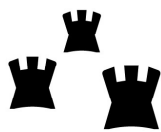


# **A Management Plan for North Bull Island**

**August 2009**

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**Dublin City**

Baile Átha Cliath  
Parks and Landscape Services

## Executive Summary

Mark McCorry and Tim Ryle were commissioned by The Parks and Landscape Services section, Dublin City Council (DCC) to prepare a Management Plan for the practical management of the terrestrial, intertidal and sub-tidal areas of North Bull Island using best-practice methods. The main objectives of this Management Plan are to summarize and update the key data, particularly about the current status of habitats and species of conservation status, to discuss the current management issues affecting natural heritage importance of the island and to outline specific recommendations to manage these issues.

North Bull Island is a coastal sand spit located in Dublin Bay. It is one of the finest sand dune systems in Ireland and is internationally important in terms of its conservation value. There are high quality examples of several rare and threatened coastal habitats present on the island. It has a wealth of biodiversity, which includes several habitats and species listed in Annexes I and II and the EU Habitats Directive, the use of the site by national and internationally important numbers of wintering waders and wildfowl and the presence of several rare plants listed on the Flora Protection Order (S.I. No. 94 of 1999) and in the Red Data Book (Curtis & McGough 1988).

North Bull Island has several notable ecological and geomorphological features. The site is unique due to its relatively young age (just over 200 years) when compared to other coastal sites, and that the island is still growing. Young accreting sand-dune systems are very rare in Ireland. Both these factors positively influence the conservation status and diversity of some of the habitats present such as embryonic dunes and dune slacks. The dune slacks are at an early stage in their development and consequently are quite diverse. Several rare bryophyte species such as Petalwort favour the conditions found in the early phases of dune succession. This island also contains intact natural successional stages between sand dune and saltmarsh habitats, which are rare in Ireland.

This site is also managed as a public park by DCC. It is utilized on a daily basis by many other users, including walkers, cyclists, bathers using Dollymount Strand and nature enthusiasts. Several management issues were identified by NPWS and DCC staff, consultees and by previous studies as this site.

### Management Issues

The main management issues included:

- Impacts on the hydrology of the island affecting the dune slacks.
- North Bull Island causeway affecting sedimentation patterns.
- Saltmarsh accretion and erosion dynamics.
- Management of Common Cordgrass (invasive species).
- Management of Sea Buckthorn (invasive species).
- Designation boundary errors (cSAC and Nature Reserves).

- Site boundary issues, as part of the saltmarsh/golf course boundary is unfenced.
- Impacts of bait-digging on wintering waterfowl populations and intertidal environment.
- Impacts of recreational disturbance including un-restrained dogs on wildlife.
- Potential to re-establish a Little Tern breeding colony at the tip of North Bull Island.
- Impacts of disturbance by wind-powered recreation (kite-surfing & land-surfing) on wildlife.
- Beach-cleaning and its effect on dune formation by using *Ectocarpus detritus* as a soft engineering option to reduce impacts of erosion.
- Management of the sand dune system including erosion.
- Vehicular access to Dollymount Strand.
- Conservation of rare bryophytes.
- Gaps in research and information on impacts and activities.

## **Recommendations**

The main recommendations to mitigate these management issues include:

### **Actions**

- Continue control of Sea Buckthorn using methods already developed by DCC, with regard to the Wildlife Act and sensitivity to vulnerable habitats.
- Address unfenced boundary along the saltmarsh.
- Re-draft cSAC and Nature Reserve boundaries (NPWS).
- Continue current vehicle restrictions to Dollymount Strand.

### **Controls**

- Continue to enforce current legislation related to dog control on the island (dogs on leash) to minimize recreational disturbance to wildlife.
- Enforce current legislation related to bait-digging (NPWS).

### **Consultation**

- Continue consultation with golf clubs about water management, control of Buckthorn and boundary issues.
- Liaise with bait diggers to establish code of conduct.
- Continue to liaise with the public regarding importance of dog control on the island.
- Continue to develop a formal code of conduct for wind-powered recreation (kite-surfing & land-surfing) to minimise recreational disturbance to wildlife.

### **Monitoring**

- Continuation of hydrology monitoring.
- Monitor impacts of bait-digging disturbance and impacts to target species.
- Monitor the effect of using *Ectocarpus detritus* as a 'soft engineering option' to protect dunes from erosion on fore-dune development.
- Continue monitoring the development of sand dune, saltmarsh and intertidal habitats on the island (NPWS).

### **Review**

- Review interpretation and public awareness of the island.
- Continue to review the effect of invasive Common Cordgrass and continue policy of no control at this time.
- Continue to review beach-cleaning activities.
- Continue to allow the sand dune system to continue to develop naturally as a dynamic system.
- Allow natural dynamics to develop in the intertidal and saltmarsh zones, including sedimentation, erosion and natural changes in intertidal habitat extent.

### **Research**

- Model in detail the potential spread of invasive Common Cordgrass in the future.
- Carry out a survey of Little Tern habitat suitability and attempted breeding by this species at the northern tip of the island.
- Survey population of Hares and Rabbits on the island.



- Reduce gaps in information by continuing to fund research projects about various features of the island.

A comparison of the best-practice management to the current management being carried out at North Bull Island by DCC shows that DCC is already using best-practice management in many instances. Some of the active management by DCC has been extremely successful in enhancing the conservation value of North Bull Island, e.g. vehicle management on Dollymount Beach.

## Acknowledgements

We would like to thank the various consultees who responded to consultations, supplied information and made comments about different management issues affecting the island (listed in Appendix I). Particular thanks go to the staff of Dublin City Council and National Parks and Wildlife Service including Mairéad Stack (Dublin City Council Biodiversity Officer), Pat Corrigan and Paul Hughes, (Dublin City Council staff at North Bull Island), Dr Karen Gaynor (National Parks and Wildlife Service), Rebecca Jeffrey (National Parks and Wildlife Service) and Niall Harmey (National Parks and Wildlife Service, Conservation Ranger). Thanks also to Neil Lockhart, Fiona Devaney, Anthony Woods and Nigel Molyer who contributed photos for the plan.



Photo: Anthony Woods

## Contents

<b>Executive Summary</b>	<b>1</b>
Acknowledgements	5
<b>Part 1     <a href="#">Introduction</a></b>	<b>9</b>
<b>Part 2     <a href="#">Methodology</a></b>	<b>11</b>
2.1 <a href="#">Information search</a>	11
2.2 <a href="#">Consultation with relevant DCC and NPWS staff, stakeholders and other interested parties</a>	11
2.3 <a href="#">Preparation of the plan and other outputs</a>	11
<b>Part 3     <a href="#">Site Description</a></b>	<b>13</b>
3.1 <a href="#">Location of the site</a>	13
3.2 <a href="#">Site designations and relevant legislation</a>	13
3.2.1 <a href="#">Regional designations</a>	13
3.2.2 <a href="#">National designations</a>	14
3.2.3 <a href="#">European designations</a>	14
3.2.4 <a href="#">Other designations</a>	16
3.3 <a href="#">Legal status of North Bull Island</a>	19
3.3.1 <a href="#">Ownership</a>	19
3.3.2 <a href="#">Government Departments and Agencies</a>	19
3.4 <a href="#">Physical features of North Bull Island</a>	21
3.4.1 <a href="#">Climate</a>	21
3.4.2 <a href="#">Geology and geomorphology</a>	21
3.4.3 <a href="#">Soils and soil processes</a>	21
3.4.4 <a href="#">Hydrography</a>	22
3.4.5 <a href="#">Hydrology</a>	22
3.4.6 <a href="#">Water Quality</a>	23
3.4.7 <a href="#">Site Infrastructure</a>	23
3.5 <a href="#">Land-uses</a>	23
3.6 <a href="#">Biological features</a>	24
3.6.1 <a href="#">Habitats and vegetation</a>	24
3.7 <a href="#">Biological features of importance</a>	36
3.7.1 <a href="#">Annex I habitats</a>	36
3.7.2 <a href="#">Notable plant species</a>	37
3.7.3 <a href="#">Notable fungal species</a>	39
3.7.4 <a href="#">Notable animal species</a>	43
3.8 <a href="#">Geological/geomorphological features of importance</a>	47
<b>Part 4     <a href="#">Management Issues and Recommendations</a></b>	<b>48</b>
4.1 <a href="#">Impacts on the hydrology of the island</a>	48
4.2 <a href="#">North Bull Island causeway and sedimentation</a>	49
4.3 <a href="#">Saltmarsh accretion and erosion</a>	51
4.4 <a href="#">Management of Common Cordgrass (invasive species)</a>	52

4.5	<a href="#">Management of Sea Buckthorn (invasive species)</a>	54
4.6	<a href="#">Other alien or invasive species</a>	55
4.7	<a href="#">Boundary issues</a>	56
4.8	<a href="#">Bait-digging</a>	56
4.9	<a href="#">Impacts of recreational disturbance</a>	59
4.10	<a href="#">Little Tern conservation at North Bull Island</a>	61
4.11	<a href="#">Impacts of wind-powered recreation</a>	63
4.12	<a href="#">Sutton to Sandycove cycleway</a>	65
4.13	<a href="#">Beach-cleaning and its impact on dune formation</a>	66
4.14	<a href="#">Seals at North Bull Island</a>	68
4.15	<a href="#">Management of Hares and Rabbits at North Bull Island</a>	69
4.16	<a href="#">Management of the sand dune system</a>	71
4.17	<a href="#">Vehicular Access to Dollymount Strand</a>	72
4.18	<a href="#">Conservation of rare bryophytes</a>	73
4.19	<a href="#">Some general recommendations</a>	75
4.20	<a href="#">Significant gaps in knowledge about notable species, impacts and activities at North Bull Island</a>	77
<b>Part 5</b>	<b><a href="#">Timeframe for actions</a></b>	<b>78</b>
<b>Part 6</b>	<b><a href="#">Bibliography</a></b>	<b>80</b>
<b>Part 7</b>	<b><a href="#">Appendices</a></b>	<b>88</b>
I	<a href="#">Consultee list</a>	88
II	<a href="#">I-WeBS counts 2002-2007</a>	91
III	<a href="#">Photos of some notable species</a>	96
IV	<a href="#">Additional information on ecological and management issues</a>	99
V	<a href="#">Glossary</a>	121
VI	<a href="#">Contact Information</a>	126
	<b>List of Maps</b>	
Map 1	Map showing nature conservation designations	
Map 2	Map showing nature conservation designations (alternative format)	
Map 3	Ownership	
Map 4	Habitat map showing Annex I habitats at North Bull Island	
Map 5	Habitat Map showing habitats according to Heritage Council classification	
	<b>Abbreviations</b>	
ASM	Atlantic salt meadows (Annex I habitat)	
BAP	Biodiversity Action Plan (DCC 2008)	
BoCCI	Birds of Conservation Concern Ireland (Red and Amber lists) compiled by Birdwatch Ireland	
CMP	Coastal Monitoring Project (Ryle <i>et al.</i> 2009)	
cSAC	candidate Special Area of Conservation	
DCC	Dublin City Council	
DNFC	Dublin Naturalist's Field Club	
ERU	Environmental Research Unit	
FPO	Flora Protection Order	

MAB	Man and Biosphere
MSM	Mediterranean salt meadows (Annex I habitat)
MS	Mairéad Stack
NHA	National Heritage Area
NGO	Non-Governmental Organisation
NIEA	Northern Ireland Environment Agency
NPWS	National Parks and Wildlife Service
pNHA	proposed National Heritage Area
pers. comm.	information supplied by personal discussion or communication (like email or phone)
RDB	Red Data Book
RDB CR	Red Data Book, status – critical
RDB EN	Red Data Book, status – endangered
RDB LC	Red Data Book, status – lesser concern
RDB prop	Red Data Book, status – proposed
RDB VU	Red Data Book, status – vulnerable
RDGC	Royal Dublin Golf Club
SAGC	St Anne's Golf Club
SPA	Special Protection Area
SMP	Saltmarsh Monitoring Project (McCorry 2007).
SAAO	Special Area Amenity Order

# 1 INTRODUCTION

Mark McCorry and Tim Ryle were commissioned by the Parks and Landscape Services section, Dublin City Council (DCC) to prepare a Management Plan for the practical management of the terrestrial, intertidal and sub-tidal areas of North Bull Island. It is the responsibility of Parks and Landscape Services, DCC, as the local authority and main landowner on the island, to manage this site. The study area was defined as the terrestrial, intertidal and sub-tidal area north-east of the North Bull Wall within the North Dublin Bay candidate Special Area of Conservation (cSAC) and included the two golf courses on the island.

There is a wealth of information about the ecology and natural environment of North Bull Island to be found in many different sources. Several very detailed excellent publications and reviews of the natural history of North Bull Island have already been produced (e.g. An Foras Forbartha 1977, Jeffrey *et al.* 1977, Dublin Corporation 1994, ESB International 1996, draft NPWS Conservation Plan for North Dublin Bay cSAC & ESB International 2002). It is not the intention of this document to reproduce all this data, particularly as some of the data are out of date.

The main objectives of this Management Plan are to summarize and update the key data, particularly about the current status of habitats and species of conservation status, to discuss the current management issues affecting natural heritage importance of the island and to outline specific recommendations to manage these issues.

North Bull Island is a unique site in Ireland and also in an international context in terms of its wealth of habitats, biodiversity, its relatively young age (just over 200 years), its geomorphology and the range of natural successional stages between habitats. There are high quality examples of several rare and threatened coastal habitats present on the island. The relatively young age of the island is significant for the ecological development and value of some of the habitats such as the dune slacks, which are at an early stage in their development and consequently are quite diverse. This island is still accreting sediment, which means that the sand dunes are overall still growing. Accreting sand-dune systems are quite rare in Ireland. The presence of intact natural transitional stages between sand dune and salt marsh habitats is also quite rare in Ireland. The presence of high quality habitats also means that the site is able to support significant populations of wildlife in a regional, national and international context.

North Bull Island is also one of the most 'designated' sites in Ireland in recognition of its conservation importance, particularly for the presence of several rare and threatened habitats and species listed in Annexes I and II of the EU Habitats Directive, the use of the site by national and internationally important numbers of wintering waders and wildfowl and the presence of several rare and threatened plants listed on the Flora Protection Order (S.I. No. 94 of 1999) and in the Red Data Book (Curtis & McGough 1988). The production of a Management Plan is essential for the protection and enhancement of habitats and species of conservation interest on the island.

North Bull Island is a very important amenity for the people of Dublin and is managed as a public park and Nature Reserve by Parks and Landscape Services, DCC. The island is utilised on a



daily basis by many users, including walkers, cyclists, bathers using Dollymount Strand and wildlife enthusiasts. Two golf courses are located on the island, Royal Dublin Golf Club (RDGC) and St Anne's Golf Club (SAGC), and are very popular with golfers. A Visitor and Interpretative Centre managed by DCC is located on the island and provides a popular educational resource for primary, secondary and third-level students including PhD students. This centre is also a popular resource for NGOs such as Birdwatch Ireland, Dublin Naturalist's Field Club etc.

As a Special Amenity Area, DCC manage North Bull Island for both nature conservation and recreation. However, the use of sites of nature conservation value as an amenity by many different users can sometimes cause conflicts with nature conservation (e.g. disturbance to wildlife). Conforming to nature conservation designations can also pose difficulties for management (e.g. how to deal with invasive species). The production of a practical Management Plan is essential to minimize these types of conflicts between recreational use and nature conservation. A management plan is also a very useful tool for informing policy makers at local and national government levels about the conservation value of North Bull Island, particularly those who direct policy that can affect its conservation status.

The preparation of a Management Plan for North Bull Island is an action of the Dublin City Biodiversity Action Plan (DCC 2008) and of the Special Area Amenity Order (SAAO) (Dublin Corporation 1994). The Dublin City Biodiversity Action Plan (BAP) identifies a number of priority species and habitats to be protected in the city. The BAP also emphasises the commitment of DCC to play its part in protecting habitats and species designated under the EU Habitats Directive and EU Birds Directive. Major tenets of the BAP are to increase awareness of biodiversity, protect BAP priority species and habitats, work with stakeholders to protect local biodiversity hotspots and Natura 2000 sites and provide guidance on conserving Dublin City's natural heritage.



**Dollymount Strand**  
(Photo: Nigel Molyer)

## 2 METHODOLOGY

A 'brief for consultants' document outlined the proposed methodology for the preparation of the Management Plan. This brief was based on an initial meeting held in November 2007 between relevant NPWS and DCC staff about the preparation of a Management Plan and about any particular issues this plan should address. The strategic direction of this plan was developed at this meeting.

### 2.1 Information Search

Various sources of published and unpublished information related to North Bull Island were identified. The Natural Heritage Surveys Database report (DCC 2003) reviewed all of the natural environment surveys carried out in the DCC area and identified at least 63 surveys related in some way to North Bull Island. Several very detailed excellent publications and reviews of the natural history of North Bull Island have already been produced. Dublin City Council and The North Bull Island Interpretative Centre hold many of the relevant reports produced by local authorities. Other material was collected from scientific journals, NPWS databases, files and research reports, DCC files and various Dublin 3<sup>rd</sup> level institutions.

The team also reviewed relevant up-to-date information related to the best practice management for the conservation of sub-tidal, sand dune and saltmarsh habitats.

### 2.2 Consultation with relevant DCC and NPWS staff, stakeholders and other interested parties

Consultation was carried out with relevant DCC and NPWS staff, stakeholders and other interested parties. These stakeholders include land-owners and tenants on the island, local and national government organisations, non-government organisations including nature conservation groups, and other users of North Bull Island interested in its nature conservation value. These stakeholders were approached for their assistance. (The consultees are listed in Appendix I).

Consultation was carried out to collect information relevant to the Management Plan and about management issues on the island that affected the various different stakeholders and interested parties. Consultees were contacted using a variety of post, email, phone discussions and direct meetings.

### 2.3 Preparation of the plan and maps

The most current information was reviewed for the preparation of the Management Plan. The plan summarises much of this relevant information to describe the physical and biological features of the island. The current status of notable habitats and species of conservation interest



was also reviewed. The main management issues were described and practical prescriptions for dealing with these issues were also outlined.

Digitised GIS maps were prepared that indicated the current extent of mapped habitats, positions of notable species, features of biodiversity interest and positions of features of management interest. The habitat maps (Maps 4 & 5) were primarily based on habitat maps already produced by the NPWS Coastal Monitoring Project 2004-2007 (CMP) (Ryle *et al.* 2009) and Saltmarsh Monitoring Project 2006 (SMP) (McCorry 2007). Digitising of habitat maps was carried out according to NPWS guidelines.

Some fieldwork was carried out on site to ground-truth the main habitat boundaries and check for any significant changes. Positions of biodiversity and management interest were also checked during fieldwork. A GeoExplorer handheld GPS minicomputer (Trimble GeoXT) was used for recording the locations of the features in the field, such as habitat boundaries or the position of features of ecological interest. This data were downloaded onto a computer and imported into GIS software to allow digital mapping.

## 3 SITE DESCRIPTION

Much of the information in this section has already been published in other sources or has been taken from unpublished reports (e.g. draft NPWS Conservation Plan for North Dublin Bay cSAC & North Bull Island SPA, NPWS undated 1996?). This section is focused on updating this information using the most current sources available.

### 3.1 Location of the site

North Bull Island is found nestled along the northern edge of Dublin Bay on the east coast of Ireland (53° 58' N, 6° 15' W). The island has developed to the north-east to the North Bull Wall and is a low-lying sandy spit about 4.85 km long and 0.70 km wide. (The South Bull refers to the sandflats located at Sandymount and some distance towards Dun Laoghaire.)

A sandy beach occurs on the seaward side of the island and a salt marsh fringes its mainland side. The island is separated from the mainland by intertidal mud and sandflats. A causeway built in 1965 divides the intertidal flats into the northern and southern intertidal areas. Both intertidal areas are covered completely by nearly every tide and are drained by permanent channels. The area dealt with by this Management Plan includes the whole of the island and the adjacent intertidal and marine areas within the North Bull Island Nature Reserves (Map 1).

### 3.2 Site designations and relevant legislation

North Bull Island is one of the most protected sites in Ireland in recognition of its conservation importance, particularly for the presence of several coastal habitats that are either rare or are threatened, the use of the site by national and internationally important numbers of wintering waders and wildfowl and the presence of rare plant and animal species. The location of the site adjacent to Dublin City and the continuing presence of these rare/threatened habitats and species at this site in spite of its location and pressure from this urban area are also notable. The site has been protected by several different regional, national and international designations since it was first designated as an official bird sanctuary in 1931 (Dublin Corporation 1994).

#### 3.2.1 Regional designations

In 1994 Dublin Corporation (now DCC) made a Special Area Amenity Order (SAAO) for North Bull Island to combine amenity and nature conservation interests on the basis of the outstanding natural beauty of the area, its special recreational value and its need for nature conservation (Dublin Corporation 1994). This SAAO was designated by a Statutory Instrument (S.I. 70 of 1995).

Several bye-laws issued by DCC are also relevant to management on the island. The Parks and Open Spaces Bye-laws (DCC 2002) prohibit activities such as camping and the use of quad bikes on the island. The Control of Dogs Bye-laws (DCC 1998) prohibits unleashed dogs on the island.

### 3.2.2 National Designations

The biodiversity value of North Bull Island has long been recognised and it was first designated as an official bird sanctuary under the Wild Bird Protection Act, 1931, the first bird sanctuary in Ireland. This designation was then superseded by the establishment of the site as a Wildfowl Sanctuary under the Wildlife Act (S.I. 243 of 1977) which protects certain geese, ducks and waders from hunting.

North Bull Island was established as a National Nature Reserve in 1988. Two separate Statutory Nature Reserves cover much of the island east of the Bull Wall and the surrounding intertidal flats. The first (S.I. 231 of 1988) covers the intertidal and subtidal areas around the island while the second covers the terrestrial dune, beach and saltmarsh habitat (S.I. 232 of 1988). The two golf courses and site infrastructure have been largely excluded from the Nature Reserve.

The Wildlife Act (S.I. 39 of 1976, as amended by S.I. 371 of 2001) details legislation that protects particular species of plants and animals and habitats from various practices. All areas are subject to the Wildlife Act, not just designated areas. Consultation is required with NPWS regarding exemptions. The Flora Protection Order (1999) protects sites of plant species listed in the order. There are three species listed on the Flora Protection Order that have been recorded on the island, Lesser Centaury (*Centaureum pulchellum*), Red Hemp-nettle (*Galeopsis angustifolia*) and Meadow Saxifrage (*Saxifraga granulata*).

Formerly, North Bull Island was listed by An Foras Forbartha as an Area of Scientific Interest (Goodwillie & Fahy 1973). This designation has been superseded by the designation of the site as a proposed Natural Heritage Area (pNHA). Natural Heritage Areas (NHAs) are sites that were designated for the protection of flora, fauna, habitats and geological sites of national importance. Under the Wildlife Amendment Act (2000), NHAs are legally protected from damage from the date they are formally proposed for designation. Proposed NHAs have statutory protection under the Planning and Development Act (2000) when listed in a Local Authority's Development Plan.

### 3.2.3 European designations

North Bull Island is also a very notable site in a European context. Two European Union legislative instruments for nature conservation; the Birds Directive (Council Directive 79/409/EEC on the conservation of wild birds, S.I. No. 291 of 1985) and the Habitats Directive (Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora, S.I. No. 94 of 1987), have been transposed into Irish law by way of regulations, introduced in 1985 and in 1997 respectively. EU member states are required to designate Special Areas of Conservation (SACs) for natural habitats and species that are threatened, rare, or outstanding. The Birds Directive requires that Special Protection Areas (SPAs) are designated for particular bird species. Special Protection Areas may overlap with SACs.

North Bull Island has been designated as part of a candidate Special Area of Conservation (North Dublin Bay cSAC - NPWS site code 000206) due to the presence of qualifying interests listed in Table 1. North Bull Island was previously designated as a Special Protection Area (North Bull Island SPA – NPWS site code 4006) due to the presence of qualifying interests listed in Table 1. The boundaries of this SPA have been reviewed recently by Department of Environment, Heritage and Local Government but remain unchanged within the study area (August 2008).

**Table 1.** Rationale for designation of North Dublin Bay cSAC and North Bull Island SPA.

<b>Habitats listed in Annex I for the EU Habitats Directive</b>	
Habitats	1140 – Intertidal mud and sandflats
	1210 – Annual vegetation of drift-lines
	1310 – <i>Salicornia</i> flats
	1330 – Atlantic salt meadows
	1410 – Mediterranean salt meadows
	2110 – Embryonic shifting dunes
	2120 – Shifting dunes along the shoreline with <i>Ammophila arenaria</i> (white dunes)
	2130 – Fixed coastal dunes with herbaceous vegetation (grey dunes) (priority habitat)
	2170 – Dunes with <i>Salix repens</i> ssp. <i>argentea</i> (Salicion arenaria)
	2190 – Humid dune slack
<b>Species listed in Annex II of the EU Habitats Directive</b>	
Plant	Petalwort ( <i>Petalophyllum ralfsii</i> )
<b>Birds listed in Annex I of the EU Birds Directive</b>	
Birds	Bar-tailed Godwit ( <i>Limosa lapponica</i> ) (internationally important numbers)
	Several other Annex I bird species use the site.
	SPA of international importance to wildfowl as it regularly supports > 20,000 waders and wildfowl during winter.
	SPA supports internationally important numbers of Brent Geese and nationally important numbers of several other bird species.

The Minister for the Environment, Heritage and Local Government must transmit information on cSACs to the European Commission for consideration. Following agreement by the Commission, the Minister will formally designate the sites as SACs. Sites are legally protected once they are publicly advertised and while they have candidate status. North Bull Island SPA does have statutory protection (under S.I. 48 of 1986).

### 3.2.4 Other designations

There are several other international designations that affect North Bull Island (Table 2).

**Table 2.** Other designations at North Bull Island.

Designation type	Name of site	Site code	Area (ha)	Date of designation
World Biosphere Reserve	North Bull Island		1436	designated in 1981 under UNESCO's Man and Biosphere Programme
Ramsar Site	North Bull Island & adjoining foreshore Nature Reserve		1436	6/9/1988 under the Ramsar Convention
Biogenetic Reserve	North Bull Island Nature Reserve		1436	Council of Europe designation.
Important Bird Area	Dublin Bay	IE109	3000 ha	2000 (Hunt <i>et al.</i> 2000).
Corine Biotope Site	North Dublin Bay	800000150	1436	1985
Sister reserve to the Polar Bear Pass National Wildlife Area on Bathurst Island (Canadian Wildlife Service)	North Bull Island			1986

One of the most important international designations at North Bull Island is the World Biosphere Reserve designation by UNESCO. This is one of only two such reserves in Ireland. The main objective of this designation and the biosphere reserve concept is to reconcile the multiple uses in this small area ([www.unesco.org](http://www.unesco.org)). These reserves are considered to act as laboratories testing and demonstrating approaches to conservation and sustainable development. Main lines of action on these sites also include research, monitoring, as well as networking and sharing of information, ideas on and solutions to sustainable development. The development of the Visitor and Interpretive Centre to aid educational use of North Bull Island is partly the result of this designation. The total area of the reserve is 1008 ha (listed on the UNESCO website) and there are maps indicating the boundary of the reserve in the draft NPWS conservation plan of North Dublin Bay (NPWS undated, 1996?) and the SAAO (Dublin Corporation 1994). The boundaries of this reserve are comparable to the boundaries of the SAAO and also include the shoreline and intertidal areas within the Fingal County Council jurisdiction (Sutton Strand). The two golf courses are excluded from the Biosphere Reserve.

North Bull Island is also designated as a Ramsar site. The Ramsar Convention protects wetland habitats used by migratory waterbirds. Ramsar is an intergovernmental treaty signed by Ireland whose main objective is the conservation and wise use of all wetlands through local, regional and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world (Ramsar Convention Secretariat 2006). Member countries are required to work towards the wise use of all their wetlands through national land-use planning, appropriate policies and legislation, management actions, and public education; designate

suitable wetlands for the List of Wetlands of International Importance ("Ramsar List") and ensure their effective management; and cooperate internationally concerning trans-boundary wetlands, shared wetland systems, shared species, and development projects that may affect wetlands. The Ramsar database ([www.wetlands.org](http://www.wetlands.org)) lists some information for North Bull Island about the habitats present, land use threats etc.

North Bull Island Biogenetic Reserve is an older European designation, designated by the Council of Europe (separate organisation to the European Union). These reserves were designed to conserve representative samples of natural habitats that are especially valuable for nature conservation in Europe. The Important Bird Area (IBA) programme of Birdlife International (a non-governmental organization) is a world-wide initiative aimed at identifying and protecting a network of critical sites of importance to birds (Crowe 2005). Sites are selected according to rigorous ornithological criteria similar to that used for SPAs.

Ireland and/or DCC have undertaken to comply with these designations or treaties. These international designations generally have broad based objectives. Most of the conservation objectives of these international designations overlap with conservation objectives of the EU Habitats Directive/Birds Directive and of national designations such as Nature Reserves. However, McKenna *et al.* (2000) point out that these international designations generally do not offer any additional statutory protection to these sites and the designation of a site as a Ramsar site was generally because it was already designated as a SPA (which does have statutory protection). Hickie (1997) states that the Biosphere Reserve designation has no legal standing and UNESCO has no powers to enforce this designation. The designations have similar objectives to the European SAC/SPA designations and to the national designations of NHA and Nature Reserve. It is likely that fulfilling the core objectives of the SAC and SPA and also of the DCC Biodiversity Plan such as to maintain the site, and habitats and species of conservation value in '*favourable conservation status*' will also fulfil the objectives of these international designations.

### IMPLICATIONS OF SITE DESIGNATIONS AT NORTH BULL ISLAND

The implications of several site designations at North Bull Island could lead to difficulties for management if they have conflicting objectives. However, all of the designations have generally similar intentions with nature conservation as the main objective. The cSAC and SPA are the primary designations as these have been designated under EU Directives. The EU Habitats Directive (Article 6) requires that Annex I habitats and Annex II species be maintained with '*favourable conservation status*'. The fact that most of the area within the cSAC is also a Nature Reserve (land owned by DCC or the state) means that it can be managed relatively easily with nature conservation as the main land-use.

The key designation for DCC in relation to its management of the site is the SAAO. This designation sets out a more detailed framework for implementing objectives on the island than the DCC Development Plan. The SAAO (Dublin Corporation 1994) indicates that this designation was necessary to preserve the 'Biosphere Status' conferred by the UNESCO designation.

NPWS also requires that any Management Plan prepared by DCC for North Bull Island fits into any future conservation plan that will be prepared for the North Dublin Bay cSAC and North Bull Island SPA. (The SPA designation has been recently reviewed by the Department of

Environment, Heritage and Local Government.) The main conservation objectives should be equivalent between these two plans, but the NPWS plan is likely to cover a larger area including the River Tolka Estuary (dependant on SPA designation). Strategies to deal with management issues should conform to the cSAC/SPA designation and some strategies will require licensing/permission from NPWS.

The designation of a site as a cSAC/SPA/pNHA/NHA can affect certain activities, land use practices and development within the site, such as removal of sand and the development of leisure facilities. Certain activities restricted within cSACs, SPAs and NHAs can only be carried out with the permission of the Minister for the Environment, Heritage and Local Government. This is usually dealt with through the Notifiable Actions procedure. Planning authorities are required by law to ensure that developments in their area do not cause any significant damage to cSACs and SPAs.

### OVERLAPPING DESIGNATIONS

The various designations overlap but cover different areas. The cSAC and the two Nature Reserve designations largely overlap and cover a similar area, although the actual boundaries are not consistent with each other. Both designations cover the inner part of North Dublin Bay, including the island and intertidal areas, with the southern boundary being the North Bull Wall and the eastern seaward boundary being a line extending from Bull wall lighthouse across to Drumleck Point at Howth Head. The two golf courses are mainly excluded from the cSAC and Nature Reserve but included in the SPA. Maps 1 and 2 show how the various designations overlap. The implications of having different boundaries for the various designations are explored further in [Section 4.7](#).

The SAAO for North Bull Island covers a somewhat different area compared to the cSAC and Nature Reserve designations. The SAAO covers the whole of the island and most of the intertidal areas, and includes the two golf courses. The southern boundary is still the North Bull Wall but the eastern seaward boundary is marked as the lower tide boundary (County Borough boundary 1986) so the outer marine area that is part of the nature reserve and the cSAC is not included. Not all the inner intertidal flats between the island and the mainland are included either. The estuarine channels that drain both these channels have been excluded. The boundary also follows the line of the estuarine channel to the north of the island around Sutton Creek, so a large area of intertidal flats adjacent to Kilbarrick and Sutton has been excluded from the SAAO. This intertidal area is part of the Fingal County Council local authority area.

The pNHA designation covers part of the Tolka River Estuary and a large intertidal section of the inner Dublin Port, south of the North Bull Wall. The pNHA designation adjoins Howth Head pNHA at the south-east corner (NPWS site code 000202). These areas are not considered in this Management Plan.

The Dublin Bay SPAs have been recently reviewed by the Department of Environment, Heritage and Local Government. Some sites have been amalgamated and some additional parts of the bay have also been included. The SPA boundaries around North Bull Island have not been changed so there are no boundary changes within the area considered by the Management Plan.

### 3.3 Legal status of North Bull Island

#### 3.3.1 Ownership

North Bull Island is owned by several land-owners (Table 3 & Map 3). The Dublin Port Company has recently proposed the transfer of its lands on North Bull Island into public ownership as part of a proposed port development.

**Table 3.** Ownership at North Bull Island.

Owner	Area	Description of land
DCC	144.1 ha	North Bull Island Nature Reserve - S.I. 232 of 1988 (118 ha) & lands on North Bull Island leased to St. Anne's Golf Club (26.1ha).
State		Intertidal, estuarine and marine areas around the island including the saltmarsh. Designated as Nature Reserve - S.I. 231 of 1988.
Royal Dublin Golf Club	66.7 ha	Golf course on North Bull Island
Dublin Port Company	~ 19 ha	A strip of land contiguous with the Bull Wall.

#### 3.3.2 Government Departments and Agencies

Several regional and national government departments and agencies have responsibility for particular policies that affect the site or are involved directly in the management of this site.

<b>Dublin City Council (DCC)</b>	DCC owns the North Bull Island Nature Reserve (terrestrial). DCC is also the Local Authority for the site and manages the site through a SAAO. As such it is obliged to ensure appropriate assessment of the implications of developments requiring planning permission that may have an impact, either individually or in combination with other developments on the designated area.
<b>Department of the Environment, Heritage and Local Government (DoEHLG)</b>	DoEHLG is the government department with responsibility for the protection and conservation of Ireland's natural heritage.
<b>National Parks &amp; Wildlife Service (NPWS)</b>	NPWS is the section of the DoEHLG responsible for maintaining the nature conservation value of the site. Periodic inspection of the site is carried out by the local Conservation Ranger.  Regional staff also participate in research and survey projects by collecting data on the site, provide advice to planning authorities on the impacts of development applications and provide an education and advisory service to the public.



**Environmental Protection Agency (EPA)**

The EPA is an independent state sponsored body with a wide range of statutory duties including monitoring environmental quality and overseeing the performance by local authorities of their statutory environmental protection functions. The EPA oversees water quality testing carried out by DCC.

The EPA is responsible for implementing the EU Water Framework Directive (Council Directive 2000/60/EC on the protection of water quality), which aims to establish a framework for the protection of water quality of inland surface waters, transitional waters, coastal waters and groundwater. Irish waters must achieve favourable water status by 2015.

**Department of Agriculture, Fisheries and Food (DAFF)**

The DAFF is responsible for licensing and regulating fishing, aquaculture, commercial and other development below mean high water; and under Regulation 31 of the EU Natural Habitats Regulations, for ensuring that such activities in the cSAC do not adversely affect it. The former Department of Marine (now part of DAFF) was the authority listed as responsible for the management of North Bull Island Nature Reserve (intertidal, estuarine and marine sections). However this department has had no direct involvement in management at the island.

**The Central Fisheries Board**

The Central Fisheries Board is the statutory body responsible for the co-ordination and support of the seven regional fisheries boards.

**Eastern Regional Fisheries Board**

The Eastern Regional Fisheries Board is responsible for maintaining and improving environmental quality and developing and protecting the fisheries resource in their region. The Board's responsibilities cover both inland waterways and out to the twelve-mile limit off the coast.

**Dublin Port Company**

Dublin Port Company is responsible for the care, maintenance and superintendence of the Port of Dublin, which includes all the water areas between Rory O'More Bridge and an imaginary line between Sorrento Point, Dalkey and the Martello tower, Sutton. Therefore, all the intertidal and marine areas within the site are within the Port of Dublin.

## 3.4 Physical features of North Bull Island

### 3.4.1 Climate

The east coast of Ireland contrasts with the west coast in being drier and less exposed. The closest synoptic weather station to the site is at Dublin Airport. This station receives a mean annual rainfall of about 1060 mm. The mean daily air temperature at this station is 9.2 °C, ranging from a mean low of 5.2 °C in February to 14.0 °C in August. Mean monthly wind speeds range between 13.2 - 19.0 knots. There is an annual average of 25 days with sleet or snow recorded. During the period 1951-1980 Dublin had the lowest annual rainfall in the country.

