuals/m ²	Conserve the high quality of the <i>Mytilus edulis</i> -dominated community, subject to natural processes	Estimated during 2010 intertidal survey (ASU, 2011). See marine supporting document for further details
Community distribution	Hectares	Conserve the following community types in a natural condition: Fine sand with oligochaetes, amphipods, bivalves and polychaetes community complex; Estuarine sandy mud with Chironomidae and <i>Hediste diversicolor</i> community complex; and Sand to muddy sand with <i>Peringia ulvae</i> , <i>Tubificoides benedii</i> and <i>Cerastoderma edule</i> community complex. See map 4	Based on intertidal surveys undertaken in 2010 and 2011 (ASU, 2011). See marine supporting document for further information

Conservation Objectives for : Malahide Estuary SAC [000205]

1310 Salicornia and other annuals colonising mud and sand

To maintain the favourable conservation condition of *Salicornia* and other annuals colonising mud and sand in Malahide Estuary SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes, including erosion and succession. For sub-site mapped: Malahide Estuary- 1.93ha. See map 5	Based on data from Saltmarsh Monitoring Project (SMP) (McCorry, 2007). Habitat surveyed and mapped as a single sub-site, giving a total estimated area of 1.93ha. NB further unsurveyed areas maybe present within the site. See coastal habitats supporting document for further details
Habitat distribution	Occurrence	No decline, or change in habitat distribution, subject to natural processes. See map 5 for known distribution	Based on data from SMP (McCorry, 2007). <i>Salicornia</i> is an annual species, so its distribution can vary significantly from year to year. The largest area of <i>Salicornia</i> flats occurs in the outer estuary. See coastal habitats supporting document for further details
Physical structure: sediment supply	Presence/ absence of physical barriers	Maintain, or where necessary restore, natural circulation of sediments and organic matter, without any physical obstructions	Based on data from SMP (McCorry, 2007). Sediment supply is particularly important for pioneer saltmarsh community, as the distribution of this habitat depends on accretion rates. The saltmarsh habitats at this site have been disturbed in the past by the construction of the railway viaduct across the estuary. This has led to the development of more brackish or lagoonal-type conditions in the inner estuary and a reduced tidal range. See coastal habitats supporting document for further details
Physical structure: creeks and pans	Occurrence	Maintain creek and pan structure, subject to natural processes, including erosion and succession	Based on data from SMP (McCorry, 2007). Creeks deliver sediment throughout saltmarsh system. See coastal habitats supporting document for further details
Physical structure: flooding regime	Hectares flooded; frequency	Maintain natural tidal regime	Based on data from SMP (McCorry, 2007). This pioneer saltmarsh community requires regular tidal inundation. The viaduct that was built over the estuary in the 1800s has modified the tidal regime of the estuary over time and prevents the inner estuary emptying completely at low tide, thereby creating a lagoon. See coastal habitats supporting document for further details
Vegetation structure: zonation	Occurrence	Maintain the range of coastal habitats including transitional zones, subject to natural processes including erosion and succession	Based on data from McCorry (2007). At Malahide Island there are natural transitions between ASM and <i>Salicornia</i> flats and there are also transitions between ASM and sand dune habitats. Transitions between ASM and <i>Spartina</i> swards occur at the northern end of the outer estuary. See coastal habitats supporting document for further details
Vegetation structure: vegetation height	Centimetres	Maintain structural variation within sward	Based on data from McCorry (2007). Grazing by livestock is absent from Malahide Estuary resulting in a high vegetation cover and a wide range of sward heights. See coastal habitats supporting document for details
Vegetation structure: vegetation cover	Percentage cover at a representative sample of monitoring stops	Maintain more than 90% of area outside creeks vegetated	Based on data from SMP (McCorry and Ryle, 2009). See coastal habitats supporting document for details
Vegetation composition: typical species and sub-communities	Percentage cover	Maintain the presence of species-poor communities listed in SMP (McCorry and Ryle, 2009)	Based on data from SMP (McCorry and Ryle, 2009). See coastal habitats supporting document for further details

Vegetation structure: negative indicator species - <i>Spartina anglica</i>	Hectares	No significant expansion of common cordgrass (<i>Spartina anglica</i>). No new sites for this species and an annual spread of less than 1% where it is already known to occur	Based on data from SMP (McCorry, 2007). There is frequent <i>Spartina</i> recorded throughout the SAC. See coastal habitats supporting document for further details
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Spartina swards (*Spartinion maritimae*) was originally listed as a qualifying Annex I habitat for Malahide Estuary SAC due to historical records of two rare forms of cordgrass—small cordgrass (*Spartina maritima*) and Townsend's cordgrass (*S. x townsendii*). However, Preston et al. (2002) considers both forms to be alien. In addition, all stands of cordgrass in Ireland are now regarded as common cordgrass (*S. anglica*) (McCorry et al., 2003; McCorry and Ryle, 2009). As a consequence, a conservation objective has not been prepared for this habitat. It will therefore not be necessary to assess the likely effects of plans or projects against this Annex I habitat at this site.

Conservation Objectives for : Malahide Estuary SAC [000205]

1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)

To restore the favourable conservation condition of Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) in Malahide Estuary SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes, including erosion and succession. For sub-site mapped: Malahide Estuary - 25.33ha. See map 5	Based on data from Saltmarsh monitoring Project (SMP) (McCorry, 2007). Habitat surveyed and mapped as a single sub-site, giving a total estimated area of 25.33ha. NB further unsurveyed areas maybe present within the site. See coastal habitats supporting document for further details
Habitat distribution	Occurrence	No decline or change in habitat distribution, subject to natural processes. See map 5 for known distribution	Based on data from SMP (McCorry, 2007). The ASM is the most prominent saltmarsh habitat at this SAC. See coastal habitats supporting document for further details
Physical structure: sediment supply	Presence/ absence of physical barriers	Maintain natural circulation of sediments and organic matter, without any physical obstructions	Based on data from McCorry (2007). The saltmarsh habitats have been disturbed in the past by the construction of a railway viaduct across the estuary. This has led to the development of more brackish or lagoonal-type conditions in the inner estuary and a reduced tidal estuary. In spite of the M1 Broadmeadow motorway bridge having been constructed across the saltmarsh at Lissenhall (2001 -2003), the saltmarsh has remained more or less intact. See coastal habitats supporting document for further details
Physical structure: creeks and pans	Occurrence	Allow creek and pan structure to develop, subject to natural processes, including erosion and succession	Based on data from McCorry (2007). At Malahide Island the saltmarsh is in good condition. The ASM at Lissenhall is also in relatively good condition despite any disturbance resulting from construction of the M1 motorway bridge. See coastal habitats supporting document for further details
Physical structure: flooding regime	Hectares flooded; frequency	Maintain natural tidal regime	Based on data from McCorry (2007). The viaduct that was built over the estuary in the 1800s has modified the tidal regime of the estuary over time, which prevents the inner estuary emptying completely at low tide. thereby creating a lagoon. See coastal habitats supporting document for further details
Vegetation structure: zonation	Occurrence	Maintain range of coastal habitats including transitional zones, subject to natural processes including erosion and succession	Based on data from McCorry (2007). At Malahide Estuary ASM is the dominant saltmarsh habitat where it occurs in mosaic with other saltmarsh habitats, including ' <i>Salicornia</i> and other annuals colonising mud and sand' and MSM. At Malahide Island there are also some natural transitions between the ASM and sand dune habitats. See coastal habitats supporting document for further details
Vegetation structure: vegetation height	Centimetres	Maintain structural variation within sward	Based on data from SMP (McCorry, 2007). Grazing by livestock is absent at this site. See coastal habitats supporting document for further details
Vegetation structure: vegetation cover	Percentage cover at a representative sample of monitoring stops	Maintain more than 90% area outside creeks vegetated	Based on data from SMP (McCorry and Ryle, 2009). See coastal habitats supporting document for further details
Vegetation composition: typical species and sub-communities	Percentage cover at a representative sample of monitoring stops	Maintain range of sub-communities with typical species listed in SMP (McCorry and Ryle, 2009)	See coastal habitats supporting document for further details

