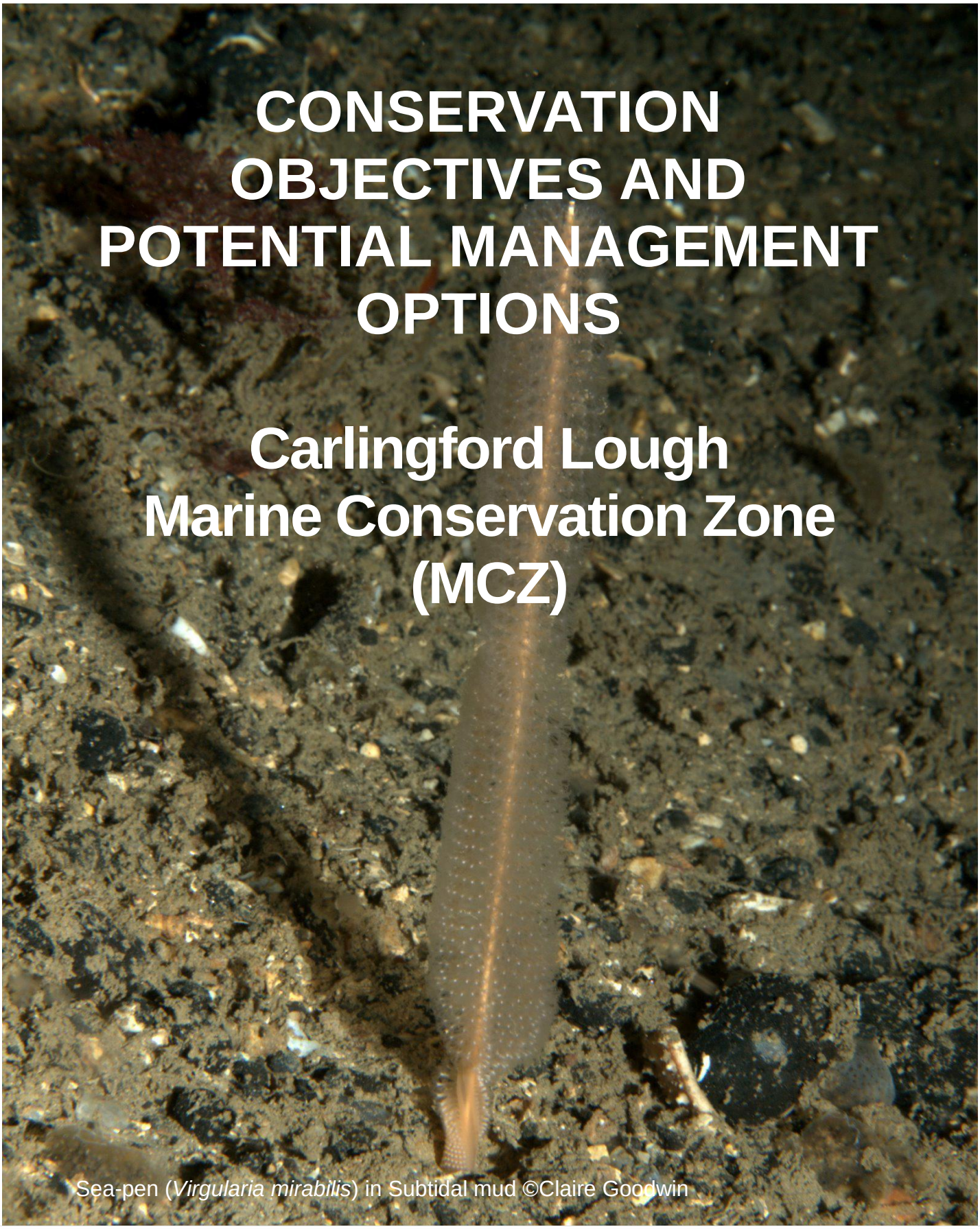
CONSERVATION OBJECTIVES AND POTENTIAL MANAGEMENT OPTIONS

Carlingford Lough Marine Conservation Zone (MCZ)



Sea-pen (*Virgularia mirabilis*) in Subtidal mud ©Claire Goodwin

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Summary

This document provides information on the various uses and activities occurring within Carlingford Lough Marine Conservation Zone (MCZ) and surrounding area. The document has been produced to advise stakeholders about the activities that may cause a threat to the designated feature, the potential management options for these activities and their compatibility with conservation objectives of the protected feature.

The information is organised by the type of activity, and briefly describes potential impacts on the feature and potential management options. The grouping of activities was initially based on the standardised UK pressures-activity matrix[1] as developed by JNCC (2013), which classed similar activities that exerted similar pressures together, for example, anchoring by commercial and recreational vessels. Since the public consultation, a new Pressures-Activities Database (PAD) has been developed by Cefas and APBmer (2015). This database and the list of activities are currently under review by JNCC in conjunction with each country agency. The Department has used this database and the improved activities list along with a revised methodology (Marine Evidence based Sensitivity Assessment, MarESA, developed by JNCC and Natural England) to review the vulnerability assessments for the MCZs (where applicable). Detailed management plans will be developed post designation based on this document, the feature vulnerability assessment and the conservation objectives of the MCZ feature. The management options will only include activities considered capable of affecting the feature of the MCZ based on the risk of damage assessment. New management options will need to be harmonised with any existing management developed for Carlingford Lough SAC/SPA where overlapping boundaries occur.

This paper has been based on data, evidence from peer-reviewed scientific journals and stakeholder engagement. Due to the high degree of variability within some habitats, the variety of activities under consideration and local variation, it is inevitable that the document is somewhat generalised. Where possible, the paper will give comprehensive evidence-based guidance as a starting point for discussions about the development of management options to achieve the conservation objectives for the MCZ.

This document should be read alongside the Guidance on the development of Conservation Objectives and potential Management Options document.

Additional information on Carlingford Lough MCZ and the MCZ process includes:

- Guidance on selection and designation of Marine Conservation Zones (MCZs) in the Northern Ireland Inshore Region
- Justification report for selection of proposed Marine Conservation Zones

[1] Refer to Paper for HBDSEG Meeting 9-10 October 2013 – Progress towards the development of a standardised UK pressure-activities matrix http://jncc.defra.gov.uk/pdf/Final_HBDSEG_P-A_Matrix_Paper_28b_Website_edit%5B1%5D.pdf

(pMCZ) features

- Assessment against the Selection Guidelines for Carlingford Lough Marine Conservation Zone (MCZ)
- Data Confidence Assessment for Carlingford Lough Marine Conservation Zone (MCZ)
- Site Summary Document for Carlingford Lough Marine Conservation Zone (MCZ)

Glossary of Terms and Acronyms

AFBI – Agri-food and Biosciences Institute

AONB – Area of Outstanding Natural Beauty, designated under the Nature Conservation and Amenity Lands Order (Northern Ireland) 1985

ASSI – Area of Special Scientific Interest are notified under The Environment (Northern Ireland) Order 2002

Biotope – The region of the habitat associated with a particular ecological community

Circalittoral –describes the zone from a depth where 1% light reaches the seabed down to 200m (JNCC)

Conservation objective – A statement of the desired ecological/geological state (quality) of a feature (habitat, species or geological) for which the MCZ is designated

DAERA – Department of Agriculture, Environment and Rural Affairs (also referred to as the Department in the text)

DfC – Department for Communities

DfE – Department for the Economy

DfI – Department for Infrastructure

DOE – Department of the Environment (now lies within DAERA)

EUNIS – European Nature Information System, is a habitat classification system used throughout Europe and covers all types of natural and artificial habitats, both aquatic and terrestrial

IMO – The International Maritime Organization

Infralittoral – Describes the zone from mean low water down to a depth where 1% of light can reach the seabed (JNCC). This zone is dominated by erect algae, typically Kelp species.