### 3.4.2 Geology and geomorphology

Dublin Bay and the North Bull Island area are underlain by Carboniferous Limestone. North Bull Island is a sandy spit and is a relatively recent geomorphological feature having built up over the last 200 years against a man-made harbour wall.

Estuarine/alluvial gravels, sands and silts, which have been deposited through river and sea sedimentation processes, exist throughout Dublin Bay. These are underlain by glaciomarine clays, which in turn are underlain by glacial gravels and boulder clays (NPWS, undated 1996?).

North Bull Island is subject to three main types of geomorphological change: (a) a broadening of the island due to continuing development of fore-dunes; (b) evolution of the 'hook' at the north-eastern tip of the island, which provides a classic example of recurve geomorphology; and (c) deposition of silty sediments in the 'lagoons' or intertidal areas located between the island and mainland (Harris 1977, Jeffrey 1984).

Unusually for an east coast dune system, the island is actively accreting, as indicated by the continued development of parallel ridges on a prograding shore on the east side of the island (Ryle *et al.* 2009). A striking example of this may be seen in the south dunes, where a permanent public convenience erected on the beach in the 1970s is now located about 90 m into the dunes.

### 3.4.3 Soils and soil processes

Most of the soils throughout the terrestrial part of the site are derived from sandy material. The dunes are composed almost entirely of fine grained quartz sand (Harris, 1977). However, on the older, fixed dunes organic matter has accumulated on the dune surface forming a humus layer or thin soil (Jeffrey *et al.* 1977). As the dunes age they will gradually become more acidic.

Some glacial soil has been imported onto the island for embankment improvement works around the RDGC (An Bord Pleanála 2004). Glacial soil has also been used in the 1970s to cap the former dump north of the causeway and now part of SAGC.

The saltmarsh is derived from mud and silt of a marine source. The intertidal mud and sandflats, estuarine channels and sub-tidal areas are composed of fine-grained material of various size classes.

#### 3.4.4 Hydrography

Overall, the gross tidal movement in Dublin Bay is clockwise. However, the localised movements are complex. Around North Bull Island the flow is altered due to interference from the Bull Wall, the Tolka River and Sutton Creek. Generally, tidal flow on Dollymount Strand is longshore to the north-east, although on the ebb tide the water is caught up in a fluvial 'jet' which emanates from between the Bull Wall and South Wall. The so-called 'lagoons' landward of North Bull Island are connected to two different channels: the southern area fills and empties beneath Bull Bridge, while water in the northern area is channelled in and out through Sutton Creek (Harris, 1977).

#### 3.4.5 Hydrology

A number of smaller rivers and streams also enter the site, including two on the landward side of North Bull Island: the Santry River, which flows into Sutton Creek, and the Naniken Stream which enters a channel flowing south-westward under Bull Bridge.

The North Bull Island is considered to have a lens of fresh groundwater that develops immediately below the ground surface and extends many metres below the surface. This freshwater lens 'floats' on denser seawater situated below the island. The freshwater lens is dynamic and discharges around the margins of the island. Winter rains recharge the lens resulting in the water table forming a mound at the centre of the island (Environmental Impact Services 2001). The RDGC collects ground water for irrigation via ground bores, which is pumped to a central reservoir for distribution around the golf course (RDGC 1999). St Anne's Golf Club abstracts ground water from a pond and shallow well located to the north of the clubhouse (Environmental Impact Services 2001).

A recently completed PhD research project studied the hydrology, vegetation and restoration prospects of several dune slacks on North Bull Island (Devaney 2008). This project found that there are significant signs of drying in one of the largest dunes slacks on the island known as the 'Alder marsh' (see [Section 4.1](#)).

#### 3.4.6 Water quality

Dublin Bay has suffered from nutrient enrichment and eutrophication for many years. One symptom of this eutrophication was the recurring blooms of the brown alga, *Ectocarpus siliculosus* that washed up on Dollymount Strand during the summer. Eutrophication in Dublin Bay and nutrient cycling has been well studied by a series of reports (ERU 1992a-d) and other research (Jeffrey *et al.* 1991, Wilson & Parks 1998). These studies emphasize the role of particulate nutrients in Dublin Bay and their contribution to algal growth. These particulate nutrients, along with dissolved forms, are brought into Dublin Bay by both sewage discharge and the rivers to mix in the bay with inputs and outputs through tidal exchange. It was hoped that the recent upgrading of the sewage treatment plant at Ringsend would improve water quality in Dublin Bay and alleviate some of the systems, such as alga blooms.

There is some recent evidence that the upgrading of the sewage treatment plant has been to some extent successful. Dollymount Strand qualified for a Blue Flag in 2005, lost it in 2006-2007 but has subsequently regained it in 2008. Qualification for Blue Flag status is one indication that water quality has improved. Analysis of bacteria levels in bathing water samples by DCC during 2007 for Dollymount Strand shows that 17 out of 20 samples had bacteria levels within water quality limits for Blue Flag status. (Samples should not exceed 500 total coliforms, 100 faecal coliforms and 100 faecal streptococci/100 ml) ([www.dublincity.ie](http://www.dublincity.ie)). The 3 other samples were within mandatory limits of EU guidelines. However, a nationwide EPA assessment of water quality in Ireland states that it is too early to tell whether the stranding of macro-algae on the beaches of Dublin Bay has been adequately addressed by the treatment processes already in place at Ringsend (Toner *et al.* 2005).

### 3.4.7 Site infrastructure

The North Bull Wall marks the southern boundary of the site. It is 1.75 km long and 7 m high. The wall is connected to the mainland by a wooden bridge, which allows flow into the southern intertidal area. Traffic can cross the bridge and a road along the wall accesses the RDGC and Dollymount Strand. A causeway accesses the central part of the island and there are minor roads from a roundabout that access SAGC, RDGC and Dollymount Strand.

There are several buildings on the site. The North Bull Island Interpretative Centre is positioned near the causeway at the former site of SAGC club-house. A newer club-house and car park have been built in SAGC. The RDGC club-house is located at the southern end of the island near the North Bull wall. There are several paved paths and other buildings used for maintenance within the golf club. Several old cottages are also located on the North Bull wall. There is also a toilet block situated on the dunes in the southern half of the island that has recently been assessed for possible conservation works (Murphy 2008).

## 3.5 Land-uses

The two main land-uses on the island are nature conservation and amenity use. The two golf courses on the island are mainly used for amenity purposes (and included within the SPA boundary) while the rest of the terrestrial, intertidal and sub-tidal sections of the island are used or managed for a combination of amenity and nature conservation uses.

Active nature conservation management currently includes activities such as using *Ectocarpus* detritus to prevent dune erosion, vehicle management on Dollymount Strand and removing invasive Sea Buckthorn (these activities are described in more detail in subsequent sections.) Previous nature conservation management included controlling Common Cordgrass and planting Marram-grass in eroded dune areas.

North Bull Island is subject to heavy recreational pressure at times due to its proximity to the centre of Dublin. It is, in any case, an extremely attractive site, with a wide beach along its full length, consisting to a large degree of fine-grained sand. Dollymount Strand is a 'Blue Flag' beach and is popular with bathers and beach-lovers, especially on sunny bank holiday weekends. Numbers of beach users have reached peaks of 8000-10000 in the past (Environmental

Research Unit 1992a). Cars are still parked on the beach but vehicle access to the beach has been significantly restricted by DCC in recent years. Walking, kite-flying and water sports are among the regular activities at the site. Daily numbers of walkers were estimated to be 150 in 1992 while numbers participating in canoeing and rowing were 30-40 per day. Several football teams train at North Bull Island. There are several yachting or water-sports clubs located around the site including the Sea Scouts that are located on the site. Dog-walkers frequently use paths in the dunes and around the beach. Wind-powered activities such as kite-surfing have increased in popularity in recent times.

The site is also used for training activities by the Irish Army, FCA, Irish Whale and Dolphin Group (re-floating beached whales) and also for water safety training. The high nature conservation value of the site also attracts nature-lovers including bird-watchers. Several nature conservation groups such as Birdwatch Ireland, Irish Wildlife Trust and Dublin Naturalist's Field Club regularly run field-trips to the island.

Bait digging is a common activity, especially at the northern and southern ends of the site, in Sutton Creek and near the Wooden Bridge. Some of this bait digging is likely to be a commercial activity. More recently, individuals and small groups have collected shellfish including Mussels (*Mytilus edulis*) from the North Bull Wall. Dollymount Strand is used for angling as is the North Bull Wall. Some potential damaging activities related to angling include catching Mullet along the Bull Wall by 'snibing' and the setting of night-lines. However, there is very little commercial fishing in the site at present. There has been commercial fishing in the past with seed Mussel being dredged from the site on one occasion in the past 6 years (under license from the former Department of Marine) and occasional boats have trawled for Sea Bass and White Mullet in the past (NPWS undated 1996?).

The island is frequently used for educational and research purposes and there is a Visitor and Interpretative Centre located near the causeway. This centre attracts school groups and other groups for talks on the island. The centre is a 'Discover Primary Science' field centre. Third-level colleges frequently have field-trips to the site and there have been many undergraduate and post-graduate studies on various aspects of the island.

## 3.6 Biological features

### 3.6.1 Habitats and vegetation

This section describes the characteristic features of the habitats found at North Bull Island. These habitats are classified according to European Annex I EU habitat classification (Commission of the European Communities 2003) (Map 4) and Irish classification (Fossitt 2000) (Map 5). Classification is dependent on vegetation communities and physical features such as sediment type etc. There is some overlap between these two classification systems and with older classification systems that have been used in Ireland (while the names may have changed, the habitats remain the same).

North Bull Island is one of the finest coastal systems present on the east coast of Ireland. The habitats around North Bull Island are typical of those that form around a coastal sand spit and

both the sand dunes and saltmarsh display characteristic zonation. The terrestrial part of North Bull Island is dominated by the two golf courses. The two golf courses are positioned along the west side or the mainland side of the island and occupy much of the length of the transitional zone between the dunes and the saltmarsh. The construction of the causeway and associated minor roads accessing Dollymount Strand and the two golf courses has largely divided the island into two main sections. The RDGC extends along nearly all the southern section, while the SAGC extends along about two-thirds of the northern section.

A largely unmodified zone containing sand dunes is located on the seaward side of the golf courses and extends along the whole of the island (see Maps 4 & 5). The sand dunes are an excellent example of an eastern coastal system and show typical zonation from a sandy beach at the eastern side of the island to established fixed dunes. The first stages of dune formation are marked by drift-line vegetation (1210) on the beach close the base of the dunes. Embryonic dunes (2110) develop at the edge of the shifting or mobile dunes, which some develop into the taller more typical dunes characterised by the high cover of Marram (*Ammophila arenaria*) (2120). Further landward the dune vegetation becomes more species-rich and fixed dune habitat (2130) becomes more established. Long linear dune slacks (2190) also appear in low-lying areas between some of the tall dune ridges.

Saltmarsh has developed along the back of the island, where it is sheltered (see Maps 4 & 5). The established saltmarsh is quite wide and flat and displays one of the best examples of saltmarsh vegetation zonation in Ireland. The saltmarsh pan and creek topography are also particularly well-developed because the site is so flat. The northern tip of the island, north of SAGC, is still intact so an unmodified natural transition between intertidal saltmarsh and terrestrial sand dune is still present. This is a rare feature on Irish coastal dune/saltmarsh systems. Most of this transition zone, however, has been destroyed by the development of the two golf courses and the upper limit of the saltmarsh is marked by a low embankment. The saltmarsh is dominated by Atlantic salt meadows (1330). Mediterranean salt meadows (1410) is found at the back of the saltmarsh, adjacent to the sand dunes and SAGC. Pioneer saltmarsh represented by *Salicornia* flats (1310) is found in a narrow strip along the seaward side of the saltmarsh. A large patch of pioneer saltmarsh made up of *Salicornia* flats and containing Common Cordgrass has developed on a raised sediment bank to the north of the causeway.

A small patch of saltmarsh also occurs on the mainland north of the causeway, at the confluence of the Santry River. This saltmarsh was formerly larger in size and was called Watermill Lane saltmarsh (O'Reilly & Pantin 1957). However, most of it was destroyed by the construction of the causeway in 1964.

Intertidal mud and sandflats (1140) are found between the saltmarsh and the mainland. Small estuarine channels drain both intertidal areas with the outflow from the Naniken Stream flowing south and the outflow from the Santry River flowing north. Sandflats (1140) are distributed around the northern tip of the island and a wider sub-tidal channel develops in this area. Dollymount Strand (a long sandy beach) extends along the seaward side of the island and the sand dunes. The beach is continuous with sandflats that extend out into Dublin Bay. This part of the bay is quite shallow and the intertidal zone is quite wide. Further seaward within the study area a sub-tidal zone develops that remains covered at low tide. This area also has a sandy substrate.

Other habitats found on the island include those within the golf courses and those associated with some of the infrastructure on the island. The golf courses are dominated by modified habitats. Amenity grassland (GA2) is the most prominent habitat and is found on the fairways and greens of the golf courses. Some of the golf course 'rough' is similar to Marram dunes (CD2) and some of the short turf is species-rich and is typical of fixed dune (CD3). Other features include scrub. There are several artificial ponds that collect or hold water used for irrigation. The golf courses also contain several paved tracks, buildings and car parks (BL3). Improved grassland (GA2) is also found along the causeway and associated footpaths. This grassland is mown quite regularly.

The following table lists all the habitats within the site (Table 4) and also mapped in Maps 4 and 5. The relevant Heritage Council (Fossitt 2000) category for Annex I habitats (EU Habitats Directive) are also shown. Annex I priority habitats are marked with an asterisk (\*). (These are a subset of the habitats listed in Annex I of the EU Habitats Directive that have highest conservation status). Non-Annex I habitats are also listed. Each habitat is described in the following sections.

**Table 4.** List of all the habitats present on the site.

Annex I Habitat Type	Fossitt (2000) Category
*Fixed dunes with herbaceous vegetation (grey dunes) (2130)	Fixed dunes (CD3)
Embryonic shifting dunes (2110)	Embryonic dunes (CD1)
Shifting dunes along the coast line with <i>Ammophila arenaria</i> (white dunes) (2120)	Marram dunes (CD2)
Humid dune slacks (2190)	Dune slacks (CD5)
Dunes with <i>Salix repens</i> ssp. <i>argentea</i> (Salicion arenaria) (2170)	Dune slacks (CD5)
Mudflats and sandflats not covered by seawater at low tide (1140)	Sand shores (LS2) Muddy sand shores (LS3) Mud shores (LS4)
Annual vegetation of drift-lines (1210)	Shingle and gravel shores (LS1)
<i>Salicornia</i> flats (1310)	Lower saltmarsh (CM1)
Atlantic salt meadows (1330) (ASM)	Lower & upper saltmarsh (CM1 & CM2)
Mediterranean salt meadows (1410) (MSM)	Upper saltmarsh (CM2)
	Lower saltmarsh (CM1) ( <i>Spartina</i> swards)
	Amenity grassland (GA2)
	Estuarine channels (MW4)
	Infra-littoral muddy sands (SS2)
	Sheltered rocky shores (LR3)
	Dune scrub (CD4)
	Lagoon (CW1)
	Drainage ditches (FW4)
	Artificial ponds (FL8)
	Sea Walls piers and jetties (CC1)
	Artificial surfaces (BL3)



## ANNEX I HABITATS:

<p>*Fixed coastal dunes with herbaceous vegetation (2130)</p>	<p>This is the most extensive dune habitat present at North Bull Island. This is a Priority habitat as defined in the Habitats Directive. (This habitat type is sometimes referred to as 'grey dunes'.) It is characterised by species rich, generally low turf that develops in older, more stabilised dunes to the landward side of the taller dune ridges. Among the typical species found in this habitat are Red Fescue (<i>Festuca rubra</i>), Kidney Vetch (<i>Anthyllis vulneraria</i>), Bird's-foot Trefoil (<i>Lotus corniculatus</i>), Rest Harrow (<i>Ononis repens</i>), Lady's bedstraw (<i>Galium verum</i>), Cat's Ear (<i>Hypochaeris radicata</i>), Eyebright (<i>Euphrasia officinale</i> agg.) and Yellow Rattle (<i>Rhinanthus minor</i>). Several rarities are also present including Petalwort, (<i>Petalophyllum rafflesii</i>) (liverwort), several Bryum species (mosses), Lesser Centaury (<i>Centaureum pulchellum</i>) and Meadow Saxifrage (<i>Saxifraga granulata</i>) (see also <a href="#">Section 3.7.2</a>).</p> <p>Marram, (<i>Ammophila arenaria</i>), is common throughout much of this sand dune habitat, and becomes rank in places, particularly in the southern half. A certain portion of the mapped fixed dune area (at the seaward side of the habitat) consists of semi-fixed dunes, in which the vegetation is quite open and dominated by Marram. The grassland is grazed mainly by rabbits.</p> <p>Scattered trees and shrubs such as Sycamore (<i>Acer pseudoplatanus</i>) and Lilac (<i>Syringa vulgaris</i>) are present in this habitat. The dunes are also dissected by pedestrian tracks, some of which are bare sand.</p>
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**Fixed-Shifting Dunes**

(Photo: Anthony Woods)

<p>Embryonic shifting dunes (2110)</p>	<p>Embryonic dunes consist of a very narrow band of habitat on the seaward edge of the mobile dunes. This habitat is characterised by the presence of two dune grasses, Sand couch (<i>Elytrigia juncea</i>) and Lyme-grass (<i>Leymus arenarius</i>), and the typical high cover of bare sand. Movement of sediment towards the recurved, northern tip of the island has resulted in the formation of a wide swathe of fore-dune habitat at this location.</p>
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Shifting dunes along the coast line with <i>Ammophila arenaria</i> (white dunes) (2120)	This habitat forms a continuous strip at or near the entire seaward edge of the dunes. (This habitat type is sometimes referred to as white dunes or mobile dunes). The vegetation is characterised by the dominance of Marram in vegetation communities, while lesser amounts of Lyme-grass are also present. It is present on most of the dune ridges. To the landward side of the mobile dunes, there is some semi-fixed dune habitat that is intermediate in character between mobile dunes and fixed dunes.
Humid dune slacks (2190)	<p>Several long linear dune slacks are located in low-lying depressions between dune ridges in the older part of the sand dunes. The largest dune slack is located in the northern section of the island. This area is known as the 'Alder marsh' due to the presence of occasional Alder (<i>Alnus glutinosa</i>). A recent study (Devaney 2008) studied the vegetation and hydrology of this area.</p> <p>The vegetation of these areas is characterised as species-rich. Species found in the dune slacks include Creeping Bent (<i>Agrostis stolonifera</i>), Sand Sedge (<i>Carex arenaria</i>), Marsh Helleborine (<i>Epipactis palustris</i>), Jointed Rush (<i>Juncus articulatus</i>) and Silverweed (<i>Potentilla anserina</i>). A wider low-lying area located towards the southern end of the island is characterised by the dominance of Saltmarsh Rush (<i>Juncus gerardii</i>) and the frequent presence of Saltmarsh Flat-rush (<i>Blysmus rufus</i>). This area is likely to have some saline influence.</p> <p>The CMP survey noted that the dune slack known as the Alder marsh is more diverse compared to the dune slacks in the southern part of the island. There are indicators of brackish and freshwater marsh vegetation. The vegetation of this area also includes Spear Moss (<i>Calliergonella cuspidata</i>), Glaucous Sedge (<i>Carex flacca</i>), Marsh Orchids (<i>Dactylorhiza</i> spp.), Meadowsweet (<i>Filipendula ulmaria</i>), Autumn Gentian (<i>Gentianella amarella</i>), Common Bird's-foot Trefoil (<i>Lotus corniculatus</i>), Marsh Pennywort (<i>Hydrocotyle vulgaris</i>), Twayblade (<i>Listera ovata</i>) and Devil's-bit (<i>Succisa pratensis</i>). Other parts are dominated by Sea Rush (<i>Juncus maritimus</i>).</p>
Dunes with <i>Salix repens</i> ssp. <i>argentea</i> ( <i>Salicion arenariae</i> ) (2170)	<p>The CMP did not record this habitat on the island and it was not mapped by any of the previous surveys of the island.</p> <p>However, recent survey work for this Management Plan located some vegetation near the Alder marsh in the northern section of the island that might be classified as this habitat according to the CMP criteria and to criteria in the EU Annex I habitat interpretation manual (Commission of the European Communities 2006).</p> <p>This habitat is dominated by patches of Creeping Willow (<i>Salix repens</i>) forming low-lying scrub. There is some debate as to the integrity of this habitat type as a number of Willow hybrids are currently being examined (Liverpool Hope University staff, pers. comm., 2008).</p> <p>This habitat is often associated with mature dune systems and the drier edges of dune slacks. Other species present include Meadowsweet, Creeping Buttercup (<i>Ranunculus repens</i>), Devil's Bit, Yellow Rattle, Glaucous Sedge, Silverweed, Yorkshire Fog (<i>Holcus lanatus</i>), Red Fescue (<i>Festuca rubra</i>), Sweet Vernal-grass (<i>Anoxanthum odoratum</i>), Common Bird's-foot Trefoil, Quaking-grass (<i>Briza media</i>), False Oat-grass (<i>Arrhenatherum elatius</i>), Jointed Rush and Marsh Orchid.</p>



**Dune Slack**

(Photo: Fiona Devaney)

Mudflats and sandflats not covered by water at low tide (1140)

Intertidal sand and mudflats form a continuum around North Bull Island. Most of the area between the island and the mainland can be classified as intertidal flats although there are some deeper areas associated with the channels that are sub-tidal and are not exposed at low tide. The Annex II habitat can be further divided according to sediment type and the littoral fauna (Fossitt 2000). The intertidal areas between the island and the mainland have regularly been described as 'lagoons', although they cannot strictly be classified as this habitat.

The sediment in the intertidal area is muddier closest to the causeway and becomes sandier towards Sutton Creek and the Bull Bridge (ESB 2002). The area seaward of the island forms a continuum of sandy sediments from Dollymount Beach to sandflats and then to sub-tidal areas that also have sandy sediment. Some of the sub-tidal areas are exposed very rarely at extreme low spring tides.

There have been several analyses of the intertidal fauna of the sediments around North Bull Island. ESB (2002) described 5 sediment shore biotopes in a survey of the intertidal area between the island and the mainland. The bivalve Peppery Furrow Shell (*Scrobicularia plana*) is prominent in the muddiest areas, Baltic Tellins (*Macoma balthica*) in the less muddy areas and Cockles (*Cardium edule*) were prominent throughout. Species such as the gastropod *Hydrobia ulvae* and the crustacean *Corophium volutator* were locally abundant and polychaetes such as Ragworm (*Hediste diversicolor*) and *Nephtys* spp. were also abundant. There are some Mussel beds in the muddier sediments. There were no significant differences in infaunal distribution between the north and southern areas. One feature of these areas is the very high biomasses of the infauna found in the sediment.

	<p>Jovanovic <i>et al.</i> (2007) recently studied the fish populations of the intertidal (and sub-tidal) habitats around North Bull Island. The community was largely dominated by the Lesser Sand Eel (<i>Ammodytes tobianus</i>) and the Common Goby (<i>Pomatoschistus microps</i>). Russo <i>et al.</i> (2007) identified both intertidal and sub-tidal habitats of North Bull Island as important nursery areas for commercial fish species i.e. Flounder (<i>Platichthys flesus</i>) and Plaice (<i>Pleuronectes platessa</i>).</p> <p>The dominant plants of the flats are green algae (<i>Enteromorpha</i>, <i>Ulva</i>, <i>Cladophora</i>, <i>Rhizoclonium</i> &amp; <i>Chaetomorpha</i>) with some Beaked Tasselweed (<i>Ruppia maritima</i>). The ERU report (ERU 1992d) has described the marine flora of the intertidal area in detail.</p> <p>Also present are Eel-grasses (<i>Zostera</i> spp.). There is a sparse bed of <i>Zostera noltii</i> on sandy sediments in Sutton Creek and a narrow 100m long strip of <i>Zostera angustifolia</i> on mud nearer the North Bull Island causeway (Madden <i>et al.</i> 1993).</p> <p>The mudflats and sandflats support very important populations of wintering waterfowl at very high densities (see also <a href="#">Section 3.7.4</a>).</p>
Annual vegetation of drift-lines (1210)	<p>Large amounts of organic-rich debris are washed out along this strandline. The sand dunes generally begin to form along the drift-line on the beach which is colonised by characteristic species including Prickly Saltwort (<i>Salsola kali</i>), Sea Rocket (<i>Cakile maritima</i>) and Oraches (<i>Atriplex</i> spp.). This is an ephemeral habitat and its extent is dependant on levels of disturbance. This habitat is generally a relatively narrow zone and also contains frequent Wrack seaweed.</p> <p>The CMP noted that there was no substantial drift-line vegetation along the seaward edge of the dunes in the southern half of the island, which was attributed to the mechanical beach-cleaning in this part of the site at the time of the survey (2004). Only a very small patch was noted near the Bull Wall. This habitat was more extensive in the northern half of the island. The current policy of DCC is to leave as much drift-line vegetation as possible (See also <a href="#">Section 4.13</a> for more information on current beach management).</p>
<i>Salicornia</i> flats (1310)	<p>The habitat is mainly distributed in the area known as the <i>Salicornia</i> bank, north of the causeway. It is a pioneer saltmarsh habitat and is characterised by the presence of dense Glasswort (<i>Salicornia</i> sp.) on mudflats. It is flooded by spring and neap tides. A much smaller patch is located south of the causeway. <i>Salicornia</i> flats is also found along the edge of the established saltmarsh forming a narrow strip sometimes &lt; 5 m wide that becomes more extensive around the mouths of creeks, which drain the saltmarsh. Small patches of this habitat may also be found in some of the numerous salt pans found on the saltmarsh.</p> <p>Madden (1984) classified the Glasswort colonising on the <i>Salicornia</i> bank as <i>S. dolichostachya</i> (<i>S. procumbens</i> agg.). Glasswort along the edges of the ASM tended to be <i>S. europaea</i>. Several other <i>Salicornia</i> sp. have been recorded from North Bull Island in the past. (The taxonomic status of several <i>Salicornia</i> spp. have been revised in recent years with Stace (1997) suggesting that possibly only three species are recognised.)</p>



	<p>Clumps of Common Cordgrass are present in this habitat. Few other plant species apart from Fucoids (mainly, <i>Fucus ceranoides</i> with some <i>Fucus vesiculosus</i> and <i>Ascophyllum nodosum</i>) and green algae (<i>Enteromorpha</i> and <i>Vaucheria</i> sp.) (CAAS 1990) are present, particularly on the <i>Salicornia</i> bank. Species such as Sea Spurrey, Lax-flowered Sea Lavender and Annual Sea-blite occasionally appear in this habitat along the established saltmarsh. Some of the small creeks and depressions towards the seaward side of the <i>Salicornia</i> bank contain Eelgrass (<i>Zostera augustifolia</i>).</p> <p>This habitat is ephemeral in nature, as it is made up of annual species. Its boundaries on the mudflats may change from year to year. Its disappearance or reappearance in certain areas from year to year can be dependant on geo-morphological trends such as shifting sediment.</p>
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***Salicornia* flats in autumn with clumps of invasive Common Cordgrass**

(Photo: Mark McCorry)



Atlantic salt meadows (1330)	<p>This Annex I habitat is the most extensive saltmarsh habitat present at North Bull Island. It extends along much of the mainland side of the island. Zonation of this habitat is particularly well-developed. Both O'Reilly and Pantin (1957) and Moore and O'Reilly (1977) have described the vegetation communities and zonation in detail.</p> <p>Most of the lower saltmarsh boundary is marked by a low saltmarsh cliff. The ASM extends from a low saltmarsh cliff (the boundary with the mudflats) back to the golf courses or with MSM dominated by Sea Rush. A pioneer saltmarsh zone dominated by patchy Common Saltmarsh-grass (<i>Puccinellia maritima</i>), Glasswort, Annual Sea-blite (<i>Suaeda maritima</i>), Common Cordgrass (<i>Spartina anglica</i>) and Lax-flowered Sea Lavender (<i>Limonium humile</i>) is present in an accreting zone to the north of the causeway. The lower saltmarsh community is dominated by Sea Purslane (<i>Atriplex portulacoides</i>). Clumps of Common Cordgrass are scattered over this zone but overall their frequency is low.</p>
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	<p>Further back (landward) a more typical mid marsh community with a very low sward dominated by Sea Pink (<i>Armeria maritima</i>) and Sea Plantain (<i>Plantago maritima</i>) develops. The upper marsh is grassy and dominated by Red Fescue and Saltmarsh Rush. There is an additional notable community marked by the presence of Rock Sea Lavender (<i>Limonium binervosum</i>) near the tip of the island.</p> <p>Infilling in the past has affected the natural zonation so these zones do not extend along the whole of the saltmarsh. This can be seen north of the causeway where the upper zone is only represented by a narrow strip of vegetation along the golf course boundary. The most complete zonation is located at the northern end of the island.</p> <p>This saltmarsh also has a particularly well-developed pan and creek topography. This development is mainly due to the relatively large extent and the low gradients from the front to the back of the saltmarsh. Some of the creeks have been canalised in the past to help drainage from the golf courses. This habitat is flooded by spring tides. The lower zone and the pioneer zones are flooded to some extent by the higher neap tides.</p> <p>Healy (1975) studied the fauna of this saltmarsh. The creeks in the saltmarsh have a brackish habitat and contain low salinity tolerant species such as Shore Crab (<i>Carcinus maenas</i>), the polychaete worms Ragworm, <i>Eteone longa</i>, Lugworm (<i>Arenicola marina</i>), and <i>Tubifex costata</i> (Oligochaete).</p> <p>Koutsogiannopoulou &amp; Wilson (2007) studied the fish fauna of the saltmarsh creeks. Ten species from 10 fish families were found. Common Goby, 3-spined Stickleback, (<i>Gasterosteus aculeatus</i>), Thick-lipped Grey Mullet, (<i>Chelon labrosus</i>) and Flounder, (<i>Platichthys flesus</i>) contributed 98.4% of all fish sampled.</p>
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#### Atlantic salt meadow

(Photo: Mark McCorry)



	<p>The fish population of the channels was dominated by the resident gobies (true estuarine resident species), but also hosted juveniles of species such as Bass (<i>Dicentrarchus labrax</i>) (marine juvenile migrant species).</p> <p>In turn, the nekton populations were dominated by Brown Shrimp, (<i>Crangon crangon</i>) and Fairy Shrimp (<i>Palaemonetes varians</i>) especially in winter when fewer fish (numbers of species and abundance) were found.</p>
Mediterranean salt meadows (1410)	<p>This habitat is characterised by the presence of Sea Rush (<i>Juncus maritimus</i>). The habitat is found in the upper zone of the saltmarsh adjacent to the SAGC boundary and along the sand dunes further north, in the northern section of the island. This habitat is flooded by only the extremely high spring tides.</p> <p>This tall rush forms large clumps in places and though it may not actually dominate the cover (cover varies from 20-50%), it is the most characteristic part of the vegetation. The vegetation is usually dominated by graminoids (grasses) such as including Red Fescue, Creeping Bentgrass and Saltmarsh Rush. Small grassy areas in the transitional area to the dune slack contain Rock Sea Lavender and Long-bracted Sedge (<i>Carex extensa</i>).</p> <p>Some zonation within this habitat can be seen and large clumps of Sea Rush grow in the mid marsh zone and are associated with Sea Pink and Sea Plantain. Sea Purslane is frequently found colonising only these clumps of Sea Rush in the upper marsh.</p> <p>Creeks and pans are present in this habitat but are less frequent. This habitat also has an irregular micro-topography in places and mounds and hollows are present. The sward height within this habitat is quite diverse and tall (0.2-0.8 m high). The tall rushes may be shielding the other vegetation from natural grazing to some extent.</p> <p>Some upper saltmarsh has been recorded inside the north-western RDGC boundary and separated from the rest of the saltmarsh by an embankment (Environmental Impact Services 2003). This brackish area is thought to develop due to occasional saline intrusion into the water table beneath the embankment (An Bord Pleanála 2004). Some of this habitat supports the Lesser Centaury (FPO).</p>

**OTHER HABITATS:**

<p>Lower saltmarsh (CM1) (<i>Spartina</i> swards)</p>	<p>This habitat is characterised by patches of saltmarsh with &gt; 40% cover of Common Cordgrass (<i>Spartina anglica</i>). Clumps of this species are found scattered over much of the ASM (1330), on mudflats classified as <i>Salicornia</i> flats (1310) and on other bare mudflats (1140). Overall, its cover is generally low and it is only occasionally frequent. Several small patches of this habitat have been mapped on the established saltmarsh (lower zone) and within the large area of <i>Salicornia</i> flats to the north of the causeway. This habitat is flooded by most tides.</p> <p>Nearly all the saltmarsh can be classified as one of three Annex I habitats (see above). However, areas dominated by Common Cordgrass do not fit in with the criteria for any of these Annex I habitats. <i>Spartina</i> swards was formerly listed as an Annex I habitat (1320) but it is now not considered as a qualifying interest, as Common Cordgrass is a non-native species and stands of non-native <i>Spartina</i> species are excluded according to the criteria for <i>Spartina</i> swards (1320) according to Commission of European Communities (2003).</p>
<p>Amenity grassland (GA2)</p>	<p>This habitat is quite variable and contains several sub-types. It is mainly characterised by modified grassland types found within the golf courses. Greens and fairways are heavily managed and contain grasslands of much lower diversity compared to fixed dune grassland. Both golf courses originally contained extensive fixed dune grassland, but it is no longer considered as part of the functioning dune system, due to the disruption to vegetation successions and other disturbance from golf course management.</p> <p>However, this heavily managed grassland is used by roosting Brent Geese (<i>Branta bernicla horta</i>) and feeding by species such as Starlings (<i>Sturnus vulgaris</i>), Oystercatchers (<i>Haematopus ostralegus</i>), Rooks (<i>Corvus frugilegus</i>) and Jackdaws (<i>Corvus monedula</i>) (RDGC 1999).</p> <p>This habitat also includes species-poor grassland found along the causeway. These areas were probably re-seeded after the construction of the causeway, are frequently mown and are quite disturbed. RDGC (1999) describes 'rough type' rank grassland on the course that is drier and species-poor and dominated by grasses such as Yorkshire Fog (<i>Holcus lanatus</i>), Cocksfoot (<i>Dactylis glomerata</i>), False Oat-grass, Quaking-grass, Sweet Vernal-grass, Crested Dog's-tail (<i>Cynosurus cristatus</i>) and Red Fescue. The vegetation also contains stands of Nettle (<i>Urtica dioica</i>), Thistle (<i>Cirsium</i> sp.) and Horsetails (<i>Equisetum</i> spp.). This habitat is found along the north-western side of the course. While it is not directly managed for amenity purposes, it was classified as this habitat for the purposes of the survey. Environmental Impact Services (2001) also describe similar rank grassland in SAGC and classify it as GS2 (Grassy Verges and Meadows).</p>
<p>Fixed dunes (CD3)</p>	<p>Some un-mown areas within the golf courses are likely to still have some conservation value and could be classed as this habitat. Several surveys have described areas of grassland within both golf courses as species-rich fixed dune grassland (RDGC 1999, Environmental Impact Services 2001, 2003). RDGC (1999) has produced a habitat map of the golf course indicating areas of fixed dune grassland. Marram-covered dunes are present along the southern side of the RDGC.</p>



	There are also several small hollows that contain dune slack type vegetation (RDGC 1999). Both golf courses are excluded from the cSAC (Ryle <i>et al.</i> 2009).
Estuarine channels (MW4)	Two small channels drain the two main intertidal areas between the island and the mainland. The Santry River forms the larger channel in the northern intertidal section and flows north into Sutton Creek. Several smaller channels are linked to it that drain from the island and from outflows along the mainland shore. The second channel is formed by the Naniken Stream and flows south under the wooden bridge. Both these channels are maintained by some freshwater flow but are generally quite shallow. The salinity of the channels varies depending on the state of the tide.
Infra-littoral muddy sands (SS2)	This habitat is characterised by the sub-tidal area, mainly located to the east of the island, which extends into Dublin Bay. The boundary between the intertidal and the sub-tidal zones is usually taken as the Mean Low Water Spring tide line (MLSW). This means that occasionally part of the upper area mapped as sub-tidal is exposed at low tide during extreme low spring tides. The subtidal sands are covered by <i>Ectocarpus</i> sp. (Environmental Research Unit 1992).
Sheltered rocky shores (LR3)	This habitat is found along the mainland and the causeway between the intertidal area and the shoreline. Sheltered rocky shores of bedrock or stable boulders and cobbles are typically characterised by a dense cover of Furoid algae that form distinct zones. A zone of Channelled Wrack ( <i>Pelvetia canaliculata</i> ) is present on the upper shore and there is further zonation to a band of Serrated Wrack ( <i>Fucus serratus</i> ) on the lower shore. ESB (2002) identified 10 different sub-types or biotypes within this habitat.
Dune scrub (WS1)	This habitat is characterised by patches of Gorse ( <i>Ulex europaeus</i> ) and Sea Buckthorn ( <i>Hippophae rhamnoides</i> ) that are found in the golf courses and in other parts of the island. Sea Buckthorn is a non-native highly invasive species that was planted to provide shelter in the golf courses. It has subsequently spread to other parts of the island. These patches vary in size and small patches may not be mapped.
Lagoon (CW1)	<p>One of the artificial drainage channels in RDGC is classified as a lagoon by Healy (2003). The salinity is described as oligo-mesohaline (3-14 g/l) and it only covers a small area (0.5 ha). This is one of only two lagoons recorded in Co. Dublin. A small pond connected to this drain contains brackish vegetation such as Grey Club-rush (<i>Schoenoplectus lacustris</i> spp. <i>tabernaemontani</i>), Sea Arrowgrass (<i>Triglochin maritimum</i>), Creeping Bent and Distant Sedge (<i>Carex distans</i>) (Environmental Impact Services 2003). This drainage channel and adjacent embankment is used by several Nesting Mallard (<i>Anas platyrhynchos</i>) and Shelduck (<i>Tadorna tadorna</i>).</p> <p>In the past the two large intertidal areas between North Bull Island and the mainland have been described as 'lagoons'. In Europe, lagoons are generally described as an isolated or partially enclosed body of brackish water with a restricted tidal range (Healy 2003). Therefore these areas should not be classified as lagoons.</p>



Drainage ditches (FW4)	<p>Several drains within the RDGC are brackish and more like saltmarsh creeks (see also lagoons). They contain species such as Sea Rush, Sea Beet (<i>Beta maritima</i>), Celery-leaved Buttercup (<i>Ranunculus sceleratus</i>) and Common Cordgrass within the drains and along their edges (Environmental Impact Services 2003).</p> <p>Other drains in the RDGC (1999) sometimes completely dry up during summer. Some drains contain freshwater vegetation such as Duckweed (<i>Lemna minor</i>), Great Willowherb (<i>Epilobium hirsutum</i>) and Willowherb sp. (<i>E. parviflorum</i>). A small stand of Bulrush (<i>Typha latifolia</i>) is present in one drain.</p>
Artificial ponds (FL8)	<p>Several small artificial ponds are present in the golf courses. These are used to store water used for irrigation. One of these reservoirs in the RDGC is fringed with Jointed Rush, Common Spike Rush (<i>Eleocharis palustris</i>), Great Willowherb, Marsh Arrowgrass (<i>Triglochin palustris</i>) and some Bulrush (<i>Typha latifolia</i>). Duckweed and Water Starwort (<i>Callitriche stagnalis</i>) float in the water.</p>
Sea walls, piers and jetties (CC1)	<p>This habitat is categorised by artificial structures on the coastline that are exposed at low tide. The North Bull wall, the wooden bridge and the edges of the causeway that are inundated by the tide is classified as this habitat.</p> <p>The North Bull wall has developed distinctive zonation of seaweed and animal communities with the limestone boulders being covered with notable communities of crinoids, corals and Bryozoa (Healy 1977).</p>
Artificial surfaces (BL3)	<p>Buildings, roads, pavements and car-parks found on the island are included in this category.</p>

### 3.7 Biological features of importance

This section describes in more detail the biological features of importance that have been recorded on the island and the current status of these habitats and species.