Vegetation structure: negative indicator species - <i>Spartina anglica</i>	Hectares	No significant expansion of common cordgrass (<i>Spartina anglica</i>), with an annual spread of less than 1% where it is known to occur	Based on data from SMP (McCorry and Ryle, 2009). <i>Spartina</i> is widely distributed throughout the SAC. See coastal habitats supporting document for further details
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Conservation Objectives for : Malahide Estuary SAC [000205]

1410 Mediterranean salt meadows (*Juncetalia maritimi*)

To maintain the favourable conservation condition of Mediterranean salt meadows (*Juncetalia maritimi*) in Malahide Estuary SAC, which is defined by the following list of attributes and targets:

Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes, including erosion and succession. For sub-site mapped: Malahide Estuary - 0.64ha. See map 5	Based on data from the Saltmarsh Monitoring Project (SMP) (McCorry, 2007). Habitat surveyed and mapped as a single sub-site (0.64ha). NB further unsurveyed areas maybe present within the site. See coastal habitats supporting document for further details
Habitat distribution	Occurrence	No decline, subject to natural processes. See map 5 for known distribution	Based on data from McCorry (2007). MSM only occurs in the outer estuary. See coastal habitats supporting document for further details
Physical structure: sediment supply	Presence/ absence of physical barriers	Maintain/restore natural circulation of sediments and organic matter, without any physical obstructions	Based on data from McCorry (2007). The saltmarsh habitats have been disturbed in the past by the construction of a railway viaduct across the estuary. This has led to the development of more brackish or lagoonal-type conditions in the inner estuary and a reduced tidal estuary. In spite of the M1 Broadmeadow motorway bridge having been constructed across the saltmarsh at Lissenhall (2001 -2003), the saltmarsh has remained more or less intact. See coastal habitats supporting document for further details
Physical structure: creeks and pans	Occurrence	Maintain creek and pan structure, subject to natural processes, including erosion and succession	Based on data from the SMP (McCorry, 2007). See coastal habitats supporting document for further details
Physical structure: flooding regime	Hectares flooded; frequency	Maintain natural tidal regime	Mediterranean salt meadows is found high up in the saltmarsh but requires occasional tidal inundation. Based on data from McCorry (2007). The viaduct that was built over the estuary in the 1800s has modified the tidal regime of the estuary over time, which prevents the inner estuary emptying completely at low tide. thereby creating a lagoon. See coastal habitats supporting document for further details
Vegetation structure: zonation	Occurrence	Maintain range of saltmarsh habitats including transitional zones, subject to natural processes including erosion and succession	Based on data from McCorry (2007). At Malahide Estuary there are mosaics of ASM, MSM and <i>Salicornia</i> flats. See coastal habitats supporting document for further details
Vegetation structure: vegetation height	Centimetres	Maintain structural variation in the sward	Based on data from McCorry (2007). Livestock grazing is absent from Malahide Estuary. See coastal habitats supporting document for further details
Vegetation structure: vegetation cover	Percentage cover at a representative sample of monitoring stops	Maintain more than 90% of area outside creeks vegetated	See coastal habitats supporting document for further details
Vegetation composition: typical species and sub-communities	Percentage cover at a representative sample of monitoring stops	Maintain range of sub-communities with characteristic species listed in SMP (McCorry and Ryle, 2009)	See coastal habitats supporting document for further details
Vegetation structure: negative indicator species - <i>Spartina anglica</i>	Hectares	No significant expansion of common cordgrass (<i>Spartina anglica</i>), with an annual spread of less than 1% where it is already known to occur	Based on data from McCorry (2007). <i>Spartina</i> is widely distributed throughout the SAC. See coastal habitats supporting document for further details. See coastal habitats supporting document for further details

2120 Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes)

To restore the favourable conservation condition of Shifting dunes along the shoreline with *Ammophila arenaria* ('white dunes') in Malahide Estuary SAC, which is defined by the following list of attributes and targets:

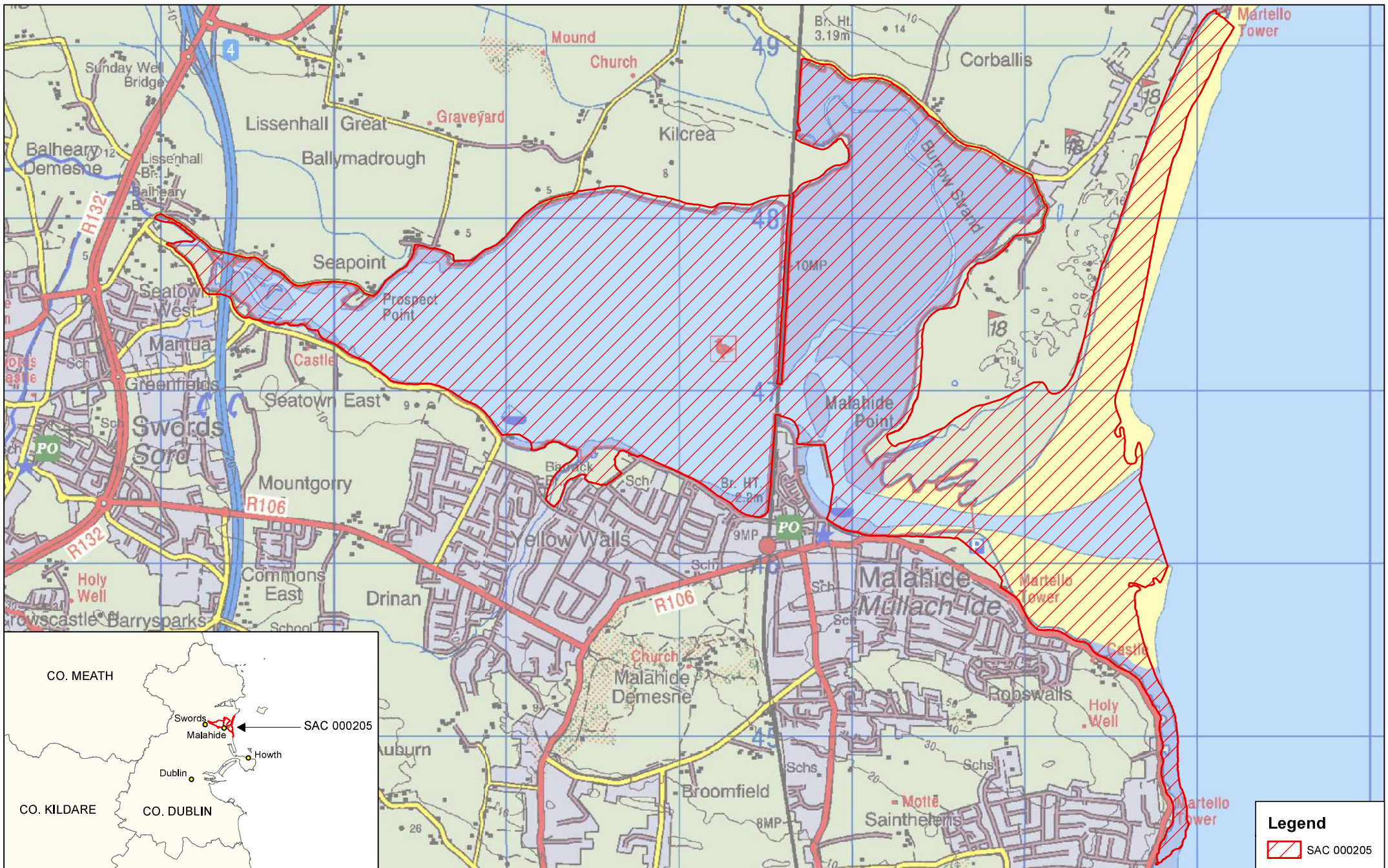
Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes including erosion and succession. Total area mapped: 1.80ha. See map 6	Based on data from the Coastal Monitoring Project (CMP) (Ryle et al., 2009). Habitat was mapped from a single sub-site - Malahide Island. Habitat is very difficult to measure in view of its dynamic nature. See coastal habitats supporting document for further details
Habitat distribution	Occurrence	No decline, or change in habitat distribution, subject to natural processes. See map 6 for known distribution	Based on Ryle et al. (2009). At Malahide Island the mobile dunes occur as a thin band along the northeastern edge of the spit. See coastal habitats supporting document for further details
Physical structure: functionality and sediment supply	Presence/ absence of physical barriers	Maintain the natural circulation of sediment and organic matter, without any physical obstructions	Based on Ryle et al. (2009). Dunes are naturally dynamic systems that require continuous supply and circulation of sand. Marram grass (<i>Ammophila arenaria</i>) reproduces vegetatively and requires constant accretion of fresh sand to maintain active growth encouraging further accretion. The mobile dunes at Malahide Island are undergoing some erosion along the north and eastern edge as well as some accretion to the south. See coastal habitats supporting document for further details
Vegetation structure: zonation	Occurrence	Maintain the range of coastal habitats including transitional zones, subject to natural processes including erosion and succession	Based on data from Gaynor (2008) and Ryle et al. (2009). At Malahide Island, there are transitional communities between a range of sand dune habitats as well as a range of saltmarsh habitats. See coastal habitats supporting document for further details
Vegetation composition: plant health of dune grasses	Percentage cover	95% of marram grass (<i>Ammophila arenaria</i>) and/or lyme-grass (<i>Leymus arenarius</i>) should be healthy (i.e. green plant parts above ground and flowering heads present)	Based on Ryle et al. (2009). See coastal habitats supporting document for further details
Vegetation composition: typical species and sub-communities	Percentage cover at a representative number of monitoring stops	Maintain the presence of species-poor communities dominated by marram grass (<i>Ammophila arenaria</i>) and/or lyme-grass (<i>Leymus arenarius</i>)	Based on Ryle et al. (2009). Sea holly (<i>Eryngium maritimum</i>) occurs occasionally throughout the mobile dunes at Malahide Island. See coastal habitats supporting document for further details
Vegetation composition: negative indicator species	Percentage cover	Negative indicator species (including non-natives) to represent less than 5% cover	Based on Ryle et al. (2009). Negative indicators include non-native species; species indicative of changes in nutrient status and species not considered characteristic of the habitat. Sea-buckthorn (<i>Hippophae rhamnoides</i>) should be absent or effectively controlled. This species has been planted on the seaward side of the spit as a coastal protection measure by the adjacent golf course. See coastal habitats supporting document for further details

Conservation Objectives for : Malahide Estuary SAC [000205]

2130 Fixed coastal dunes with herbaceous vegetation (grey dunes)

To restore the favourable conservation condition of Fixed coastal dunes with herbaceous vegetation ('grey dunes') in Malahide Estuary SAC, which is defined by the following list of attributes and targets:

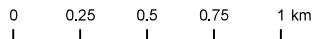
Attribute	Measure	Target	Notes
Habitat area	Hectares	Area stable or increasing, subject to natural processes including erosion and succession. Total area mapped: 21.42ha. See map 6	Based on data from Coastal Monitoring Project (CMP) (Ryle et al., 2009). Habitat was mapped from a single sub-site- Malahide Island. See coastal habitats supporting document for further details
Habitat distribution	Occurrence	No decline, or change in habitat distribution, subject to natural processes. See map 6 for known distribution	Based on data from Ryle et al. (2009). The fixed dune habitat flanks the eastern and southern edge of Malahide Island. See coastal habitats supporting document for further details
Physical structure: functionality and sediment supply	Presence/ absence of physical barriers	Maintain the natural circulation of sediment and organic matter, without any physical obstructions	Physical barriers can lead to fossilisation or over-stabilisation of dunes, as well as beach starvation resulting in increased rates of erosion. Coastal protection works consisting of railway sleepers and chestnut paling have been installed on the seaward side of the spit. In addition, concrete filled plastic barrels and planting of sea buckthorn (<i>Hippophae rhamnoides</i>) are measures that have been used for coastal protection by the adjacent golf course. See coastal habitats supporting document for further details
Vegetation structure: zonation	Occurrence	Maintain the range of coastal habitats including transitional zones, subject to natural processes including erosion and succession	Based on data from Ryle et al. (2009). At Malahide Island, there are transitional communities between a range of sand dune habitats as well as a range of saltmarsh habitats. This site represents one of the more intact examples of a dune-saltmarsh complex on the northeastern coastline. See coastal habitats supporting document for further details
Vegetation structure: bare ground	Percentage cover	Bare ground should not exceed 10% of fixed dune habitat, subject to natural processes	Based on data from Gaynor (2008) and Ryle et al. (2009). See coastal habitats supporting document for further details
Vegetation structure: sward height	Centimetres	Maintain structural variation within sward	Based on data from Gaynor (2008) and Ryle et al. (2009). Grazing by livestock is absent from the dunes. See coastal habitats supporting document for further details
Vegetation composition: typical species and sub-communities	Percentage cover at a representative sample of monitoring stops	Maintain range of sub-communities with typical species listed in Ryle et al. (2009)	Based on data from Ryle et al. (2009). The protected and Red Data Book species hairy violet (<i>Viola hirta</i>) occurs at this site. See coastal habitats supporting document for further details.
Vegetation composition: negative indicator species (including <i>Hippophae rhamnoides</i>)	Percentage cover	Negative indicator species (including non-natives) to represent less than 5% cover	Based on data from Ryle et al. (2009). Negative indicators include non-native species, species indicative of changes in nutrient status and species not considered characteristic of the habitat. Sea-buckthorn (<i>Hippophae rhamnoides</i>) should be absent or effectively controlled. This species has been planted on the seaward side of the spit as a coastal protection measure by the adjacent golf course. See coastal habitats supporting document for further details
Vegetation composition: scrub/trees	Percentage cover	No more than 5% cover or under control	Based on data from Ryle et al. (2009). At Malahide Island, the fixed dune has been invaded by dog-rose (<i>Rosa canina</i>), privet (<i>Ligustrum</i> sp.) as well as single trees of turkey oak (<i>Quercus cerris</i>). See coastal habitats supporting document for further details