JNCC – Joint Nature Conservation Committee, the statutory nature conservation adviser to the Department and the UK Government in the marine environment

MCAA – Marine and Coastal Access Act 2009

MCA – The Maritime and Coastguard Agency

MCZ – Marine Conservation Zone designated under section 13 of the Marine Act (Northern Ireland) 2013 in the Northern Ireland inshore region and in section 116 of the Marine and Coastal Access Act 2009 in the Northern Ireland offshore region

MCZ Feature – Marine Conservation Zone feature(s) that underpins the MCZ

designation

MPA – As a generic term Marine Protected Areas are a clearly defined geographical space, recognised, dedicated and managed, through legal or other means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values. As a specific term it refers to a national designation in Scotland (equivalent to MCZ)

NIEA – Northern Ireland Environment Agency

NIW – Northern Ireland Water

OSPAR – OSPAR is the mechanism by which fifteen Governments of the western coasts and catchments of Europe, together with the European Union, cooperate to protect the marine environment of the North-East Atlantic

OSPAR T&D – OSPAR List of Threatened and/or Declining Species and Habitats

PMF – Priority Marine Feature - collective term for those features (habitats, species and geological/geomorphological features) which are considered to be of conservation importance in the Northern Ireland inshore region

PSA – particle size analysis

ROV – Remotely Operated Vehicle

SAC – Special Area of Conservation, designated under the Habitats Directive

Sessile Epifauna – Describe organisms which are found attached to, or on top of, substrates in the shallow subtidal area (e.g. mussels, oysters)

Spyball – Underwater drop camera operated by crew aboard a vessel used to study submerged habitats and species

SSNI – Sublittoral Survey Northern Ireland

SPA – Special Protection Area, designated under the Birds Directive

VMS – Vessel Monitoring System

WFD – Water Framework Directive

Introduction

Carlingford Lough is a narrow and shallow sea-lough that lies on the east coast of Ireland located at the border of Northern Ireland and the Republic of Ireland (RoI).

The MCZ is located off the northern shore and north of the navigation channel in the inner part of the Lough. It extends from Warrenpoint to Rostrevor Quay and encompasses an area of 3.23km^2 (Figure 1). The MCZ is an area of shallow Subtidal (sublittoral) mud that contains high densities of *Philine aperta* and *Virgularia mirabilis*.

Carlingford Lough waters are also important for shellfish aquaculture and pot fishing. Cultivation of Blue (Edible) mussel (*Mytilus edulis*) and the Pacific oyster (*Crassostrea gigas*) is an expanding industry and, along with Edible crab (*Cancer pagurus*) and European lobster (*Homarus gammarus*) potting, these products are exported primarily to the European market. Although industrial activity is minimal along the Lough, Greenore and Warrenpoint are significant commercial ports with considerable shipping traffic. The sheltered waters of the Lough are popular for recreational boating and sailing with three marinas, several anchorage areas, visitors mooring and two sailing clubs. Water sports are popular in the Lough and include windsurfing schools, kayaking, canoeing and scuba diving. Bird watching and recreational fishing also take place at various points in the area. A navigation channel maintained by dredging forms a natural mid-line through the centre of the Lough.

Carlingford Lough MCZ lies adjacent to an Area of Outstanding Natural Beauty (AONB). Areas of the Lough adjacent to the MCZ have been designated as a RAMSAR site, Area of Special Scientific Interest (ASSI), Special Protection Area (SPA) and Special Area of Conservation (SAC). To the south of the MCZ the RoI has proposed a Natural Heritage Area (NHA). Carlingford Lough MCZ lies entirely within Carlingford Lough Shellfish waters.

Further information on the MCZ can be found in the Site Summary Document.