#### 3.7.1 Annex I habitats

The conservation status of the Annex I habitats has been assessed recently by the Coastal Monitoring Project (Ryle *et al.* 2009) and the Saltmarsh Monitoring Project (McCorry 2007) (See [Appendix IV Section 7.4.1](#)). The following sections summarise the findings of these reports.

In general, the sand dune and salt marsh habitats were noted as being in fairly good condition according to the criteria used by the CMP and the SMP (McCorry 2007 & Ryle *et al.* 2009). The sand dunes are actively accreting at North Bull Island and this has a very positive influence on the conservation status of the sand dune system and the various different habitats. It is a very stable sand dune system, as indicated by the continued development of parallel ridges on a prograding shore on the east side of the island. There are a variety of habitats, and a diverse flora with many rare and interesting species. Its future conservation prospects should be enhanced by the range of designations it carries, although recreational pressures will undoubtedly remain high (Ryle *et al.* 2009).

Some of the main negative impacts acting on the sand dune habitats at North Bull Island as identified by the CMP come from recreational pressures (Ryle *et al.* 2009). Heavy pedestrian traffic creates tracks, erodes vegetation cover and exposes sand in places and this affects all the sand dune habitats. The other main negative indicator was noted as the development of species-poor rank grassland dominated by Marram in parts of the fixed dune area.

Some of the main impacts recorded as acting on the saltmarsh habitats at North Bull Island include the presence of Common Cordgrass, recreational pressures and erosion (McCorry 2007). Common Cordgrass has the capacity to increase in extent in the future at the expense of *Salicornia* flats on the mudflats. However, while it is present in the Atlantic salt meadow habitat, overall it is present at low cover values and is not likely to spread significantly in the habitat in the future. Recreational pressures on the saltmarsh habitats are generally much lower compared to the sand dune habitats. Indications of erosion of Atlantic salt meadow habitat were noted in places along its seaward boundary, but this is compensated by accretion along the north side of the causeway.

### 3.7.2 Notable plant species

This section describes the current status of notable plant species at North Bull Island. Notable plant species include protected species listed on the Flora Protection Order (1999), rare and threatened species listed in the Red Data Book (RDB) (Curtis & McGough 1988) and in the updated Red Data lists (vascular plants and bryophytes) ([www.botanicgardens.ie](http://www.botanicgardens.ie)) and other high priority plant species, with some listed in the Dublin City BAP (DCC 2008). This section is based on the most up-to-date information made available during the preparation of the Management Plan. Photos of some of these species are in [Appendix III](#).

#### BRYOPHYTES

<b>Petalwort</b> <i>(Petalophyllum ralfsii)</i> Annex I RDB	This bright green liverwort resembles minute lettuce plants and is less than 5mm in diameter. The preferred habitat for this species is moist shallow calcareous dune slacks and dampish hollows in sand dunes. North Bull Island is the only known station away from the western seaboard. Re-found at North Bull Island in 1999 in the Alder dune slack. About 100 plants recorded (NPWS 2007). Possibly affected by track disturbance and changes to water table.
<b>Many Seasoned Thread-moss</b> <i>(Bryum intermedium)</i> RDB	This is a tufted moss with pendent fruiting capsules, which often differs from other species of <i>Bryum</i> in having capsules at differing stages of development on the same tuft. Recorded recently at North Bull Island (Holyoak, pers. comm. to NPWS, 2007).
<b>Baltic Bryum</b> <i>(B. marratii)</i> RDB	Found in slightly more saline conditions than most other <i>Bryum</i> species, this is another small moss that is known to be at risk in slacks in Ireland. Recorded recently at North Bull Island (Holyoak, pers. comm. to NPWS, 2007).
<b>Cernuous Bryum</b> <i>(B. uliginosum)</i> RDB EN	Cernuous Bryum is another moss that grows in coastal dune slacks and in patches on damp soil, mainly inland such as beside streams. It is considered to be extinct in Britain. Recorded recently at North Bull Island (Holyoak, pers. comm. to NPWS, 2007).

<b>Warne's Thread-moss</b> <i>(B. warneum)</i> RDB	One of the distinguishing features of this small moss include the pear-shaped fruit capsule. The species is considered to be at serious risk as it has suffered from a drastic decline in distribution habitat due to pressure on its habitat. (Holyoak, pers. comm. to NPWS, 2007).
<b>Megapolitan Feather- Moss</b> <i>(Rhynchostegium megapolitanum)</i>	Another species which may in the near future be included in the red data list. Recorded recently at North Bull Island (Holyoak, pers. comm. to NPWS, 2007).
<i>Bryum calophyllum</i> RDB	Recorded in 19 <sup>th</sup> Century. Not recorded in recent past.

**Megapolitan Feather- Moss**

*(Rhynchostegium megapolitanum)*

(Photo: Neil Lockhart).



## HIGHER PLANTS

<b>Lesser Centaury</b> <i>(Centaurium pulchellum)</i> FPO 1999	Very rare on bare sandy ground subject to occasional inundation by the sea. Known from damper hollows in dune slack and upper saltmarsh Over 1000 plants recorded in 1991 (NPWS Rare plant database). Many plants present that are intermediate in characteristics between <i>C. pulchellum</i> and Common Century ( <i>C. erythraea</i> ) (more common sand dune species). Thought to have become more common in recent years at North Bull Island (Doogue <i>et al.</i> 1998). Recorded by CMP in 2004 in fixed dune habitat in the southern part of the island. Likely to be affected by embankment works along RDGC boundary in recent years 2004-2007
<b>Red Hemp-nettle</b> <i>(Galeopsis angustifolia)</i> FPO 1999	Extremely rare on track-side gravel. No records from Doogue <i>et al.</i> (1998). Current status unknown.
<b>Meadow Saxifrage</b> <i>(Saxifraga granulata)</i> FPO 1999 RDB CR	Recorded in 1988 from fixed dune in southern side of the island. 2 clumps recorded. (NPWS Rare plant database).
<b>Marsh Helleborine</b> <i>(Epipactis palustris)</i> RDB LC	Rare in dune slacks and marshes. Known from Alder Marsh and dune slacks (Doogue <i>et al.</i> 1998). Recorded by CMP in 2004 in dune slacks in northern and southern parts of the island. Also recorded by Devaney (2008).
<b>Autumn Gentian</b> <i>(Gentianella amarella)</i> RDB prop	Rare in sand-dunes and limestone grassland. Scattered in dune slacks and adjoining sand hills near the Alder Marsh (Doogue <i>et al.</i> 1998). Recorded by CMP in 2004 in dune slacks in northern part of the island.
<b>Field Gentian</b> <i>(Gentianella campestris)</i> RDB prop	Known from the Alder Marsh with <i>Gentianella amarella</i> (Doogue <i>et al.</i> 1998).
<b>Wild Sage</b> <i>(Salvia verbenaca)</i> RDB VU	Frequent at south end of North Bull Island (Doogue <i>et al.</i> 1998). Noted in 1993 in fixed dune in the southern part of the island. Present in low sand dunes and almost bare sandy ground. 37 flowering plants present in 1991. Has increased in distribution since 1970s (NPWS Rare plant database).
<b>Rough Clover</b> <i>(Trifolium scabrum)</i> RDB LC	Very rare on shallow soils over rock by coast. Noted in 1993 in fixed dune in the southern part of the island. Found in grassy very short dune turf (NPWS Rare plant database). Known from southern end of North Bull Island (Doogue <i>et al.</i> 1998).
<b>Knotted Clover</b> <i>(Trifolium straitum)</i> RDB LC	Very rare in short grassland by sea (Doogue <i>et al.</i> 1998). Known from sandy ground near North Bull Wall (Doogue <i>et al.</i> 1998).
<b>Spring Vetch</b> <i>(Vicia lathyroides)</i> RDB VU	Known from fixed dune and occasional on low sand hills in northern part of island (Doogue <i>et al.</i> 1998).





**Autumn Gentian** (Photo: Fiona Devaney)



**Marsh Helleborine** (Photo: Fiona Devaney)

<b>Dune Fescue</b> <i>(Vulpia fasciculata)</i> RDB VU	Very rare on bare thinly vegetated ground in sand dunes. Known from the south end of North Bull Island (Doogue <i>et al.</i> 1998).
<b>Salt marsh Flat-sedge</b> <i>(Blysmus rufus)</i>	Rare in dune slacks and salt marshes. Abundant in dune slacks at southern end of island (Doogue <i>et al.</i> 1998).
<b>Sea Bindweed</b> <i>(Calystegia soldanella)</i>	Rare in sand dunes and sand hills. Known from eroding sand dunes at southern end and newer dunes at the northern end of island (Doogue <i>et al.</i> 1998).
<b>Field Mouse-ear</b> <i>(Cerastium arvense)</i>	Rare on sandy roadside banks and sand dunes. Noted in 1993 in fixed dune in the southern part of the island. Has been recorded in 1980s north of the Alder Marsh (Doogue <i>et al.</i> 1998).
<b>Northern Marsh Orchid</b> <i>(Dactylorhiza purpurella)</i>	Rare in dune slacks, marshes and wet meadows. Known from the Alder Marsh (Doogue <i>et al.</i> 1998).
<b>Variegated Horsetail</b> <i>(Equisetum variegatum)</i>	Very rare in dune slacks and on canal banks. Recorded in dune slacks at south end of North Bull Island and also west and south of causeway (Doogue <i>et al.</i> 1998).

<b>Imperforate St John's-wort</b> ( <i>Hypericum maculatum</i> )	Recorded by older floras (Colgans supplement) but not re-found recently on North Bull Island (Doogue <i>et al.</i> 1998).
<b>Sharp Rush</b> ( <i>Juncus acutus</i> )	10 clumps recorded in RDGC (Doogue <i>et al.</i> 1998).
<b>Southern Adder's Tongue</b> ( <i>Ophioglossum vulgatum</i> )	Very rare in dune slacks and damp grassland. Frequent in the Alder Marsh (Doogue <i>et al.</i> 1998). Recorded by CMP in 2004 in Alder marsh north of the island. Recorded by Devaney (2008) also at this location.
<b>Bee Orchid</b> ( <i>Ophrys apifera</i> )	Rare in dune grassland, limestone quarries and sandy roadside cuttings. Scattered in small quantities in sand hills in the southern part of the island and in the Alder Marsh (Doogue <i>et al.</i> 1998). Recorded by Devaney (2008) in Alder Marsh north of island. Also recorded during fieldwork for this survey in fixed dune in the north of the island.



**Southern Adder's Tongue**  
(left)

(Photo: Fiona Devaney)



**Bee Orchid**  
(right)

(Photo: Anthony Woods)

<b>Tassel-weed</b> ( <i>Ruppia maritima</i> )	Rare in brackish drains and on estuarine mud. Plentiful in a drain on the western boundary of the RDGC and around north lagoon on North Bull Island (Doogue <i>et al.</i> 1998).
<b>Townsend's Cordgrass</b> ( <i>Spartina x townsendi</i> )	Line of clumps originally recorded on the saltmarsh adjacent to RDGC by Doyle (1934) and its identity confirmed by Boyle (1977). Now thought to be extinct as the clumps were removed during the initial <i>Spartina</i> control programmes during the 1970's. Photo taken in Boyle (1977).

<b>Small Cordgrass</b> <i>Spartina maritima</i> forma <i>dublinensis</i>	A 'dwarf' form of <i>Spartina</i> recorded on lower saltmarsh at North Bull Island (Boyle 1976). Photo taken in Boyle (1977). Not recorded recently (Doogue <i>et al</i> 1998). Not recorded by McCorry (2002, 2007).
<b>Autumn lady's-tresses</b> ( <i>Spiranthes spiralis</i> )	Very rare in unimproved calcareous grassland and low sand dunes. Known from the edge of the Alder Marsh (Doogue <i>et al.</i> 1998).
<b>Narrow-leaved Eelgrass</b> ( <i>Zostera angustifolia</i> )	Rare on mudflats. Known from the mudflats at northern end near Howth and small area north of causeway (Doogue <i>et al.</i> 1998). Narrow band 2-3 m wide and about 100 m long vegetating a flooded creek near in the north-east section of the <i>Salicornia</i> flats north of the causeway (Madden <i>et al.</i> 1993). Also noted by McCorry (2002). Recently re-found during fieldwork for this survey (2008). Significantly reduced in cover but may have increased in distribution as it is found in several shallow creeks. May be under-recorded on the <i>Salicornia</i> flats and mudflats.
<b>Dwarf Eelgrass</b> ( <i>Zostera noltii</i> )	Rare on mudflats One small 100 m <sup>2</sup> patch at Sutton Creek (O255, 390) on mudflats (at northern end on the island) opposite North Bull Island (Madden <i>et al.</i> 1993).

### 3.7.3 Notable fungal species

This section describes the current status of notable fungal species at North Bull Island. Notable fungal species include some listed in the Dublin City BAP (DCC 2008)

<b>Marram Oyster</b> ( <i>Hohenbuehelia culmicola</i> )  proposed Annex I	Recorded from North Bull Island. This is a small agaric mushroom with a dark cap that grows saprotrophically on the base of Marram culms in coastal sand dunes. <i>Hohenbuehelia culmicola</i> is threatened across Europe due to disturbance of sandy coasts; it is red-listed in at least 4 countries including the UK ('vulnerable status') and is one of 33 threatened fungi in Europe identified as candidate organisms for listing in Appendix 1 of the Bern Convention (H. Fuller UCD, pers. comm. 2008).
<b>Waxcaps</b> ( <i>Hygrocybe</i> spp.)	Recorded from North Bull Island. Notable species listed in DCC Biodiversity Plan.



### 3.7.4 Notable animal species

This section describes the current status of notable animal species at North Bull Island. Notable animal species include rare and threatened species listed in Annex II, Annex IV and V of the Habitats Directive, the Red Data Book (RDB) (Whilde 1993), waterbird species occurring in national and international important numbers (Crowe 2005), bird species of conservation concern (Newton *et al.* 1999) and other high priority animal species, with some listed in the Dublin City BAP (DCC 2008). This section is based on the most up-to-date information made available during the preparation of the Management Plan.

#### INVERTEBRATES

This information is taken mainly from NPWS (undated 1996?) and DCC (2008).

<i>Salticella fasciata</i> (Diptera: Sciomyzidae)	This is a fixed dune species which is well established on North Bull Island. In Ireland, this fly is confined to sand dunes in Co. Dublin, which form the most northerly known location for the species.
<i>Orthoceratium lacustre</i> (Diptera: Dolichopodid)	This fly is found on the saltmarsh areas and is vulnerable to excessive trampling and grazing.
<i>Sphaerophoria rueppellii</i> (Diptera: Syrphidae)	The upper reaches of the North Bull Island saltmarshes are the only known Irish location for this hoverfly.
<b>Hairy Woodlouse</b> ( <i>Eluma purpurascens</i> )	The only known localities in the British Isles for this species are North Bull Island, Howth and Portmarnock (see check lists in Jeffrey <i>et al.</i> 1977). Elsewhere in Europe this species is not found further north than Portugal.
<b>White Satin Moth</b> ( <i>Leucoma salicis</i> )	This moth occurs on willows on North Bull Island and has been found at only one other location in Ireland.

#### AMPHIBIANS AND REPTILES

<b>Viviparous Lizard</b> ( <i>Lacerta vivipara</i> )	No records for North Bull Island in 2008 (IWT Lizard survey <a href="http://www.Biology.ie">www.Biology.ie</a> ).
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#### BIRDS

There is a significant amount of information about the usage of North Bull Island by various bird species. Waterbird monitoring has taken place in North Dublin bay since the 1960s. The site has been designated as an SPA due to the presence of internationally important numbers of wintering waders and wildfowl (> 20,000 waterbirds). These species are regularly counted as part of the I-WeBS survey (Crowe 2005). Different parts of the island are now counted as sub-sites of the overall site Dublin Bay. It should be noted that many wintering waders and wildfowl species that use North Bull Island also use other parts of the bay and also move to other sites in Ireland. Crowe (2005) summarises I-WeBS count data for Dublin Bay as a whole. Crowe notes that overall numbers of wildfowl and waders using Dublin Bay have fallen by 32% and 22% since counts in 1984-86.

The intertidal mudflats and sandflats, when exposed, are used for feeding by the majority of all waterbird species using Dublin Bay (Crowe 2005). Green algal mats found in the intertidal areas provide rich feeding habitat for some species like Brent Geese and Wigeon. As the tide rises waterbirds generally move northwards in Dublin Bay and are forced to move away from the area or onto the saltmarsh. At very high tides practically all the birds roost at the North Bull Island complex. Dollymount Strand is used by both roosting and feeding waders, mainly Sanderling, Bar-tailed Godwits, Knot and Dunlin. Dabbling ducks tend to concentrate largely in the channels on the north and south side of the causeway. The populations of Light-bellied Brent Goose, Bar-tailed Godwit and Pintail are of particular note as they comprise more than 10% of the respective national totals (Crowe 2005).

Much of the information about current status of notable species is taken from Crowe (2005) and the NPWS Natura 2000 database explanatory notes. More up-to-date I-WeBS counts of various parts of North Bull Island are present in [Appendix II](#).

<b>Species listed on Annex I (Birds Directive)</b>	
<b>Golden Plover</b> ( <i>Pluvialis apricaria</i> ) BoCCI Red (Breeding)	Golden Plover frequent site on irregular basis although numbers can be substantial. The two intertidal areas are used for feeding and roosting. Will use other habitats. Numbers using Dublin Bay 2.3% of national total.
<b>Bar-tailed Godwit</b> ( <i>Limosa lapponica</i> ) BoCCI Amber	This species uses the site regularly during the winter. Occurs in internationally important numbers. Usually recorded in the southern intertidal area. Also feed and roost on Dollymount Strand. Generally strictly associated with intertidal sandflats but may roost on saltmarsh. Numbers using Dublin Bay 10.6% of national total.
<b>Little Tern</b> ( <i>Sterna albifrons</i> ) BoCCI Amber	No breeding since 1992. Formerly one of the most important breeding sites in the country. Habitat still present at northern end of island and still regarded as a potential site for this species. Only 1 individual recorded by I-WeBS counts at North Bull Island in past 5 years. Up to 5 recently observed by NPWS staff flying at North Bull Island.
<b>Ruff</b> ( <i>Philomachus pugnax</i> ) BoCCI Amber	Individual birds intermittently recorded in the intertidal areas.
<b>Short-eared Owl</b> ( <i>Asio flammeus</i> ) BoCCI Amber	The island is a regular wintering site for Short-eared Owl, with up to 5 present in some winters. Short-eared owls and Kestrels use the Pine on the golf courses for roosting.

<b>Waterbird species present in Internationally Important numbers</b>	
<b>Light-bellied Brent Goose</b> ( <i>Branta bernicla horta</i> ) BoCCI Amber	Major night-time roost for this species throughout the season. During autumn and winter feed on <i>Zostera</i> beds but as food declines move to other areas for feeding. Numbers using Dublin Bay 11.6% of national total.
<b>Black-tailed Godwit</b> ( <i>Limosa limosa</i> ) BoCCI Amber	Tends to form dense roosts north of the causeway. Numbers using Dublin Bay 2.7% of national total.
<b>Redshank</b> ( <i>Tringa <math>\square</math> etanus</i> )	Scattered distribution throughout the mudflats. Numbers using Dublin Bay 5.8% of national total.

<b>Waterbird species present in nationally important numbers</b>	
<b>Shelduck</b> ( <i>Tadorna tadorna</i> ) BoCCI Amber	Several pairs breed at North Bull Island intermittently. Wintering numbers using Dublin Bay 8.1% of national total.
<b>Wigeon</b> ( <i>Anas penelope</i> ) BoCCI Amber	Tend to concentrate largely in the channels on the north and south side of the causeway. Numbers using Dublin Bay 0.8% of national total.
<b>Teal</b> ( <i>Anas cracca</i> ) BoCCI Amber	Tend to concentrate largely in the channels on the north and south side of the causeway. Numbers using Dublin Bay 1.7% of national total.
<b>Pintail</b> ( <i>Anas acuta</i> ) BoCCI Red (Wintering)	Tend to concentrate largely in the channels on the north and south side of the causeway. Numbers using Dublin Bay 10.9% of national total.
<b>Shoveler</b> ( <i>Anas clypeata</i> ) BoCCI Red (Wintering)	Tend to concentrate largely in the channels on the north and south side of the causeway. Numbers using Dublin Bay 3.0% of national total.
<b>Red-breasted Merganser</b> ( <i>Mergus serrator</i> )	Numbers using Dublin Bay 1.2% of national total.
<b>Oystercatcher</b> ( <i>Haematopus ostralegus</i> ) BoCCI Amber	Scattered distribution throughout the mudflats and also accumulate in species-specific roosts near the saltmarsh. Numbers using Dublin Bay 4.9% of national total.
<b>Ringed Plover</b> ( <i>Charadrius hiaticula</i> ) BoCCI Amber	Several pairs of Ringed Plover breed, on the shelly shingle/beach material at the northern tip of the island. Wintering populations also present. Numbers using Dublin Bay 2.5% of national total.
<b>Grey Plover</b> ( <i>Pluvialis squatarola</i> ) BoCCI Amber	Scattered distribution throughout the mudflats. Numbers using Dublin Bay 2.3% of national total.
<b>Knot</b> ( <i>Calidris canutus</i> ) BoCCI Red (Wintering)	Large groups feed and roost on the mudflats. Also feed and roost on Dollymount Strand. Numbers using Dublin Bay 8.9% of national total.
<b>Sanderling</b> ( <i>Calidris alba</i> )	Feed and roost on Dollymount Strand. Numbers using Dublin Bay 5.9% of national total.
<b>Dunlin</b> ( <i>Calidris alpina</i> ) BoCCI Amber	Scattered distribution throughout the mudflats. Also feed and roost on Dollymount Strand. Numbers using Dublin Bay 4.6% of national total.
<b>Curlew</b> ( <i>Numenius arquata</i> ) BoCCI Red (Breeding)	Tends to favour the area north of the causeway and the saltmarsh. Numbers using Dublin Bay 1.7% of national total.
<b>Turnstone</b> ( <i>Arenaria interpres</i> )	Present in the rocky intertidal shoreline along the landward edge and along the causeway. Numbers using Dublin Bay 2.0% of national total.

<b>Other species</b>	
<b>Breeding birds</b>	Breeding passerines include Skylark (BoCCI Amber), Meadow Pipit, Stonechat and Reed Bunting. The fixed dune habitat at the northern end of the island is an important breeding area for the first two species. Mallard also breed on the RDGC (Environmental Impact Services 2003).
<b>Other species</b>	Species such as Grey Heron, Cormorant, Goldeneye and Greenshank are regular in winter in numbers of regional or local importance. Gulls are a feature of the site during winter, especially Black-headed Gull and Common Gull. The North Bull Island SPA is a regular site for passage waders, especially Curlew Sandpiper and Spotted Redshank. Kestrel also breed on the island is some of the nesting boxes.

## MAMMALS

<b>Grey Seal</b> ( <i>Halichoerus grypus</i> ) Annex II	There are regularly between 30-40 seals (mixed group with Common Seal) that haul out at the tip of the island or on sandbanks that are exposed at low tide in this area. Grey Seals are breeding at this location (Brendan Price, Irish Seal Sanctuary, pers. comm., 2008).
<b>Common Seal</b> ( <i>Phoca vitulina</i> ) Annex V	Both Grey Seals and Common Seals (also known as Harbour Seal) haul out at the tip of North Bull Island in a mixed group. Common Seals are more common during the summer. Common Seals also breed at this location (Niall Harmey, NPWS, pers. comm., 2008)
<b>Harbour Porpoise</b> ( <i>Phocoena phocoena</i> ) Annex II	It is likely Dublin Bay will be declared a cSAC for porpoises this year (Irish Whale and Dolphin Group, pers. comm., 2008).
<b>Irish Hare</b> ( <i>Lepus timidus hibernicus</i> ) Annex V RDB	Wolfe (1995) estimated the population at 15-20 animals. Since then there has been some declines as well as introductions during the 1990s. Current estimates of the population put the number of Hares as low as 6 with another estimate at 10-15.
<b>Bat species</b> Annex IV RDB	Several species are known to forage over the site although there is very little potential for roost sites on the island. Three species recorded using the site include Leisler's Bat ( <i>Nyctalus noctula</i> ), Common Pipistrelle ( <i>Pipistrellus pipistrellus</i> ) and Soprano Pipistrelle ( <i>Pipistrellus pygmaeus</i> ) (Kealy pers. comm. 2008). Several bat boxes were erected on North Bull Island by DCC staff to encourage Leisler's Bat but it is not known if they are being used by this species. The area around the Wooden bridge is a good area for foraging bats.
<b>Badger</b> ( <i>Meles meles</i> ) Wildlife Act (Sch. 5) RDB	This species is resident on island. Noted as road kill on causeway in the past and an individual has also been caught in traps set for feral cats.
<b>Other Mammals</b>	Both Foxes and Hedgehogs (RDB) are resident on the island. RDGC (1999) noted two Fox dens on the golf course in 1999. Hedgehogs are protected under Schedule 5 of the Wildlife Act (1976).

### 3.8 Geological/geomorphological features of importance

North Bull Island is a relatively young system, having been developing since 1800 (just over 200 years), making it quite unique in Ireland in terms of its relatively young age. Most sand dune systems are much older. The origin of North Bull Island is directly related to the development of Dublin Port and the construction of the North and South Bull walls in the 17<sup>th</sup> and 18<sup>th</sup> centuries. The construction of the two walls led to a change in currents and sedimentation patterns in the bay, and a small dry area was mapped in 1800 soon after the construction of the first wall (South Bull). Subsequent maps indicate the rapid growth of the island (Flood 1977). In 1836 there was a sand barrier with developing dunes 1.61 km (1 mile) long. In 1873 the island had lengthened to 3.22 km (2 miles) and by 1903 it had reached its present length (Mc Intyre 1987).

The formation of the island led directly to the formation of the present mud flats and salt marsh. There was a constant supply of organic material coming down the River Liffey in the 18<sup>th</sup> and 19<sup>th</sup> centuries, because sewage systems were not developed in Dublin City at this time (Mc Intyre 1987). The organic mud built up quite quickly and was soon colonised by salt marsh plants to form a salt marsh against the island. O'Reilly and Pantin (1957) stated that most of the salt marsh at North Bull Island had formed before 1867. The oldest salt marsh is on the southern end of the island. The northern end of the salt marsh from the causeway to the tip of the island developed during 1867 – 1936 (O'Reilly & Pantin 1957). A photograph, taken around 1906 (Flood 1977), had indicated that this salt marsh was already eroding.

The North Bull wall and the developing island soon became an amenity to the people of Dublin (Dublin Corporation 1994). The RDGC developed their golf course in the 1880s and then in 1927 sub-let a portion of their site to SAGC to develop another course. Dublin Corporation then acquired most of the island from the Vernon Estate (apart from the RDGC) and leased some land to SAGC (Dublin Corporation 1994).

The relatively young age of the site is also significant for the geomorphology of the island. The site is actively accreting and is still growing in size with broadening of the sand-dunes, particularly at the southern end adjacent to the North Bull Wall. An Foras Forbartha (1981) describes North Bull Island as of International importance for geomorphological (and ecological) interests. North Bull Island is described as a continually evolving sand spit. The evolution of the 'hook' at the north-eastern tip of the island provides a classic example of recurve geomorphology. The geomorphology of the island is described in detail in Jeffrey *et al.* (1977).

The Geological Survey Ireland (GSI) is still in the process of preparing a draft list of Irish sites of geological importance. The Irish Geological Heritage Programme is being developed by GSI in conjunction with NPWS using a survey on Areas of Scientific Interest in Ireland by An Foras Forbartha (1981) as an initial starting point. North Bull Island is listed on the draft County Geological Sites list (GSI pers. comm. 2008) as a site of regional importance for its coastal geomorphology. The Wildlife (Amendment) Act 2000 provides for designation of Natural Heritage Areas (NHAs) which will include geological sites. Until actually designated, there is no real protection for any important sites identified by GSI and recommended for NHA status. Any future designation at North Bull Island for geological or geomorphological importance is likely to be at NHA level.

## 4 MANAGEMENT ISSUES AND RECOMMENDATIONS

This section discusses some of the main management issues that affect North Bull Island. Many of these issues were raised during the preliminary meeting held at North Bull Island in December 2007 between relevant DCC and NPWS staff. Some issues were also raised during the consultation process. Recommendations according to best practice and practical day-to-day management are made for each of these issues.

### 4.1 Impacts on the hydrology of the island

One of the most important dune habitats at North Bull Island are the dune slacks, which are also an Annex I habitat. The North Bull Island Alder marsh (northern dune slack) contains several rare and uncommon plant species. Dune slacks support characteristic vegetation communities dependent on a seasonally high freshwater table, including the formation of temporary or even permanent ponds during winter when water rises above the ground level. There may also be some brackish (seawater) influence on the dune slacks from a layer of percolating seawater that is situated under the freshwater 'lens'.

In some dune systems with important slacks, a long term fall in the water table has led to loss of the specialist slack flora and invasion by coarse vegetation and scrub at sites across Europe (Doody 2002, Grootjans *et al.* 2004). While unusually dry summers can exacerbate this problem, the most consistently cited long-term causes are believed to be local extraction of water and/or drainage of adjacent land used for agriculture, housing and golf courses (JNCC 2007, NPWS 2008).

There have been several indications in the past few years that the Alder marsh at North Bull Island was subject to changes in hydrology. DCC staff noted changes in the vegetation of this area during the 1990's and initiated PhD research recently completed by Devaney (2008). The recent spread of scrub (including the invasive Sea Buckthorn) in this area is one indicator, signifying drier conditions. Increases in Sea Rush abundance possibly indicate an increased saline element to the hydrology. It has been hypothesised that impacts on the hydrology of the freshwater lens is leading to increased saline infiltration into the freshwater table. Standing water levels during the winter were also affected and the Alder marsh was not flooding as extensively in winter (Devaney 2008). It is thought that these changes were occurring too rapidly to be explained by natural habitat succession.

A recently completed PhD research project partially funded by DCC studied the hydrology, vegetation and restoration prospects of the Alder Marsh at North Bull Island (Devaney 2008). Two boreholes were used to study groundwater levels. One was placed in the Alder marsh and an additional borehole (funded by NPWS) was placed in a dune slack at the south of the island. Piezometers were used to measure groundwater levels in the Alder marsh.

This study found that several moss species that indicate wetter conditions in the Alder marsh were disappearing and the abundance of Devil's-bit (*Succisa pratensis*) was increasing, which would suggest a drier habitat). Devaney (2008) considered that vegetation more typical of wetter conditions could be lost due to changing soil conditions and inability to compete in drier areas. The impacts of climatic factors such as changes in rainfall deposition along the east coast of Ireland were also considered. This study predicted that continued drying of the Alder marsh would probably lead to the loss of important dune slack habitat, and to the development of dune heath habitat (scrub) and finally to woodland. Devaney (2008) concluded that there was a strong indication that water extraction could be affecting ground water levels in the Alder marsh.

### **RECOMMENDATIONS**

- It is recommended that the hydrological monitoring on the island is continued by DCC/NPWS/EPA. Further monitoring of the water tables and of the size of the annual recharge to the water table on the island is needed. This monitoring programme should be expanded if possible.
- Active management is required for this issue and consultation with both golf courses is needed about water management issues such as drainage, local water abstraction on the island, water budgets, methods of water collection and irrigation.

## **4.2 North Bull Island causeway and sedimentation**

The construction of the causeway to the island in 1964-65 had a significant impact on current flows and sedimentation patterns in the intertidal area. This soon led to the sudden accretion of a sediment bank north of the causeway that was soon vegetated by Glasswort, creating the *Salicornia* flats, and then was colonised by Common Cordgrass. Extensive green algal mats also appeared. Concerns were soon raised about the habitat changes caused by the construction of the causeway, particularly as it was thought they would have a negative impact on the status of the feeding grounds used by the wintering waders and wildfowl (Goodwillie & Fahy 1973). There have been several surveys and reports carried out by An Foras Forbartha (1977, 1980, 1984) and for DCC by independent consultants e.g. (CAAS 1990, ESB International 2002) since the causeway was built to examine various issues with the construction of the causeway, subsequent sedimentation and the spread of Common Cordgrass.

Dublin Corporation commissioned a study in 1996 (ESB 1996) to examine the impact of reopening the causeway and enhancing water-flow between the north and southern sections with the aim to reduce or prevent further sedimentation in the intertidal areas. This was in response to continued public concerns about sedimentation in the intertidal areas between North Bull Island and the mainland and perceived negative impacts of this sedimentation on the environment and on the amenity use. A second report, the Environmental Impact Assessment (ESB International 2002) came to the conclusion that re-opening the causeway would have a minimal or no impact on sedimentation and that the 'do-nothing approach' was recommended. This report also noted that retaining the causeway also prevented any major pollution episode in Dublin Port from directly affecting the intertidal area to the north of the causeway.



Older reports documented a sudden change in sedimentation patterns and a rapid development of *Salicornia* flats after the construction of the causeway (An Foras Forbartha 1977). The extent of the *Salicornia* Bank was measured at 35-38 ha in 1977. By the late 1980's CAAS (1990) noted that sedimentation had reduced to scarcely measurable rates and the extent of *Salicornia* flats (32 ha) was not increasing significantly. By 2006, the area of *Salicornia* flats was measured at 28 ha (McCorry 2007). So the extent of *Salicornia* flats has not increased significantly, although there have been some losses and gains since 1990. Changes in the extent of the *Salicornia* flats can be used as a simple indicator of accretion during this period.

The North Bull Island Causeway Study (ESB International 1996) found that there had been significant deposition of sediment between 1970 and 1995. This study predicted that in the long-term (in excess of 200 years) the extent of the water body between the island and the mainland would decrease. ESB (2002) found that sediment was accumulating at a rate of about 5 mm/year between 1995 and 2000. Recent growth to the ASM along this causeway also indicate there is some active accretion, as a wide pioneer vegetation zone is present (McCorry 2007). So sedimentation is likely to be still occurring, although at a much slower rate compared to the period immediately after the construction of the causeway.