**MAP 1:
MALAHIDE ESTUARY SAC
CONSERVATION OBJECTIVES
SAC DESIGNATION**

Map to be read in conjunction with the NPWS Conservation Objectives Document.

SITE CODE: SAC 000205
CO DUBLIN; version 1.02



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 EN 0059208).
Níl sna teorainneacha ar na léarscálanna ach nod garshuíomhach ginearálta. Féadfar athbhreithnithe a déanamh ar theorainneacha na gceantar comharthaite. Macasamhail d'ábhar na Súrbréacharta Ordónais le chead na Rialtas (Ceadúnas Uimh, EN 0059208)

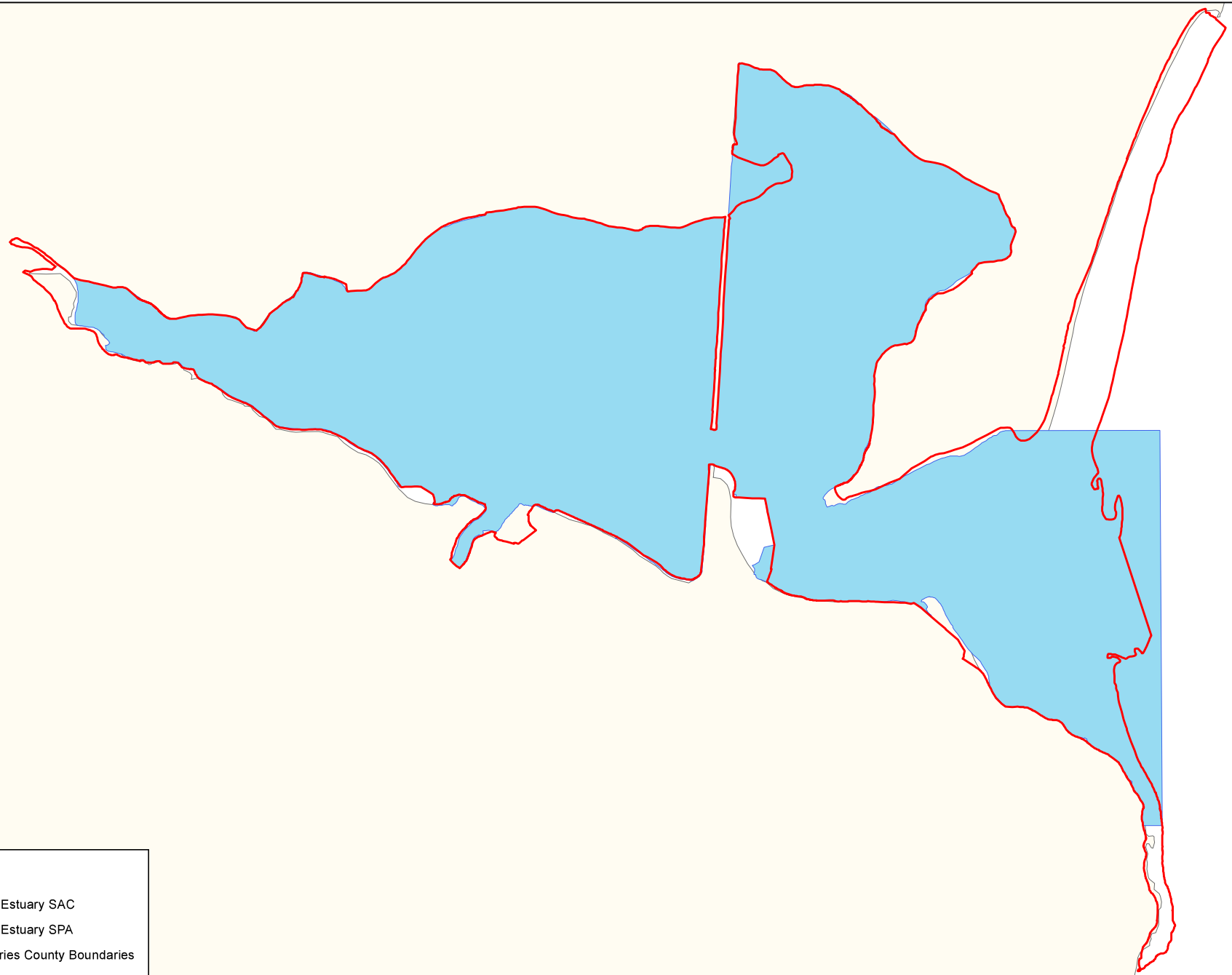
Legend

SAC 000205



Map Version 1
Date: October 2012





Legend

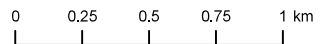
- 000205 Malahide Estuary SAC
- 004025 Malahide Estuary SPA
- OSi Discovery Series County Boundaries



**MAP 2:
 MALAHIDE ESTUARY SAC
 CONSERVATION OBJECTIVES
 ADJOINING / OVERLAPPING DESIGNATIONS**

Map to be read in conjunction with the NPWS Conservation Objectives Document.