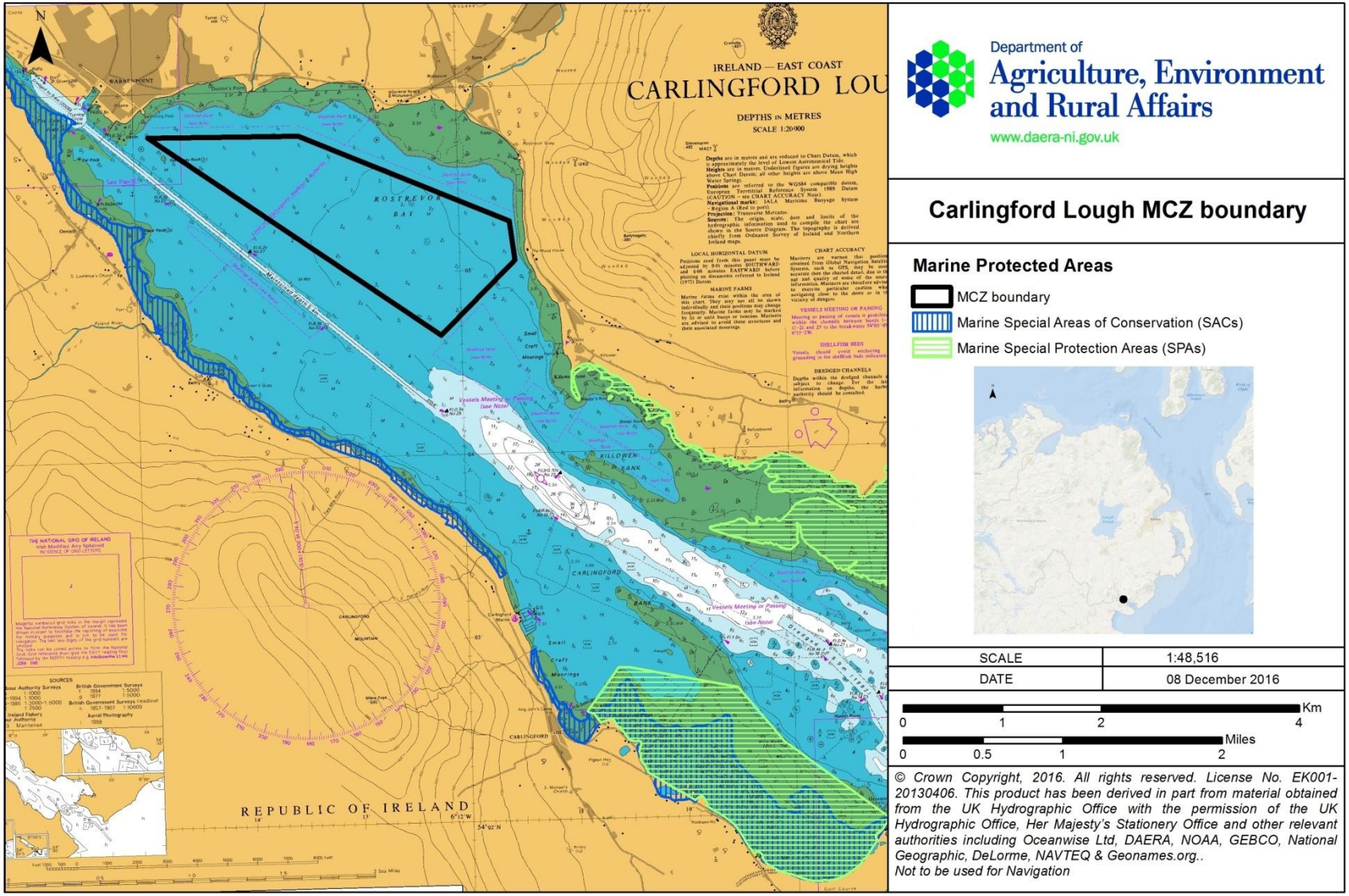

Figure 1 Location of the boundary of Carlingford Lough MCZ

Conservation Objectives, Vulnerability Assessment and MCZ Features

A conservation objective is a statement of the desired ecological quality of a feature (habitat, species or geological) for which an MCZ is designated. The conservation objective establishes whether the feature condition meets the desired state and should be maintained, or falls below the desired state and should be recovered to favourable condition.

The conservation objectives are the first step towards developing management options and monitoring programmes. The procedure used to establish conservation objectives is described in the document - Guidance on the development of Conservation Objectives and Potential Management Options.

Vulnerability Assessment

The level of vulnerability is based on a features' sensitivity, and current exposure to pressures associated with human activities. It aids in the development of potential management options.

MCZ Features

Carlingford Lough has been designated as an MCZ for the habitat ***Philine aperta*** **and *Virgularia mirabilis* in soft stable infralittoral mud.** This habitat will be referred to as Subtidal (sublittoral) mud containing *Philine aperta* and *Virgularia mirabilis* communities.

The MCZ habitat consists of a shallow subtidal area of fine mud with dense populations of the White lobe shell *Philine aperta* and the Sea-pen *Virgularia mirabilis.* The sea cucumber *Ocnus planci* is occasionally present. The biotope for this habitat is SS.SMu.IFiMu.PhiVir. This MCZ feature is thought to be a temporal variant of other sublittoral cohesive mud and sandy mud communities (SS.SMu). At present, this feature is not on any conservation lists; however, it is rare due to the shortened height of the individual *Virgularia* and overall density of the population in the MCZ.

There are also Priority Marine Features (PMFs) present within the MCZ boundary. While the PMFs identified within the MCZ boundary did not meet the criteria for consideration as a feature in their own right, they are afforded a level of protection based on vulnerability and risk assessment. A full list of these features is provided in Annex II.

The location and extent of this MCZ is shown in Figure 2. The map shows point records of the biotope and individual species as components of the habitat (AFBI Carlingford Lough Survey 2012, Sublittoral Survey Northern Ireland (SSNI) 1982-1985, 2007-2012). Survey work carried out in 2015 confirmed the biotope and sediment types enabling a boundary to be drawn (DOE Carlingford Lough MCZ spyball survey 2015).

Annex I gives more detail on the conservation objectives and the attributes against which the targets for the features are measured.

Figures 3 – 11 have been produced using the MCZ feature point data shown in Figure 2 to illustrate the location of various activities in relation to Carlingford Lough MCZ. The Subtidal (sublittoral) mud habitat is thought to be present across the entirety of the MCZ, and so for simplicity, this habitat has not been included in Figures 3 – 11.

As Subtidal (sublittoral) mud containing *Philine aperta and Virgularia mirabilis* communities in Carlingford Lough MCZ are currently in favourable condition, the Department recommends that the **conservation objectives are set to *maintain* this feature in favourable condition**.

Historic and Archaeological Interest

The Department's mechanism to protect underwater cultural heritage is principally the Protection of Wrecks Act 1973 and the Historic Monuments and Archaeological Objects Order 1995 and these will be utilised when and where appropriate. However, the Department will have regard to any historic assets that lie within the MCZ boundary and these may be afforded incidental protection. It is recognised that management measures to protect MCZ features could protect historic assets.