It seems likely that the intertidal areas will slowly gain sediment and increase in level (ESB 2002). There are indications that the saltmarsh (ASM) is growing at the causeway (McCorry 2007 and fieldwork for this Management Plan), but this is likely to occur at a slow rate. Changes in sea-level due to predicted climate change also have the potential to modify the physical environment in the intertidal area (Fealy 2003). It is difficult to predict with any accuracy the rate of any changes in the extent of intertidal habitats due to sedimentation. ESB (2002) noted that predictions of changes in the intertidal area between the mainland and the island were 'fraught with uncertainty'.

### **RECOMMENDATIONS**

- Since the publication of the last major report on the impacts of the causeway (ESB 2002), there have been no significant moves to re-open the causeway. Both DCC and NPWS recommend that this policy is continued. No active management is required as these changes are largely benign, occurring at slow rates and will result in natural succession of habitats.
- Further monitoring of the development of intertidal and saltmarsh habitats in relation to sediment accretion, erosion of saltmarsh, changes to the extent of the *Salicornia* flats and the spread of Common Cordgrass would be useful, particularly as there is already extensive information available about changes in this area between 1970's to present. This monitoring would form part of general monitoring of habitat extent and change on the island.

### 4.3 Saltmarsh accretion and erosion

The Saltmarsh Monitoring Project (McCorry 2007) noted that the saltmarsh is undergoing some changes due to geo-morphological erosional and accretional cycles. Some of these changes are related to the presence of the North Bull Island causeway and are discussed above.

Signs of natural erosion occur along the seaward side of the saltmarsh and the saltmarsh cliff at certain places, particularly towards the northern tip of the island and the central part of the southern section. The vegetation of the seaward side of the saltmarsh seems to be dying back in places. Sea Purslane seems to be dying off and the layers of saltmarsh mud (distinct from the mudflats) are eroding in places. *Salicornia* spp. are colonising the bare mud patches in the eroded areas, so erosion is creating pioneer saltmarsh in places. This was noted by McCorry (2007). However, recent survey work for this study found that the impacts of erosion in 2008 seemed much more extensive compared to the last survey (McCorry 2007) in 2006.

The erosion of the saltmarsh may be part of a relatively long geomorphological cycle, as signs of erosion were noted at these locations in the 1950s (O'Reilly & Pantin 1959). These erosion indicators have been present for some time (Jeffrey *et al.* 1977). The actual rate of erosion is quite slow. There was no significant loss of saltmarsh due to erosion as indicated from a comparison of aerial photos between 1995-2005. Any loss of saltmarsh from the island close to the northern and southern ends may be compensated by the growth of the saltmarsh north of the causeway.

#### **RECOMMENDATIONS**

- It is recommended that accretion and erosion of the saltmarsh should be allowed to continue naturally. The northern tip of the island is extremely dynamic and any natural changes in the position of the dunes are likely to influence the extent of saltmarsh, including possible erosion.
- Further monitoring of the development of intertidal and saltmarsh habitats in relation to sediment accretion, erosion of saltmarsh, changes to the extent of the *Salicornia* flats and the spread of Common Cordgrass would be useful, particularly as there is already extensive information available about changes in this area between 1970s to present. This monitoring would form part of general monitoring of habitat extent and change on the island.

## 4.4 Management of Common Cordgrass (invasive species)

Common Cordgrass (*Spartina anglica*) is a non-native fertile grass species that spreads on mudflats, sandflats and saltmarsh and is listed on the National Invasive Species list (Stokes 2004). It can form extensive swards in the lowest part of the saltmarsh. Stands of Common Cordgrass have been considered of low intrinsic value to wildlife and this species has been controlled at North Bull Island in the past.

### STATUS OF COMMON CORDGRASS

The ecology and spread of Common Cordgrass at North Bull Island has been documented in detail by Boyle (1977) and McCorry (2002). Small clumps of species initially began to spread on the mudflats north of the causeway after its construction in 1965. The construction of the causeway to the island in 1965 affected tidal currents and lead to the deposition of sediment north of the causeway. This area was soon colonised by Glasswort (*Salicornia* spp.). Around this time Common Cordgrass began to spread in this area. It spread quickly over the large area known as the *Salicornia* bank and is now distributed along most of the salt marsh. DDC attempted to control Common Cordgrass during this period (1970-1995) with varying success.

Clumps of Common Cordgrass are now distributed over a defined area on the *Salicornia* flats north of the causeway with occasional clumps also being found in the area mapped as mudflats. Common Cordgrass is still patchy in the *Salicornia* flats, forming a mosaic with Glasswort, and generally does not form the dense swards on soft mud seen at other sites, such as at Baldoyle (McCorry 2007). The average cover was estimated to be about 14% in 1999 (McCorry 2002). Clumps are also frequently found along the edge of the saltmarsh and causeway and distributed over the entire length of the saltmarsh on both sides of the island. Common Cordgrass has colonised bare salt pans on the saltmarsh and can also be found amongst established Atlantic salt meadow vegetation, though it is generally found at low cover values (0-5%) with some denser patches towards the seaward edge (20-40%).

### ECOLOGICAL IMPACTS OF COMMON CORDGRASS

Many of the impacts of Common Cordgrass on flora, infauna, birds and environment recorded at other sites (Doody 1984, Nairn 1986, Adam 1990, Grey & Benham 1990, McCorry *et al.* 2003, Lacambra *et al.* 2004, Doody 2008) have not been noted specifically at North Bull Island (See Appendix IV, [Section 7.4.2](#) for a more detailed discussion). Significant areas of sward have not developed yet at North Bull Island and Common Cordgrass is not considered a significant threat to Atlantic salt meadow habitat. Many clumps of Common Cordgrass are present on the *Salicornia* flats and this species does pose a threat to the extent of this habitat if it forms a sward in the future.

Many wintering wader species are also dependent on the rich macro-invertebrate populations of mudflats that occur seaward of salt marshes. It was suggested that the spread of Common Cordgrass reduced the size of the feeding area and the amount of feeding time available to wintering waders and wildfowl (Goss-Custard & Moser 1988). Most waders and wildfowl can not or will not feed within or close to dense swards or meadows of Common Cordgrass. However, there are no quantitative data available for North Bull Island to indicate that the spread of

Common Cordgrass has had a measurable impact on the conservation status of wintering waders and wildfowl. Common Cordgrass does not form extensive swards that exclude these species. Several studies (An Foras Forbartha 1977 & CAAS 1990) have stated that as Common Cordgrass only affected a small proportion of the whole feeding grounds in Dublin Bay, the effect of Common Cordgrass on wintering birds might be negligible. However, other scientists (Crowe 2005), state that even small losses of feeding ground habitat could have a negative impact (which may not be shown by I-WeBS bird counts). More specific bird counts are probably required to properly measure any impact on wintering birds from the spread of Common Cordgrass.

### MANAGEMENT OF COMMON CORDGRASS

DDC attempted to control Common Cordgrass in the past (1970-1995) with varying success (See Appendix IV, [Section 7.4.2](#) for more detailed discussion). Dublin Corporation re-assessed its *Spartina* management strategy in 1994 and decided to cease control of Common Cordgrass and to monitor its spread (Otte 1994). Stands of invasive *Spartina* (mainly *S. anglica* and *S. alterniflora*) grasses are still being controlled in many parts of the world due to negative impacts on nature conservation value (Doody 2008). Control was carried out in Northern Ireland in the past using the herbicide, Dalapon, but this is now ceased as Dalapon is not produced any more and is not licensed for use in this environment. The NIEA is currently attempting to get another herbicide (Fusilade) licensed for use in the intertidal environment by the appropriate authorities in Britain.

However, it should be noted that attitudes towards Common Cordgrass have changed somewhat in Britain and elsewhere. Lacamdra *et al.* (2004) in a review of the status and management of Common Cordgrass in Britain stated that there is no general consensus about its management and Common Cordgrass is generally not actively managed in Britain. This change in attitude recognises that the threat of Common Cordgrass on established saltmarsh in Britain is now less than originally perceived (Boorman 2003). This change in attitude also takes account of the general ineffectiveness and cost of some control attempts in the past.

### RECOMMENDATIONS

- There are valid arguments both for the control of Common Cordgrass and for non-intervention and this is a very complicated issue (See also Appendix IV, [Section 7.4.2](#) for a more detailed discussion). However, it is not recommended to begin control of Common Cordgrass at this time. At present, any measurable beneficial impacts of control on conservation status of notable habitats and species do not significantly offset the potential negative impacts of any control programme. However this policy may change in the future following reviews of saltmarsh conservation by NPWS.
- Further monitoring of the situation is recommended. It would be useful to carry out more detailed modelling of the potential spread of Common Cordgrass in the future, similar to the modelling carried out by Cooper *et al.* (2006) in Northern Ireland. This would produce a more accurate model of the potential climax distribution of Common Cordgrass at North Bull Island and would be more accurate than the models produced by McCorry (2002).
- There are significant gaps in knowledge of actual impacts of Common Cordgrass on avian fauna in Ireland. A research programme investigating the use of saltmarsh,

*Salicornia* flats, mudflats and sandflats containing clumps and swards of Common Cordgrass by resident and wintering bird species would be extremely useful in quantifying any negative impact of Common Cordgrass on avian fauna. NPWS should initiate this research in partnership with third level institutions with experience in avian ecology and/or with Birdwatch Ireland.

- Several rarer forms of *Spartina* (*S. x townsendi* and *Spartina maritima* forma *dublensis*) have been recorded at North Bull Island in past but not recently (See Appendix IV, [Section 7.4.2](#)). These species are worthy of conservation if they are ever re-recorded.

## 4.5 Management of Sea Buckthorn (invasive species)

Sea Buckthorn (*Hippophae rhamnoides*) is a native of South East England and was introduced to Ireland in the 19<sup>th</sup> Century. It has now become established on a number of dune systems around the country. This is a thorny bush that grows generally as a shrub up to 3 m high but can form trees up to 6 m high (Pearson & Rogers 1962) (see also Appendix IV, [Section 7.4.3](#)). Sea Buckthorn was deliberately planted as hedging for amenity purposes, particularly in coastal situations, as it is very effective at stabilising sand dunes. However it can form extensive impenetrable thickets with low species diversity and can rapidly spread on open and closed sand dunes, significantly changing the vegetation cover and replacing natural dune plant communities (Binggelli *et al.* 1992, Gaynor 2008). Nutrient enrichment, increased stabilization and acceleration of succession occurs. Sea Buckthorn also changes the composition of invertebrate fauna such as ground beetle communities.

The spread of this species is a significant threat to the priority Annex I sand dune habitat, fixed dune (2130), in Ireland (NPWS 2008). As a non-native and invasive species, it is no longer recommended for use in dune stabilisation projects. Sea Buckthorn was planted on North Bull Island in the past, mainly within both golf courses for shelter. It is now widespread in its distribution, mainly within the fixed dune habitat, but can also be found within dune slack and more recently in some of the more open fixed dune/Marram dune habitat.

Dublin City Council has removed some stands of Sea Buckthorn in the recent past. DCC staff at North Bull Island have attempted several methods in conjunction with some volunteer groups including Conservation Volunteers from Fingal. Some large areas were cut and the stumps were painted with Glyphosate herbicide. This method had variable results and there was some regrowth in these areas. Volunteers have also been used to pull up seedlings.

Most recently a JCB has been used by staff on North Bull Island to 'rip' the bushes from the ground. The mechanical bucket of the JCB is used to pull out the shrub from the loose sandy soil and generally rips the surface leaving a small gap. This method means that root material is also removed and there are fewer possibilities for regrowth from underground rhizomes. Controlled material is stacked up for disposal. This method of control with the use of heavy machinery comes under cSAC 'Notifiable Actions' that require the consent of the DoEHLG. However, NPWS staff were happy with this method of control and it was felt that the damage to the soil was minimal as long as wide low pressure types were used on the JCB. This method is similar to

best-practice methods of Sea Buckthorn removal used at other sites (Brooks & Agate 2000, Sefton Coast Partnership 2004) (See Appendix IV, [Section 7.4.3](#)).

NPWS staff have indicated that Sea Buckthorn control should not be carried out between March and August due to the impact on songbirds nesting in the various patches of scrub and to conform with the requirements of the Wildlife Act.

Consultation with the two golf clubs is required about the management of this invasive species. Even if Sea Buckthorn is cleared from the areas of the island managed by DCC, the remaining Sea Buckthorn within the golf courses provides a seed source for re-colonisation. DCC has initially made contact with the two golf courses regarding the management of Sea Buckthorn. The Irish Golf Course Ecosystems Project recommends that suitable scrub species for use on golf courses as alternative species to Sea Buckthorn include native species such as Willow, Elder, Gorse and Scots Pine ([www.ckes.ie/golf](http://www.ckes.ie/golf)).

### **RECOMMENDATIONS**

- It is recommended that the current methods for the control of Sea Buckthorn using the mechanical bucket of the JCB continue to be used. This method is one of the most successful methods of control used at other sites.
- Sea Buckthorn leaf litter in the larger cleared areas should be raked up.
- Volunteers should continue to be used to gather and pull up young seedlings in open fixed dune and dune slack habitats.
- Control works should continue to comply with the Wildlife Act so no shrubs should be removed during the bird-nesting season (April to August). This does not apply to the collection of seedling plants. Official consent should be obtained from NPWS before control works, as these works are a notifiable action.
- Detailed consultations with the two golf courses and a management programme to replace Sea Buckthorn scrub on the two golf courses is required to effectively manage this issue on North Bull Island.

## **4.6 Other alien or invasive species**

There are numerous shrubs and small trees throughout the site, but not currently to such an extent as would require intensive management (Ryle *et al.* 2009). This potential spread of Sycamore was highlighted by the draft NPWS conservation plan of North Dublin Bay cSAC (NPWS undated 1996?).

### **RECOMMENDATIONS**

- It is recommended that a survey of the terrestrial parts of the island identify any areas that are at risk from the spread of Sycamore.



- Species such as Sycamore could be cut down as there is little potential for regrowth. Shrubs and small trees can be left to rot away on the ground.

## 4.7 Boundary issues

Most of the island apart from the two golf courses, which are excluded, has been designated as a cSAC and as a Nature Reserve. The current digital cSAC and Nature Reserve boundaries around the excluded golf courses approximate to but do not correspond with the actual boundaries of the two golf courses, meaning that some Annex I habitat (sand dune and saltmarsh) is excluded from the statutory designations (see Map 1). The cSAC boundaries are actually different than the Nature Reserve boundaries, although they should correspond to approximately the same area. This is most obvious when digital GIS layers marking the cSAC and Nature Reserve boundaries are overlain over aerial photos and OSI maps of the island. There are no significant problems with pNHA and SPA boundaries. These boundary problems were caused by a combination of imprecise cartography, the use of several out-of-date base maps to prepare boundaries and the transformation of OSI 6 inch map projection to a digital format. Boundaries of designated sites will be re-drawn by NPWS in the near future as digital boundaries are transferred to an OSI 1:5000 map series projection, and this should correct these errors.

Currently in the northern section of the island there is an issue with a section of ill-defined boundary between the SAGC and the salt marsh. Generally there is low embankment at the landward side of the saltmarsh. A fence marking the golf course boundary is present on top of this embankment. However, part of this boundary has always remained unfenced and the embankment is open. There are ongoing consultations between DCC, NPWS and SAGC to resolve these boundary issues.

### RECOMMENDATIONS

- Any unenclosed sections of the golf courses should be fully fenced off to the satisfaction of all parties. Any fencing should be 'wildlife friendly' and should not pose a threat to low flying birds or cut off wildlife corridors used by mammals, especially Hares. Fencing should only be 1 m high with small gaps at the base to allow access between the golf course and surrounding habitats to mammals. A 'ranch style fence with three strands of wire may be the most 'wildlife friendly' option.
- The cSAC and nature reserve boundaries should be re-drawn by NPWS in the near future to properly correspond with the actual boundaries of the two golf courses.

## 4.8 Bait-digging

The taking of bait by individuals for the purposes of fishing has long been carried out on the intertidal mudflats and sandflats at North Bull Island. The areas around the wooden bridge to the Bull Wall and around Sutton Creek at the north of the site are most frequently used. Bait digging at 'low-levels of intensity' does not represent a significant negative impact. However, in the recent past, this process has been observed by NPWS staff and staff at North Bull Island on a

“commercial” basis where larger organised groups have come to dig for bait. This type of bait digging is not carried out under licence from any authority. There are concerns that sustained bait digging could deplete invertebrate infauna within the mud and sandflats that are an important food source for wintering (and resident) waders and wildfowl. Disturbance of wintering waders and wildfowl by bait diggers during the autumn and winter is also of particular concern and this disturbance affects feeding.

Both NPWS staff and DCC staff at North Bull Island have indicated that bait digging at North Bull Island now requires regulation and strict guidelines to prevent negative impacts to the wintering waders and wildfowl. However, there is no research available to indicate the level of impact of this activity to wintering waterfowl or the impact of any depletion of bait as a food source for waders at North Bull Island.

The Department of the Marine (now in The Department of Agriculture, Fisheries and Food) is the authority that regulates and issues licenses to commercial activities such as fishing and aquaculture below the foreshore and is the authority listed as responsible for management of North Bull Island Statutory Nature Reserve (S.I. 231 of 1988) (intertidal, estuarine and marine sections). However, this department has had no direct involvement in the conservation management of this site. NPWS and DoEHLG are now the authority with responsibility for regulation of bait digging within designated areas such as North Bull Island cSAC/SPA.

The mechanism for controlling bait-digging is the notifiable actions procedure for the SPA. Notifiable Actions issued by NPWS for designated sites (SACS/SPAs/NHAs) with intertidal mudflats and sandflats indicate that ‘digging, ploughing or otherwise disturbing the substrate’ requires the permission of the Minister for the Environment, Heritage and Local Government. (This also would apply to commercial bait digging.) Therefore, bait digging on a designated site should be regulated by NPWS. An application for consent form for activities listed under Notifiable Actions is supplied by NPWS.

A related impact is the collection of shellfish. DCC Staff at North Bull Island suspect that there may be commercial collection of Cockles and Mussels at times. However, there is no official licensing of this practice by The Department of Agriculture, Fisheries and Food.

### IMPACTS OF BAIT-DIGGING

There is a significant gap in the knowledge about the impacts of bait digging in Ireland. Heffernan (1999) reviewed some of the impacts of inter-tidal harvesting in Ireland and found that both bait-digging and commercial harvesting of bait had significant negative impacts on their environment. Harvesting of Lug and Ragworms has a severe impact on the benthos whether harvesting is by hand or by machine, although harvesting by hand is by far less harmful to the non-target sediment fauna (Heffernan 1999): Harvesting may result in the sediment becoming coarser in the long term, may destroy/damage food sources for both birds and fish, and larger species may take years to recover. Manual or mechanical digging can also cause disturbance to wintering wildfowl feeding.

Fowler (1999) also reviewed the impacts of bait digging in Britain. The review found that disturbance of wintering waterfowl by the presence of bait collectors on the shoreline is well documented. However the impacts of prey species depletion on wintering waterfowl populations

are less well known. Impacts on the physical environment have been recorded and bait-digging can leave persistent holes for months and cause mixed sediments to become coarser through the loss of fine sediment via erosion. Population studies of prey species show that over-collection can significantly deplete target prey species such as Lugworm and Ragworm, and can also affect non-target invertebrate species living in the intertidal sediment.

### MANAGEMENT OF BAIT-DIGGING

Several stakeholders have suggested that monitoring of the actual quality of Ragworm, Lugworm and other bait being taken is required. Other suggestions for management is a zero-take zone in the intertidal area where there could be no bait-digging, a possible bag limit to limit the quantity of bait being taken and a possible time or seasonality limit to reduce disturbance to wintering waders and wildfowl. The development of a permit system (issued by NPWS) possibly through local angling groups has been suggested. Fowler (1999) states that a precautionary approach be taken in response to disturbance and habitat loss to waterbirds. Codes of conduct for bait-digging have been produced by local authorities in Britain (see Appendix IV [Section 7.4.4](#)).

### RECOMMENDATIONS

There are no quantitative data to show that the collection of bait is having a negative impact on the wintering waterbird populations, infauna populations or the intertidal mudflat and sandflats environment at North Bull Island. However there is plenty of anecdotal evidence that disturbance to wildlife is taking place. DCC staff have indicated that this is one of the most important issues affecting North Bull Island at present.

- It is recommended that bait-digging is regulated in some way at North Bull Island. This activity is already listed as a Notifiable Action for the cSAC and SPA and therefore should be licensed by NPWS. However, this activity is taking place despite the current regulations. Stricter enforcement and regulation are required. Guidelines for bait-digging regulation in designated areas are required from NPWS.
- Options such as no-take zones in the intertidal areas or even sacrificing areas to bait-digging should be considered. A bait-digging management plan and a code of conduct should be considered. Signage may be required at suitable points at the Wooden Bridge, North Bull Island Causeway and Sutton Strand to outline the code of conduct and publish any restrictions. Monitoring of the impacts of disturbance from bait-diggers to waterfowl and impacts to populations of target species should be considered as part of any Bait-digging management plan. Commercial collection of bait should be prohibited or licensed within the cSAC. 'Appropriate assessment' may be required for this activity.
- Consultation is required with bait-diggers regarding establishing a code of conduct for bait digging.
- Liaison is also required with Fingal County Council which manage the Sutton Strand section to the intertidal area.

## 4.9 Impacts of recreational disturbance

North Bull Island is an important amenity to the people of Dublin. The site is used by walkers, cyclists, bathers, beach lovers, nature enthusiasts, bird-watchers and many other users. However, the use of the site as an amenity can create conflicts for nature conservation, particularly where users can disturb wildlife. Recreational use can also have positive impacts as well, particularly on the dune vegetation (see [Section 4.16](#)). The impacts of recreational disturbance are wide-ranging and some specific impacts are dealt with in different sections such as impacts on dune vegetation and the use of the site by kite buggies and land yachts. Several recreational activities such as bonfires, barbecues and the use of model aircraft etc are regulated or prohibited in parks in Dublin (including North Bull Island) by the Parks and Open Spaces Bye-laws (DCC 2002).

It is difficult to quantify the various individual impacts of different recreational activities on wildlife, such as bird-watchers, walkers, walkers with dogs, unrestrained dogs and other users such as kite-surfers and land-yachters. The below section focuses on unrestrained dogs, as DCC and NPWS staff have indicated that this is one main causes of disturbance to wildlife at North Bull Island.

### IMPACTS OF DISTURBANCE BY UNRESTAINED DOGS

As an easily accessible and large site, North Bull Island is favoured by walkers including dog walkers. Many people walk their dogs along numerous trails within the dune system, on the saltmarsh and along Dollymount Strand. Dogs are required to be on a leash at North Bull Island according to bye-laws issued by DCC (Dublin City Council 1998). These bye-laws describe times when dogs are required to be on a leash in gardens, parks, fields, open space and seashore. The SAAO states that “unleashed dogs shall not be permitted on the island in order to protect the Irish Hare population and also to protect ground nests and chicks of ground nesting birds (7.13)” (Dublin Corporation 1994).

However, it is not uncommon for owners to allow dogs off the lead to enjoy some freedom. This can cause disturbance to wildlife on North Bull Island. This includes Hares that are resident on the fixed dune and the saltmarsh, Seals that use the sand banks near the north tip of the island, ground-nesting birds (like Skylark) that use the fixed dune and saltmarsh, waders such as Sanderling and Plover spp. that feed on the beach and sandflats along Dollymount Strand and groups of wintering waders and wildfowl that feed and roost on the intertidal habitats around North Bull Island. DCC staff at North Bull Island have frequently observed dogs off their leash that disturb individuals and groups of birds on the beach, dune and saltmarsh.

DCC staff at North Bull Island frequently request owners of unrestrained dogs to put them on a lead according to the bye-laws for North Bull Island (as a public park). There have also been some successful prosecutions by the DCC Dog Warden at North Bull Island.

The DCC BAP discusses the negative impact of unrestrained dogs by disturbing wildlife, especially in Dublin Bay, and states that since North Bull Island is a nature reserve, dogs must be kept on leads. Natural England, which manages many of the nature reserves in England, also states that dogs are required to be on leads at many of its reserves. Some Nature Reserves ban dogs altogether. The British Countryside and Rights of Way Act (Countryside right to roam)

requires members of the public to keep their dogs on leashes in open countryside (Natural England 2008). The National Trust welcomes responsible dog walkers to its properties but states that loose dogs is one of the most significant issues affecting nature conservation on its properties (National Trust 2008). The National Trust has drawn up guidelines for responsible dog walking on its properties.

### IMPACTS OF ROAMING DOGS ON WILDLIFE AT NORTH BULL ISLAND

Research by Wolfe (1995) found that human disturbance (walkers and unrestrained dogs) was the most significant factor in the decline of Hare numbers at North Bull Island during the early 1990s. However there is little other quantitative data at North Bull Island to indicate levels of disturbance or to measure levels of disturbance to birds at North Bull Island from unrestrained dogs. Most of the evidence at North Bull Island is of an anecdotal nature and focuses on observations of disturbance to birds and other wildlife. However, Phalan and Nairn (2007) point out that the current rates of disturbance on waterbirds from people and dogs in South Dublin Bay are high enough to have an impact on their survival during stressful periods when days are short, food is scarce and weather can be harsh. Taylor *et al.* (2005) cite several studies that show negative impacts on waders from dogs and dog walkers at other sites (See Appendix IV, [Section 7.4.6](#)). So uncontrolled dogs on Dollymount Strand are likely to have some impact on wildlife using this area although its magnitude is unknown.

The impact of disturbance to breeding birds in the dunes, beach and saltmarsh areas is not known. Several species still breed in these areas, but it is not known what the reproductive potential would be if this disturbance was removed. Studies at other sites have shown that if the level of disturbance is removed or lowered, then breeding bird populations can increase (Taylor *et al.* 2005).

Phalan and Nairn (2007) recommend that initiatives that are aimed to minimise contact between dogs and waterbirds would be the most effective way of reducing disturbance. They recommend the zoning of important feeding and roosting areas as dog-free during sensitive times of the year and continued public education to encourage people to keep dogs on a leash and adhere to any regulations. They also point out that despite high levels of human activity around Dublin Bay, the site still remains an internationally important for wintering waterbirds, which suggests that the birds are compensating to some degree to the levels of disturbance.

### RECOMMENDATIONS

Experience of dog control policies by site managers in Britain on sites of nature conservation interest (Taylor *et al.* 2005) indicates that regulations and bye-laws remain the one of the most effective methods to control disturbance by dogs.

- It is recommended that current legislation related to dog control (restricting dogs to being 'on leash') at North Bull Island is enforced. There is anecdotal evidence that dogs 'off leash' at North Bull Island disturb wildlife. There is plenty of evidence from other sites that dog disturbance can have a significant negative impact on factors like reproductive potential and breeding success of birds, and feeding by waders (See Appendix IV, [Section 7.4.6](#)).

- As part of this policy, there should be renewed effort to increase awareness of this by-law amongst the public. Some access points already have signs indicating that dogs must be on a leash at all times. The posting of regulations and fines for having your dog 'off leash' on the signs around North Bull Island should be considered to help enforcement.
- Public awareness should also be increased by the use of the internet (DCC web page) and via signs, leaflets and information at the Interpretative Centre. There is currently no information about restrictions to dogs on the DCC web page about North Bull Island. DCC staff indicate that there is considerable mis-information about the management of North Bull Island and the 'rights' of its users, many of which think they have the 'right' to allow dogs to roam.
- The potential for prohibiting dogs (including dog walkers and other walkers) from the northern tip of the island should be explored. This area is the most isolated spot on the island and is the most suitable spot on the island to prevent all access to reduce disturbance. This would significantly reduce dog disturbance to the Seal colony and may also help breeding success of Ringed Plovers, Skylark and Meadow Pipit that breed in this area. Some of this area was fenced off in the past to prevent disturbance to the Little Tern breeding colony.

#### 4.10 Little Tern conservation at North Bull Island

Little Terns (*Sterna albifrons*) bred at North Bull Island until the early 1990s but there have been no recorded breeding pairs in the past 15 years. Little Tern is an Annex I (Birds Directive) species and is one of the rarest breeding seabirds in Ireland. Its overall population status in Ireland was estimated to be 390 pairs in 2000 (xxxx). It is a migratory species and is a summer visitor to Ireland. This species nests in a small scrape in sand or shingle material. The main stronghold for this species on the east coast is the Kilcoole/Newcastle colony in Co. Wicklow. This colony has been protected by a 24-hour warden service in the breeding season, managed by Birdwatch Ireland and NPWS. The wardens limit disturbance to breeding colonies by people and by predators. A second colony has developed at Baltray in County Louth in recent years and 30 pairs nested at this site in 2007 (Louth Nature Trust 2007). This colony has also been monitored by wardens organised by local bird-watchers.

On North Bull Island, this species bred on the shelly beach material found around the northern tip of the island. Breeding pairs peaked in 1987 when 88 pairs were recorded. DCC actively managed this area for breeding birds and the northern tip of the island was temporally fenced off to limit disturbance from walkers and other users. A temporary warden was also hired in 1987. Walkers on the beach were requested to avoid nesting birds between May-July and to keep dogs under control in this area. However, numbers dwindled and in 1992 only 1 pair was recorded. It is thought that breeding declined due to increased disturbance, impacts of predators such as foxes, magpies and crows and to possible changes in substrate (Merne pers. comm., to MS 2008).



Merne (pers. comm. to MS 2008) has not seen any terns (of any species) attempting to nest at North Bull Island for several years. However, he considers that it would be worthwhile to monitor the northern tip between May-August to see if any attempts are made to nest. NPWS staff have noted several tern species cruising in this area and feel that some attempts to nest may have been made in recent years. The I-WeBS counts of waterbirds show that only one Little Tern individual has been recorded at North Bull Island in the past 5 years, although up to 5 individuals have been observed flying in the area by NPWS staff. Merne (pers. comm. to MS 2008) considers that a successful breeding colony would require 24 hour/7 day a week protection by a warden stationed on site between May to the end of August (arrival of adults to last fledging of young).

Birdwatch Ireland has developed significant experience in the conservation of Little Tern colonies in the recent past through the Kilcoole/Newcastle Little Tern protection scheme. Wardens at Newcastle/Kilcoole use a caravan on site and are on site 24 hours a day during the breeding season. Wardening involves liaisons with users on the site to limit disturbance to breeding sites and preventing disturbance by predators as well as monitoring the success of breeding. Other management involves the use of pest controllers to scare off predators like rooks and fencing to keep out predators like foxes.

The Louth Nature Trust (Louth Nature Trust 2007) in collaboration with NPWS and Birdwatch Ireland is managing the conservation of the Little Tern colony at Baltray, Co. Louth. This conservation management involves fencing off the breeding site and organising wardens to keep predators at bay and liaise with other users of the area to prevent disturbance. Predation by Hooded Crows was found to be the main cause of Little Tern nest failure but 41 chicks fledged successfully in 2007. The report about this project describes a huge amount of effort involved with the conservation of Little Terns, including many hours by volunteers.

The potential for this species to begin re-breeding at North Bull Ireland is low without significant intervention, resources and management, such as wardens being present on the site for 24 hours. This could pose practical difficulties at North Bull Island, especially at the tip of the island. However, the experience developed by Birdwatch Ireland and The Louth Nature Trust could aid the management objectives for this species at North Bull Island. These experiences indicate that considerable effort (and funding) is required to successfully re-establish and maintain a Little Tern breeding colony.

### **RECOMMENDATIONS**

- It is recommended that a survey takes place to examine the suitability of the habitat at the northern tip of North Bull Island as a breeding site for Little Tern. Advice should be sought from Birdwatch Ireland and/or NPWS staff experienced in Little Tern conservation to assess the potential for Little Tern to breed at this site with suitable conservation measures.
- A field study to survey for any breeding attempts by this species is also recommended before any detailed conservation measures are put in place.

## 4.11 Impacts of wind-powered recreation

Over the past number of years, the popularity of kite-surfing, land-surfing, land-boarding and land-yachting has increased in Ireland. Dollymount Strand, with a long wide expanse of the exposed beach, has proved popular for these activities. Kite-surfing involves the use of a kite with a surf-board to manoeuvre and 'surf' over incoming waves to the beach. Land-Surfing (also known as land-kiting) involves the use of a small buggy that travels on the beach and is powered by a kite. A similar activity called land-boarding involves the use of a combination of a kite and a board to travel over sand. Another activity called land-yachting combines a larger vehicle with a fixed sail to travel over the beach.

There have been some concerns about the impact of these activities on the habitats and wildlife at North Bull Island. DCC staff have regulated wind-powered activities at North Bull Island since 2000. DCC staff have also liaised with these users to attempt to establish rules to regulate these activities at Dollymount Strand. Currently, there are no specific bye-laws or definitive legislation in place that regulates these activities. Several formal and informal groups of wind-powered activity enthusiasts have recently been set up in Ireland including the Irish Kite Surfing Association, KitingIreland and Irish Power-Kite and Land-Yacht Association.

The Irish Kite Surfing Association (IKSA, [www.iksa.ie](http://www.iksa.ie)) is attempting to regulate kite-surfing activities and also provides insurance to members. Due to concerns from other beach users at Dollymount Strand, a code of conduct was established between IKSA and DCC in 2008 (Appendix IV, [Section 7.4.7](#)). Kite-surfing is permitted to be carried out at a prescribed area at the southern end of Dollymount Strand. A voluntary team of Beach Representatives from IKSA has been established who independently communicate the current regulations issued by DCC to kites. Four signs on tall poles indicating the launch area were erected in 2004 and marked "Caution Kite Surfers Launching".

Additional rules have been agreed for Land-kiting, which has raised the greatest number of complaints to DCC staff. Unlike kite-surfing, land-kiting requires a greater area in which to carry out this activity. There are several poles on the beach that mark the boundaries of the area designated for this activity but there are no actual signs indicating the use of this area for this activity. A 700 m long stretch of beach extending northwards from the boulders at the beach car park in the northern part of Dollymount Strand has been allocated for the use of land-kiting. It has been recommended that the activity is carried out between 2.5 hours before and 2.5 hours after low tide, when the greatest area of sandflats are exposed. A second informal group called KitingIreland has listed an informal code of conduct for Land-kiting at Dollymount Strand ([www.kitingireland.com](http://www.kitingireland.com)).

A third organisation called the Irish Power-Kite and Land-Yacht Association (IPKSA) has also been created recently ([www.ipksa.info/index.html](http://www.ipksa.info/index.html)). This organisation provides insurance for these activities and also hold races. There is no content on its web-page about Dollymount Strand.

DCC staff have observed land-kites taking their equipment a considerable distance north of the prescribed area and exceeding the agreed code of conduct, including operating land-kites around high tide, which increases disturbance to roosting water birds. Some of these activities have at times been noted to disturb several bird species feeding on the beach, including Terns, Plover

and Sanderling, and Seals hauled out near the tip of the island. However, there is no quantitative research from North Bull Island to indicate that these activities are having a negative impact on the wildlife or habitats at Dollymount Strand. DCC staff at North Bull Island advocate banning of this activity if there is continued disturbance to wildlife, breaches of the code-of-conduct and health and safety considerations.

There is also very little information from other sites studying the actual impacts of these activities on coastal habitats and wildlife. One reason for this is that these activities have only become popular relatively recently, and there had very little impact previously. The Department of Environment, Food and Rural Affairs (2004) in a recent publication on guidelines for managing coastal activities recognises that these activities can disturb wildlife but presents no evidence to support this view. The National Trust in Britain has recognised that these activities may have some disturbance impact on wildlife and has issued several guiding principles to begin to regulate these activities on their properties ([www.nationaltrust.org.uk](http://www.nationaltrust.org.uk)).

Several other local authorities in Britain are also attempting to regulate these activities on coastal sites of conservation interest. One example is the Thanet Coast Project which manages coastline in Kent ([www.thanetcoast.org.uk](http://www.thanetcoast.org.uk)). The management strategy for this area involves multi-use activities and codes of conduct have been put in place for different users including kite-surfers. Management for kite-surfers and land-kilters involves avoiding sensitive areas such as Little Tern breeding grounds and avoiding groups of roosting birds.

While there is potential for these activities to disturb birds feeding and roosting on the shoreline at North Bull Island the actual impact of these activities is unknown. Environmental Research Unit (1992a) estimated that on average there were 15 'land-yachts' using this site every day during the summer, although this data is somewhat out of date. The impact of wind-based activities should be considered as only part of the overall impact of amenity use of Dollymount Strand. For example, it is difficult to quantify which activity causes more disturbance, dog-walking or these wind-based activities.

The impact of kite-surfers in the southern part of the island is likely to be relatively smaller compared to the impact of land-kilters, who require a larger area for their activities. Land-kilters also have the potential to disturb any ground-nesting birds using the shelly beach area at the northern tip of the island. The liaison between DCC and the wind-powered activity groups such as the IKSA and the IPKSA is a positive move as is the development of a code of conduct.