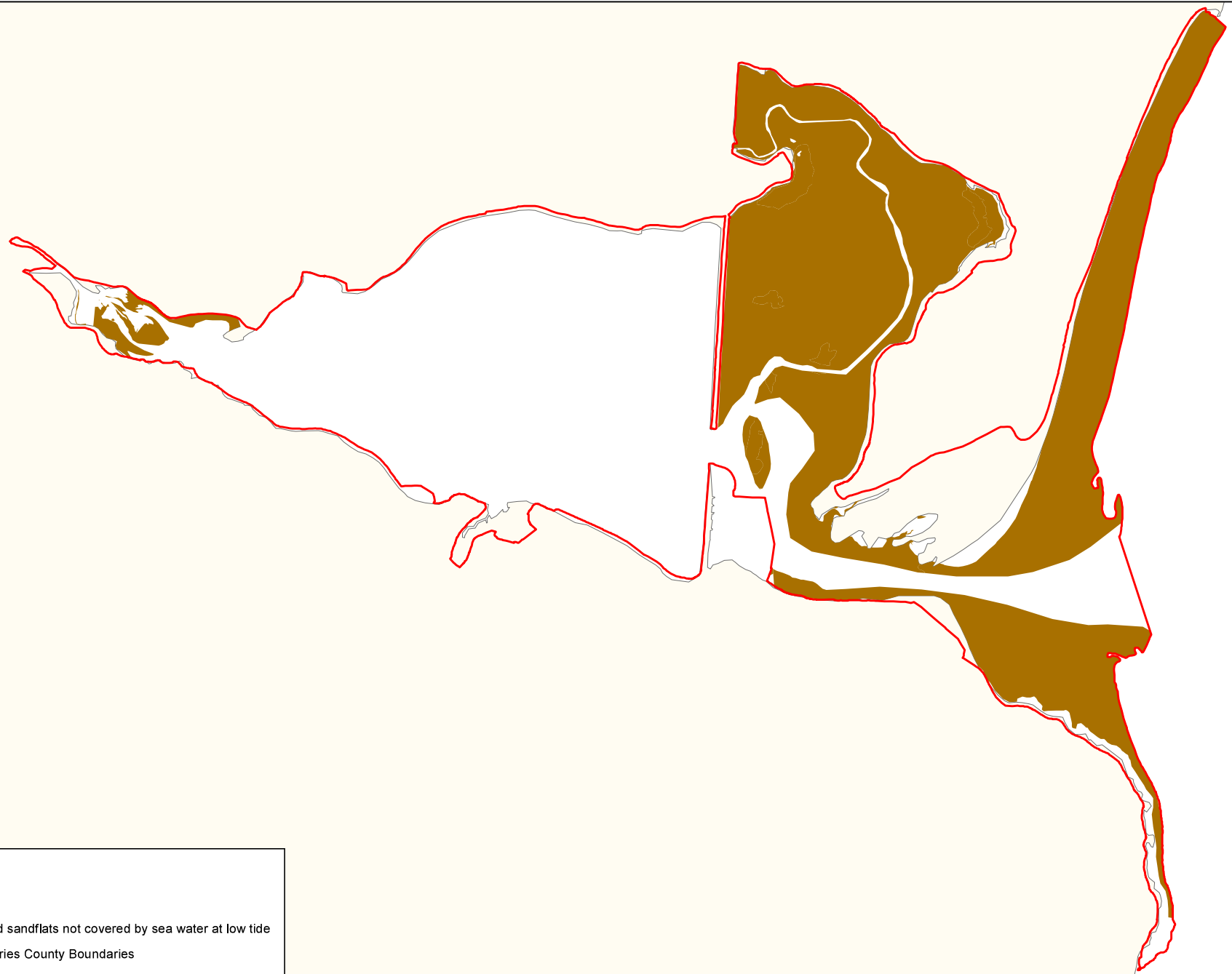
SITE CODE: SAC 000205
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 Níl sna teorainneacha ar na léarscálleanna ach nod garshuíomhach ginearálta. Féadfar athbheithnithe a déanamh ar theorainneacha na gceantar comharthaíthe. Macasamhail d'ábhar na Súrthéarachta Ordonáis le chead ón Rialtas (Ceadúnas Uimh, EN 0059208)



Map Version 1
 Date: October 2012



Legend

- SAC 000205
- 1140 Mudflats and sandflats not covered by sea water at low tide
- OSi Discovery Series County Boundaries

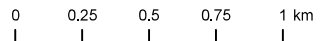


*An Roinn
Eolaíoch, Gníomhaireachta agus Gaeltachta
Department of
Arts, Heritage and the Gaeltacht*

**MAP 3:
MALAHIDE ESTUARY SAC
CONSERVATION OBJECTIVES
TIDAL MUDFLATS AND SANDFLATS**

Map to be read in conjunction with the NPWS Conservation Objectives Document.

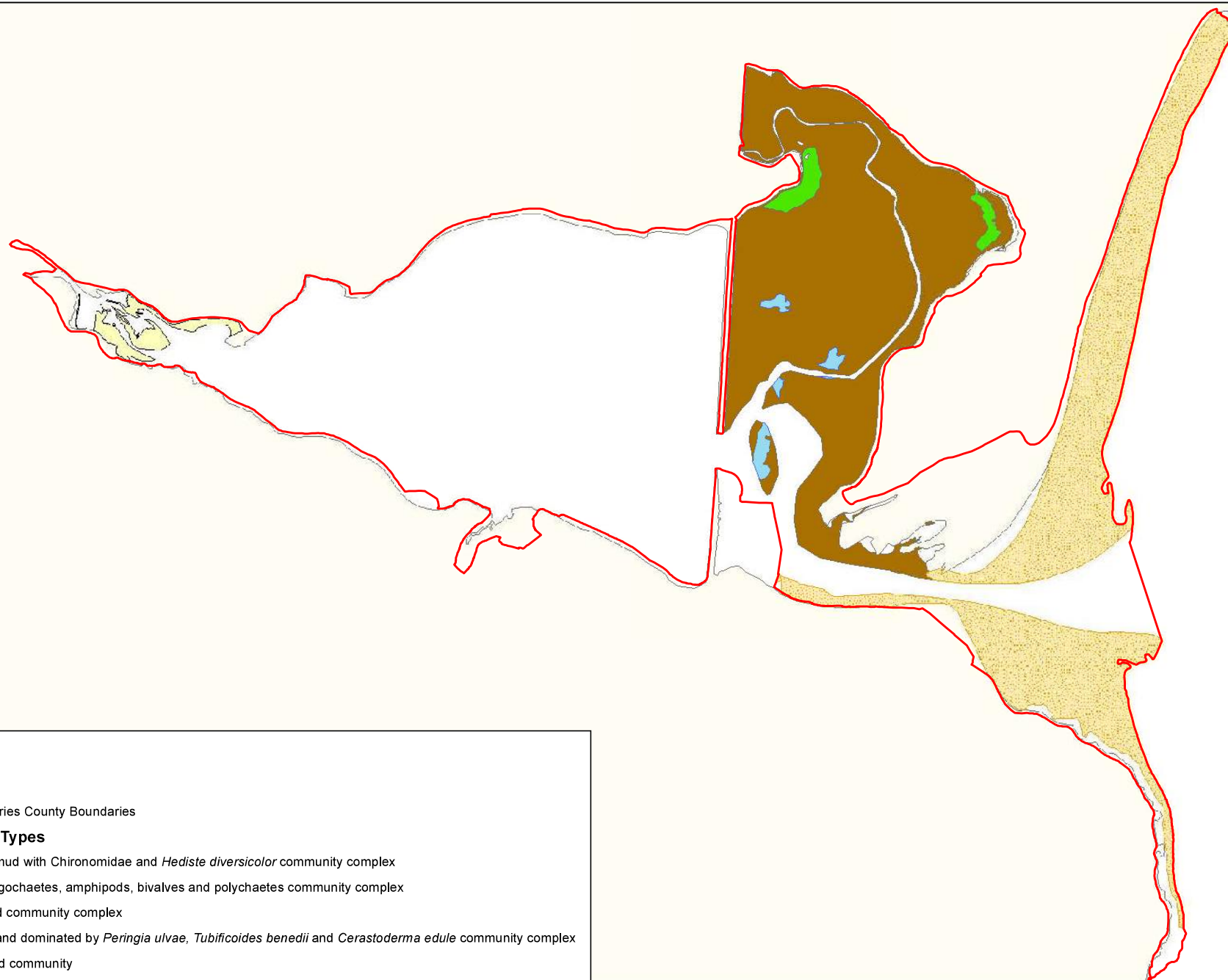
SITE CODE: SAC 000205
CO DUBLIN; version 1.02