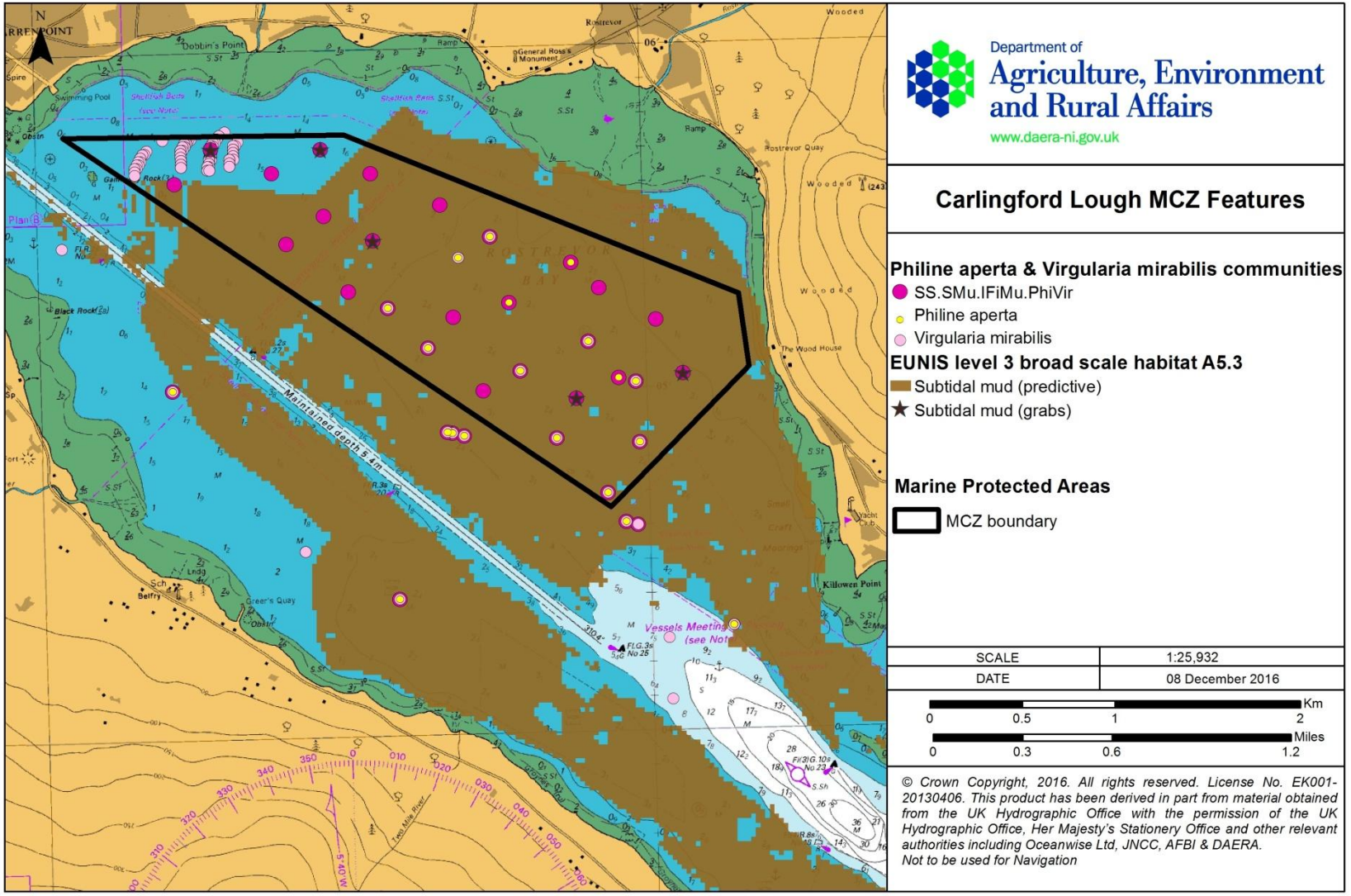

Figure 2 Distribution of the MCZ features in Carlingford Lough

Activities and Potential Management Options in Carlingford Lough

Table 1 lists the activities that have the potential to affect Carlingford MCZ. This list has been generated based on activities that are current, historical and already identified as potential future activities. Any activities that have not yet been considered, e.g. new emerging technologies or new fishing techniques will need to be considered as they are developed. This document discusses the various activities and their potential impacts on the designated feature and has been developed from a range of data, scientific literature including peer-reviewed publications and reports and stakeholder comments. Details of the literature used have been provided in a reference section at the end of this document.

Table 1 Activities that have the potential to affect Carlingford Lough MCZ

Type of activity	Activities
Production of living resources	*Aquaculture – shellfish*
Extraction of living resources	*Fishing – dredging (mussels)* *Fishing – demersal trawling* *Fishing – traps (potting/creeling)*
Coastal infrastructure	*Coastal docks, ports & marinas* *Coastal defence & land claim*
Extraction of non-living resources	*Navigational dredging (capital & maintenance)*
Waste management activities	*Sewage disposal (Waste water treatment Works & outfalls)* *Dredge disposal*
Transport	*Shipping – general at sea (Moorings, Anchorage & Vessel movements)* *Shipping – port operations within harbour authority limits (mooring, beaching, launching, ferry route, etc.)*
Recreation and leisure	*Recreational activities (SCUBA Diving, Sailing, Windsurfing, Kayaking/canoeing, Bird watching Recreational fishing)*
Marine research	*Scientific and Archaeological activities*
Other man-made structures	*Submarine cable & pipeline operations*

All the activities are assessed against the level of impact or risk of damage to the proposed features based on the latter's vulnerability to each activity (vulnerability assessment). Only those activities considered capable of affecting the proposed features (or likely to impact the feature) will be detailed in the management options. The management options considered for each activity include no management required, reduce or limit pressures, or to remove or avoid pressures altogether. Where management is required the options recommended will be implemented as management measures with reporting structures. The full vulnerability and risk of damage assessments are provided in Annex III.

The Guidance on the development of Conservation Objectives and potential Management Options document fully details the procedure used to develop potential management options.

Advice on management implications

In order to meet the conservation objectives listed above, all public authorities are required to manage activities within their remit to avoid significant loss, damage or change to the qualifying feature of the site. Within Carlingford Lough the biotope is vulnerable to the following pressures – activities should be managed so they do not result in these pressures:

- Salinity changes
- Water flow (tidal current) changes
- De-oxygenation
- Organic enrichment
- Physical loss (to land or freshwater habitat)
- Physical change (to another seabed or sediment type)
- Habitat structure changes - removal of substratum (extraction)
- Overall abrasion/disturbance of the surface/subsurface of the substratum or the seabed
- Siltation rate changes (including smothering)
- Removal of non-target species

Production of living resources: *Aquaculture – shellfish*

The Lough supports a wide variety of aquaculture activities with high productivity, good meat yields and growth rates. Historically, shellfish growth has always been productive in Carlingford Lough.

The main species cultivated are the Pacific oyster and Blue mussel. Oysters are grown in bags on metal trestles usually on the intertidal area (trestle culture). The bottom cultivation of Blue mussels uses seed dredged from naturally settled wild seed mussel beds (from outside the Lough) and re-laid onto licensed aquaculture beds. Harvesting usually involves dredging which can re-suspend sediments and pseudofaeces.

The location of the licensed areas for shellfish cultivation and the MCZ is shown in Figure 3. Although there is no direct spatial overlap with the MCZ boundary, there are two mussel sites immediately adjacent to the MCZ that may pose a risk to the conservation objectives being achieved. In addition, operations on the perimeter of the aquaculture sites, such as site clearing and mussel predator control, may have an effect inside the MCZ. A buffer zone of 100m from aquaculture sites (north to south-east borders) was incorporated into the MCZ boundary following pre-consultation discussion and advice with industry representatives. This was set to reduce the effects of sedimentation and organic enrichment. The buffer will not have an impact on the farms as it lies outside the licensed areas for shellfish cultivation and still enables normal operations associated with the farms to continue.

Potential impacts or pressures associated with aquaculture (to which the feature is highly vulnerable) include **de-oxygenation**, **organic enrichment**, **physical change to another seabed type**, **habitat structure changes** - removal of substratum (extraction), **overall abrasion** (surface and subsurface), and **removal of non-target species**. In addition, the feature has a moderate vulnerability to **siltation rate changes** (including smothering).

Collection of shellfish and associated aquaculture operations (using mobile gear) can mobilise and re-suspend sediments. *Philine aperta* and *Virgularia mirabilis* communities are highly vulnerable to **physical changes to another seabed type** and **habitat structure changes** as they are associated with fine mud sediments. *V. mirabilis* is slow growing with intermittent recruitment so recovery from damage may take several years. Recovery of mud habitats to their original condition may take years. In addition, the modified sediment may not be a suitable habitat for the feature to colonise.

Philine aperta and *Virgularia mirabilis* communities are moderately tolerant to **siltation rate changes** (including smothering) by sedimentation as most of the species are able to self-clean. *V. mirabilis* is able to withdraw into the sediment so can recover from smothering. However, large deposits can adversely affect this biotope by smothering individuals (leaving them unable to self-clean or dig out) preventing the substratum from being re-colonised.

There is a high risk of habitat degradation through aquaculture-derived **organic enrichment**. Nutrient enrichment can lead to eutrophication with detrimental effects to the feature. Heavy organic pollution may reduce the population abundance.

There is a high risk of habitat degradation and species loss through **abrasion and physical disturbance of the seabed surface** and **removal of non-target species**. Mobile fishing gear can damage sessile epifauna and shallow burrowers leading to a reduction in the overall diversity of the area and may alter the seabed habitat.

The **biological oxygen demand** of the mud may also increase as a direct result of aquaculture activities, affecting the mud communities. Although Sea-pens are tolerant to a wide range of environmental conditions and can tolerate some nutrient enrichment, *V. mirabilis* communities have been shown to be absent from areas heavily affected by sewage pollution where sediments were severely deoxygenated.