## **RECOMMENDATIONS**

- It is recommended that wind-powered recreation are continued to be regulated by strict guidelines. This should include a strong formal code of conduct to reduce impacts on wildlife and strict adherence to the use of the agreed launch areas. A code of conduct should include references to avoiding putting large groups of waterbirds to flight while feeding or roosting. Seals at sea and on sand banks should be given a wide berth. Consideration should be given to banning activities or groups that will not adhere to these guidelines. A code of conduct should also be published on an information leaflet.

- It is recommended that liaison between DCC and wind-powered activity groups is continued. Any discussions should continue to emphasise the potential impact of these activities on disturbing wildlife.
- It is recommended that wind-powered recreation in the northern half of the island is banned if there are further breaches to agreed codes of conduct and further disturbance to wildlife.
- The possibility of including wind-based activities in future DCC Parks and Open Spaces Bye-laws could be considered. This may aid future regulations if required.

## 4.12 Sutton to Sandycove cycleway

The Dublin Regional Authority and voluntary groups (S2S) have advocated the construction of a continuous dedicated cycleway along the fringe of Dublin Bay running between Sutton and Sandycove, which would link and upgrade existing cycleways and walkways. Parts of it are already in existence e.g. along Clontarf and Sutton. There is no dedicated cycleway between Clontarf and the North Bull Island causeway.

A technical report studying potential design options, the baseline environment and constraints of the development has been prepared (AWN Consulting 2006). This study was not a full environmental impact statement. Several options have been considered along North Bull Island including building out a promenade or a supporting structure to incorporate the cycleway including other features such as additional lighting, street furniture and interpretative information. It is suggested that an overhanging deck is attached to the seawall running alongside the Clontarf-Howth Road to create a promenade 8.5 m wide between North Bull Island and Irishtown. A narrower deck (2.5m) is required for much the northern section between the causeway and Sutton. This project is still in the initial stages of planning and still requires funding and planning permission from the local authorities.

The technical report identified several potential impacts on the environment, habitats, flora and fauna along North Bull Island including habitats and species listed in the EU Habitats and Birds Directives. The development of a promenade along the shoreline would mean that some habitat is lost or degraded during land-take. There would also be potential for increased disturbance to bird species that use the intertidal areas between North Bull Island and the mainland.

### RECOMMENDATIONS

- It is recommended that detailed appropriate assessment of the potential impacts of this development is required when this project is proposed for planning permission. Careful planning and mitigation would be necessary to minimize any negative impact to the environment, habitats and wildlife along North Bull Island.

### 4.13 Beach-cleaning and its impact on dune formation

The accumulation of seaweed/brown algae is a natural feature of the coastal systems. Ordinarily, the accumulation of organic matter is an important feature of the development of dunes and the seaward accretion of dune systems takes place through the build-up of wind-blown sand caught by plants or debris along the drift-line. These initial accumulations of organic material are colonised by pioneer plant species. The drift-line has been recognised as a specific Annex I habitat 'Annual vegetation of drift-lines' (1210). The build-up of sand and vegetation can result in the development of embryonic dunes.

Drift-lines can be problematic when exceptionally large deposits of algae are not washed away. One of the principal and offending species of algae is *Ectocarpus* spp. This is a sub-tidal species that grows profusely in shallow relatively sheltered waters (Biosphere Environmental Services 2006). This has been related to excessive nutrients entering Dublin Bay (Environmental Research Unit 1992d). The Dublin Bay Water Quality Management Plan studied algal growth in Dublin Bay (Environmental Research Unit 1992a-d). The upgrading of sewage works at Ringsend was predicted to reduce nutrient enrichment and reduce the amount of *Ectocarpus* fouling Dollymount Strand. Within three days of deposition on Dollymount Strand it begins to decompose, a process which releases many strong odours. The overpowering smell is generally not appreciated by beach users and certainly not by people living nearby.

Mechanical beach-cleaning is being used at North Bull Island. This forms part of the requirements for Blue Flag beach status. Not all of Dollymount Strand is being cleaned as part of the DCC beach-cleaning policy. A tractor pulling a surf rake cleans the upper beach zone every day during the bathing season between the car-parks at the end of the causeway and the North Bull Wall. *Ectocarpus* blooms have been managed somewhat differently. The *Ectocarpus* detritus is scraped up and transferred along the fore-dune area to protect the dunes from erosion (see Appendix IV, [Section 7.4.6](#) for more information).

On heavily used beaches the development of embryonic dune communities can be retarded or locally inhibited through a combination of the pressure of pedestrian and vehicular traffic and by mechanised beach-cleaning (McKenna *et al.* 2000). Ryle *et al.* (2009) noted that beach-cleaning practices at North Bull Island were having a negative impact on the conservation status of the Annex I habitat 'Annual vegetation of drift-lines' and possibly impacting on dune development overall. Significant expanses of drift-line and embryonic dune Annex I habitat were mapped in 2004 by the CMP survey.

The fore-dune zone was noted to be in 'good' condition in 2008 and embryonic dune formation was continuing even with beach-cleaning practices in the southern half of the island. This suggests that current management at Dollymount Strand is having a positive or benign impact, particularly the restrictions on vehicles. Beach-cleaning may be a disruptive influence, but it is not preventing the continued development of the sand dunes at North Bull Island.

The current policy of DCC at North Bull Island is to use *Ectocarpus* detritus to help rehabilitate damaged parts of the dunes. The use of this material to protect sections of the fore-dunes means that the sediment in this detritus is re-cycled. There are no indications that the use of *Ectocarpus* detritus at North Bull Island is inhibiting fore-dune formation and fieldwork during this study noted healthy embryonic dune formation on some of these former piles of detritus deposited in previous



years. Larger quantities of this detritus may pose a greater problem compared the smaller amounts collected in 2007.

**Embryonic dune formation on old piles of *Ectocarpus***

(Photo: Mark McCorry)



## RECOMMENDATIONS

These recommendations are based on the fact that Dollymount Strand is an important amenity and is managed as a Blue Flag beach. They are also based on general advice that reducing the intensity of beach-cleaning is a positive management objective. Management has to balance requirements of Blue Flag beach management with maintaining beach habitats like the drift-line communities and fore-dune development in favourable conservation status. Several of these recommendations are already being carried out as part of the DCC beach-cleaning policy.

- It is recommended that manual beach-cleaning of the strandline zone to collect non-organic litter is continued as this is the most environmentally friendly method.
- It is recommended that the northern half of the island continues to be less intensively cleaned allow a drift-line to develop during the year.
- The practise of manually cleaning litter from *Ectocarpus* blooms on the beach prior to any mechanised beach scraping should be continued to avoid mixing unwanted waste material into the *Ectocarpus* detritus used for any sand dune rehabilitation.
- The use of *Ectocarpus* detritus as a soft engineering option to reduce the impact of erosion along the fore-dunes in the northern section can be continued. However, the use of large volumes of this detritus in this way in one place may not be suitable. Care



should be taken to distribute this detritus in piles that are not obtrusive relative to the adjacent dunes. Smaller piles are more suitable in the southern section compared to the northern section where larger piles could be placed along the tall dune faces.

- Continued review of beach-cleaning practices is recommended.
- It is recommended that monitoring is put in place to monitor the effect of placing *Ectocarpus* detritus along the fore-dunes, particularly in the southern half of the island, where these piles are being incorporated into the embryonic dunes. A proper monitoring programme would be able to establish the rate at which these piles are assimilated into the fore-dunes and the mechanisms of establishment of fore-dune vegetation on these piles.

#### 4.14 Seals at North Bull Island

Both Grey Seals and Common Seals (also known as Harbour Seal) haul out on the beach and sandflats exposed at low tide at the northern tip of North Bull Island and a group containing between 20-40 animals is common. Both species are breeding at this location and North Bull Island is a vital part of their habitat in Dublin Bay (Brendan Price, Irish Seal Sanctuary, pers. comm., 2008).

The conservation status of Grey Seal and Common Seal in Ireland has been assessed as favourable. Excessive disturbance at key breeding and haul-out sites is listed as a significant negative impact (NPWS 2008). One notable issue is that North Bull Island is not included in any of the recent population censuses of both these species (Lyons 2004, Cronin *et al.* 2004, O'Cadhla *et al.* 2007).

NPWS staff and DCC staff have noted that these seals are subject to some disturbance from unrestrained dogs, people and land-kickers. There are no quantitative data for North Bull Island to indicate the actual level of disturbance to seals at North Bull Island. There are few other reports of seals being disturbed by dogs at other sites, generally because seal haul-out sites are in areas that are hard to reach by dog walkers (Taylor *et al.* 2005). North Bull Island is used periodically by the Irish Seal Sanctuary for the release of re-habilitated seal pups.

#### RECOMMENDATIONS

- DCC should continue to advise users of the island such as dog walkers and land-yachters not to disturb the Seal colony.
- It is recommended that NPWS includes this site in any future censuses of Seal populations on the east coast of Ireland.

## 4.15 Management of Hares and Rabbits at North Bull Island

Wolfe (1995) carried out research on the status of Hares and Rabbits at North Bull Island in the early 1990's. Most data and considerations for management at North Bull Island come from this research. O'Gorman (1977) also reviewed information relevant to mammals on the island. Both Rabbit and Hare populations have fluctuated over the years.

### IRISH HARE

The species of Hare at North Bull Island is the native Irish Mountain Hare (*Lepus timidus hibernicus*), also known as the Irish Hare. This is a different species compared to Brown Hare (*Lepus europaeus*), which is an introduced second species mainly found in Northern Ireland (Anon. 2005). Hares were thought to be introduced to North Bull Island sometime at the beginning of the 20<sup>th</sup> century. The Hare population in 1931 was estimated at less than 6 whereas Rabbits were plentiful. In the past large numbers of Hares were removed from the island. However, by 1977 numbers of Hares were estimated to be 60-70. Hare numbers in 1994 were estimated to be 15-20 (Wolfe 1995). Some Hares were introduced from Mosney, Co. Meath during the 1990s. Current estimates of the population range from as low as 6 to between 10-15 individuals. Irish Hare populations have declined in recent years in Northern Ireland and recent estimates of the population in the Republic of Ireland have shown that numbers fluctuated significantly between 2006 (233,000) and 2007 (535,000) (Reid *et al.* 2007).

Wolfe (1995) found that the main cause for the decline of Hare numbers was human disturbance including unrestrained dogs, which caused juveniles to be born in unsuitable habitat. The two golf courses were thought to be areas of refuge for Hares, where they could escape disturbance from elsewhere, although the saltmarsh and fixed dune areas were thought to be more suitable habitat. The population at North Bull Island is dependant on the reproductive success of the adults already present on the island as there is no migration of new individuals into this population. Wolfe (1995) stated that adult survival of Hares was actually quite good compared to other study areas (upland sites).

Wolfe (1995) stated that there was a high probability of local extinction of this species at North Bull Island if certain measures were not taken. Wolfe suggested the creation of sanctuaries for Hares, increased dog control and habitat management on the golf links were three measures that could be introduced. Increased areas of rough within the golf courses with low levels of disturbance would benefit the Hares. Wolfe (1995) stated that introduction of new Hares was a option but would not necessarily solve the problems that the Hare population faces, as the new Hares would face the same pressures.

Wolfe (1995) noted that it was not known what minimum numbers of Hares were required to sustain a viable population at North Bull Island. There is also no information available in this research to specify the actual current Hare carrying-capacity of the island. While numbers of Hares were higher in the past, it is likely that conditions on the island have also changed, more specifically the level of disturbance from recreation.

### RABBITS

The Rabbit population has also fluctuated significantly over the years. In the 1930s, Rabbits were observed to be plentiful. However they were thought to have died out (or were not recorded) and

were not listed on a checklist of mammals in O’Gorman (1977). They then re-colonised or were re-introduced to the island and the population by 1988 was estimated to be 5000 (Wolfe 1995). Rabbits were thought to be significant grazers at North Bull Island at this time and significantly affected the flora of the fixed dunes (Wolfe 1995). The population did decline and by 1993 numbers were estimated to be 2000-3000. Myxomatosis was also introduced (NPWS undated 1996?). There has been some control of Rabbits on the golf courses in the past as they were damaging fairways and greens (NPWS undated, 1996?).

The CMP survey (Ryle *et al.* 2009) noted that the fixed dune vegetation was generally in good condition. This survey noted that Rabbits were abundant and were causing some localised damage in places. However, grazing by Rabbits is beneficial in maintaining species diversity in the fixed dune grassland and maintaining a short grass turf, especially as grazing by livestock is not carried out on the Island. DCC staff on the island believe that the Rabbit population has decreased in recent years. At present the Rabbit population is not thought to be causing any problems or damaging the sand dunes.

### **RECOMMENDATIONS**

Wolfe (1995) stated that the presence of Hares on the island and the high level of amenity use may be incompatible unless management restrictions are placed on how people use the island.

- It is not recommended to re-introduce Hares to the island to increase the population without first attempting to deal with some of the factors that are causing the decline of the population on the island, such as levels of disturbance. Any introduction should be in accordance with IUCN guidelines on re-introductions for establishing viable populations of animals (IUCN 1998).
- The implementation and effective enforcement of more stringent restrictions on access of people and dogs to certain sections of the island including the saltmarsh and fixed dunes is likely to be the most effective measure to improve the status of the Irish Hare on the island. However, this would significantly impact on amenity use of certain parts of the island. This may also have the impact of reducing disturbance to the fixed dune habitat where this disturbance is having a somewhat positive impact, by helping to maintain short species-rich sward. The creation of Hare refuges in the fixed dune areas is not recommended at this time.
- No measures are required at present to control Rabbits at North Bull Island, as they are not considered to be having a significant negative impact on the sand dunes at this time.
- A new population survey of both Hares and Rabbits on the Island is recommended.
- Any future introduction of Rabbits on to the island, if populations crash, should also be carried out in accordance with IUCN guidelines (IUCN 1998).

## 4.16 Management of the sand dune system

The sand dune system at North Bull Island is affected by several impacts and activities, some of which have both positive and negative impacts on these habitats. These impacts and activities include various amenity uses of the dunes and impacts like erosion and grazing (Ryle *et al.* 2009). Some local authorities in Ireland, NPWS and local and national authorities in Britain have a range of management regimes on sand dune systems under their control (Brooks & Agate 2000, Doody 2002, McKenna *et al.* 2000, Natural England - [www.english-nature.org.uk](http://www.english-nature.org.uk), Scottish Natural Heritage 2000, Sefton Coast Partnership 2004). Much of the more recent research into dune functioning advocates a dynamic approach and attempting to minimize interference with natural sand dune processes and dune evolution.

Pedestrian tracks in the mobile dunes, fixed dunes and dune slack habitats, some of which are bare of vegetation, are extensive (Ryle *et al.* 2009). Pedestrian trampling and tracks can erode vegetation cover and this is most noticeable at access points around the end of the causeway. Overall, the pedestrian use of the fixed dune and dune slack areas at North Bull Island is important for maintaining the current levels of diversity and cover of short species rich fixed dune sward. However, permanent way-marked tracks would not be recommended as these could focus trampling onto several paths rather than spreading the trampling disturbance over a network of tracks.

There are no grazing livestock on the island, although Rabbits are present on the island in considerable abundance, and have created localised overgrazing problems in the past. In general however, their activities are beneficial in helping to maintain the short-cropped sward that promotes species diversity. Overgrazing has affected many dune systems around Ireland (NPWS 2008). A more widespread problem can be under-grazing, leading to invasion by coarse grasses such as Marram and this was highlighted by CMP. However, NPWS staff believe that the fixed dune area is in good condition and does not require any specific grazing management, such as introduction of livestock.

In general, North Bull Island has been a naturally accreting system that has seen significant dune formation over the past 50 years (Jeffrey *et al.* 1977, Ryle *et al.* 2009). The northern tip is known to be extremely dynamic and significant changes in its position have been noted over the years (Harris 1977). Indicators of accretion and natural dune growth are present along the southern part of the dunes/beach where there is a healthy mobile and embryonic dune system.

However, in the past few years there has been increasing signs of erosion noted by DCC staff along the dune face in the northern half of the island, especially during the winter. This was exacerbated during winter 2007-2008 and a significant cliff was 'cut' along the front of the sand dunes. Sand was re-accreting in this area in summer 2008. NPWS take the view that the erosion seen during winter 2007-2008 is part of the natural dynamism of this coastal environment and is not a significant management issue. McKenna *et al.* (2000) point out that erosion is important and necessary part of a functioning dune system. In most sand dune sites in Britain where sand dune erosion is occurring, insufficient sand supply is generally the major cause (UK BAPs - [www.ukbap.org.uk](http://www.ukbap.org.uk)). However, this does not seem to be the case at North Bull Island, as this site is still accreting overall (see Appendix IV, [Section 7.4.8](#) for more discussion).

## **RECOMMENDATIONS**

- No specific regulation of pedestrian access is recommended. Trampling disturbance by pedestrians is important for maintaining overall diversity of the fixed dune and dune slack habitat, particularly in the absence of grazing livestock. There may be some localised damage where pedestrian pressure is heavy, for example around the end of the causeway.
- There are no specific recommendations for the management of localised damage to the sand dunes, such as at the end of the causeway or on dune grassland near the North Bull Wall. Fencing off small damaged sections of the sand dunes may have the effect of transferring the trampling pressure to undamaged sections. Continued monitoring of this damage may be required.
- The introduction of some low-level grazing management by livestock is not recommended. NPWS staff also consider that the fixed dune habitat is in good condition and does not require any grazing management at this time.
- It is recommended that a benign approach is taken to sand dune erosion at present. 'Hard' coastal protection measures are not required at this time. The current erosion is likely to be of a cyclic nature and accretion and growth of the island is likely to continue in the future, as the sediment supply is healthy. There may be some re-profiling of the sand dunes, salt marsh (and shape of the island) in the future. It should be noted that North Bull Island is still evolving as a sand spit and likely to continue to evolve (change shape) in the future. One of the original policies of the SAAO (Dublin Corporation 1994) is to allow the sand spit to take its natural course.
- It is recommended that a monitoring programme is put in place to study changes to the northern tip of the island, including the dynamics of erosion and accretion. This monitoring programme should include beach profiling. This monitoring programme should identify any significant changes in sedimentation patterns around North Bull Island.

### **4.17 Vehicular access to Dollymount Strand**

The construction of the causeway in 1965-66 greatly facilitated access onto North Bull Island and Dollymount Strand and increased the value of the site as an amenity. For much of the 1970s-1980s, cars and other motorised vehicles were freely allowed onto the beach and also had access to some of the fixed dune sections. However, over the years, car-free zones on the beach have been introduced by DCC and vehicular access onto the strand has become more restricted. Currently there are two main access points to Dollymount Strand at the Bull Wall and near the end of the causeway with car parking on the beach. Car parks have been created by using large boulders that restrict access to the rest of the beach. Boulders have been set out to form a rectangle about 10-20 m from the beginning of the fore-dunes on the upper beach. Currently most of the beach is now car-free (81%).

The main reasons for these restrictions were conservation orientated and also to restrict anti-social behaviour on the beach. The Blue Flag Scheme ([www.blueflag.org](http://www.blueflag.org)) also stipulates that part of the beach should be kept car-free. The negative impact of vehicular access to the beach on the embryonic dunes and formation of the sand dunes was recognised by the SAAO (Dublin Corporation 1994). McKenna *et al.* (2001) also notes that beach car-parking can also impact on the erosion/accretion dynamics by compacting beach sand, preventing percolation of tidal back-wash and increasing potential for erosion.

The impact of vehicles on the formation of the dunes and the conservation status of the strandline and embryonic dune habitats has already been significantly reduced with current traffic restricted to several relatively small car-parks on the beach. The creation of car-free zones at Dollymount Strand over the years has had a very significant positive impact on conservation status in this way. Dublin City Council moves the boulders marking the car-parks away from the beach-dune interface to reduce disturbance of this area. Disturbance to wildlife has also been reduced by these measures (although 'freeing' the beach from vehicles has indirectly allowed the introduction of other amenity activities that also disturb wildlife, such as land-yachting).

The complete restriction of vehicles from Dollymount Strand may have some further positive impact on the conservation status of the beach and dune habitats and on wildlife using these areas (and also on pedestrian safety and enjoyment). However, the impact of vehicles on the beach is already significantly restricted and only affects a relatively small area. This policy may also just move negative impacts of traffic and car-parking elsewhere to affect other habitats. The use of the beach as a car-cark is much more preferable to creating a new cark-park in any of the Annex I dune habitats. In any case the cost-effectiveness of large permanent car parks at beaches may be questioned if maximum visitor volumes are reached only a few times per year (McKenna *et al.* 2000). Beach-parking is part of many beach management plans in Britain (Sefton Coast Partnership 2004) as part of an overall multi-use plan.

The increasing interest in leisure pursuits and the relative abundance of other small motorised vehicles such as quad bikes, has resulted in disturbance and in some cases localised erosion of sand dune habitats elsewhere in Ireland (Ryle *et al.* 2009). These activities are prohibited by Bye-laws at North Bull Island (DCC 2002).

### **RECOMMENDATIONS**

- It is recommended that restricted car parking continues on Dollymount Strand. The current vehicle management is not having a significant impact on dune formation. Consideration could be given to further reducing the size of the car parks, or making them narrower if practicable.

## **4.18 Conservation of rare bryophytes**

Several rare mosses and liverwort species are found at North Bull Island, including Petalwort (*Petallophyllum ralfsii*), which is listed on Annex II of the Habitats Directive and several Bryum species, which are listed on a provisional Red Data List for mosses (Holyoak 2006). Recently rediscovered species at North Bull Island include *Bryum intermedium*, *Bryum uliginosum* and *Bryum warneum* (Appendix III), which had not been located since the 19<sup>th</sup> century. North Bull



Island has recently been considered to be the best site in Ireland and Britain for this assemblage of *Bryum* species (D.T. Holyoak, pers. comm. to NPWS, 2007).

### PETALWORT

North Bull Island is the only known station for this rare species on the Eastern seaboard (NPWS 2007) and it is mainly found on western dune slacks and machair in Ireland. This liverwort (c. 5mm diameter) favours conditions found in the early phases of dune slack succession (or damp machair). Often this equates to poached tracks or ruts in the dune habitat. Grazing, light trampling and disturbance appears to assist the conservation of this species (Lockhart, pers. comm. 2008).

### BRYUM MOSS SPECIES

All of these species prefer open dune habitats and it is thought that the relative immaturity of North Bull Island sand dune system coupled with the presence of “early successional” stages in dune slacks is ideal for the mosses. At North Bull Island, they are found around the partially exposed sand around tracks alongside some of the dune slacks.

### GENERAL MANAGEMENT FOR THESE SPECIES

North Bull Island is not actively managed for the presence of Petalwort, as it is a species that is overlooked given its size. Likewise, there is no requirement to change the current management regime on North Bull Island in terms of protection for the rare *Bryum* species, as these mosses are small and unlikely to be recognised except by experts.

The persistence of these species at North Bull Island (and other sites) is often at odds with the conservation objectives of Annex I sand dune habitats including fixed dune and dune slack, where disturbance and over-use are generally avoided. The presence of somewhat eroded or poached tracks, which would be a negative indicator for these Annex I habitats, is a positive feature for these species.

General management advice from Holyoak (2003) for Petalwort and for the rare *Bryum* moss species listed below includes:

- maintaining trampled tracks in dune slacks will promote the status of these species
- keeping the system as dynamic as possible,
- maintaining Rabbit grazing
- avoiding the introduction of boardwalks near areas with these species
- avoiding the introduction of fenced-off areas with these species
- avoiding drainage or significant changes to the hydrology regime.

NPWS (Lockhart, pers. comm. 2008) has indicated that the current levels of disturbance such as the intensity of trampling and rabbit grazing in the dunes at North Bull Island are probably adequate to maintain the conservation status of these species. Any future impacts to the

hydrological status of the fixed dunes and dune slacks and drying of these habitats are likely to negatively affect the conservation status of this species. Further research on the hydrological status of North Bull Island and its dune slacks is required (see [Section 4.1](#)).

In terms of enhancing the conservation value of the site however, some additional management measures could be carried out to ensure the persistence of these mosses (Holyoak 2003). These measures are relatively straightforward and inexpensive, requiring the creation of a small number of hand-dug scrapes (e.g. about 2 m x 2 m in area) where the vegetation is removed to reveal damp sand underneath. The location of the “scrapes” should be planned with advice from NPWS. In this way, the persistence of the mosses could be assisted, as vegetative cover of vascular plants could not inhibit the successful establishment of the mosses.

### **RECOMMENDATIONS**

Petalwort and rare Bryum species require particular levels of disturbance in the dune slack habitats to maintain their conservation status.

- No specific management is required for these species. The maintenance of the fixed dune and dune slack habitats in ‘*favourable conservation status*’ also protects these rare bryophytes, as long as the current levels of pedestrian disturbance in the fixed dunes and dune slacks are maintained.
- General management objectives listed in Section 4.1 and 4.16 related to hydrology and fixed dune management should be considered.
- The level of ‘disturbance’ in dune slack and fixed dune habitats should be monitored. Restricting access to particular sections of these habitats could result in the development of tall rank vegetation to the detriment of these rare species. Likewise, a crash in rabbit populations and the absence of rabbit grazing for long periods could also be detrimental.

## **4.19 Some general recommendations**

Some general recommendations can be made about management and conservation issues at North Bull Island. These recommendations cover many of the issues raised in the previous sections. Best practice shows that many of the issues can not be dealt with effectively by just one strategy and the use of several strategies is most favourable. A comparison of the best-practice management to the current management being carried out at North Bull Island by DCC shows that DCC is already using best practice management in many instances.

One way to alleviate some of the main management issues is increased public awareness. Studies from other sites show that actively liaising with users of nature conservation sites about various issues can alleviate the impact of various issues. Increased public awareness at North Bull Island is required. The DCC website has significant potential to inform the public about the conservation value of the island and policies for nature conservation. The website should be updated to supply much more information about North Bull Island, including educational resources. A review of the interpretation of natural heritage value and nature conservation issues on North Bull Island should be carried out.

Signage is another way to provide the public with information and there are already frequent signs around North Bull Island displaying various interpretative information and regulations about various issues. Increased signage on its own will not solve all these issues but there are some gaps where increased signage may be required, e.g. 'code of conduct for wind-powered recreation'. Some signs are also out of date.

Dublin City Council has already implemented successful policies to alleviate some the management issues that have affected North Bull Island. Some of the active management by DCC has been extremely successful, e.g. vehicle management on Dollymount Beach. Some of these policies range from the formal to the informal. Several stakeholders advocated formal zoning of the island for various users and for nature conservation. The current vehicle management, assignment of areas for wind-powered activities and variations in beach-cleaning along Dollymount Strand are already applying informal zoning to Dollymount Strand and separating the site into areas of amenity use and areas of nature conservation prioritization. A combination of the position of the two access points and the relatively large size of the island also imposes informal natural zoning with some sections of the island, particularly the northern tip, being much less disturbed by users because of its distance from the access points. There are appropriate regulations and policies for several issues already put in place but increased enforcement or implementation of these regulations and policies is required.

Ongoing consultation with NPWS over various management issues affecting the island should be continued. Some of the various recommendations refer to specific actions that should be carried out by NPWS (e.g. redraft cSAC and nature reserve boundaries). NPWS will also carry out continued monitoring of the extent and development of the various Annex I habitats present on the island in the future as part of reporting and monitoring requirements of various EU directives, such as the Habitats Directive and the Water Framework Directive.

Dublin City Council has already helped fund some research projects about various management issues. However, there are still significant gaps in information and knowledge required to make evidence-based decisions about some of the main management issues. For example, there is abundant anecdotal evidence that recreational activities are disturbing wildlife at North Bull Island. However, there is little evidence of actual impacts in terms of declines in population numbers or changes in conservation status of notable species and the previous sections made frequent inferences from studies at other sites. Several different monitoring programmes or more detailed studies of impacts would be extremely useful for evidence-based decision making. Detailed information on the recreational use of North Bull Island is somewhat out of date for effective planning about recreational pressures on species and habitats of conservation interest (ERU 1992d). An updated survey on recreational usage would be valuable, while not being directly related to conservation management.

## 4.20 Significant gaps in knowledge about notable species, impacts and activities at North Bull Island

This section outlines some of the major gaps in knowledge about impacts and activities on the island highlighted in the previous sections that would benefit from increased monitoring or more detailed study. The below list could aid suggestions for future research projects. However, any research or study of aspects of the national history of North Bull Island would add to knowledge of the site and aid future management. Dublin City Council should encourage continued study of the site.

1. Further monitoring of the hydrology and of the size of the 'annual recharge' at North Bull Island
2. Regular monitoring of habitat extent, particularly areas subject to dynamic change, such as the saltmarsh/intertidal mudflats and the dune/beach complex to identify issues such as erosion etc.
3. More detailed modelling is required to identify the limits of the potential future spread of Common Cordgrass, similar to the modelling carried out by Cooper *et al.* (2006) in Northern Ireland.
4. A research programme investigating the use of saltmarsh, *Salicornia* flats, mudflats and sandflats containing Common Cordgrass and swards of Common Cordgrass by resident bird species and wintering waders and wildfowl would be extremely useful in quantifying any negative impact of Common Cordgrass on avian fauna.
5. Monitoring of the impacts of disturbance from bait-diggers to waterfowl and impacts to populations of target species should be considered as part of any Bait-digging management plan.
6. A survey is required to examine the suitability of the habitat at the northern tip of North Bull Island as a breeding site for Little Tern.
7. A study should be put in place to monitor the impact of placing *Ectocarpus detritus* along the fore-dunes, particularly in the southern half of the island, on dune formation.
8. A census should take place of the current Rabbit and Hare populations on the island.
9. A monitoring programme is required to examine changes to the northern section of the island, including the dynamics of erosion and accretion. This monitoring programme should include beach profiling.
10. Some of the information on notable species present on the island is out of date. A field survey of rare plant status on the island is required. The current status of other groups such as mammals and breeding birds should also be investigated with specific surveys.

## 5 TIMEFRAME FOR ACTIONS

Section		Action	Time-frame for action
<a href="#">4.1</a>	Impacts on the hydrology of the island	Develop hydrological monitoring in partnership with NPWS and EPA Continue consultation with golf courses about water management	Immediately Ongoing
<a href="#">4.2</a>	North Bull Island causeway and sedimentation	No active management required Monitor extent and development of habitats (NPWS)	/ Every 3 years
<a href="#">4.3</a>	Saltmarsh accretion and erosion	No active management required Monitor extent and development of habitats (NPWS)	/ Every 3 years
<a href="#">4.4</a>	Management of Common Cordgrass	Continue to review the effect of invasive Common Cordgrass and continue policy of no control at this time Detailed modelling of the potential future spread of Common Cordgrass	Ongoing Long-term
<a href="#">4.5</a>	Management of Sea Buckthorn	Continued control of Sea Buckthorn (using existing methods) Continue consultation with two golf courses	Ongoing Ongoing
<a href="#">4.6</a>	Other alien or invasive species	Control of other invasive species	Ongoing
<a href="#">4.7</a>	Boundary issues	Address unfenced boundary along the saltmarsh using 'wildlife friendly' fencing Re-draft cSAC and Nature Reserve boundaries (NPWS)	Short-term Ongoing
<a href="#">4.8</a>	Bait digging	Enforce current legislation related to bait-digging (NPWS) Liaise with Fingal County Council, which manage the Sutton Strand intertidal area. Development of bait-digging code of conduct/management plan Liaise with bait diggers regarding code of conduct	Ongoing Long-term Long-term Long-term

<a href="#">4.9</a>	Impacts of recreational disturbance	Continue to enforce current dog control legislation 'dogs on leash' Increase public awareness of the importance of dog control	Ongoing Ongoing
<a href="#">4.10</a>	Little Tern conservation at North Bull Island	Survey of Little Tern habitat suitability and breeding attempts	Long-term
<a href="#">4.11</a>	Impacts of wind-powered recreation (Kite-surfing etc)	Continued development of formal code of conduct Continued liaison with wind-powered activity groups	Ongoing Ongoing
<a href="#">4.12</a>	Sutton to Sandycove cycleway	No action required	/
<a href="#">4.13</a>	Beach-cleaning and its impact on dune formation	Continue to carry out beach-cleaning activities in a sensitive manner Continue to review beach-cleaning activities Monitor the effect of <i>Ectocarpus</i> use on fore-dune development	Ongoing Ongoing Short-term
<a href="#">4.14</a>	Seals at North Bull Island	Include Seal populations in future national censuses (NPWS)	Ongoing
<a href="#">4.15</a>	Management of Hares and Rabbits at North Bull Island	Survey populations of these species on the island	Long-term
<a href="#">4.16</a>	Management of the sand dune system	No active management of any dune erosion required at present Monitor extent and development of habitats (NPWS) Continued monitoring of localised damage caused by pedestrian use of sand dunes	/ Every 3 years Ongoing
<a href="#">4.17</a>	Vehicular access to Dollymount Strand	Continue current vehicle restrictions	Ongoing
<a href="#">4.18</a>	Conservation of rare bryophytes	No active management required	/
<a href="#">4.19</a>	Other recommendations	Review interpretation and public awareness of the island Continued liaison with NPWS about specific nature conservation and management issues listed above	Ongoing Ongoing
<a href="#">4.20</a>	Recommended future research projects	Research into actual impacts of <i>Spartina</i> on wintering birds Field survey of notable rare plants on island Monitor impacts of bait-digging disturbance and impacts to populations of target species Monitor erosion/accretion dynamics on dunes including beach profiling Survey recreational usage of the island	Long-term Long-term Long-term Long-term Long-term



## 6 BIBLIOGRAPHY

Adam, P. (1990). *Saltmarsh ecology*. Cambridge University Press, London.

AWN Consulting (2006). *Technical report for the S2S project*. Technical report for the Dublin Regional Authority. <http://www.dra.ie/s2s.html>

An Bord Pleanála (2004). *Inspectors Report. Rehabilitation/augmentation works to raise existing embankment together with provision of a new section of embankment*. Royal Dublin Golf Club. File reference PL 29N. 206536.

An Foras Forbartha (1977). *A study of North Bull Island County Dublin*. An Foras Forbartha, Dublin.

An Foras Forbartha (1980). *Ecological monitoring of sediment at North Bull Island*. An Foras Forbartha, Dublin.

An Foras Forbartha (1981). *Areas of Scientific Interest in Ireland*. An Foras Forbartha, Dublin.

An Foras Forbartha (1984). *Ecological monitoring of sediment at North Bull Island*. An Foras Forbartha, Dublin.

Anonymous (2005). *All Ireland Species Action Plans: Irish Lady's-tresses (Spiranthes romanzoffiana), Pollan (Coregonus autumnalis), Irish hare (Lepus timidus hibernicus), and Corncrake (Crex crex)*. Environment & Heritage Service, Department of Environment, Northern Ireland and the National Parks & Wildlife Service, Department of Environment, Heritage and Local Government, Republic of Ireland.

Beale C.M. & Monaghan P. (2004). Human disturbance: people as predation free predators? *Journal of Applied Ecology*, 41, 335-343.

Binggelli, P., Eakin, M., Macfayden, A., Power, J. & McConnell, J. (1992). Impact of the alien sea buckthorn (*Hippophae rhamnoides* L.) on sand dune ecosystems in Ireland. In: *Coastal Dunes: Geomorphology, Ecology and Management for Conservation*. (Eds. R.W.G. Carter, T.G.F. Curtis, and M.J. Sheehy-Skeffinton), pp 325-337. Balkema, Rotterdam.

Biosphere Environmental Services (2006). *Management of beaches in south Dublin Bay*. Unpublished report prepared for Dublin City Council.

Boorman, L.A. (2003). *Saltmarsh Review. An overview of coastal saltmarshes, their dynamic and sensitivity characteristics for conservation and management*. JNCC Report, No. 334, JNCC, Peterborough.

Boyle, P.J. (1976). *Spartina* M9, a variant *Spartina* in three regions north of Dublin. *Scientific Proceedings of the Royal Society of Dublin, Series A*, 5, 415-427.

Boyle, P.J. (1977). *Spartina* on North Bull Island. In: *North Bull Island Dublin Bay - a modern coastal history*, (Eds. D.W. Jeffrey, R.N. Goodwillie, B. Healy, C.H. Holland, J.S. Jackson & J.J. Moore), pp 88-92. Royal Dublin Society, Dublin.

Brooks, A. & Agate, E. (2000) *Sand dunes. A practical handbook*. British Trust for Conservation Volunteers. <http://handbooks.btcv.org.uk/handbooks/index/book/137>.

CAAS Environmental Services Ltd (1990). *Sedimentation in the North Bull Island channel*. CAAS Environmental Services Ltd, Dublin.

Commission of the European Communities (2003). *Interpretation manual of European Union Habitats-EUR 25*. DG Environment-Nature and Biodiversity. Brussels.