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Níl sna teorainneacha ar na léarscáil anna ach nod garshuíomhach ginearálta. Féadfar athbheithníthe a déanamh ar theorainneacha na gceantar comharthaíthe. Macasamhail d'ábhar na Súrbhéarachta Ordonáis le chead ón Rialtas (Ceadúnas Uimh, EN 0059208)



Map Version 1
Date: October 2012



Legend

SAC 000205

OSi Discovery Series County Boundaries

Marine Community Types

Estuarine sandy mud with Chironomidae and *Hediste diversicolor* community complex

Fine sand with oligochaetes, amphipods, bivalves and polychaetes community complex

Mytilus-dominated community complex

Sand to muddy sand dominated by *Peringia ulvae*, *Tubificoides benedii* and *Cerastoderma edule* community complex

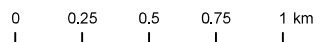
Zostera dominated community



**MAP 4:
MALAHIDE ESTUARY SAC
CONSERVATION OBJECTIVES
MARINE COMMUNITY TYPES**

Map to be read in conjunction with the NPWS Conservation Objectives Document.

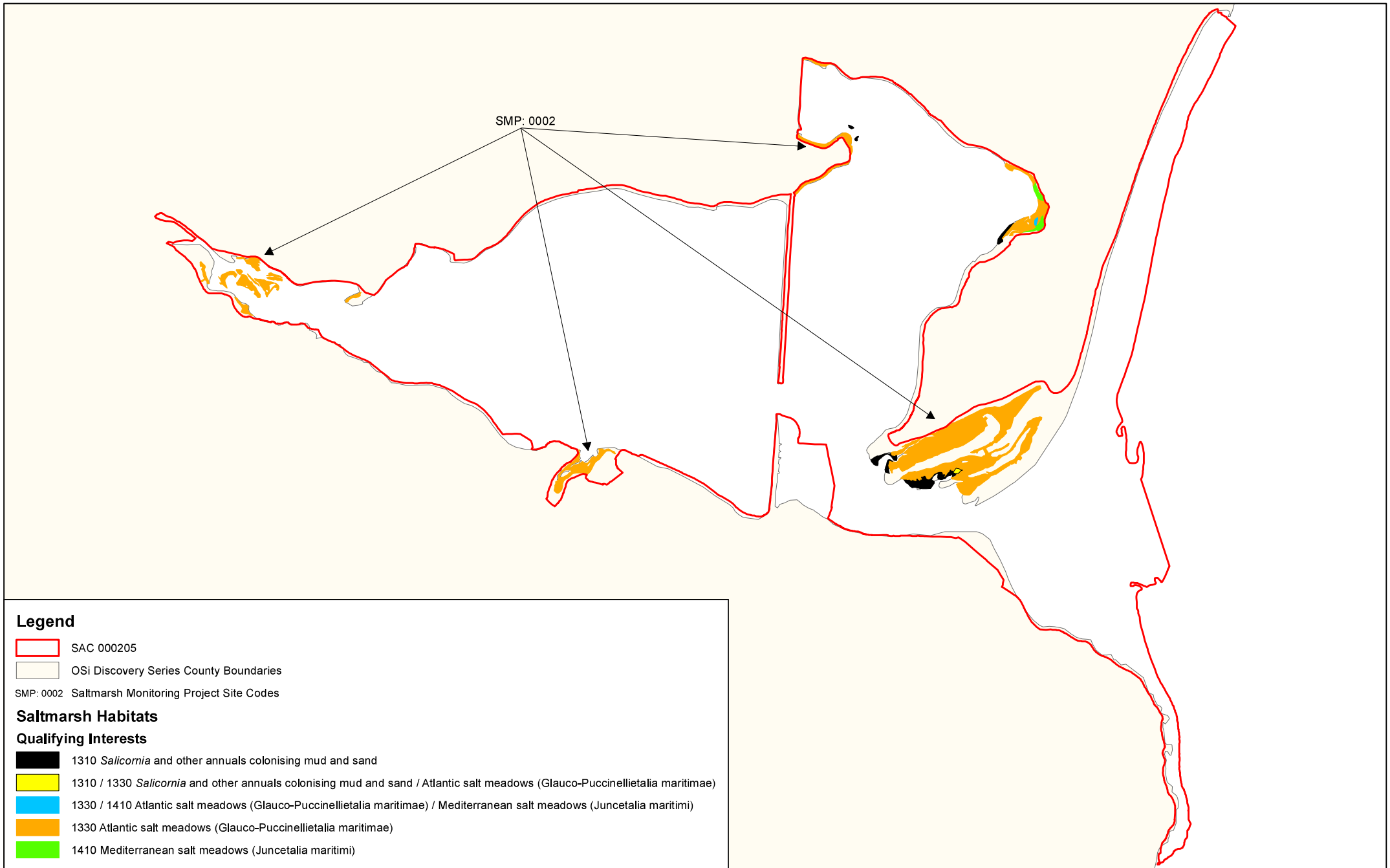
SITE CODE: SAC 000205
CO DUBLIN; version 1.02



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Map Version 1
Date: October 2012



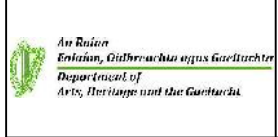
Legend

- SAC 000205
- OSi Discovery Series County Boundaries
- SMP: 0002 Saltmarsh Monitoring Project Site Codes

Saltmarsh Habitats

Qualifying Interests

- 1310 *Salicornia* and other annuals colonising mud and sand
- 1310 / 1330 *Salicornia* and other annuals colonising mud and sand / Atlantic salt meadows (*Glauco-Puccinellietalia maritima*)
- 1330 / 1410 Atlantic salt meadows (*Glauco-Puccinellietalia maritima*) / Mediterranean salt meadows (*Juncetalia maritimi*)
- 1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritima*)
- 1410 Mediterranean salt meadows (*Juncetalia maritimi*)