In Carlingford Lough, *Philine aperta* and *Virgularia mirabilis* communities have a high vulnerability to the pressures associated with aquaculture activities. As such, these activities have the potential to cause deterioration in the condition of the MCZ feature. However, at present with the buffer zone in place, the Department is content that no additional management is required (Table 2). **At present no additional management is required as this activity is licensed. Future aquaculture applications will be subject to the Departmental licensing processes which will take potential impacts on the MCZ feature into consideration.**

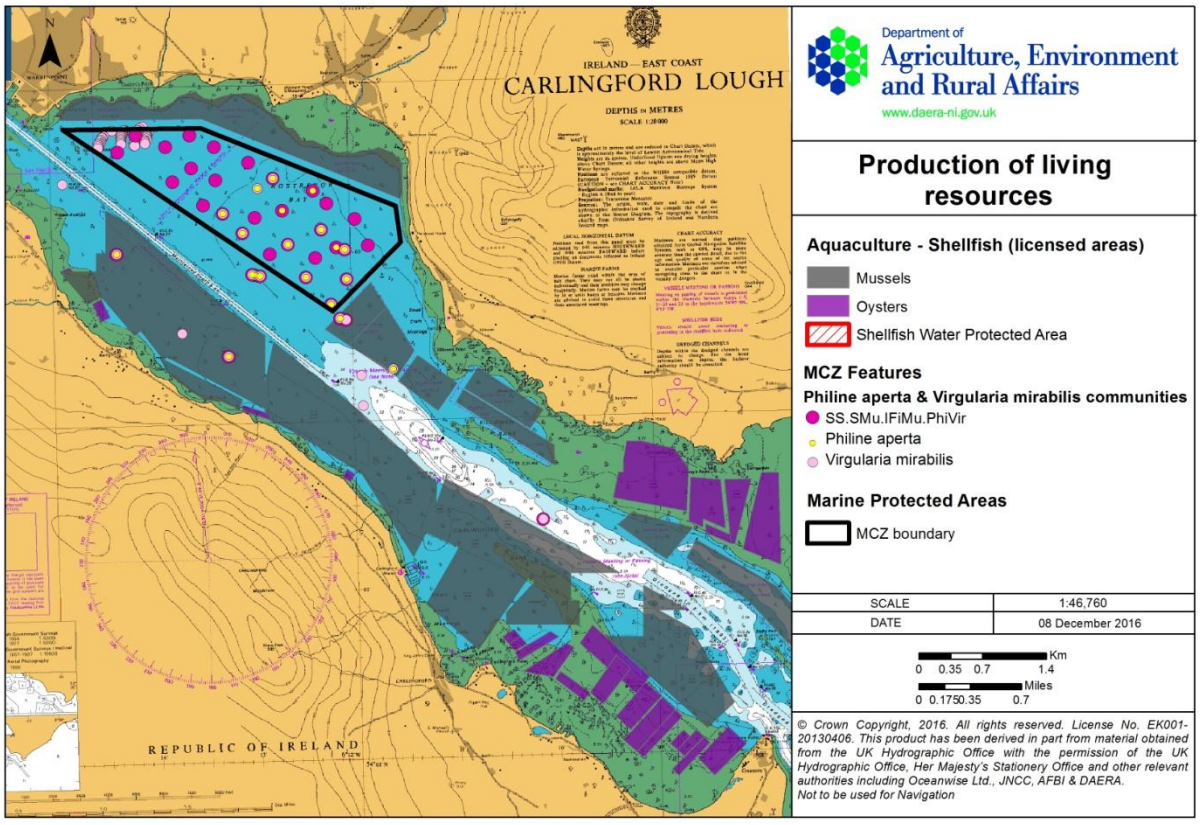

Figure 3 Location of licensed areas for shellfish cultivation in Carlingford Lough

Table 2 Potential Management Options for production of living resources

Potential Management Options	**No additional management is required**.
Proposed way forward	Within Carlingford Lough, *Philine aperta* and *Virgularia mirabilis* communities are highly sensitive to pressures associated with aquaculture activities. The development of new aquaculture farms or expansion of existing areas will require a licence from the Department to determine any impacts on the MCZ feature. The MCZ feature will be monitored within a 6 yearly rolling cycle to assess biotope distributions and species abundances. This will determine whether the conservation objectives are being achieved.
Relationship with existing Management Options	On the Northern Ireland side of Carlingford Lough the Department is responsible for granting aquaculture and fishery licences under the Fisheries Act (Northern Ireland) 1966.

Extraction of living resources: *Fishing – dredging (mussels), demersal trawling and traps (potting/creeling)*

Carlingford Lough is fished by traps (pots/creels) for European lobsters (*Homarus gammarus*) and Edible crabs (*Cancer pagurus*).

At present, there is no evidence of this activity happening within the MCZ (Figure 4), however, pot landings at Warrenpoint and Greencastle and interviews with fishermen suggest that this activity occurs in the inner part of the Lough (part of ICES rectangle 37E3). In addition, mussel relaying is often accompanied by potting activity to reduce predator density on the mussel beds.

Some sea-pen species (*V. mirabilis* and *Pennatula phosphorea*) are more tolerant of trap based fishing due to their ability to bend away from the pressure wave generated by the pot or by withdrawing into the sediment. Other species (e.g. *Funiculina quadrangularis*) are unable to withdraw into the sediment and are more likely to sustain damage. Sea-pens are able to re-burrow or right themselves after traps have been removed. If fishing activity is low, direct impact on the habitat is likely to be minimal and the seabed structure will likely be maintained.

Small vessels (under 10m) are known to prosecute a wild fishery within Carlingford Lough targeting Blue mussels and flatfish using several different gear types (including dredges and demersal trawling). Such gear has the potential to damage the MCZ features. Information on the intensity and location of this activity was not available at the time of this assessment.

Fishing activity at higher levels could adversely impact the MCZ feature by **de-oxygenation**, **physical change** (to another seabed type), **habitat structure changes**, **siltation rate changes** (including smothering) **overall abrasion** (surface and subsurface) and **removal of non-target/target species**.

At present, no additional management is required for the dredging of Blue mussel occurring in the licensed areas for shellfish cultivation. The risk of not achieving the conservation objectives for the MCZ feature is moderate for demersal trawling and fishing with traps (pot/creels). The Department considers that **demersal trawling** should be **removed or avoided** where likely to impact the MCZ feature. **Fishing with traps** should be **reduced or limited** within the MCZ.