- Commission of the European Communities (2006). *Assessment, monitoring and reporting under Article 17 of the Habitats Directive: Explanatory Notes & Guidelines*. (DocHab 04-03/03-rev.3: Annex E). [www.ec.europa.eu](http://www.ec.europa.eu). DG Environment-Nature and Biodiversity. Brussels. DG Environment-Nature and Biodiversity. Brussels.
- Cooper, A., Cook, S., Rogers, D., & Bareham, G. (2006). *Historical, Current and Predicted Distribution of Spartina anglica in Northern Ireland*. Environment and Heritage Service Research and Development Series. No. 06/17.
- Cronin, M., Duck, C., Ó Cadhla, O., Nairn, R., Strong, D. & O' Keeffe, C. (2004). *Harbour seal population assessment in the Republic of Ireland: August 2003*. Irish Wildlife Manuals, No. 11. National Parks & Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.
- Crowe, O. (2005). *Ireland's wetlands and their waterbirds: status and distribution*. Birdwatch Ireland, Newcastle, Co. Wicklow.
- Curtis, T.G.F. & McGough, H.N. (1988). *The Irish Red Data Book*. Stationary Office, Dublin.
- DEFRA (2004). *Managing coastal activities: A guide for local authorities*. Published by the Department for Environment, Food and Rural Affairs. Printed in the UK, March 2004. [www.defra.gov.uk](http://www.defra.gov.uk).
- Devaney, F. (2008). *The Alder Marsh: Ecohydrology and Restoration Prospects of a Desiccating Dune Slack*. PhD Thesis. University College Dublin.
- Doody, J.P. (1984). *Spartina anglica in Great Britain. Focus on Nature Conservation No. 5*. Nature Conservancy Council, Huntingdon.
- Doody, J.P. (2002). *Coastal conservation and management: An ecological perspective*. Springer
- Doody, J.P. (2008). *Saltmarsh conservation, management and restoration*. Springer.
- Doogue, D., Nash, D., Parnell, J., Reynolds, S. & Wyse Jackson, P. (1998). *Flora of County Dublin*. Dublin Naturalists Field Club, Dublin.
- Doyle, J. (1934). *Spartina townsendii* H & J Groves, at the north Bull, Co. Dublin. *Irish Naturalists' Journal*, 5, 158.
- Dublin Corporation (1994). *The north Bull Island special amenity area order - report*. Dublin Corporation, Dublin.
- Dublin City Council (1998). *Control of Dogs Bye-laws 1998*. Dublin City Council
- Dublin City Council (2002). *Parks and Open Spaces Bye-Laws 2002*. Dublin City Council
- Dublin City Council (2003). *Dublin City: Natural Heritage Surveys*. Dublin City Council.
- Dublin City Council (2008). *Dublin City Biodiversity Action Plan 2008-2012*. Dublin City Council.
- Environmental Impact Services Ltd (2001). *Environmental Impact Statement for Alterations to St Anne's Golf Course*. Unpublished report prepared for St Anne's Golf Club by Environmental Impact Services Ltd.
- Environmental Impact Services Ltd (2003). *Environmental Impact Statement for Embankment Rehabilitation Works at Royal Dublin Golf Course, North Bull Island*. Unpublished report prepared for The Royal Dublin Golf Club by Environmental Impact Services Ltd.
- Environment & Heritage Service (2007). *Environmentally Sustainable Seaweed Harvesting in Northern Ireland*. <http://www.ni-environment.gov.uk/seaweedharvestingniehspostionstatement.pdf>
- Environmental Research Unit (1992a). *Dublin bay water quality management plan. Technical Report No. 1*. Recreation, amenity and wildlife conservation study : prepared for Dublin Corporation, Dublin County, Dun Laoghaire Corporation ; by Reid McHugh and Partners.. Environmental Research Unit, Dublin.

- Environmental Research Unit (1992b). *Dublin bay water quality management plan. Technical Report No. 3. Field studies of currents and dispersion* / M.J. Mansfield.. Environmental Research Unit, Dublin.
- Environmental Research Unit (1992c). *Dublin bay water quality management plan. Technical Report No. 6. Studies on the benthos* / Benthos Research Group. Environmental Research Unit, Dublin.
- Environmental Research Unit (1992d). *Dublin bay water quality management plan. Technical Report No. 7. Algal growths and foreshore quality*. Environmental Research Unit, Dublin.
- ESB International. (1996). *North Bull Island causeway study - technical report*. ESB, Dublin.
- ESB International (2002). *Breaching of the causeway and provision of bridge at North Bull Island*. Environmental impact Statement (Draft). ESB Dublin.
- Flood, D.T. (1977). Historical evidence for the growth of North Bull Island. In: *North Bull Island Dublin Bay - a modern coastal natural history*. (Eds D.W. Jeffrey, R.N. Goodwillie, B. Healy, C.H. Holland, J.S. Jackson & J.J. Moore), pp 8-12. Royal Dublin Society, Dublin.
- Fealy, R. (2003). The impacts of climate change on sea level and the Irish coast. In: *Climate change: Scenarios and impacts for Ireland*. (Eds. J. Sweeney *et al.*). (2000-LS-5.2.1-M1). Environmental Protection Agency, Johnstown.
- Flood, D.T. (1977). Historical evidence for the growth of North Bull Island. In: *North Bull Island Dublin Bay - a modern coastal natural history*. (Eds D.W. Jeffrey, R.N. Goodwillie, B. Healy, C.H. Holland, J.S. Jackson & J.J. Moore), pp 8-12. Royal Dublin Society, Dublin.
- Fossitt, J. A. (2000). *A guide to habitats in Ireland*. The Heritage Council, Kilkenny.
- Fowler, S.L. (1999). *Guidelines for managing the collection of bait and other shoreline animals within UK European marine sites*. English Nature. [www.ukmarinesac.org.uk/bait-collection.htm](http://www.ukmarinesac.org.uk/bait-collection.htm)
- Gaynor, K (2008). *The phytosociology and conservation value of Irish sand dunes*. PhD thesis. University College Dublin.
- Goodwillie, R. & Fahy E., (1973). *A preliminary report on areas of scientific interest in County Dublin*. An Foras Forbartha.
- Goss-Custard, J.D. & Moser, M.E. (1988). Rates of change in the numbers of Dunlin *Calidris alpina* wintering in British estuaries in relation to the spread of *Spartina anglica*. *Journal of Applied Ecology*, 25, 95-109.
- Grootjans, A.P., Adema, E.B., Bekker, R.M., & Lammerts (2004). Why coastal dune slacks sustain a high biodiversity. In: *Coastal Dunes, Ecology and Conservation*. (Eds. M.L. Martinez and N.P. Psuty). Ecological Studies 171, Springer. ‘
- Government of Ireland (1996). *ECOPRO: Environmentally friendly coastal protection*. The Stationary Office, Dublin.
- Gray, A.J. & Benham, P.E.M. (1990). *Spartina anglica - a research review*. ITE research publication, HMSO, London.
- Gray, A.J., Marshall, D.F. & Raybould, A.F. (1991). A century of evolution in *Spartina anglica*. *Advances in Ecological Research*, 21, 1-62.
- Gray, A.J., Warman, E.A., Clarke, R.T. & Johnson, P.J. (1995). The niche of *Spartina anglica* on a changing coastline. *Coastal Zone Topics: Process, Ecology and Management*, 1, 29-34.
- Hammond, M.E.R. & Cooper, A. (2002). *Spartina* eradication and intertidal recovery in Northern Ireland estuaries. In: *Turning the tide: the eradication of invasive species*. (Eds. C.R. Veitch and M.N. Clout), pp 124-131. IUCN SSC Invasive Species Specialist Group. IUCN, Gland, Switzerland and Cambridge, UK.
- Harris, C. R. (1977). Sedimentology and geomorphology. In: *North Bull Island Dublin Bay - a modern coastal natural history*. (Eds. D.W. Jeffrey, R.N. Goodwillie, B. Healy, C.H. Holland, J.S. Jackson & J.J. Moore). Royal Dublin Society, Dublin.

- Healy, B. (1975). Fauna of the salt-marsh, North Bull Island Dublin. *Proceedings of the Royal Irish Academy B* 75: 225-244.
- Healy, B. (1977). The Bull Wall. In: *North Bull Island Dublin Bay - a modern coastal natural history*. (Eds. D.W. Jeffrey, R.N. Goodwillie, B. Healy, C.H. Holland, J.S. Jackson & J.J. Moore). Royal Dublin Society, Dublin.
- Healy B. (2003). Coastal lagoons. In: *Wetlands in Ireland*, (Ed. M.J. Otte). UCD Press, Dublin.
- Heffernan, M.L. (1999). *A review of the ecological implications of mariculture and intertidal harvesting in Ireland*. Irish Wildlife Manuals, No. 7. National Parks & Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland.
- Hickie, D. (1997). *Evaluation of environmental designations in Ireland*. The Heritage Council, Kilkenny.
- Holyoak, D. (2003). *Looking after rare mosses and liverworts in coastal dune slacks*. Plantlife International.
- Holyoak, D.T. (2006). Progress towards a species inventory for conservation of bryophytes in Ireland. *Biology and Environment: Proceedings of the Royal Irish Academy*, Vol. 106B (3), 225-236.
- Hunt, J., Derwin, J., Coveney, J. & Newton, S. (2000). Ireland. In: *Important Bird Areas in Europe: priority sites for conservation 1: Northern Europe*. (Eds. M.F. Heath and M.I. Evans), pp 365-416. Birdlife international, Cambridge, UK.
- IUCN (1998). *Guidelines for Re-introductions*. Prepared by the IUCN/SSC Re-introduction Specialist Group. IUCN, Gland, Switzerland and Cambridge, UK.
- Jeffrey, D.W., Goodwillie, R.N., Healy, B., Holland, C.H., Jackson, J.S. & Moore, J.J. (1977). *North Bull Island Dublin Bay - a modern coastal natural history*. Royal Dublin Society, Dublin.
- Jeffrey, D.W. (1984). Case History: North Bull Island Dublin Bay – an assessment of a nature conservation resource. In: *Nature Conservation in Ireland – progress and problems*. (Ed. D.W. Jeffrey), pp 67-80. Royal Irish Academy, Dublin.
- Jeffrey, D. W., B. Madden, B. Rafferty, R. Dwyer & J. G. Wilson, (1991). Indicator organisms as a guide to estuarine management. In: *Bioindicators and environmental management*. (Eds. D.W. Jeffrey and B.M. Madden), pp 55-64. London, Academic Press.
- Joint Nature Conservation Committee (2004). *Common Standards Monitoring guidance for saltmarsh habitat*. JNCC, Peterborough.
- Joint Nature Conservation Committee (2007). *Conservation status assessment for Habitat: H2190 - Humid dune slacks*. Second Report by the UK under Article 17 on the implementation of the Habitats Directive from January 2001 to December 2006. Peterborough: JNCC. Available from: [www.jncc.gov.uk/article17](http://www.jncc.gov.uk/article17)
- Jovanovic, B., Longmore C., O'Leary A. & Mariani S. (2007). Fish community structure and distribution in a macro-tidal inshore habitat in the Irish Sea. *Estuarine, Coastal and Shelf Science* 75 (2007) 135-142.
- Kirby, R. (1994). Sediments 2 - Oysters: the case histories of two legal disputes involving fine sediment and oysters. *Journal of Coastal Research*, 10, 466-487.
- Koutsogiannopoulou, V. & Wilson, J.G. (2007). The fish assemblage of the intertidal salt marsh creeks in North Bull Island, Dublin Bay: seasonal and tidal changes in composition, distribution and abundance. *Hydrobiologia* 588 (1), pp 213-224.
- Lacambra, C., Cutts, N., Allen, J., Burd F., & Elliott, M. (2004). *Spartina anglica: a review of its status, dynamics and management*. Institute of Estuarine and Coastal Studies, University of Hull. English Nature Research Reports Number 527.

- Liley, D. (1999). *Predicting the consequences of human disturbance, predation and sea-level rise for ringed plover populations*. PhD thesis. University of East Anglia.
- Louth Nature Trust (2007). *Little Tern Conservation Project at Baltray 2007*. [www.louthnaturetrust.org/little\\_terns\\_20072](http://www.louthnaturetrust.org/little_terns_20072)
- Lyons D. O. (2004). *Summary of National Parks & Wildlife Service surveys for common (harbour) seals (*Phoca vitulina*) and grey seals (*Halichoerus grypus*), 1978 to 2003*. Irish Wildlife Manuals, No. 13. National Parks & Wildlife Service, Department of Environment, Heritage and Local Government. Dublin, Ireland
- Madden, B. (1984). *The nitrogen and phosphorous turnover of the Salicornia flat at North Bull Island, Dublin Bay*. B.A. (Mod) Thesis, University of Dublin, Trinity College.
- Madden, B., Jennings, E. & Jeffrey, D.W. (1993). Distribution and ecology of *Zostera* in Co. Dublin. *Irish Naturalists' Journal*, 24, 303-310.
- McCorry, M.J. & Otte, M.L. (2001). Ecological effects of *Spartina anglica* on the macro-invertebrate infauna of the mudflats at North Bull Island, Dublin Bay. *Web Ecology*, 2, 71-73.
- McCorry, M. (2002). *The ecology of Spartina anglica and its control on the mudflats and saltmarsh at North Bull Island*. Ph. D Thesis. University College Dublin.
- McCorry, M.J., Curtis, T.G.F. & Otte, M.L. (2003). *Spartina* in Ireland. In: *Wetlands in Ireland*. (Ed. M.J. Otte). UCD Press, Dublin.
- McCorry, M. (2007). *Saltmarsh Monitoring Project 2006 – Summary Report*. An unpublished report for the National Parks & Wildlife Service, Department of Environment, Heritage and Local Government, Dublin.
- Mc Intyre, D. (1987). *The meadow of the Bull: a history of Clontarf*. Future Print, Dublin.
- McKenna, J., MacLeod, M., Power, J. & Cooper, A. (2000). *Rural Beach Management: A good practice guide*. Donegal County Council, Donegal.
- Moore, J.J. & O' Reilly, H. (1977). Saltmarsh: vegetation patterns and trends. In: *North Bull Island Dublin Bay - a modern coastal history*. (Eds. D.W. Jeffrey, R.N. Goodwillie, B. Healy, C.H. Holland, J.S. Jackson & J.J. Moore), pp 83-87. Royal Dublin Society, Dublin.
- Murphy, T. (2008). *Bathing Shelters and Associated Structures in Clontarf and on the Bull Wall, North Dublin City*. Post-Graduate Diploma in Applied Building Conservation and Repair Thesis, Trinity College Dublin.
- Nairn, R.G.W. (1986). *Spartina anglica* in Ireland and its potential impact on wildfowl and waders - a review. *Irish Birds*, 3, 215-258.
- National Trust (2008). *Dog Walking*. [http://www.nationaltrust.org.uk/main/w-chl/w-countryside\\_environment/w-activities/w-activities-other/w-activities-other-dog\\_walking.htm](http://www.nationaltrust.org.uk/main/w-chl/w-countryside_environment/w-activities/w-activities-other/w-activities-other-dog_walking.htm)
- Natural England (2008). *Countryside Agency Archive*. [http://www.countryside.gov.uk/LAR/archive/presscentre/dog\\_on\\_lead.asp](http://www.countryside.gov.uk/LAR/archive/presscentre/dog_on_lead.asp)
- Newton, S., Donaghy, A., Allen, D. & Gibbons, D. (1999). *Birds of conservation concern in Ireland*. *Irish Birds*, 6, 333-342.
- North Cornwall District Council (undated). *Beach Management Plan Polzeath*. <http://www.ncdc.gov.uk/index.cfm?articleid=19198>
- NPWS (undated, 1996?) Draft *Conservation Plan for North Dublin Bay cSAC*. Unpublished draft 1 plan. National Parks and Wildlife Service.

NPWS Rare Plant database. Database held by NPWS containing records about sites of rare species listed on the Flora Protection Order. Less detailed records available at [www.npws.ie](http://www.npws.ie).

NPWS (2007). *Conservation Assessment of Petalwort (Petalophyllum ralfsii (Wils.) Nees & Gottsche) in Ireland*. NPWS. [www.npws.ie](http://www.npws.ie).

NPWS (2008). *The status of EU protected habitats and species in Ireland. Conservation Status in Ireland of Habitats and Species listed in the European Council Directive on the Conservation of Habitats, Flora and Fauna 92/43/EEC*. [www.npws.ie](http://www.npws.ie).

Ó Cadhla, O., Strong, D., O'Keeffe, C., Coleman, M., Cronin, M., Duck, C., Murray, T., Dower, P., Nairn, R., Murphy, P., Smiddy, P., Saich, C., Lyons, D. & Hiby, A.R. (2007). *An assessment of the breeding population of grey seals in the Republic of Ireland, 2005*. Irish Wildlife Manuals No. 34. National Parks & Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin, Ireland.

O'Gorman, F. (1977). Mammals of the island. In: *North Bull Island Dublin Bay - a modern coastal history*. (Eds. D.W. Jeffrey, R.N. Goodwillie, B. Healy, C.H. Holland, J.S. Jackson & J.J. Moore), pp 111-114. Royal Dublin Society, Dublin.

O'Reilly, H. & Pantin, G. (1957). Some observations on the salt marsh formation in Co. Dublin. *Proceedings of the Royal Irish Academy*, 58B, 89-128.

Otte, M.L. (1994). *A re-evaluation of the management policy concerning Spartina grasses at the North Bull Island saltmarshes*. An unpublished report to Dublin Corporation, University College Dublin.

Pearson, M.C. & Rogers, J.A. (1962). Biological flora of the British Isles: *Hippophae rhamnoides* L. *Journal of Ecology*, 50, 501-513.

Pienkowski, M.W. (1984). Breeding biology and population dynamics of ringed plovers *Charadrius hiaticula* in Britain and Greenland: nest-predation as a possible factor limiting distribution and timing of breeding. *Journal of Zoology, London*, 202, 83-114.

Phalan, B. & Nairn, R.G. (2007). Disturbance to waterbirds in South Dublin Bay. *Irish Birds* 8: 223-230.

Ramsar Convention Secretariat (2006). *The Ramsar Convention Manual. A Guide to the Convention on Wetlands (Ramsar, Iran, 1971)* 4th edition Ramsar Convention Secretariat, Gland, Switzerland.

Ranwell, D.S. (Ed.) (1972). *The management of sea buckthorn Hippophae rhamnoides on selected sites in Great Britain*. Report of the Hippophae Study Group. Nature Conservancy, Norfolk.

Reid, N., Dingerkus, K., Montgomery, W. I., Marnell, F., Jeffrey, J., Lynn, D., Kingston, N., & McDonald, R. A. (2007) *Status of hares in Ireland*. Irish Wildlife Manuals N. 30. National Parks and Wildlife Service. Department of Environment, Heritage and Local Government, Dublin, Ireland.

Roberts, D., Davies, C., Mitchell, A., Moore, H., Picton, B., Portig, A., Preston, J., Service, M., Smyth, D., Strong, D. and Vize, S. (2004). *Strangford Lough Ecological Change Investigation (SLECI)*. Report to Environment and Heritage Service by the Queen's University, Belfast.

Royal Dublin Golf Club (1999). *Environmental Policy Statement*. The Royal Dublin Golf Club.

Russo, T., Pulcini, D., O'Leary, A., Cataudella, S. & Mariani S. (2007). Relationship between body shape and trophic niche segregation in two closely related sympatric fishes. *Journal of Fish Biology*, 73, 1-20.

Ryle T, Connelly, K., Murray, A. & Swan, M. (2009). *Coastal Monitoring Project*. Unpublished survey for the National Parks & Wildlife Service, Department of Environment, Heritage and Local Government, Dublin.

Scottish Natural Heritage (2000). *A Guide to Managing Coastal Erosion in Beach/Dune Systems*. Scottish Natural Heritage.



- Sefton Coast Partnership (2004). *Nature and Wildlife - Best Practice Towards Best Practice in the sustainable management of sand dune habitats*. [http://www.seftoncoast.org.uk/natcons\\_bestpra3.html](http://www.seftoncoast.org.uk/natcons_bestpra3.html)
- S.I. No. 39 (1976). *Wildlife Act 1976*. Dublin Stationary Office, Dublin.
- S.I. No. 243 (1977). *Wild Birds (Open seasons) Order, 1977*. Dublin Stationary Office, Dublin.
- S.I. No. 291 (1985). *European Communities (conservation of wild birds) regulations, 1985*. Dublin Stationary Office, Dublin.
- S.I. No. 48 (1986). *European Communities (conservation of wild birds) (Amendment) regulations, 1986*. Dublin Stationary Office, Dublin.
- S.I. No. 231 (1988). *Nature Reserve (North Bull Island) Establishment Order, 1988*. Dublin Stationary Office, Dublin.
- S.I. No. 232 (1988). *Nature Reserve (North Bull Island) Recognition Order, 1988*. Dublin Stationary Office, Dublin.
- S.I. No. 70 (1995). *North Bull Island Special Amenity Area Order, 1994 (Confirmation) Order, 1995*. Dublin Stationary Office, Dublin.
- S.I. No. 94 (1997). *European Communities (Natural Habitats) Regulations, 1997*. Dublin Stationary Office, Dublin.
- S.I. No. 94 (1999). *Flora Protection Order, 1999*. Dublin Stationary Office, Dublin.
- S.I. No. 371 (2001). *Wildlife (Amendment) Act, 2000 (Commencement) (no.2) order, 2001*. Dublin Stationary Office, Dublin.
- Stace, C.A. (1997). *New Flora of the British Isles*, 2<sup>nd</sup> edition. Cambridge University Press, Cambridge.
- Stokes, K., O'Neill, K. & McDonald, R.A. (2004). *Invasive species in Ireland*. Unpublished report to Environment & Heritage Service and National Parks & Wildlife Service. Quercus, Queens University Belfast, Belfast.
- Taylor, R.S., Penrose, L. & Rotherham I.D. (2003). *Gorse and its Management: Studies in Golf Course Management No 4*. Royal and Ancient Golf Club of St. Andrews, England & Sports Turf Research Institute (Bingley). Published by STRI.
- Taylor, K., Anderson, P., Taylor, R., Longden, K. and Fisher, P. (2005). *Dogs, access and nature conservation*. English Nature Research Reports 649. English Nature.
- Thompson, J.D. (1990). *Spartina anglica*, characteristic feature or invasive weed of coastal saltmarshes? *Biologist*, 37, 9-11.
- Toner, P., Bowman, J., Clabby, K., Lucey, J., McGarrigle, M., Concannon, C., Clenaghan, C., Cunningham, P., Delaney, J., O'Boyle, S., MacCárthaigh, M., Craig M., & Quinn R. (2005). *Water Quality in Ireland 2001-2003*. Environmental Protection Agency.
- Tubbs, C.R., Tubbs, J.M. & Kirby, J.S. (1992). Dunlin *Calidris alpina alpina* in the Solent, southern England. *Biological Conservation*, 60, 15-24.
- Wilde, T. (1993). *Threatened mammals, birds, amphibians and fish in Ireland. Irish Red Data Book 2: Vertebrates*. HMSO, Belfast.
- Wilson, J. G. & Parkes, A. (1998). Network analysis of the energy flow through the Dublin Bay ecosystem. *Biol. Environ.* 98B, 179-90.
- Wolfe, A. (1995). *A study of the ecology of the Irish mountain hare (Lepus timidus hibernicus) with some considerations for its management and that of the rabbit (Oryctolagus cuniculus) on North Bull Island, Dublin Bay*. PhD Thesis. University College Dublin.

[www.botanicgardens.ie](http://www.botanicgardens.ie). *Website lists the updated Red List for vascular plants and bryophytes.*

[www.blueflag.org/publicattachment/explanatory%20notes/BeachCriteriaExplanatoryNotes2008.pdf](http://www.blueflag.org/publicattachment/explanatory%20notes/BeachCriteriaExplanatoryNotes2008.pdf). *Website outlining Blue flag beach criteria and explanatory notes 2008-2009.*

[www.english-nature.org.uk/livingwiththesea/project\\_details/good\\_practice\\_guide/habitatcrr/ENRestore/Habitats/SandDune/index.htm](http://www.english-nature.org.uk/livingwiththesea/project_details/good_practice_guide/habitatcrr/ENRestore/Habitats/SandDune/index.htm). *Series of web pages discussing sand dune restoration in Britain.*

[www.nationaltrust.org.uk/main/w-chl/w-countryside\\_environment/w-activities/w-activities-other/w-activities-other-parakarting.htm](http://www.nationaltrust.org.uk/main/w-chl/w-countryside_environment/w-activities/w-activities-other/w-activities-other-parakarting.htm). *Website of The National Trust in Britain outlining some guidelines for power-kiting activities on their properties.*

[www.thanetcoast.org.uk/thanet\\_coast\\_project.aspx](http://www.thanetcoast.org.uk/thanet_coast_project.aspx). *Website of the Thanet Coastal Project and includes codes of conduct for different users. See also [www.thanetcoast.org.uk/docs/5\\_Air\\_Based\\_Activities\\_0407.doc](http://www.thanetcoast.org.uk/docs/5_Air_Based_Activities_0407.doc)*

[www.ukbap.org.uk/ukplans.aspx?ID=28](http://www.ukbap.org.uk/ukplans.aspx?ID=28). *UK Biodiversity Action Plan – Coastal sand dunes. Website outlining strategies for the conservation of sand dune habitats in Britain to meet biodiversity targets set by the Convention on Biological Diversity.*

[www.unesco.org/mab/BRs/offDoc.shtml](http://www.unesco.org/mab/BRs/offDoc.shtml). *UNESCO website outlining the Man and Biosphere programme including links to information about North Bull Island.*  
<http://www.unesco.org/mabdb/br/brdir/directory/biores.asp?code=IRE+01&mode=all>

[www.wetlands.org/rsis/](http://www.wetlands.org/rsis/). *Website containing a database of all Ramsar sites including information on North Bull Island.*

## 7 APPENDICES

### 7.1 Appendix I – Consultee list

The following organisations and individuals were invited to comment about management issues affecting the island and make available any information relevant to the plan. Fifty-four of these consultees responded.

#### **Local, regional and national authorities and government organizations**

Dublin City Council (Parks and Landscape Services)

Mairéad Stack (Biodiversity officer)

Gerry Barry

Maryann Harris

Eoin Ward

Charles Duggan

Noel McEvoy

Mick Harford

Donnocha O'Dualing

Pat Corrigan (North Bull Island Visitor and Interpretative Centre)

Paul Hughes (North Bull Island Visitor and Interpretative Centre)

Bord Iascaigh Mhara

Central Fisheries Board

Department of the Environment, Heritage and Local Government (NPWS)

Dr Karen Gaynor (Research Section – habitats)

Dr Naomi Kingston (Research Section – rare species)

Dr Rebecca Jeffrey (Research Section – conservation planning)

Dr Neil Lockhart (Research Section – bryophytes)

Dr Mike Wyse-Jackson (Research Section – designations and rare species)

Dr Liz Sides – intertidal and marine)

Dr Maurice Eakin (NPWS regional staff)

Neil Harmey (NPWS ranger)

Dr David Tierney (Research Section – SPA, birds)

Dr Eamon Kelly (Research Section – intertidal)

Department of Agriculture, Fisheries and Food (Foreshore Section – Clonikilty)

Dublin Harbour and Port Authority

Dublin Dockland Development Authority  
Dublin Regional Authority  
Eastern Regional Fisheries Board  
Environmental Protection Agency  
Geological Survey of Ireland  
Marine Institute  
National Biodiversity Data Centre  
National Botanical Gardens  
Office of Public Works  
The Heritage Council

**Other land owners**

St Anne's Golf Club  
Royal Dublin Golf Club  
Dublin Port Company

**Other stakeholders and consultees**

An Taisce (NGO conservation group)  
Bat Conservation Ireland (NGO conservation group)  
Birdwatch Ireland (NGO conservation group) (Olivia Crowe & Siobhan Egan)  
Birdwatch Ireland South Dublin Branch  
Birdwatch Ireland Dublin Fingal  
Birdwatch Ireland Dublin Tolka Branch  
Botanical and Environmental Consultants (Louise Scally)  
Botanical Society of Britain and Ireland (NGO conservation group)  
North Bull Island Action Group  
Clontarf Residents Association  
Coastwatch Ireland (NGO conservation group)  
Tom Cooney (ecologist)  
Dr Fiona Devaney (carried out research at North Bull Island)  
Dr Declan Doogue (botanist)  
Dublin Angling Initiative (NGO)  
Dublin Bay Sailing Club  
Dublin Bay Watch  
Dublin City University  
Dublin Naturalist's Field Club (NGO conservation group)  
Dublin Institute of Technology  
Genetic Heritage Ireland (NGO conservation group)

Roger Goodwillie (ecologist)  
Irish Kite Surfing Association  
KitingIreland (Landkiting) - Christophe Bernigaud  
Irish Seal Sanctuary (NGO conservation group)  
Irish Whale and Dolphin Group (NGO conservation group)  
Irish Wildlife Trust (NGO conservation group)  
Professor David Jeffery (retired academic TCD)  
Brian Kealy (Bat specialist)  
Dr Eleanor Landy (fungal expert - carried out research at North Bull Island)  
Louth Nature Trust (Little Tern)  
Dr Brian Madden (ecologist)  
Dr Evelyn Moorkens (ecologist)  
Dr Rinus Otte (Academic)  
Sylvia Reynolds (botanist)  
Sea Scouts North Bull Island  
Trinity College Dublin (Zoology Department)  
    Professor Jim Wilson (intertidal and sub-tidal)  
    Sandrine Launard (PhD research student intertidal)  
Trinity College Dublin (Centre for the Environment)  
Trinity College Dublin (Botany Department)  
Dr Mary Tubridy (ecologist)  
University College Dublin (School of Biology and Environmental Science)  
    Hubert Fuller (fungi)  
    Dr Stefano Mariani (marine biology)

**Other organizations**

Natural England  
    Dr Sue Rees (*Spartina* management)  
Environment and Heritage Service Northern Ireland  
Liverpool Hope University  
    Dr Paul Rooney (coastal specialist)  
    Dr John Houston (coastal specialist)  
    Dr Sally Edmondson (coastal specialist)

## 7.2 Appendix II – I-WeBS counts

### Wooden Bridge – Causeway

Species	1% National	1% International	2002/03	2003/04	2004/05	2005/06	2006/07	Mean	Peak
Little Grebe	25	4,000				1		0	1
Great Crested Grebe	55	3,600	9		4		1	3	9
Cormorant	140	1,200		5	3	4	3	3	5
Grey Heron	30	2,700	11	30	17	11	27	19	30
Little Egret		1,300	2	1	3	11	7	5	11
Mute Swan	110	110				4	5	2	5
Light-bellied Brent Goose	220	260	743	940	1,505	2,447	855	1,298	2,447
Shelduck	150	3,000	265	540	565	398	215	397	565
Wigeon	820	15,000	555	757	316	449	271	470	757
Gadwall	20	600		1				0	1
Teal	450	5,000	644	835	1,062	356	320	643	1,062
Mallard	380	20,000	77	39	42	18	26	40	77
Pintail	20	600	54	14	32			20	54
Shoveler	25	400	101	206	72	142	69	118	206
Goldeneye	95	11,500		1	12		2	3	12
Red-breasted Merganser	35	1,700	8	10	8	1	7	7	10
Oystercatcher	680	10,200	1,009	854	1,171	561	1,453	1,010	1,453
Ringed Plover	150	730		12	2	18		6	18
Golden Plover	1,700	9,300	266	1,131	3,202	562	1,020	1,236	3,202
Grey Plover	65	2,500	227	187	44	176	157	158	227
Lapwing	2,100	20,000	33	22	21	19	31	25	33
Knot	190	4,500	2,338	1,254	1,117	4,265	3,475	2,490	4,265
Sanderling	65	1,200					7	1	7
Little Stint						1		0	1
Dunlin	880	13,300	2,003	1,447	1,697	1,697	3,357	2,040	3,357
Ruff		12,500				1		0	1
Snipe		20,000					1	0	1
Black-tailed Godwit	140	470	729	890	450	439	140	530	890
Bar-tailed Godwit	160	1,200	785	1,174	2,175	687	2,229	1,410	2,229
Whimbrel		2,000				1		0	1
Curlew	550	8,500	911	435	416	524	897	637	911
Redshank	310	3,900	1,083	658	561	1,218	714	847	1,218
Greenshank	20	2,300	11	10	10	6	4	8	11
Turnstone	120	1,500	92	132	138	148	130	128	148
Mediterranean Gull				1				0	1
Black-headed Gull		20,000	60	395	883	511	975	565	975
Common Gull		16,000	64	80	33	24	8	42	80
Lesser Black-backed Gull		4,500					4	1	4
Herring Gull		13,000		2	3	6	9	4	9
Great Black-backed Gull		4,800		2	2	2	3	2	3
Common Tern							1	0	1

The counts presented in the table refer to the peak counts of species in each I-WeBS season. Site peak and mean are calculated as the peak and mean of peak counts respectively over the seasons specified. Blank cells within columns which contain positive values for one or more species constitute zero for those species. Data supplied by Birdwatch Ireland.



**North of Causeway (to saltmarsh)**

Species	1% National	1% International	2002/03	2003/04	2004/05	2005/06	2006/07	Mean	Peak
Great Crested Grebe	55	3,600				11		2	11
Cormorant	140	1,200				1		0	1
Grey Heron	30	2,700	1	1	1	3	1	1	3
Little Egret		1,300		1	2	1	2	1	2
Whooper Swan	130	210			13			3	13
Light-bellied Brent Goose	220	260	370	367	351	536	118	348	536
Shelduck	150	3,000	478	293	446	229	289	347	478
Wigeon	820	15,000	211	167	4	21	39	88	211
Teal	450	5,000	128	328	136	181	202	195	328
Mallard	380	20,000	23	18	16	14	12	17	23
Pintail	20	600	223	123	82	120	117	133	223
Blue-winged Teal						1		0	1
Shoveler	25	400	38	3	11	16	10	16	38
Red-breasted Merganser	35	1,700	2	1			1	1	2
Oystercatcher	680	10,200	92	116	49	284	60	120	284
Ringed Plover	150	730					5	1	5
Golden Plover	1,700	9,300		220	2,299	967		697	2,299
Grey Plover	65	2,500	49	12	10	200	7	56	200
Lapwing	2,100	20,000	24	22	24	108	21	40	108
Knot	190	4,500	600	13	21	260	51	189	600
Sanderling	65	1,200				318		64	318
Dunlin	880	13,300	883	20	72	46	12	207	883
Ruff		12,500		1		1		0	1
Black-tailed Godwit	140	470	275	307	167	271	143	233	307
Bar-tailed Godwit	160	1,200	1	1		26	155	37	155
Curlew	550	8,500	160	331	240	233	441	281	441
Redshank	310	3,900	181	240	97	458	196	234	458
Greenshank	20	2,300	1	2	1	3	4	2	4
Turnstone	120	1,500	16	1	2	38	27	17	38
Black-headed Gull		20,000	560	901	668	454	650	647	901
Common Gull		16,000	537	438	367	372	409	425	537
Lesser Black-backed Gull		4,500	7	9		5	5	5	9
Herring Gull		13,000	74	127	42	83	173	100	173
Great Black-backed Gull		4,800	68	139	280	104	265	171	280

The counts presented in the table refer to the peak counts of species in each I-WeBS season. Site peak and mean are calculated as the peak and mean of peak counts respectively over the seasons specified. Blank cells within columns which contain positive values for one or more species constitute zero for those species.

**Saltmarsh – Sutton**

Species	1% National	1% International	2002/03	2003/04	2004/05	2005/06	2006/07	Mean	Peak
Red-throated Diver	20	3,000				1	1	0	1
Great Northern Diver		50				2		0	2
Little Grebe	25	4,000		2				0	2
Great Crested Grebe	55	3,600	8	7	7	6	4	6	8
Cormorant	140	1,200	8	11	5	5	12	8	12
Grey Heron	30	2,700	8	7	10	14	6	9	14
Little Egret		1,300		2	5	13	12	6	13
Mute Swan	110	110		1				0	1
Light-bellied Brent Goose	220	260	1,740	863	956	2,340	1,153	1,410	2,340
Shelduck	150	3,000	452	480	396	313	561	440	561
Wigeon	820	15,000	407	675	225	161	381	370	675
Teal	450	5,000	325	505	242	426	494	398	505
Mallard	380	20,000	93	38	35	48	74	58	93
Pintail	20	600	96	154	20	107	69	89	154
Shoveler	25	400	26			24	25	15	26
Scaup	45	3,100			2			0	2
Long-tailed Duck		20,000	2		1			1	2
Goldeneye	95	11,500	5	6	4	3	6	5	6
Red-breasted Merganser	35	1,700	9	20	17	19	9	15	20
Oystercatcher	680	10,200	1,057	703	895	713	638	801	1,057
Ringed Plover	150	730	77	107	121	14	25	69	121
Golden Plover	1,700	9,300			50	1,810	101	392	1,810
Grey Plover	65	2,500	514	287	119	472	604	399	604
Lapwing	2,100	20,000	4				56	12	56
Knot	190	4,500	795	1,905	1,194	914	2,825	1,527	2,825
Sanderling	65	1,200					1	0	1
Dunlin	880	13,300	2,391	3,970	2,538	2,155	3,626	2,936	3,970
Black-tailed Godwit	140	470	236	974	453	505	447	523	974
Bar-tailed Godwit	160	1,200	205	550	46	120	698	324	698
Curlew	550	8,500	284	1,129	462	582	442	580	1,129
Redshank	310	3,900	659	595	524	326	778	576	778
Greenshank	20	2,300	4	62	15	6	10	19	62
Turnstone	120	1,500	77	114	57	299	130	135	299
Mediterranean Gull				1				0	1
Black-headed Gull		20,000	340	340	145	249	267	268	340
Common Gull		16,000	24	58	13	29	48	34	58
Lesser Black-backed Gull		4,500			2		16	4	16
Herring Gull		13,000	14	18	8	59	62	32	62
Great Black-backed Gull		4,800	4	3	8	33	148	39	148
Sandwich Tern							2	0	2

The counts presented in the table refer to the peak counts of species in each I-WeBS season. Site peak and mean are calculated as the peak and mean of peak counts respectively over the seasons specified. Blank cells within columns which contain positive values for one or more species constitute zero for those species.