**MAP 5:
MALAHIDE ESTUARY SAC
CONSERVATION OBJECTIVES
SALTmarsh HABITATS**

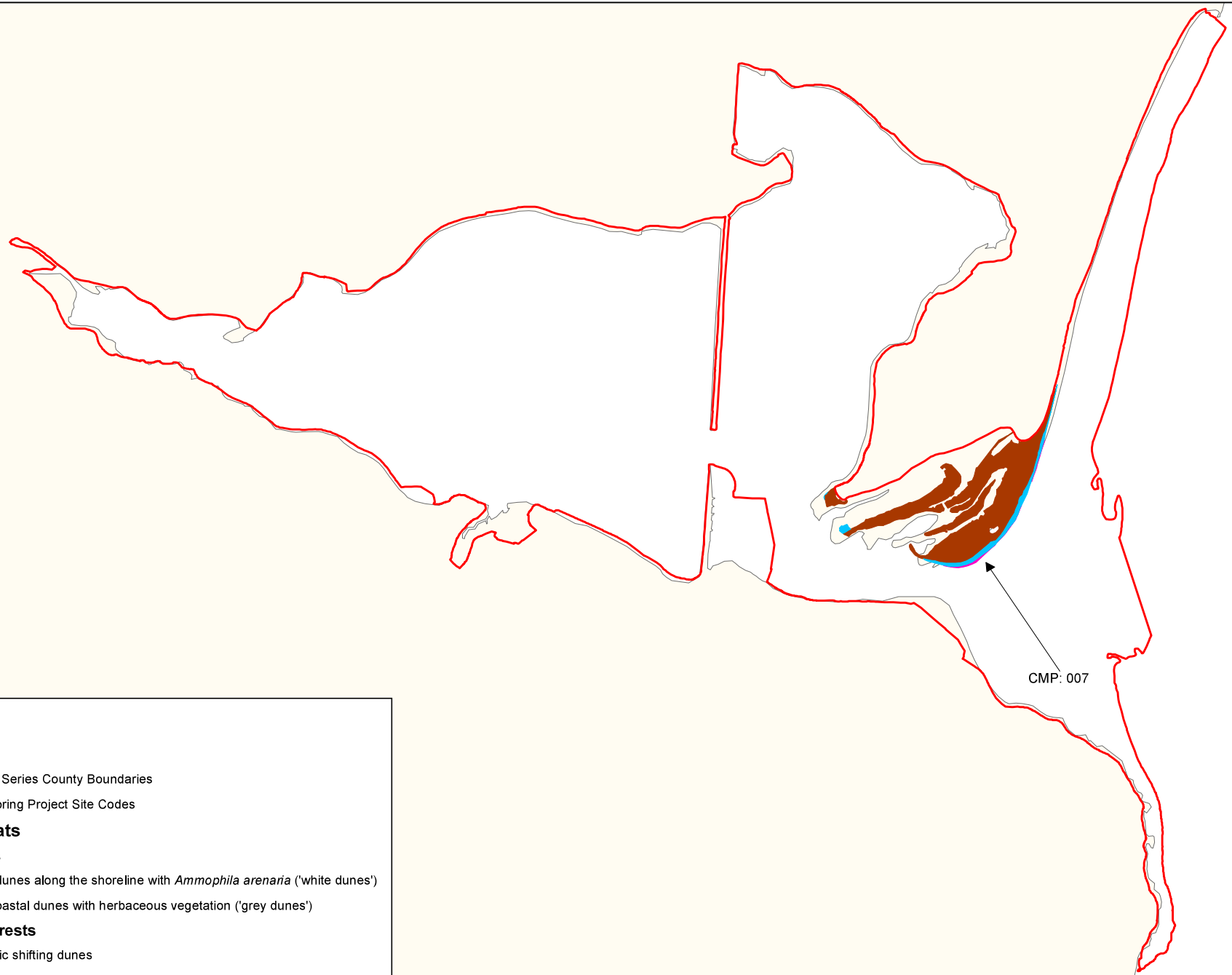
Map to be read in conjunction with the NPWS Conservation Objectives Document.

SITE CODE: SAC 000205
CO DUBLIN; version 1.02

0 0.25 0.5 0.75 1 km

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N
↑
Map Version 1
Date: October 2012



Legend

- SAC 000205
- OSi Discovery Series County Boundaries
- CMP:007 Coastal Monitoring Project Site Codes

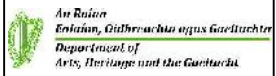
Sand Dune Habitats

Qualifying Interests

- 2120 Shifting dunes along the shoreline with *Ammophila arenaria* ('white dunes')
- 2130 *Fixed coastal dunes with herbaceous vegetation ('grey dunes')

Non Qualifying Interests

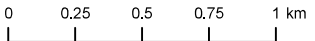
- 2110 Embryonic shifting dunes



**MAP 6:
MALAHIDE ESTUARY SAC
CONSERVATION OBJECTIVES
SAND DUNE HABITATS**

Map to be read in conjunction with the NPWS Conservation Objectives Document.

SITE CODE: SAC 000205
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Map Version 1
Date: October 2012

Appendix 4

Lighting Design

J.N. & G. Traynor & Partners

CHARTERED BUILDING SERVICES CONSULTING ENGINEERS

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BROADMEADOW WAY
NEWBRIDGE HOUSE TO MALAHIDE
CO DUBLIN

REPORT ON
PROPOSED PUBLIC LIGHTING INSTALLATIONS

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MARCH 2018

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BROADMEADOW WAY **NEWBRIDGE HOUSE TO MALAHIDE** **CO DUBLIN**

REPORT ON **PROPOSED PUBLIC LIGHTING INSTALLATIONS**

1.0 Introduction

It is envisaged that the proposed project would be a flagship scheme for tourism in the Malahide & Donabate area and be a model for recreational walking and cycling in Ireland. It will also exemplify how a sustainable trail can be built and integrated into a national cycle network, public transport, heritage sites, employment centres and local amenities.

The main objectives of this scheme are to:

- Provide an attractive first class pedestrian and cycle route;
- Encourage a larger modal shift (from private to public transport) and promote physical activity among local communities;
- Increase pedestrian and cycle activity in Malahide and Donabate villages
- Provide access to scenic areas normally inaccessible to mobility impaired users.
- Improve access within the Malahide and Donabate area and the Malahide Estuary locally.
- Provide a recreational amenity that can be recognised locally, nationally and internationally as a first rate tourist attraction.

The proposed greenway will allow the two demesnes to act together in advertising their individual attractions and also the link between the two public parks will allow for future joint development of enhanced accessibility proposals.