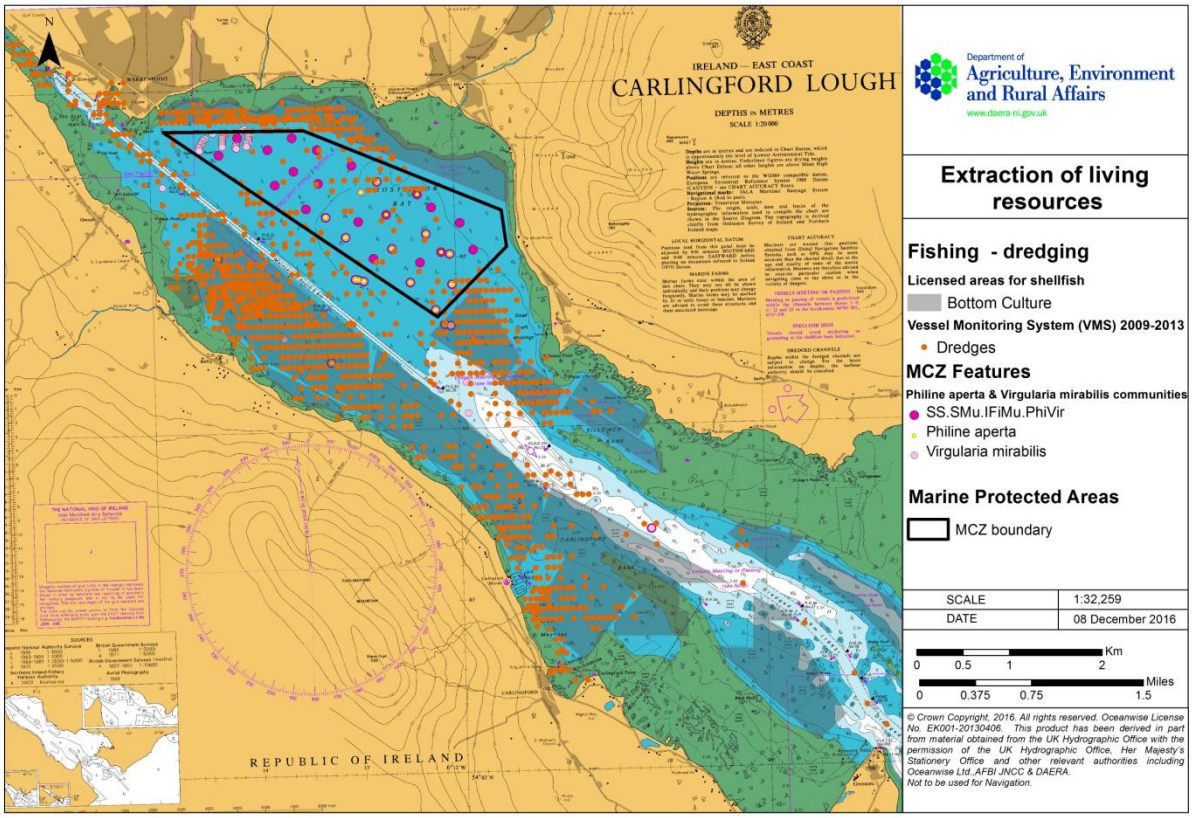

Figure 4 Location of licensed areas for shellfish dredging in Carlingford Lough

Table 3 Potential Management Options for extraction of living resources

Potential Management Options	**At present no additional management is required for dredging within the licensed areas for shellfish cultivation**. **Management measures are recommended to remove or avoid pressures associated with demersal trawling where this is likely to impact the MCZ features.** **Management measures are recommended to reduce or limit pressures associated with fishing with traps (pots/creels) within the MCZ.**
Proposed way forward	Management measures may include the use of VMS on vessels using demersal trawls & fishing with traps (pots/creels) to monitor compliance. The MCZ feature will be monitored within a 6 yearly rolling cycle to assess biotope distributions and species abundances. This will determine whether the conservation objectives are being achieved.

Relationship with existing Management Options	The Department is responsible, through regulations, for the development of fisheries management measures to protect the MCZ feature. The Loughs Agency also has specific functions under the North/South Co-operation (Implementation Bodies) (NI) Order 1999 and the Foyle Fisheries Act (NI) 1952 (as amended).

Coastal infrastructure: *Coastal docks, ports & marinas and coastal defence & land claim*

Industrial activity is limited around Carlingford Lough but there are two local commercial ports: Greenore (Republic of Ireland) and Warrenpoint (Northern Ireland). Greenore Port is a relatively small cargo port while Warrenpoint Port is the second largest general cargo port in Northern Ireland and fifth largest on the island of Ireland.

There are also three marinas in the Lough close to the MCZ: Carlingford Marina (location of Carlingford Sailing Club), Warrenpoint Marina and Killowen point quay (Carlingford Lough Yacht Club).

Coastal defences and land reclaim are localised management practices used to reduce the impact of erosion. In Carlingford Lough there is both natural and hard coastal reinforcement from Killowen Bank to Warrenpoint and there is a large coastal defence off the town of Carlingford.

Infrastructure within or adjacent to the MCZ is shown in Figure 5. Part of the MCZ falls within the Warrenpoint Harbour Authority's jurisdiction. The construction and maintenance of structures in the area has the potential to cause direct damage to the MCZ feature. In addition, the two marinas in the North, the existing coastal defences and associated operations may cause pressures to which the MCZ feature is sensitive.

Philine aperta and *Virgularia mirabilis* communities have **moderate** vulnerability to the following pressures associated with infrastructure operations: increase and decrease in **water flow** (tidal current), **de-oxygenation**, **physical loss** (to land or freshwater habitat), **physical change** (to another seabed type) and **habitat structure changes**. The feature has a low vulnerability to **organic enrichment**, **overall abrasion** (surface and subsurface) and **siltation rate changes** (including smothering).

Habitat loss or alteration, and direct damage to individual species are the main risks associated with existing infrastructure operations. In addition, the construction of new infrastructure may affect the local hydrodynamic and sediment transport regimes of inshore enclosed areas and consequently lead to a change in seabed type with subsequent loss of biodiversity.

At present it is considered that the risk of not achieving the conservation objectives for the MCZ feature is low unless the location or intensity of coastal infrastructure operations was to change in the future.