**Dollymount Strand (incl. open water)**

Species	1% National	1% International	2002/03	2003/04	2004/05	2005/06	2006/07	Mean	Peak
Great Crested Grebe	55	3,600	5	8	16	7	15	10	16
Cormorant	140	1,200	33	110	66	72	124	81	124
Shag							1	0	1
Grey Heron	30	2,700	1	2		1		1	2
Light-bellied Brent Goose	220	260	13	10	8	8	7	9	13
Mallard	380	20,000		3				1	3
Goldeneye	95	11,500	2		1			1	2
Red-breasted Merganser	35	1,700	11	21	2	5		8	21
Oystercatcher	680	10,200	346	735	138	227	105	310	735
Ringed Plover	150	730		105	5	28		28	105
Golden Plover	1,700	9,300	376			2		76	376
Grey Plover	65	2,500	76	158	85	104	101	105	158
Knot	190	4,500	142	400	960		48	310	960
Sanderling	65	1,200	280	334	343	300	427	337	427
Dunlin	880	13,300	111	1,620	2,125	45	11	782	2,125
Black-tailed Godwit	140	470	4	500	6	31	30	114	500
Bar-tailed Godwit	160	1,200	244	622	915	84	797	532	915
Curlew	550	8,500	31	111	11	15	5	35	111
Redshank	310	3,900	19	46	12	25	1	21	46
Turnstone	120	1,500	18	29	59	32	50	38	59
Mediterranean Gull				1				0	1
Black-headed Gull		20,000	70	733	34	82	58	195	733
Common Gull		16,000	175	334	97	237	42	177	334
Lesser Black-backed Gull		4,500		1			1	0	1
Herring Gull		13,000	8	341	47	51	45	98	341
Great Black-backed Gull		4,800	1	9	12	3	24	10	24
Unidentified Tern							244	49	244
Sandwich Tern			1			110	100	42	110
Common Tern						1		0	1
Little Tern							1	0	1

The counts presented in the table refer to the peak counts of species in each I-WeBS season. Site peak and mean are calculated as the peak and mean of peak counts respectively over the seasons specified. Blank cells within columns which contain positive values for one or more species constitute zero for those species.

**Sutton – Dinghy Club**

Species	1% National	1% International	2002/03	2003/04	2004/05	2005/06	2006/07	Mean	Peak
Great Northern Diver		50		1				0	1
Great Crested Grebe	55	3,600		11	5	10	11	7	11
Slavonian Grebe		55		1				0	1
Cormorant	140	1,200	4	21	37	18	8	18	37
Grey Heron	30	2,700		4	2	9	3	4	9
Little Egret		1,300		1	4		1	1	4
Light-bellied Brent Goose	220	260	325	240	150	201	360	255	360
Shelduck	150	3,000		57		57		23	57
Mallard	380	20,000	30			3		7	30
Goldeneye	95	11,500		3	2		1	1	3
Red-breasted Merganser	35	1,700	9	17	10	6	8	10	17
Oystercatcher	680	10,200	316	549	225	221	282	319	549
Ringed Plover	150	730	1	4		16		4	16
Golden Plover	1,700	9,300		43	3			9	43
Grey Plover	65	2,500	36	79	9	18	11	31	79
Knot	190	4,500		14				3	14
Sanderling	65	1,200		1				0	1
Dunlin	880	13,300	1	33	22		30	17	33
Black-tailed Godwit	140	470	26	43	9	15	16	22	43
Bar-tailed Godwit	160	1,200	36	125	42	76	39	64	125
Curlew	550	8,500	25	39	17	15	199	59	199
Redshank	310	3,900	207	195	102	16	129	130	207
Greenshank	20	2,300	1	4	2	1	2	2	4
Turnstone	120	1,500	69	66	57	55	77	65	77
Black-headed Gull		20,000	173	145	29	86	58	98	173
Common Gull		16,000	11	75	28	34	25	35	75
Lesser Black-backed Gull		4,500		4	4	10	2	4	10
Herring Gull		13,000	67	108	206	46	122	110	206
Great Black-backed Gull		4,800	3	14	9	36	10	14	36

The counts presented in the table refer to the peak counts of species in each I-WeBS season. Site peak and mean are calculated as the peak and mean of peak counts respectively over the seasons specified. Blank cells within columns which contain positive values for one or more species constitute zero for those species.

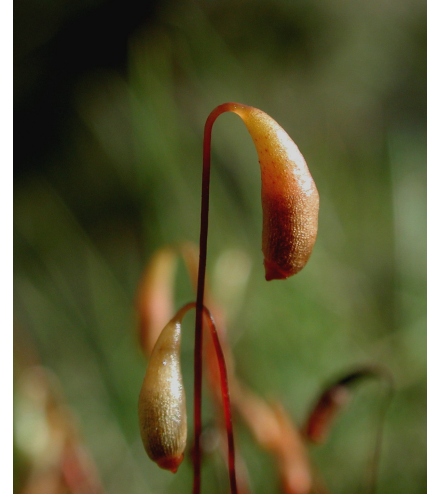
### 7.3 Appendix III – Photos of some notable species



***Bryum*  
sp.**  
(left)

***Bryum*  
*uliginosum***  
(right)

(Photo: Neil  
Lockart)



**Many Seasoned Thread-moss (*Bryum intermedium*)**  
(Photo: Neil Lockart)



**Warne's Thread-moss (*Bryum warneum*)**  
(Photo: Neil Lockart)



**Red Hemp-nettle**  
(*Galeopsis angustifolia*)

(Photo: Anonymous)



**Petalwort**  
(*Petalophyllum ralfsii*)

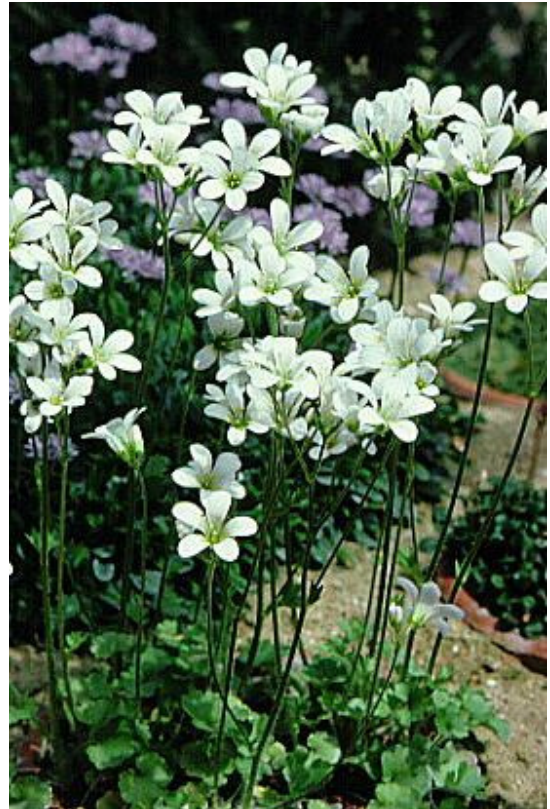
(Photo: Neil Lockhart)

(plant is magnified and  
is < 5 mm in diameter)



**Meadow Saxifrage**  
(*Saxifraga granulata*)

(Photo: Anonymous)



## 7.4 Appendix IV – Additional information on ecological and management issues

### 7.4.1 Conservation status of Annex I habitats

Achieving Favourable Conservation Status 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. 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. Conservation Assessment is divided into three sections, assessing the extent, structure and functions of the habitat and future prospects of each habitat. Conservation assessment is based on the so-called 'traffic light' system (Commission of European Communities 2006). The following table (Table 5) summarizes the conservation status of the habitats assessed by these two surveys. An assessment of unfavourable-inadequate is given if there is a 1-25% loss of extent or decline in structure and functions, so even a small amount of damage leads to this assessment. An assessment of unfavourable-bad is given if there is a > 25% decline of structure and functions in the habitat.

**Table 5.** Conservation status of various Annex I habitats present at North Bull Island

Annex I Habitat	Conservation status	Main reasons for assessment
*Fixed coastal dunes with herbaceous vegetation (2130)	Unfavourable - Bad	Mainly due to presence of rank grassland (species poor) and also related to heavy recreational pressures that influence the development of bare tracks and sand dune blow-outs.
Embryonic shifting dunes (2110)	Unfavourable - Inadequate	Extent is restricted due to recreational pressure, particularly in the northern section of the island.
Shifting dunes along the coast line with <i>Ammophila arenaria</i> (white dunes) (2120)	Unfavourable - Inadequate	The mobile dunes are overall quite healthy. Assessment mainly due to associated damage from recreational pressure, particularly close to access points around the end of the causeway, where tracks erode vegetation cover.
Humid dune slacks (2190)	Unfavourable - Inadequate	Mainly due to impacts of recreational pressure and the creation of tracks that erode vegetation cover. (Data from Devaney 2008 may indicate that the extent of the Alder marsh is decreasing, so a more up to date assessment may be unfavourable-bad). The dune slacks were noted as being some of the most impressive examples of dune slack habitat present on the east coast.
Dunes with <i>Salix repens</i> ssp. <i>argentea</i> (Salicion arenaria) (2170)	not assessed	Not mapped on North Bull Island by CMP but likely to be assessed as favourable as it is only a very small area.

Mudflats and sandflats not covered by water at low tide (1140)	not assessed	Not assessed by either project.
Annual vegetation of drift-lines (1210)	Unfavourable - Bad	Not assessed by the CMP in the southern half of the island due to its very limited extent, probably related to beach-cleaning activities. Habitat in good condition in the northern half of the island.
<i>Salicornia</i> flats (1310)	Unfavourable - Inadequate	Mainly due to the presence of <i>Spartina anglica</i> , an invasive species, which has the capacity to reduce the extent of this habitat in the future. In contrast there are indications that the extent of this habitat has increased in the recent past.
Atlantic salt meadows (1330)	Favourable	No significant negative impacts acting on the saltmarsh. Habitat in good condition.
Mediterranean salt meadows (1410)	Favourable	No significant negative impacts acting on the saltmarsh. Habitat in good condition.

#### 7.4.2 Ecology of Common Cordgrass at North Bull Island

The spread of Common Cordgrass and other invasive *Spartina* species over the past 100 years has been well documented at other sites in Britain, the rest of Europe, America and Australasia. Many studies have been carried out on the ecology of these species and its impacts on their habitat and the species that use their habitat. There have been several useful reviews of the ecology and impacts of Common Cordgrass (Doody 1984, Nairn 1986, Adam 1990, Grey & Benham 1990, McCorry *et al.* 2003, Lacambra *et al.* 2004, Doody 2008). The following review focuses on the specific and known impacts of Common Cordgrass at North Bull Island.

##### ENVIRONMENT

Common Cordgrass can affect its physical environment and has been called an 'ecosystem engineer' (Thompson 1990). The ability of the root system of Common Cordgrass to accrete and consolidate sediment more rapidly than other pioneer salt marsh plants has been one of the most obvious features of the formation of new *S. anglica* swards. The spread of Common Cordgrass is not thought to have caused sedimentation at North Bull Island (An Foras Forbartha 1984 & Otte 1994) by some authors and it is considered that the construction of the causeway had a much more significant impact on sedimentation patterns. However, a contrasting view was presented by CAAS (1990), which stated that the accretion of the *Salicornia* bank may have been enhanced by the spread of Common Cordgrass.

##### FLORA

Common Cordgrass usually colonises bare mudflats, seaward of existing salt marsh vegetation. Nevertheless, it is a serious competitor to other intertidal salt marsh plants. It has invaded pioneer salt marsh vegetation dominated by Common Saltmarsh-grass at the higher, landward level of its range at certain sites. As Common Cordgrass replaced Glasswort and Common

Saltmarsh-grass as the dominant primary coloniser on mudflats, it has had a significant impact on the course and pace of succession of salt marsh plant communities (Gray *et al.* 1991). Common Cordgrass is considered a threat to the extent of *Salicornia* flats (Annex I) at North Bull Island (McCorry 2007). It is present in the lower and pioneer saltmarsh zones of the Atlantic salt meadow habitat (Annex I), but it does not dominate overall (it may dominate in small areas) (McCorry 2007). The stand of Narrow-leaved Eelgrass (*Zostera augustifolia*) is still present on the mudflats and *Salicornia* flats north of the causeway and formed a narrow band (possibly in an old creek that remains flooded at low tide) that was not being colonised by Common Cordgrass. This stand or colony has been reduced in size between 2002-2008, although not as a result of any spread of Common Cordgrass, but due to other unidentified reasons.

### INFAUNA

The creation of *Spartina* swards with dense belowground biomass where there had previously been unvegetated mudflats has implications for the macro-invertebrate species living in the mud. However, there have been contrasting results from different studies, some showing negative impacts on diversity, some showing no significant impacts and some showing increased abundances of macro-invertebrates and increased diversity. McCorry and Otte (2001) showed that the abundance of macro-invertebrate species increased with the presence of Common Cordgrass on the intertidal mudflats at North Bull Island, with no significant impacts on species diversity.

### AVIAN FAUNA

Many wintering wader species are also dependent on the rich macro-invertebrate populations of mudflats that occur seaward of salt marshes. It was suggested that the spread of Common Cordgrass reduced the size of the feeding area and the amount of feeding time available to wintering waders and wildfowl (Goss-Custard & Moser 1988). Most waders and wildfowl can not or will not feed within or close to dense swards or meadows of Common Cordgrass. Goss-Custard and Moser (1988) demonstrated a correlation between the spread of Common Cordgrass and the decline of Dunlin in British estuaries. This correlation may not necessarily be causal however, because waders have declined in some sites in spite of decreases in Common Cordgrass cover (Tubbs *et al.* 1992).

There are no quantitative data available for North Bull Island to indicate that the spread of Common Cordgrass has had a measurable impact on the conservation status of wintering waders and wildfowl. It should be noted that Common Cordgrass still has not formed extensive dense swards at North Bull Island that could exclude waders and wildfowl. Anecdotal evidence indicates that the use of the area colonised by Common Cordgrass (*Salicornia* flats) north of the causeway by wintering waders and wildfowl is perhaps lower than the surrounding mudflats, but it should also be noted that it is used for feeding and roosting by some bird species (anecdotal information in McCorry 2002). Some waders and wildfowl will still feed and roost on the mudflats and *Salicornia* flats between the clumps of Common Cordgrass.

Monitoring of wetland bird populations with the Irish Wetland Bird Survey (IWeBS) of the Dublin Bay area since the construction of the causeway indicates that populations of some species have increased, some have decreased and some are stable during this period (McCorry 2002). An Foras Forbartha (1977) noted that numbers of some species actually increased after the

construction of the causeway due to the development of the *Salicornia* flats, as the seeds of this species is a food plant for several wildfowl (Teal). However, Crowe (2005) states that wader and wildfowl populations using Dublin Bay overall have fallen by 22% and 32% respectively since the previous Winter Wetlands Survey (1984-86).

The CAAS (1990) study noted that as Common Cordgrass only affected a small proportion of the whole feeding grounds in Dublin Bay, the effect of Common Cordgrass might be negligible. However, it should be noted that the intertidal habitats between the island and the mainland are very rich feeding grounds for wintering waders and wildfowl and have a disproportionately higher value to these populations (Crowe 2005).

An Foras Forbartha (1977) and CAAS (1990) both concluded that there was no evidence, from examination of bird counts, that habitat change (including the spread of Common Cordgrass) at North Bull Island had caused any significant decline in the bird populations visiting the area. Common Cordgrass is only found within 8% of the total area of intertidal mudflats, sandflats or *Salicornia* flats commonly used by wintering waders and wildfowl in the northern and southern intertidal areas at North Bull Island.

#### FORMER MANAGEMENT OF COMMON CORDGRASS AT NORTH BULL ISLAND

There have been several efforts to control Common Cordgrass by DCC using a variety of methods on the mudflats and saltmarsh between 1970-1995. Control was carried out at North Bull Island due to the perceived negative impact to wintering waders and wildfowl populations if rich mudflat feeding grounds were replaced with a less diverse, monospecific sward of Common Cordgrass. These control measures had varying success. The control of Common Cordgrass by the herbicide Dalapon in the late 1980s and early 1990s was successful in reducing cover of Common Cordgrass on the *Salicornia* flats and cover of Common Cordgrass was reduced from about 20% (at its most dense) in 1984 (An Foras Forbartha 1984) to 1% by 1989 (CAAS 1990) (not strict quantitative comparisons). Dublin Corporation re-assessed its *Spartina* management strategy in 1994 and decided to cease control of Common Cordgrass and to monitor its spread (Otte 1994).

#### CURRENT MANAGEMENT AND ATTITUDES TO COMMON CORDGRASS AT OTHER SITES

Stands of invasive *Spartina* (mainly *S. anglica* and *S. alterniflora*) grasses are still being controlled in many parts of the world due to negative impacts on nature conservation value (Doody 2008). Stands of Common Cordgrass are still being controlled at some nature reserves in Britain (Lindisfarne) using roto-burying techniques in response to perceived negative impacts on wintering bird feeding grounds.

Control of Common Cordgrass has been carried out in Strangford Lough in Northern Ireland in the recent past (Hammond & Cooper 2002) with varying success using a variety of techniques. The main reason for control is the replacement of intertidal mudflats and sandflats by swards of Common Cordgrass and the potential negative impact on wintering waders and wildfowl. Spraying was carried out using Dalapon between 1978-1984 and this was successful in clearing Common Cordgrass from large sections of the shoreline of Strangford Lough (Roberts *et al.* 2004). However there was no control between 1984-1996 due to consent requirements and court

actions against the control programme, due to the alleged release of sediment after control of Common Cordgrass affecting commercial aquaculture (oyster beds) (Kirby 1994).

Common Cordgrass re-colonised some of the cleared areas in Strangford Lough and was again quite extensive. Control recommenced during 1996 using Dalapon. Further experimental work used a variety of cutting, spraying and burying techniques (Hammond & Cooper 2002). Glyphosate (used without a sticking agent) was found to be ineffective (Mark Hammond, *Spartina* Working Group, NIEA, pers comm. 2008). A sticking agent called Mixture B was found to increase effectiveness of Glyphosate but was also found to be more toxic to macro-invertebrates in the mudflats and saltmarsh than the herbicide and is not used (or licensed) any more. Some control has continued, using cutting (with strimmers) and covering swards with black plastic. However, both these methods are considered impractical and uneconomic by NIEA for large areas of Common Cordgrass.

Herbicide applications are still considered to be the most effective and economic option for control of Common Cordgrass. The NIEA is currently attempting to get Fusilade (herbicide) licensed for use in the intertidal environment by the appropriate authorities in Britain. This herbicide has been used successfully by conservation managers in New Zealand and Australia to control invasive Cordgrass. An alternative management solution is the use of a new sticking agent (Topstone) with Glyphosate, which is currently being explored by NIEA. Experimental programmes with both methods are likely to be carried out by NIEA in Northern Ireland in the next few years.

There have also been several research projects and surveys to attempt to establish the potential future extent of Common Cordgrass in Northern Ireland (Cooper *et al.* 2006). These authors state that eradication of larger populations of Common Cordgrass in Northern Ireland is not realistic and that more emphasis should be placed on controlling new populations.

### ALTERNATIVE ATTITUDES

However, it should be noted that attitudes towards Common Cordgrass have changed somewhat in Britain and elsewhere. Thompson (1990) and McCorry *et al.* (2003) discussed various attitudes towards Common Cordgrass and noted that many of the pre-conceived ideas about the impact of Common Cordgrass were ill-founded and that it can have positive impacts as well as negative ones. Lacandra *et al.* (2004) in a review of the status and management of Common Cordgrass in Britain stated that there is no general consensus about its management and Common Cordgrass is generally not actively managed in Britain. This change in attitude recognises that the threat of Common Cordgrass on established saltmarsh in Britain is now less than originally perceived (Boorman 2003). Many of the concerns expressed in the 1960s about the possible loss of large areas of mixed species-rich saltmarsh to stands dominated by Common Cordgrass have proved to be unfounded.

The change in attitude towards Common Cordgrass by some conservation managers in Britain also takes account of the general ineffectiveness and cost of control attempts in the past. Lacandra *et al.* (2004) also stated that some of the reasons for the control of Common Cordgrass in the past were based on anecdotal evidence and not on established scientific research indicating measurable negative impacts. The National Parks and Wildlife Service is currently carrying out an extensive survey of the conservation status of Irish saltmarshes around the coast



and it is hoped that the results of this project will inform future policy towards the management of Common Cordgrass.

### **FUTURE MANAGEMENT OF COMMON CORDGRASS AT NORTH BULL ISLAND**

Any management of Common Cordgrass at North Bull Island should consider several issues. Positive as well as negative implications of the ecological impacts of Common Cordgrass and its control should be considered. Control of Common Cordgrass may or may not be appropriate in certain situations and any decision should be made on a site by site basis (Doody 2008). At some sites nature conservation objectives have been adapted to 'live' with *Spartina* swards.

1. It is now accepted that there is no reason to control Common Cordgrass to protect established saltmarsh vegetation (JNCC 2004) such as the ASM (the lower, mid and upper saltmarsh zones). Common Cordgrass is not likely to spread significantly within the ASM habitat at North Bull Island in the near future (McCorry 2007).

2. McCorry (2002) stated that the extent of the intertidal area north of the causeway affected by Common Cordgrass is not likely to increase significantly. Gray *et al.* (1995) found that *Spartina* swards were normally distributed between the Mean High Water Neap (NHWN) and the Mean High Water Spring (MHWS) tidal levels with a tendency to spread below MHWN in certain situations. The distribution of Common Cordgrass on the *Salicornia* flats is below the NHWN level. This level is positioned at around 0.9 m OD Malin and Common Cordgrass is already distributed between the 0.6-0.8 m levels (McCorry 2002). Common Cordgrass is not likely to spread below the 0.6 m OD Malin level. Most of the intertidal flats between the mainland and the island are positioned below the 0.6 m OD Malin level (ESB International 1996). Therefore, Common Cordgrass is not likely to affect a significant proportion of the intertidal feeding grounds used by wintering waders and wildfowl in the future. However, it would be worth modelling the potential spread of Common Cordgrass using the method devised by Cooper *et al.* (2006) in Northern Ireland.

3. While Common Cordgrass is not likely to increase its distribution significantly, it is likely to consolidate its position on the *Salicornia* bank north of the causeway. The extent of the Annex I habitat, *Salicornia* flats (1310) is notable at North Bull Island and is the largest area of this habitat recorded in the Republic of Ireland at present (although further survey work for the Saltmarsh Monitoring Project 2007-2008 is likely to produce more up-to-date data). Common Cordgrass poses a threat to this habitat. It is currently patchy and has an overall frequency of 14% within the *Salicornia* flats (McCorry 2002). It is likely to continue to spread in this area and increase its cover, albeit at a slow rate.

4. Any control of the Common Cordgrass population on the mudflats and *Salicornia* flats is likely to be a long-term programme. It should be noted that this area is being colonised by Common Cordgrass because it is a suitable habitat for this species. So even after any successful control or eradication of Common Cordgrass (80-90%), the *Salicornia* flats and surrounding mudflats will be vulnerable to re-invasion by this species. Any control would have to target all the Common Cordgrass at North Bull Island including that on the ASM to help prevent re-colonisation to adjoining habitats (*Salicornia* flats and mudflats), even though there is no risk to this habitat.

5. Predicted long-term changes in this area should be considered. The area north of the causeway is still actively accreting and that ASM is predicted to increase in extent in this area due to natural succession, although at a very slow rate. This is as a result of the changes in geomorphological cycles caused by the construction of the causeway and from natural sedimentation since then. This could mean a possible increase in extent of more established ASM at the expense of *Salicornia* flats habitat and *Spartina* swards. Control of Common Cordgrass in the long-term could be futile if a large area of mudflats and pioneer saltmarsh (*Salicornia* flats and *Spartina* swards) naturally develop into to more established ASM.

6. The environmental impact of any control measures should be considered. The use of herbicide may have potential environmental risks on other non-target species (McCorry 2002). Control experiments at North Bull Island found that herbicide (Gylphosate – Nomix) was much more efficient at killing Glasswort (*Salicornia* sp.) compared to Common Cordgrass.

7. The cost and resources for any control programme should be considered, especially as it would require a long-term timetable (5-10 years minimum). Control programmes may require expensive specialist equipment. Current health and safety legislation also has to be considered, particularly when working in a hazardous environment such as intertidal mudflats.

8. If the option of control is considered, then it would be preferable to begin control as soon as possible, before there is any substantial increase in the extent of Common Cordgrass. This would enhance the prospects of successful control of this species.

The two main arguments for controlling Common Cordgrass at North Bull Island are:

- (A) to maintain the conservation status of the Annex I habitats, *Salicornia* flats and intertidal mudflats
- (B) to maintain the conservation status of the wintering waders and wildfowl that use North Bull Island

Any successful eradication of Common Cordgrass will have a positive impact on the conservation status of the Annex I habitats, *Salicornia* flats (1310) and intertidal mudflats and sandflats (1210). North Bull Island currently has the largest area of *Salicornia* flats recorded in Ireland so it could be argued that control of Common Cordgrass is required to protect this habitat. However, the long-term impacts of saltmarsh succession on this area and the possible natural reduction in extent of this habitat in the long-term also should be considered. Even if Common Cordgrass is eradicated, the extent of *Salicornia* flats may be reduced in the future due to natural saltmarsh succession in the long-term (>100 years). The rate of this succession is difficult to quantify and is dependant on factors such as sediment supply and accretion. Climate change-induced impacts may also influence the extent of *Salicornia* flats.

The direct positive impact of successful eradication of Common Cordgrass from the *Salicornia* flats and surrounding mudflats on the current conservation status of the wintering wader and wildfowl populations is uncertain and difficult to quantify (apart from removing any future threat from the development of large areas of *Spartina* sward). This is because Common Cordgrass affects a relatively small area of potential bird feeding grounds when compared to the whole of the intertidal area around North Bull Island.

Common Cordgrass control is notoriously difficult, expensive and needs to be sustained over a long period to be effective. The negative environmental impact of any control programme (such as impacts on non-target species and potential for erosion), the cost of any control programme and the potential ineffectiveness of any control programme have to be balanced against measurable beneficial impacts on the conservation status of habitats and species at North Bull Island. However it should be noted that sustained control can be effective in the long-term. DCC also have experience of control of Common Cordgrass and have had success in the past. DCC and NPWS should be aware that any short term solution is not likely to be effective and may have counter-productive ecological impacts.

### RARE FORMS OF *SPARTINA*

The original line of *Spartina* clumps planted on the saltmarsh at North Bull Island were identified as the infertile Townsend's Cordgrass (*S. x townsendi*) by Boyle (1977). These clumps were destroyed during some of the first control attempts of Cordgrass during the 1970's. There are also several records of *Spartina maritima* in Ireland in County Dublin (Boyle 1976, 1977) but these have not been relocated recently (Doogue *et al.* 1998). A picture of a dwarf form of *Spartina* called *Spartina maritima* forma *dublinensis* is present in Boyle (1977). The origin of this species is not known. The Commission of the European Communities (2003) stated that when selecting sites for the presence of the Annex I habitat *Spartina* swards (1320), preference should be given to rare or local *Spartina*. Therefore, if either of these species are ever re-recorded at North Bull Island then they would be worthy of conservation.

### 7.4.3 Ecology and management of Sea Buckthorn

Sea Buckthorn is dioecious, i.e. male and female flowers are borne on separate bushes. This difference is easiest to see on older plants in winter, as the flower buds of male plants are large while those of females are small. It is possible to restrict the spread of newly introduced Sea Buckthorn by insuring that only individuals of one sex are planted, as only the female plants produce fruit and seed. Sea Buckthorn spreads via rhizomatous spread after being planted and birds can also carry and distribute its seed. This species is quite vigorous with measurements of spread in a thicket of 4.3 m per year in all directions at one British site (Brooks & Agate 2000).

Sea Buckthorn tolerates a variety of soils but it is most prolific on well-drained soils with adequate lime. Seedlings germinate only where the soil salinity is under 0.05%. Mature plants are more salt tolerant but they cannot penetrate the sand dune-saltmarsh transition zone. Sea Buckthorn is a nitrogen-fixing species which can colonise nitrogen-poor soils (Pearson and Rogers 1962). The decaying roots of cut plants release the nitrogen in a form which can be used by Nettle (*Urtica dioica*) and other nitrogen-demanding species, so the vegetation which results from Sea Buckthorn clearance is unlikely to be the same as that which precedes it (in the short term). The dense leaf litter can also have an adverse effect on the germination of dune plant species. The berries of Sea Buckthorn can provide a plentiful food source for some native bird species and the dense scrub also provides cover for nesting songbirds and mammals such as foxes. Badgers may also use these areas on North Bull Island and it is suspected that there may be one or more Badgers setts on the island that are protected by dense stands of Sea Buckthorn.

Sea Buckthorn was formerly planted along some of the boundaries of the two golf courses and within the golf courses to primarily create shelter belts and define the boundaries. It is now

widespread in its distribution mainly within the fixed dune habitat, but can also be found within dune slack and more recently in some of the more open fixed dune/Marram dune habitat. Most of the Sea Buckthorn has spread by natural means. However, staff at North Bull Island recently noted a row of newly developing Sea Buckthorn bushes developing across the dunes. It is thought that these bushes developed from planted seeds, planted by persons unknown.

Several people have approached staff at North Bull Island with plans to harvest the Sea Buckthorn berries. 'Oil' extracted from the berries of Sea Buckthorn can be used for its medicinal properties. Sea Buckthorn has been planted in places like North America and China to produce berry crops.

The CMP (Ryle *et al.* 2009) noted that problems caused by Sea Buckthorn were not yet as pronounced at North Bull Island as at many other eastern sand dune systems. However, the CMP survey recommended that occasional patches of Sea Buckthorn, particularly near golf course boundaries should be controlled to prevent excessive spread of the shrub. Occasional patches of Sea Buckthorn have spread in the fixed dune grassland, particularly in areas near the golf course boundaries where it has been planted.

### MANAGEMENT OF SEA BUCKTHORN AT OTHER SITES

The threat of Sea Buckthorn to Annex I sand dune habitats has been noted at many other coastal sites in Ireland. Fingal County Council is currently testing three different methods of Sea Buckthorn control. McKenna *et al.* (2000) describe the control of this species at Portstewart in Co. Derry on a coastal site owned by The National Trust. The National Trust is controlling the spread of this species using cutting but does not intend to eradicate the species from the site completely, due to its beneficial effects including providing scrub cover and refuge for birds and animals.

There is much more information available about the control of Sea Buckthorn at coastal sites in Britain. Although there is no definitive approach to the management and removal of this invasive shrub, a practical methodology is documented in several publications concerning the management of Ainsdale National Nature Reserve in England (Sefton Coast Partnership 2004). The British Trust for Coastal Volunteers have also produced extensive guidelines for the control of this species (Brooks & Agate 2000) and this has undated some older management guidelines (Ranwell 1972). These guidelines discuss a variety of control methods including cutting, use of herbicides, digging up, burning, mowing and the use of mechanical machinery. A variety of control methods may be most effective to control the variable dense stands and single bushes of various different ages and maturity. The control methods also vary in effectiveness from site to site. The guidelines discuss advantages and disadvantages of each control method and also provide health and safety advice. Brooks and Agate (2000) recommend that total eradication is the only effective policy as a policy of containment is more labour intensive in the long-term.

### CUTTING

Cutting has been found to be effective in some sites where there was no regrowth. However, cutting may actually stimulate regrowth of the plant from rhizomes around the edges of the stands. Cutting is labour intensive and regrowth may require the use of herbicide treatment. Garlon 2 herbicide has been used to treat cut stumps effectively at Ainsdale NNR.

## GRUBBING UP

At Murlough NNR in Co. Down, cutting or herbicides were not effective and large areas needed to be grubbed up. Grubbing up using machinery has been found to be efficient and an effective method, although spot treatment may be required for some regrowth from rhizomes that were not removed. The only disadvantage to this method is the potential for erosion and damage to the soil, although this method may also stimulate the seed bank of the soil. At Ainsdale National Nature Reserve a bull dozer with low pressure tyres has been used successfully to uproot plants for several years. A tractor-mounted grubber with a mechanical bucket was used at Murlough that could pull up bushes. This method is also used at Ainsdale NNR (Taylor *et al.* 2003). It is suggested that the removal of the shrub be carried out earlier in the season before any fruit in produced (September).

This method is not always considered best practice in areas of high conservation interest due to potential damage to dunes (Sefton Coast Partnership 2004). Tractors should be propelled on wide, load spreading wheels which would minimise long-term damage to fragile dune ecosystems.

## HERBICIDE USE

Herbicides can be effective if used properly, but repeated spraying of live bushes for several years generally is required to clear regrowth. Garlon 2 herbicide has been found to be effective. Glyphosate has variable effectiveness and produces a patchy clearance. Successful herbicide use can leave unsightly standing-dead scrub. The use of herbicides also introduces more health and safety concerns, especially for volunteer groups. While the use of herbicide on stumps and live bushes has been documented, some management projects prefer to avoid the use of chemicals given the sensitive nature of surrounding habitats and water regimes in sand dune systems.

## TREATMENT AFTER CLEARANCE

Brooks and Agate (2000) generally recommend that the most efficient method of disposal is that dead material is stacked up and burned after being left for several weeks to dry out. Dead material can also be stack up and allowed to rot naturally. At some sites dead material has been used to aid sand dune erosion and stabilisation. Care should be taken not to use material that was cut late in the season that may transfer seed to unclosed areas of the site. Material should also be dried out first to prevent any regrowth from root systems if they are re-buried. Removal of piles after March should involve careful examination for nesting birds as piles of dead brush can also provide habitat for nesting birds. An alternative disposal method is that dead Sea Buckthorn is chipped on-site and used as mulch on nursery beds.

Leaf litter should also be raked up and removed and this is important to help re-establishment of sand dune species. Ploughing of the cleared areas was actually found to be beneficial at Murlough NNR to stimulate the dormant seed bank of dune plants where large areas of scrub were removed.

It should be noted that the cleared areas can produce luxuriant vegetation with many ruderal 'weed' species especially in areas where there have been old stands of Sea Buckthorn. This is partially due to a combination of the nitrifying effect of Sea Buckthorn on the soil and the

presence of a deep leaf litter layer that may affect the fixed dune seed bank and also enrich the soil. It may take some time to re-establish typical fixed dune vegetation in these areas.

### HEALTH AND SAFETY

Brooks and Agate (2000) state that the control of Sea Buckthorn by manual methods is a job for cold weather. Protective equipment such as helmets, safety goggles, heavy trousers, jackets and gloves are essential to protect from the sharp deep thorns. Manual control during the summer risks the non-use of protective equipment in hot weather with the potential for injury. First year seedlings can be pulled up safely as they don't contain any thorns.

#### 7.4.4 Bait-digging

Some local authorities in Britain have developed a code of conduct for bait-diggers on coastal sites with conservation interest ([www.thanetcoast.org.uk](http://www.thanetcoast.org.uk)). The code includes:

- Take care to avoid putting roosting or feeding wintering birds to flight especially towards high tide or at night.
- Back-fill any holes that you dig to restore the seashore and make it safe for other users - unless the tide is about to do this for you!

Heffernan (1999) suggested the following management prescriptions for bait-digging in Ireland:

- If there is a choice of harvest method hand digging is preferable in relation to damage to benthic fauna.
- Diggers should be required to refill holes to protect the infauna.
- Consideration must be given to disturbance caused to birds by bait digging in an area of conservation. Areas may have to be sacrificed to concentrate the activity rather than having a low level of disturbance throughout the site.

#### 7.4.5 Impacts of dogs on wildlife

Taylor *et al.* (2005) points out that it is very important to distinguish between an effect and an impact. An effect is something we can observe, like the movement of a bird in response to a dog. An impact implies that 'dog disturbance' is affecting factors such as survival, body condition and reproductive potential, which all would be of primary conservation concern.