2.0 Requirement for Lighting of the Trail

It is envisaged that there will be a number of user types who will utilise the Broadmeadow Trail. A proportion of these users will use the trail during the hours of darkness. The projected number of persons who will use the trail is outlined in the traffic report. Examples include:

- A large number of foreign tourists visit the Malahide area throughout the entire year. It is envisaged that a number of these tourists will use the trail to travel to Malahide from the Donabate side or Donabate from the Malahide side to avail of the amenities of Malahide Castle or Newbridge House. These tourists will use this trail with the expectation of being able to travel back to their starting point by use of the trail and it is unlikely that they will be aware of the time constraints if the trail was unlit. An unlit trail will render this return journey undesirable and will effectively make the trail unsafe and undesirable particularly during late autumn and early spring.
- It is anticipated that a large number of domestic tourists will also use the trail. Malahide and Donabate provide popular destinations to the domestic market and the users will also have the expectation of being able to travel back to their starting point by use of the trail and it is unlikely that they will be aware of the time constraints if the trail was unlit.

- Local businesses and leisure attractions will be accessed via the trail by local residents. Examples would be local golf courses at Donabate and Malahide as well as the shopping facilities at Malahide Castle and Malahide Village. Many of these activities will extend into early evening / night time and an unlit trail will render their return journey undesirable thus making the trail unsafe to use and increasing car usage.
- Cyclists from the Donabate area who will use the trail to access the regular DART service from Malahide station to travel to work. Over the period between late autumn and early spring (i.e. winter), commuters will return to Malahide by Dart and will wish to complete their journey by cycling/walking but will not be prepared to do so if the trail is unlit. The only viable alternative would be to change trains to the next northern commuter service stopping at Donabate. This would be a disincentive to utilise cycling / Dart public transport. The other alternative would be for the cyclist to travel around the estuary on the road network (partly unlit) to Donabate which is not practical due to the distance involved and the absence of safe cycle paths along the entire route.
- Pedestrians from the Donabate area who will use the trail to access the regular DART service from Malahide station to travel to work. Over the period between late autumn and early spring, the pedestrians may return to Donabate by the trail. The only viable alternative would be to change trains to the next northern commuter service stopping at Donabate. This would be a disincentive to utilise Dart public transport.

- A lit trail will serve to extend the useful hours of this amenity during all times of the year as users will be aware that the trail will be lit for their return journey.

3.0 Basis of Lighting Design

There is a balance to be struck between the increased amenity and transportation value of the trail and the desire for darkness.

The benefits to be gained by adults and children being able to use the facility after dark must be balanced against the potential environmental impact. This balance is achievable by the use of controlled optics, new sources of illumination, careful placement of lighting equipment and design.

The introduction of new LED light sources has made the above goals easily achievable compared to older conventional light sources. LED light sources are easily controllable using digital signals; for example, they can easily switch on to 100% instantly or dim smoothly to 10% (or less) output and are therefore highly responsive to pedestrian traffic (i.e. the trail can be lit with a ‘glow’ of light with the lights dimmed at 10% and as soon as the pedestrian is detected, the lights rise to full output).

Of particular relevance to exterior lighting on this trail is the issue of light pollution in all of its forms. Any new lighting installation makes an impact on the night-time environment and this has to be balanced against the needs of the trail users in terms of amenity and safety. Lighting on this trail will extend the use of the trail well into the late evening, contributing to a real and perceived sense of security at night, enhancing the night-time experience for visitors and residents alike.

The trail lighting will also be used as a means to guide people, in much the same way as a road sign or traffic signal.

In addition to the visual impact, there are a number of other aspects that were considered in the development of the lighting design: the creation of a safe and pleasant environment, the appropriate use of energy, ease of maintenance and harmonising the appearance of the lighting equipment with its surroundings.

The trail lighting design will ensure that artificial light is delivered to the point where it is required, and nowhere else. Issues such as brightness, direction and context how being considered in the development of the external lighting design to ensure that light pollution and light spill is avoided.

In the development of the lighting scheme, the following issues were also considered:

- Visual brightness and contrast
- Light colour
- Colour rendering
- Visual clutter

Visual brightness and contrast determines the appearance of the lit installation and its relationship to the surroundings. The brightness of the installation has been addressed by controlling the light output which directs the light onto the trail. Contrast has been addressed by the colour of the light output.

Colour rendering is the ability of the lighting to reveal the colours of various objects accurately in comparison to their true colours. This is important in facial recognition along the trail and the light source been chosen with good colour rendering ability.

Visual clutter can be defined as a visually chaotic scene, caused by the inclusion of multiple elements of street furniture without consideration of the overall scene, which detracts from the overall quality of the environment. Street furniture contributing to visual clutter can include (but is not limited to) such items as lighting columns, signage, litter bins, pedestrian barriers, planters, benches and bollards.

The proposed lighting scheme addresses the issue of visual clutter along the entire length of the trail by the specification of a common and uniform lighting design with a common mounting height of all luminaires.

4.0 Determination of Areas of Illumination & Light Levels

The trail will be used by pedestrians and cyclists only. The area to be illuminated is the surface of the trail. The design illuminance on the trail surface is proposed to be 7.5 lux with a minimum of 1.5 lux. This illuminance complies with IS EN 13201:2015 Class P3. For comparison purposes, a full moon illuminates the ground surface to approximately 0.1 lux. A bright sunny day results in an illuminance level of in excess of 100,000 lux. The new Donabate Distributor Road design illumination is 15 lux average.

The trail illumination also provides a sense of safety for users and the selection of a 7.5 lux average illuminance level makes it possible to make out facial features of other trail users. This has an added social dimension in identifying trail users to each other as opposed to simply moving dark shapes.

The trail will be used for cyclists and pedestrians and a higher light level is required in a situation in which cycling and pedestrians are using the trail as opposed to a pedestrian only trail. The factors determining the design illumination are travel speed of pedestrians / cyclists, projected intensity of usage, ambient light levels and the requirement for facial recognition.

Light spill onto the water in the estuary had been addressed and minimised in two ways. Firstly, each light fitting will have an optic which will direct light onto the trail surface only. Secondly, the light fitting will be placed such that the rear of the fitting is facing the estuary. The resultant light levels immediately behind the luminaire are 6 lux, 500mm behind the luminaire at 4 lux, 1m behind the luminaire and 2 lux reducing to 0 lux 1.5m behind the luminaire. At an average distance between the luminaire and the water's edge of 2.5m, the spill light onto the water will be zero.

The existing ambient light in the Donabate area as well as across the causeway is mainly a product of passing traffic. Traffic levels on the Hearse Road (R126) are high as this road is the main road into Donabate (approx. population circa 7,500 persons). Testing by the author on a single car travelling along a darkened road with dipped beam and full headlights has indicated a surface illuminance of approximately 20 lux for dipped lights and 30 lux for full beam headlights approximately 4m in front of the car.

The new Donabate Distributor Road will be illuminated to ME3 standard (15 lux average illuminance). The trail will be illuminated to 50% of this level at maximum output from the lighting installation.