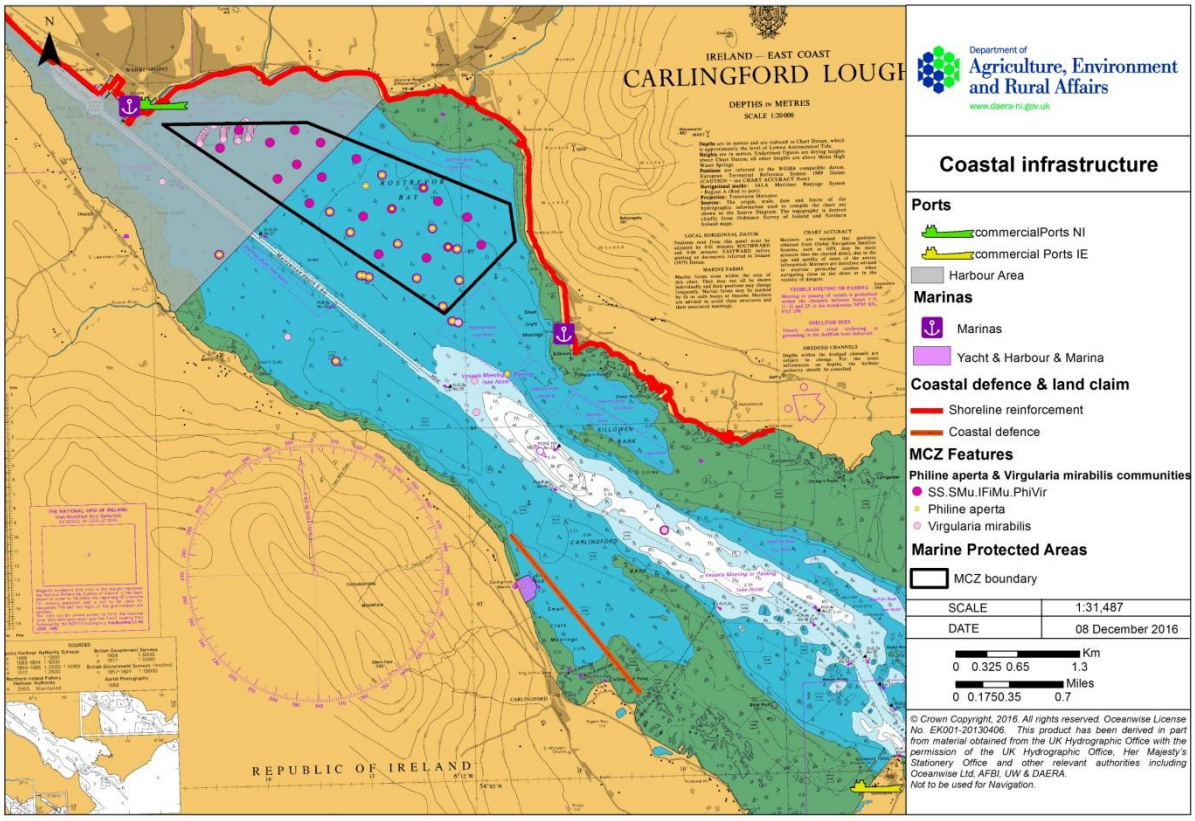

Figure 5 Location of coastal infrastructure in relation to Carlingford Lough MCZ

Table 4 Potential Management Options for coastal infrastructure

Potential Management Options	**No additional management required.**
Proposed way forward	Applications for coastal infrastructure works will be subject to the marine licensing and planning processes which will take into consideration any impacts to the MCZ feature. The Department will continue discussions with those involved with Coastal Infrastructure activities and operations within or adjacent to the MCZ to help us to understand more about the interactions with the MCZ feature.

Relationship with existing Management Options	The Department for Infrastructure (DfI) is responsible for sea defences designated under the Drainage (Northern Ireland) Order 1973. Warrenpoint Harbour Authority has responsibility for the management of ports and marinas under The Harbours (Northern Ireland) Order 2002. Port developments are covered by DfI and through marine licensing and planning.

Extraction of non-living resources: *Navigational dredging (capital & maintenance)*

Dredging for navigational purposes is a fundamental activity for ports and harbours to ensure operational charted depths are maintained for safe access of vessels which can enhance the economic viability of Northern Ireland. Warrenpoint Harbour also engages in navigational channel maintenance programmes such as ploughing the turning circle, maintenance dredging and potentially in the future capital dredging works. The latter two are subject to marine licence but plough dredging within the harbour limits is exempt from marine licensing and has the potential to impact the northwest corner of the MCZ through re-suspension and smothering. Navigational dredging takes place in a narrow channel running through the centre of the Lough from the mouth up to the Narrow Water inlet.

Navigational dredging in Carlingford Lough is shown in Figure 6. There is no overlap between the channel dredging and the MCZ. However, the potential environmental effects of navigational dredging are generally two-fold, firstly as a result of the dredging process itself (removal of species/habitat) and secondly as a result of the disposal of the dredged material (smothering/siltation; this is covered in the section on Waste management). The proximity to Warrenpoint Harbour may be a risk if dredging activity happens close to or within the MCZ boundary. Plough dredging and associated risks have been covered in the Waste Management section.

Philine aperta and *Virgularia mirabilis* communities are highly vulnerable to pressures related to navigational dredging (maintenance and capital). These pressures are: increase and decreases in **water flow** (tidal currents), **de-oxygenation, organic enrichment**, **habitat structure changes** – removal of substratum (extraction), **overall abrasion** (surface and subsurface), **siltation rate changes** (including smothering) and **removal of non-target species**.

It is considered that the risk of not achieving the conservation objectives for the MCZ feature is low unless the location or intensity of the dredging or disposal activity were to change in the future. At present no additional management is required.

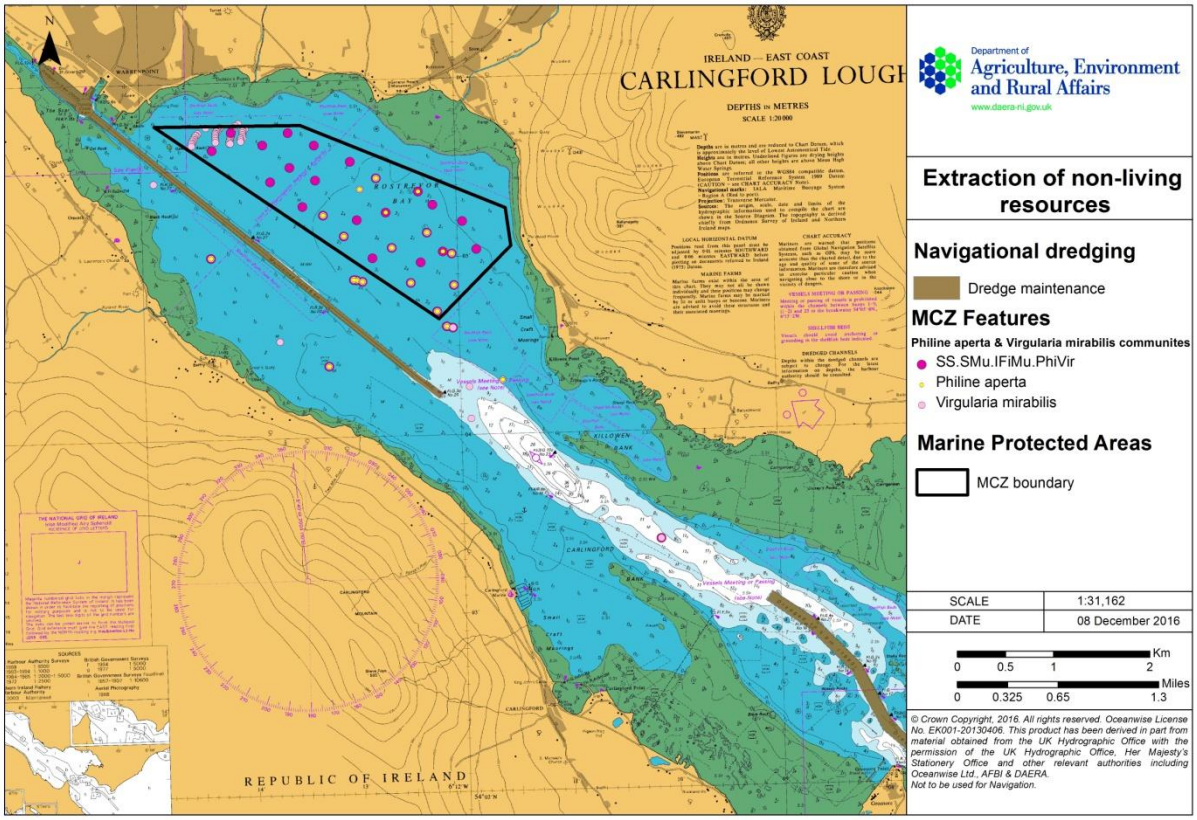

Figure 6 Location of navigational dredging in relation to Carlingford Lough MCZ

Table 5 Potential Management Options for extraction of non-living resources

Potential Management Options	**No additional management is required.**
Proposed way forward	On-going maintenance dredging can continue within the existing licensed area. Capital dredging will be subject to the marine licensing process. The Department will continue discussions with the Harbour Authorities to develop appropriate management measures.
Relationship with existing Management Options	The Department is responsible for licensing dredging and disposal activities in the inshore region. Ports and harbours with a Harbour Order or Local Act in place may be exempt from the requirement to obtain a marine licence to carry out dredging and/or disposal within the harbour limits.