Generally, disturbance increases when greater numbers of people visit the site (Beale & Monaghan 2004). A straightforward comparison could be made between the site (Sandymount Strand) studied by Phalan and Nairn (2007) and North Bull Island. It could be presumed that the level of disturbance on the intertidal area along the path between Sandymount seafront and the Poolbeg Peninsula (where Phalan and Nairn's study was carried out) is higher overall compared to Dollymount Strand, although disturbance at Dollymount Strand would be much greater at certain times of the year. The level of disturbance along the saltmarsh and intertidal flats is also likely to be lower relative to the rest of North Bull Island, as these habitats are not as popular for



recreation and dog walking (although staff at North Bull Island have noted that dog walkers are increasingly using the paths along the saltmarsh with their dogs off leash to avoid confrontation with the staff).

Disturbance of waterbirds using intertidal habitats by dogs, walkers and other activities along the mainland shoreline (Clontarf- Howth Road) may not as significant as disturbance in other parts of the site. Phalan and Nairn (2007) found that birds on the intertidal area were largely habituated to walkers and dogs using paths close to the Sandymount Strand. This study pointed out that habitation to people, dogs and vehicles by waterbirds has been noted at other sites in Ireland but that not all bird species may habituate to disturbance.

A recent study in South Dublin Bay (Phalan & Nairn 2007) examined disturbance to waterbirds in South Dublin Bay. People and unrestrained dogs walking on the beach were the greatest cause of disturbance. However, this study also found that birds were largely habituated to walkers and dogs using paths close to the beach. This study pointed out that birds can compensate to some degree by moving, but that sustained and widespread disturbance has a significant impact on their foraging success, energetic costs, use of feeding and roosting sites and may ultimately result in population declines.

English Nature (now Natural England) has recently produced a comprehensive research report about the impact of dogs on nature conservation (Taylor *et al.* 2005). This report reviewed an extensive amount of scientific literature and anecdotal information about the impacts of dogs on wildlife from around the world, including studies on breeding birds, waders and studies on coastal habitats. Some of the points made in this review are presented below.

- Birds generally perceive dogs as predators.
- A walker with a dog has a larger 'sphere of influence' on wildlife than a walker with no dog.
- The pattern of disturbance varies between bird species and at different times in their life cycle.
- All the breeding birds affected were ground-nesting species.
- Studies on breeding birds (particularly ground nesting species) have shown that disturbance by dogs exposes eggs or young to greater risk of opportunistic predation, especially from crow species.
- Breeding success has been shown to improve significantly on habitats like beaches when dogs are managed.
- Dogs can have a greater effect on wintering birds, than walkers or, for some species, joggers.
- Different species seem to be more tolerant of approach than others, with distances at which a disturbance reaction occurs differing widely.

- For one species this response distance is half that of the birds in the breeding season.
- There is no clear impact identified at the population level but there are a number of suggestions that birds have vacated sites when disturbance became too great. Generally these do not separate out dogs as a factor, although they are present on many sites.
- A reaction to dogs has an energy cost, which is particularly important in winter if resource acquisition is limited, or if winter conditions are particularly severe. Compensatory feeding is found in some species, for example, at night.
- Whether dogs impact on bird species or not will depend on the habitat involved (because of their effect on patterns of human behaviour), the numbers of dogs, frequency of disturbance, the sensitivity of the species and bird condition.
- Although mammals may be disturbed by dogs, there is no evidence that these are affected at population levels. (Behavioural effects on a number of species of deer are documented).

Pienkowski (1984) found that the breeding success of Ringed Plover at Lindisfarne was highly correlated to levels of human disturbance that included dog walkers. A second population model of Ringed Plover reproduction found that if human disturbance including dog-walkers was removed from an NNR, then the reproductive potential of this species could increase by 85% (Liley 1999 cited in Taylor *et al.* 2005). Some interesting anecdotal information in Taylor *et al.* (2005) included that fact that when paths across some upland moors were closed during the Foot and Mouth crisis in Britain in 2001, breeding success of Golden Plover, Curlew and Dunlin increased. This was interpreted as a response to the reduced level of disturbance in habitat used for breeding by these bird species.

Fouling by dogs is common within the dunes although it may be obscured by tall vegetation. It is unsightly, offensive and poses a health hazard, especially to young children. It has also been noted that localised fouling by dogs can result in eutrophication of the sand and can result in a change in the vegetation composition. Taylor *et al.* (2005) presented research that indicated that nutrient levels were elevated along paths in sand dunes, at one site commonly used by dogs. Some plant species like Wild Thyme preferred this nutrient-enriched zone along these paths. Some paths became species-poor and dominated by Perennial Rye-grass due to a combination of nutrient enrichment and trampling. However, most dune systems in Ireland are subjected to grazing with associated nutrient inputs from livestock (so some level of eutrophication is 'normal').

### ATTITUDES TO DOGS AND DOG WALKERS

The presence of dogs in areas of countryside with public access can detract from people's enjoyment (Taylor *et al.* 2005). A variety of reasons (including their tendency to disturb wildlife) are reported but dog mess is the most frequently cited. Its presence is an all-too-evident indicator of an irresponsible approach to dog ownership, and many dog owners are in denial of any responsibility. A national survey in Britain found that non-dog owning visitors to nature reserves appeared to be more than twice as likely to try to avoid contact with dogs as welcomed them. First-time dog owners do not appear to receive education about the potential effects of dogs on

wildlife and social pressure does not seem to be effective. A national survey in Britain found that that many visitors to nature conservation sites will take action to avoid encountering dogs.

### MANAGEMENT OF DOGS IN NATURE RESERVES

Many countries around the world manage dogs in nature reserves in different ways (Taylor *et al.* (2005). In the US national parks, dogs must be kept on a 6 foot leash and the superintendent of each park can designate areas where dogs are banned. All dog faeces must also be removed. Similar rules apply in New Zealand. Australia provides free-running areas in some parks where dogs are allowed off-leash but must also be under 'effective control'. Dogs may be banned from other sections or access may be restricted using a permit system. Some nature reserves offer 'time-sharing arrangements' where dogs must not be present at certain times of the day.

Taylor *et al.* (2005) stated that:

- Dog management policies vary in effectiveness but wardens/guided walks, steering (moving dogs away from restricted areas) and regulation (bans on dogs in certain areas) appear to work best.
- Multi-faceted policies are more effective than one or no policies.
- Leaflets tended not to be very effective as method to increase awareness.
- Working with dog walkers can assist in meeting objectives.

#### 7.4.6 Current and past beach-cleaning practices at North Bull Island

Mechanical beach-cleaning is currently being used at North Bull Island. However, not all of Dollymount Strand is being cleaned. A tractor pulling a surf rake cleans the upper beach zone every day during the bathing season between the car-parks at the end of the causeway and the North Bull Wall. The areas within the car-parks are also cleaned in this way. This beach-cleaning includes seaweed left along the strand-line. However a zone about 10-20 m wide along the edge of the fore-dunes is left undisturbed. This forms part of the requirements for Blue Flag beach status. The northern section of Dollymount Strand is not regularly beach cleaned and seaweed is left in this section. The build-up of seaweed is managed naturally when it is washed out at the next low spring tide. Litter is also collected manually during the bathing season, placed on a trailer and removed from the island. Other noxious material is removed, such as oil drums, but natural drift material such as timber is left where it is deemed to be safe and not causing a public nuisance.

*Ectocarpus* blooms have been managed somewhat differently. A scraper on a JCB is used to pile up *Ectocarpus* detritus along the beach when required. These piles are left for several days and then the detritus is transferred to areas along the fore-dunes deemed to be vulnerable to erosion. Piles of detritus up to 6 m high and 10-15 m wide are created and 'capped' with sand to minimise the smell of decaying seaweed. The piles of *Ectocarpus* were left on the beach for a longer period following advice, but this led to further difficulties as the bloom turned to 'mush' and was difficult to handle. This detritus was placed along areas of dune erosion with newly cut cliffs in the northern half of the island in 2007. It was hoped this detritus would protect the dunes

from erosion. The potential danger to public safety of these steep dune cliffs was also noted and it was hoped placing this material along the cliffs would alleviate this danger. About 900 wet tons of this detritus was collected in 2007. It is estimated that this detritus contains about 15% sand. This material was eventually washed away over winter 2007-2008.

In the past this detritus was also piled in some of the dune 'blow-outs' and 'capped' with sand to help rehabilitate these areas (Dublin Corporation 1994). The frequency of *Ectocarpus* blooms varies from year to year. Last year (2007) blooms only started in October and there were several tides with blooms. However, in the past there have been much more regular blooms and *Ectocarpus* has had to be managed much more regularly between May-September, sometimes every day. Biosphere Environmental Services (2006) noted that the presence of sewage in the algal beach deposits in south Dublin Bay seems to be eliminated.

### BEACH-CLEANING AT OTHER SITES

It is generally accepted that the best practice for beach-cleaning where necessary should be carried out by manual means rather than mechanical (McKenna *et al.* 2000). However, this is difficult and not cost-effective on a site as large as Dollymount Strand. The long term practice of beach-cleaning is prohibitive in terms of cost and is not to be recommended in terms of nature conservation and the environmental status of the site. The use of tractor-driven rakes can be destructive on fragile coastal ecosystem. Wading birds depend on seaweed for insects and other food. The invertebrate fauna can also suffer through the removal of the weed or indeed compaction of the sand as mechanised vehicles pass over them.

The Environmental and Heritage Service Northern Ireland takes the view that it may refuse consent for beach-cleaning activities where they may be having a significantly negative impact on a feature of conservation interest within a designated site (EHS 2007). The NIEA recommend zoning of beaches where beach-cleaning takes place, so only particular areas are targeted. Some local authorities in Britain have also recognised the impact of beach-cleaning on the development of strand line vegetation and embryonic dunes in the preparation of Local Biodiversity Action Plans and placed on the internet. North Cornwall District Council (undated) does not advocate programmed or regular beach-cleaning and states that this will only be carried out where and when it was needed.

A recent report examined beach-cleaning practices in South Dublin Bay (Biosphere Environmental Services 2006). This area is also subject to sudden algal booms. This report recommended:

- Vehicular traffic on the dune, beach and intertidal areas should be minimized as it can lead to erosion, disturbance and compaction of the substrate. However, the report noted that there was no evidence of accumulated negative impacts from vehicular activity.
- The use of light-weight vehicles that are geared for use on sensitive substrates, such as with wide tyres to distribute weight are recommended.
- Beach-cleaning activities should operate in the zone below the High Water Mark to avoid the physical disturbance of the annual drift-line vegetation. This drift-line should not be scrapped away.

- No mechanical beach-cleaning should be carried out until May, so that drift-line vegetation can be established and avoided.
- The beaches should only be cleaned when really necessary - a minimalist approach.
- Collected material should be disposed off away from the upper parts of the beach and dunes. This report considered that placing beach detritus along the sand dunes was having a negative impact on their development (Biosphere Environmental Services 2006). Piles of detritus were described as drying out and forming a hard impermeable layer through which plants find it difficult to grow up and colonise. This report also pointed out soil conditions should be mobile and porous in nature. This practice is not favourable to the conservation of the site.

The disturbance impact of beach-cleaning on water birds was also assessed by Biosphere Environmental Services (2006). The report stated that it was unlikely that beach-cleaning was having a significant impact as the cleaning activities were concentrated in the summer period when few waterfowl species are present in south Dublin Bay. Species like Turnstone that feed on the strand line are already fairly tolerant to disturbance. The use of the strand line and upper beach as a roost occurs at high tide when beach-cleaning is not carried out, so there is generally little impact on roosting.

McKenna *et al.* (2000) also point out that management of 'Blue Flag' status and also for nature conservation may not be compatible. However, they also point out that there are several sites in Donegal where nature conservation designations and active beach management happily co-exist. One of the main criteria of the Blue Flag programme is that 'the beach should be clean'. More recent criteria for Blue Flag qualification in 2008-2009 indicates that 'Algae or other vegetation should be left to decay on the beach unless it constitutes a nuisance' ([www.blueflag.org](http://www.blueflag.org), Blue flag beach criteria and explanatory notes 2008-2009). These guidelines suggest that the management of seaweed on the beach should be sensitive to both visitor needs and littoral biodiversity. The guidelines further suggest that use of dried seaweed as a dune stabilizer should not be discouraged. The key is deciding when accumulated algae becomes a nuisance. The public may not support a reduction in intensity of beach-cleaning for nature conservation objectives.

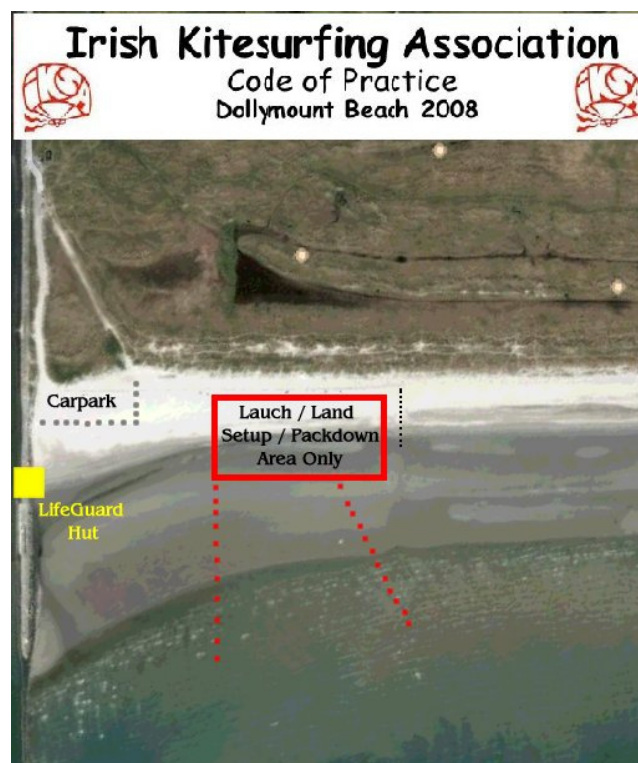
#### **7.4.7 Wind-Powered activities**

##### **DOLLYMOUNT BEACH FEBRUARY 2008 CODE OF CONDUCT (IKSA)**

- Setup, launch, and land your kite in the designated area (Figure 1). Use launch/land/setup/packdown area only to inflate and deflate kites. No launching and landing outside this area is permitted. No land-boarding (land-yachting) permitted at any time in this area.
- Wrap up lines and sand down kite when not in use.
- Promptly enter and exit the water from and to the launch zone.
- Avoid unnecessary flying of large kites, other than trainer kites, on the beach.

- Land-kiting allowed, only, on the most northern section of the beach (Marked B). (See section below).
- Use a Kite leash at all times.
- Stay 200 metres away from all swimmers and stay clear of all areas in front and to the sides of the lifeguard huts in the summer.
- Give right of way to other beach users at all times.
- Assist other kilters to safely land and launch kites.

**Figure 1.** Area for use of kite-surfers at Dollymount Strand. ([www.kitesurf.ie/](http://www.kitesurf.ie/))



A second informal group called KitingIreland has also listed a code of conduct for Land-kiting at Dollymount Strand ([www.kitingireland.com](http://www.kitingireland.com)).

### KITINGIRELAND CODE OF CONDUCT

- “All Land-kiting should take place at the north end of Dollymount beach. Access the car park from the causeway, take the first exit from the roundabout and keep to your left as you drive onto the beach. The area after the rock barrier extending northwards 700 m is allotted for us (area highlighted in red below). This is what is recommended for us so please try to observe this as the beach warden will be over to tell you if you are in the wrong.”



- “Land kiting should be kept 2.5 hours either side of the high tide. Kiting at low tide gives us a nice wide beach so issues with pedestrians should be kept to a minimum. Just remember to use your own judgement as to when it is safe and not safe to fly. i.e. if there are kids building sand castles in the normal setting up area grab your gear and walk a bit further down the beach and keep clear of them. All it takes is one incident or complaint from members of the public to the county council and we could be banned full stop no arguments.”
- “Please keep off the dunes as these are part of a protected nature reserve and again, the warden will have a word in your ear if he sees you there.”

A sketch map of the area currently agreed for this activity with DCC is also present on the website (Figure 2). Land-boarding and Land-Yachting can also be carried out in this area but not in the southern section.

**Figure 2.** Area for use of land-surfers and land-boarders at Dollymount Strand ([www.kitingireland.com](http://www.kitingireland.com)).



#### 7.4.8 Management of dunes at North Bull Island

There has been some active management of the sand dune system by DCC at North Bull Island in the past. Marram has been planted at several locations in the past to attempt to repair areas damaged by erosion. Sand traps have also been used for similar reasons (Dublin Corporation 1994). Some of these measures were carried out in conjunction with Conservation Volunteers. Vehicles were excluded from areas of dunes using large boulders during the 1990s (NPWS undated, 1996?). This measure continues to be very effective at reducing damage and erosion to the dunes and also allowing mobile dunes to continue to develop.

Current active management includes the control of Sea Buckthorn, which is discussed in Section 4.5. There have also been some recent measures taken to reduce the impact of erosion on the sand dunes by placing piles of mixed *Ectocarpus* and sand collected during beach-cleaning at vulnerable places along the fore dunes. It was noted during fieldwork for this study that these patches are being assimilated into the fore-dunes in the southern part of the island. Other patches of mixed *Ectocarpus* and sand placed along dunes towards the northern end in 2007 were washed away during the winter.

### IMPACTS ON THE SAND DUNES AT NORTH BULL ISLAND

Pedestrian tracks in the mobile dunes, fixed dunes and dune slack habitats, some of which are bare of vegetation, are extensive (Ryle *et al.* 2009). Pedestrian trampling and tracks can erode vegetation cover and this is most noticeable at access points around the end of the causeway. However the total cover of bare ground is probably less than 10% of the total dune grassland area. There are also some areas of erosion, caused by overuse and trampling, which are exacerbated in places by rabbit grazing. DCC staff have also noted that several football teams that occasionally train on the island can exacerbate erosion.

There are no grazing livestock on the island, although rabbits are present on the island in considerable abundance, and are creating localised overgrazing problems in places. In general however, their activities are probably beneficial in helping to maintain the short-cropped sward that promotes species diversity. Grazing is described as having a neutral impact, to account for both the positive and negative aspects of grazing. Hares are also present, but their numbers are probably too low to contribute significantly to any grazing impact (Ryle *et al.* 2009). It should be noted that one of the reasons for the assessment of the conservation status of fixed dune habitat as unfavourable bad was the presence of rank (species-poor) grassland as a result of under-grazing. Impacts on embryonic dunes and mobile dune habitats also include recreational pressure (Ryle *et al.* 2009).

More recently, erosion along the front of the northern section of the sand dunes has been noted. In general, North Bull Island has been a naturally accreting system that has seen significant dune formation over the past 50 years (Ryle *et al.* 2009). The northern tip is known to be extremely dynamic and significant changes in its position have been noted over the years (Harris 1977). Indicators of accretion and natural dune growth are present along the southern part of the dunes/beach where there is a healthy mobile and embryonic dune system. The CMP project also mapped embryonic dunes along a large section of the northern half of the island. However, in the past few years there has been increasing signs of erosion noted by DCC staff, especially during the winter. This was exacerbated during winter 2007-2008 and a significant cliff was 'cut' along the front of the sand dunes. Sand was re-accreting in this area in summer 2008. There are also some relatively significant changes in habitat cover of embryonic dune habitat since this area was surveyed in 2004 (Ryle *et al.* 2009). NPWS take the view that the erosion seen during winter 2007-2008 is part of the natural dynamism of this coastal environment and is not a significant management issue.

However, there are concerns that there have been some changes in sedimentation patterns in Dublin Bay in the past 10 years. Embryonic dunes are recently developing in the southern part of the bay along Sandymount and Booterstown shorelines and this may be another indicator of these changing sedimentation patterns, along with erosion at North Bull Island.

### GRAZING MANAGEMENT AND MAINTENANCE OF SPECIES-RICH DUNE HABITAT

In the absence of human interference, most stable dunes, with the exception of those experiencing severe exposure, would eventually develop into scrub and woodland in the long-term (Doody 2002). Continued grazing is normally necessary to maintain the typical fixed dune communities, but over-grazing, particularly when combined with the provision of imported feedstuffs, can have damaging effects.

A more widespread problem can be under-grazing, leading to invasion by coarse grasses. Marram-grass is the most consistently occurring plant species outside of the golf-courses and the saltmarsh. Its dominance within the Annex I fixed dune habitat is usually indicative of an absence of adequate grazing levels. The floral and structural diversity of the fixed dunes is best seen along the many pedestrian tracks that criss-cross North Bull Island. The dune sward is kept low and many of the typical dune species are associated with these areas. However, these are also the areas which are prone to damage and erosion at times such as undermining the sand in blowouts. Overall, the pedestrian use of the fixed dune and dune slack areas at North Bull Island is important for maintaining the current levels of diversity and cover of short species rich fixed dune sward. However, permanent way-marked tracks would not be recommended as these could focus trampling onto several paths rather than spreading the trampling disturbance over a network of tracks.

Natural England ([www.english-nature.co.uk](http://www.english-nature.co.uk)) points out that the importance of Rabbit grazing can not be over-estimated. Native grazers such Rabbits occur on North Bull Island and are very important in helping maintain the diversity of the fixed dune sward at present, especially as there is no grazing livestock on the island. DCC staff feel that the Rabbit population on the island has decreased in recent years. However, the presence of Rabbits is not always welcomed by managers of the golf courses and they have been controlled on the golf courses in the past.

### MANAGING BLOWOUTS AND BARE ERODING PATCHES OF SAND

Blowouts create new sandy habitats within the fixed dunes including incipient slacks, especially important for annual plants. They are an important element of the dynamic processes within the dune system. Blowouts can be exacerbated by pressure of the vegetation from overgrazing, pedestrians and vehicles. Marram, the species most commonly found in the mobile dunes and parts of the fixed dunes, is vulnerable to trampling (McKenna *et al.* 2000). Dune restoration techniques have been used at several sites, where this type of erosion has been considered a serious problem (Brooks & Agate 2000).

Soft engineering approaches include replanting with dune species such as Marram or Lyme grass (Brooks & Agate 2000). Other methodologies which have been used with great success include picket or retaining fences for trapping sand. These can consist of inorganic fencing, which is rather unsightly. Alternatively, a suitable natural product such as chestnut paling is equally effective. These fences are successful at trapping sediment and when used with a planting regime can be very effective at re-establishing the integrity of the dune vegetation. Some of these approaches are also being used at present by Fingal County Council at several coastal sites.

However, these measures can also have a negative impact and lead to over-stabilisation of dunes if used inappropriately (UK BAP –[ukbap.org.uk](http://ukbap.org.uk)). The biodiversity of healthy dune systems is dependant on natural dynamics creating bare sand for pioneer species. One recommendation (Brooks & Agate 2000) is to remove the disturbance factor (e.g. fence off areas with heavy pedestrian traffic) to see if this will allow bare eroded patches to restore naturally. However, it should be pointed out that this may just push the problem somewhere else and previously undamaged areas would be subjected to increased trampling pressure and subsequently become damaged.

A second option is to provide paths across the sand dunes to prevent the vegetation getting trampled. Boardwalks have been built at several sites in Ireland to provide access from car parks to beaches (McKenna *et al.* 2000).

### MANAGING SAND DUNE EROSION

Beaches and dunes are dynamic and must change if they are to behave in a natural way. McKenna *et al.* (2000) point out that erosion is important and necessary part of a functioning dune system. In most sand dunes site in Britain where sand dune erosion is occurring, insufficient sand supply is generally the major cause (UK BAPs - [www.ukbap.org.uk](http://www.ukbap.org.uk)). However, this does not seem to be the case at North Bull Island, as this site is still accreting. A natural shoreline is inherently flexible and consequently sustainable human use must also be flexible in strategy and accept the variation of the landforms created by natural processes (McKenna *et al.* 2000). Scottish Natural Heritage also take this view and point out in a recent guide to managing coastal erosion that it is assumed that erosion is not a problem in itself, but becomes a problem when human assets are at risk (SNH 2000).

Storm erosion of the upper beach surface and along the front of the dunes similar to that seen along the northern section of North Bull Island is a common occurrence on sand beaches in Donegal (McKenna *et al.* 2000). This type of erosion is described as cyclic as it is balanced by periods of accretion leading to no net change in the shoreline.

Hard engineering works have been commonly used in coastal situations, as these are better understood by engineers, are relatively easy to design and implement and rarely needs a follow up monitoring regime. However, the use of hard coastal protection/stabilisation methods are only advocated in extreme circumstances where imminent destruction is expected in the remainder of the site or to protect existing structures such as housing (McKenna *et al.* 2000). Examples of hard engineering works include placing large boulders along fore-dunes to reduce erosion (Natural England [www.english-nature.org.uk](http://www.english-nature.org.uk)). These approaches are often not suitable in dune stabilisation projects for a number of reasons. The overall costs for the installation of hard engineering can be prohibitive and this approach may not be sensitive to the conservation ideals of the site. McKenna *et al.* (2000) point out that beach managers should also be keenly aware of the dangers such hard defences pose for the future and integrity of the beach system. The impact of such hard engineering works may also require 'appropriate assessment' if they are likely to have a significant effect on a cSAC/SPA.

'Soft engineering' works have also been used to limit the impact of erosion on beaches and sand dunes. These include the use of hay bales as a temporary wave barrier along fore dunes (McKenna *et al.* 2000). The use of piles of mixed *Ectocarpus* and sand detritus at North Bull

Island has a similar impact to the use of items like hay bales. The use of soft engineering and environmental friendly approaches to coastline protection in Ireland, including beaches and sand dunes are outlined in Government of Ireland (1996).

## 7.5 Appendix V – Glossary

**ACCRETION** - Slow addition to saltmarsh by deposition of water-borne sediment such as mud or to sand dunes of wind-borne sediment such as sand.

**ALGAE** - Simple plants that are not differentiated into roots, stems and leaves and have no true vascular system. They can be microscopic, or very large and are capable of photosynthesis. They can be found in most habitats but the majority occurs in freshwater or marine environments.

**ALIEN** – Indicating non-native. A species that has been introduced to Ireland.

**ANNEX I** - of the EU Birds Directive, lists birds that are strictly protected so that they cannot be killed, captured, disturbed or traded.

**ANNEX I** - of the EU Habitats Directive, lists habitats including priority habitats for which SACs have to be designated.

**ANNEX II** - of the EU Birds Directive lists birds which may be hunted.

**ANNEX II** - of the EU Habitats Directive is a list of species for which SACs have to be designated.

**ANNEX III** - of the EU Habitats Directive gives the criteria for selecting sites to be designated as SACs.

**ANNEX IV** - of the EU Habitats Directive lists animal and plant species of Community interest in need of strict protection.

**ANNEX V** - of the EU Habitats Directive lists animal and plant species of Community interest whose taking in the wild and exploitation may be subject to management measures.

**ASSEMBLAGE** - A collection of organisms.

**BERN CONVENTION** – Convention on the Conservation of European Wildlife and Natural Habitats. It obliges contracting States to protect a wide range of plant and animal species and their habitats through the formation of Biogenetic Reserves

**BIODIVERSITY** – A general term used to describe all aspects of biological diversity, including: the number of species present in a given environment; the genetic diversity present within a species; the number of different ecosystems present within a given environment.

**BIOGENETIC RESERVES** - Reserves designated under the Bern Convention.

**BIOSPHERE RESERVE** - A unique category of protected area dedicated to helping discover the solutions combining both conservation and sustainable use of natural resources. There are only two of these reserves in Ireland - North Bull Island in Dublin and the Killarney National Park.

**BIOTIC FACTORS** – The influence of living components of the environment on organisms.

**BIRDS DIRECTIVE** (Council Directive 79/ 409/ 2nd April 1979) - Under this Directive Ireland is required to conserve the habitats of two categories of wild birds: 1) Listed rare and vulnerable species and 2) Regularly occurring migratory species. The Directive also obliges Ireland to conserve wetlands, especially those of international importance and regulates the hunting and trading of wildbirds. It was transposed into Irish legislation by the EU (Natural Habitats) Regulations, 1997.

**BRACKISH WATER** - Saline water with a salt concentration of between that of freshwater and seawater.

**BYROPHYTE** - A plant of the Bryophyta, a division of photosynthetic, chiefly terrestrial, nonvascular plants, including the mosses, liverworts, and hornworts.



CLIMATE - The meteorological conditions, including temperature, precipitation, and wind, that characteristically prevail in a particular region.

COLONISATION - The entry and spread of a species into an area, habitat or population from which it was formerly absent.

COMMUNITY - a well-defined assemblage of plants and/or animals, clearly distinguishable from other such assemblages.

CONSERVATION STATUS - The sum of the influences acting on a habitat and its typical species that may affect its long term distribution, structure and functions. Also refers to the long-term survival of its typical species within the European territory of the Member States.

DESIGNATION – The act of placing a nature conservation protection such as cSAC or NHA on a site.

DEHLG - Department of Environment, Heritage and Local Government

DETRITUS - Derived from reworking other material.

DEVELOPMENT PLANS - Local Authorities (Co. Councils & Corporations) are obliged under statute to produce a document which sets out the planned development of their areas for a given number of years. In the future Local Authorities will be asked to incorporate designated NHAs, SACs and SPAs classifications into their development plans.

ECOLOGY - The study of the interactions between organisms, and their physical, chemical and biological environment.

ENVIRONMENT – The biological and physical conditions in which an organism lives.

EROSION - The processes whereby coastal habitats are worn away and simultaneously moved from one place to another by natural agencies which include the tide and the wind.

EUTROPHICATION - The nutrient enrichment of aquatic ecosystems usually by phosphates and nitrates. It may occur naturally but can also be the result of human activity (fertiliser run-off/ sewage discharge/ seepage from silage etc.).

FAUNA - Animal life.

FAVOURABLE CONSERVATION STATUS - The conservation status of a natural habitat will be taken as “favourable” when: its natural range and areas 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.

FLORA - plant life.

FLORA PROTECTION ORDER - under the 1976 Wildlife Act, particular plants can be protected under a Flora Protection Order. Under such an order it becomes an offence to cut, uproot or damage these plants unless under licence from the Minister. The same order prohibits damage to the habitats of these species.

FORESHORE – That part of the shore below the high water. The foreshore is in most cases owned by the State.

GEOMORPHOLOGY – The study of the form and structure of the landscape, which is shaped by the underlying geology.

HABITAT - Refers to the environment defined by specific abiotic and biotic factors, in which a species lives at any stage of its biological cycle. In general terms it is a species home. In the Habitats Directive this term is used more loosely to mean plant communities and areas to be given protection.

HABITATS DIRECTIVE - (Council Directive 92/43/EEC). The Directive on the conservation of Natural Habitats and of Wild Flora and Fauna. This Directive seeks to legally protect wildlife and its habitats. . It was transposed into Irish legislation by the EU (Natural Habitats) Regulations, 1997.

HERBICIDE - A chemical or biological preparation which kills plants.

HYDROLOGY - The movement of water through a catchment area including freshwater and seawater inputs, water level changes and drainage mechanisms which are all influenced by the underlying geology.

INTERTIDAL - The region between the high tide mark and the low tide mark that is periodically immersed by the tide. Includes the saltmarsh, mudflats and beach.

I-WeBS - Irish Wetland Bird Survey, published by Birdwatch Ireland, summarises winter waterfowl counts from 923 sites in the Republic of Ireland.

INVERTEBRATES - Animals without backbones.

IUCN – World Conservation Union

IVASIVE -

LAGOON – A priority habitat listed in Annex I of the EU Habitats Directive describing expanses of shallow coastal salt water, wholly or partly separated from the sea by sand banks, shingle or rocks.

MANAGEMENT PLAN -

MITIGATE - To make or become less severe or harsh / moderate.

MONITORING – A repeat or repeats of a survey using the same methodology. Designed to look for or measure specific changes and the rate or extent of change. Used to check the “health” quantity or quality of a habitat or species.

MOSAIC - Used to describe habitats that occur together and cannot easily be mapped separately.

NATIONAL PARKS AND WILDLIFE SERVICE (NPWS) – the section of the Environment Infrastructure and Services division of the Department of Environment, Heritage and Local Government with responsibility for nature conservation and implementation of Government conservation policy as enunciated by the Minister for the Environment, Heritage and Local Government.

NATURA 2000 - A network of sites across the European Community, selected for the purpose of conserving natural habitats and species of plants and animals which are rare, endangered or vulnerable in the European Community. SACs and SPAs form the Natura 2000 network.

NATURE CONSERVATION - The activity of systematically protecting natural resources such as rare habitats and species, including biodiversity.

NATURALNESS - Refers to how much or little a site/habitat/species has been modified by mankind.

NATURE RESERVES (NRs) - Under National legislation, the Wildlife Act of 1976, a number of sites have been designated as Nature Reserves. These areas are mainly owned by the NPWS and are managed for the purposes of conservation.

NHAs - Proposed Natural Heritage Areas. These are areas that are important for wildlife conservation. Some of these sites are small, such as roosting areas for rare bats; others can be large such as a blanket bog or a sand dune system.

NOTIFIABLE ACTIONS - Actions specified under the cSAC regulations and are listed in the appendices of a conservation plan. These are actions which could cause damage to the site, and for which prior approval is required before they can be carried out.

ORGANISM - Any living thing.

PIEZOMETERS – A instrument used for measuring the fluctuations of water levels.

**PRIORITY HABITAT** - A subset of the habitats listed in Annex I of the EU Habitats Directive. These are habitats which are in danger of disappearance and whose natural range mainly falls within the territory of the European Union. These habitats are of the highest conservation status and require measures to ensure that their favourable conservation status is maintained.

**RARE** - An ecological term applied to distribution of species when assessed on a national grid reference system. The assessment is made on the basis of the number of occupied 10 km National Grid squares. A species is described as rare if has been recorded in to 3-10, 10 km squares.

**RARITY** - Refers to how common or scarce a site/habitat/species is.

**RECHARGE** - The downward movement of water from the soil to the water table.

**RED DATA BOOK 1 (vascular plants)** This Red Data Book deals with rare and threatened flowering plants and ferns of Ireland with an account of their present distributions and conservation status.

**RED DATA BOOK 2 (mammals, birds, amphibians and fish)** - identifies those species threatened in Ireland or those species whose populations are considered to be of international importance, though not necessarily threatened in Ireland. It details the current state of Irish vertebrates and provides a concise summary of the various legislation for each species.

**SACs** - Special Areas of Conservation have been selected from the prime examples of wildlife conservation areas in Ireland. Their legal basis from which selection is derived is The Habitats Directive (92/43/EEC of the 21st May 1992). SAC's have also been known as cSAC's which stands for "candidate Special Areas of Conservation", and pcSAC's which stands for "proposed candidate Special Areas of Conservation."

**SALINITY** - a measure of the concentration of salt in water in parts per thousand.

**SATMARSH** - A wetland that develops in the intertidal zone on mud deposited by the sea that contains specifically adapted halophytic (salt-loving) plants and is covered periodically by the tide.

**SAND DUNE** - A hill of sand built by aeolian (wind-blown) processes that is vegetated by specially-adapted plants.

**SEDIMENT** - Solid particles that can originate by the weathering and erosion of pre-existing rock, by chemical precipitation from water, or by the breakdown of organisms.

**SPAs** - Special Protection Areas for Birds are areas which have been designated to ensure the conservation of certain categories of birds. Ireland is required to conserve the habitats of two categories of wild birds under the European Birds Directive (Council Directive 79/ 409/ 2nd April 1979). The NPWS is responsible for ensuring that such areas are protected from significant damage.

**SPECIES** - the lowest unit of classification normally used for plants and animals.

**STRATEGY** - A course of action or a broad approach towards achieving an objective. It is the general thrust of management towards achieving an objective. It is a description of how the objective is to be achieved.

**SUB-TIDAL** - A biological term used to indicate an aquatic zone below the intertidal zone. In marine environments this zone is the shallow water from the extreme low tide, level to a depth of approximately 200 m.

**SUCCESSION** - The non-seasonal, directional continuous pattern of colonisation and extinction on a site by populations.

**SURVEY** - a) Study/visit to produce an inventory of what is present / record a situation.- b) Establishing a baseline (study).

**SUSTAINABLE** - The highest rate at which a renewable resource can be used without reducing its supply (without causing damage to the resource).

**SWARD** - Refers to the vegetation cover of low growing plants communities, such as grasslands.

TRANSITIONAL ZONE - Refers to the zone found along some boundaries between habitats that contains features of both habitats.

TOPOGRAPHY - the study or detailed description of the surface features of a region.

WATERBIRDS - Collective term for waders and wildfowl species. Includes Waders, ducks and geese.

WILDFOWL SANCTUARIES - These sanctuaries are areas that have been excluded from the "Open Season Order" so that game birds can rest and feed undisturbed. Shooting of game birds is not allowed in these sanctuaries.

WILDLIFE – Refers to all non-domesticated plants, animals, and other organisms.

ZONING - The division of a nature conservation site (& neighbouring lands) into a number of sub-units. Within each zone the management prescriptions will be reasonably uniform and will differ in type or intensity from the other zones in the plan.

## 7.6 Appendix VI – Contact Information

For more information please contact:

Parks and Landscape Services Division,  
Dublin City Council,  
Civic Offices,  
Wood Quay,  
Dublin 8.

Phone: (01) 2223392

Email: [parks@dublincity.ie](mailto:parks@dublincity.ie)

<http://www.dublincity.ie/RecreationandCulture/DublinCityParks/>