Waste management: *Sewage disposal and Dredge disposal*

Three main sewage treatment works discharge into Carlingford Lough and these are located at Newry Town (in the Newry River estuary), Warrenpoint and Cranfield. There are sewage discharge points into Carlingford Lough from the Republic of Ireland (Greenore and Omeath) and Carlingford. Although they do not overlap spatially with the MCZ, four of the discharge sites are located around the MCZ (Figure 7).

Secondary pressures may include diffuse land-based and accidental spills from marine, industrial or commercial sources. Vessels are not allowed to discharge any materials within Carlingford Lough.

Philine aperta and *Virgularia mirabilis* communities have low to moderate vulnerability to **salinity changes**, **de- oxygenation**, **organic enrichment, siltation rate changes** and **removal of non-target species** as a result of sewage disposal.

There is currently a dredge disposal area outside the Lough but this is unlikely to cause an impact on the MCZ. There may be a risk if new disposal grounds were to be proposed inside the Lough. *Philine aperta* and *Virgularia mirabilis* communities have low vulnerability to **organic enrichment**, **overall abrasion** (surface and subsurface), **siltation rate changes** and **removal of non-target species**. The MCZ feature is moderately vulnerable to **de-oxygenation**, **physical loss (to land or freshwater habitat)** and **habitat structure changes**.

It is considered that the risk of not achieving the conservation objectives for the MCZ feature is low unless the location or intensity of the discharge or dredge disposal activity was to change in the future. At present no additional management is required.

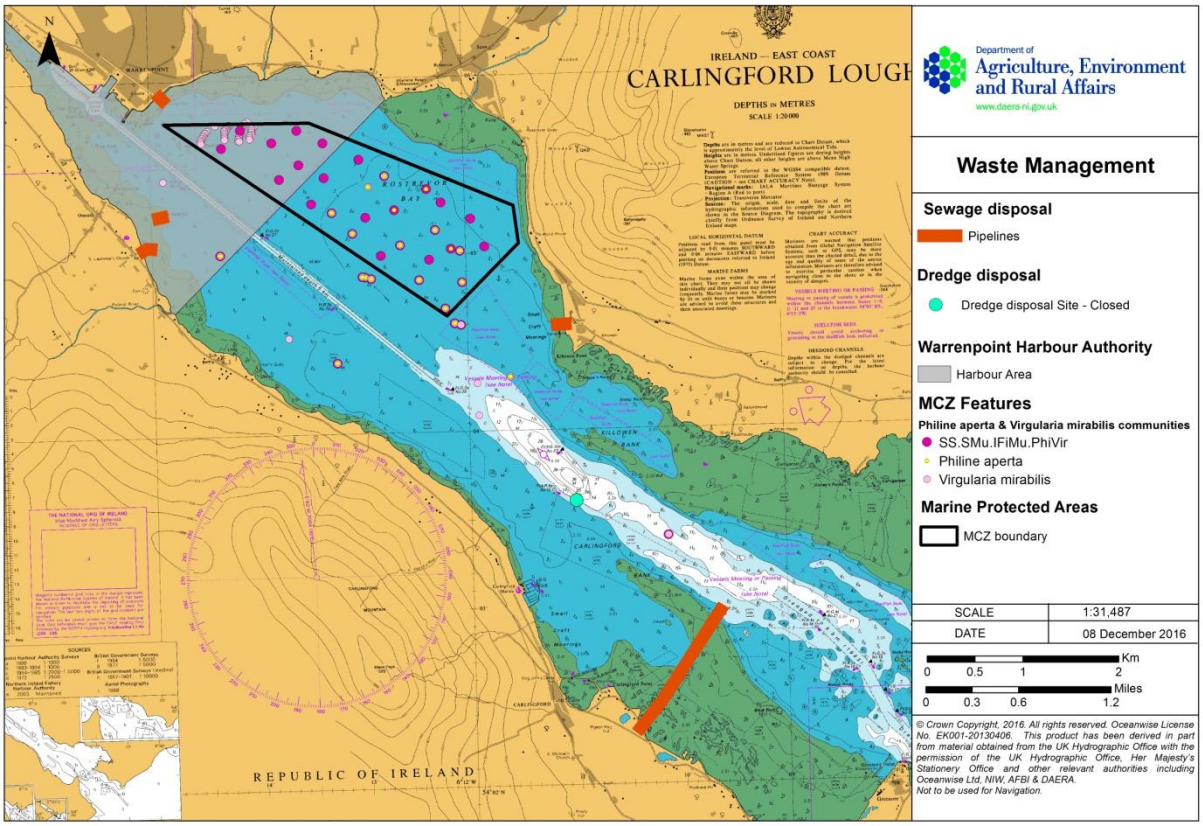

Figure 7 Location of waste management activities in relation to Carlingford Lough MCZ

Table 6 Potential Management Options for waste management

Potential Management Options	**No additional management is required.**
Proposed way forward	New applications for sewage or dredge disposal will be subject to the marine licensing and Water Order discharge consent processes which will take the MCZ feature into consideration. Any changes to the current discharge/waste disposal sites will be managed by Northern Ireland Water (NIW) in consultation with Warrenpoint Harbour Authority (where applicable) and the Department to determine any impacts to the MCZ.

Relationship with existing Management Options	NIW is responsible for waste water treatment and the construction, operation and maintenance of sewage outfalls. Water discharges are governed by requirements in European legislation (The Urban Waste Water Treatment Directive (91/271/EEC), Water Framework Directive (WFD) and Nitrates Directive and Water (Northern Ireland) Order 1999. The disposal of ship generated waste (including sewage and bilge water) must comply with the EU Directive 2000/59/EC of the European Parliament and Council on Port Waste Reception Facilities for Ship Generated Waste and Cargo Residues, the Merchant Shipping (Port Waste Reception Facilities) Regulations 1997, the Merchant Shipping and Fishing Vessels (Port Waste Reception Facilities) Regulations 2003. Ports and harbours with a Harbour Order or Local Act in place may be exempt from the requirement to obtain a marine licence to carry out dredging and/or disposal within the harbour limits.

Transport: *Shipping – general at sea (moorings, anchorage & vessel movements) and Shipping – port operations within Harbour Authority limits (mooring, beaching, launching, ferry route etc)*

In Carlingford Lough, there is one mooring point to the south, four small mooring/anchorage areas and four unrestricted boat anchorage points. There is also a freight service ferry route that runs twice daily from Warrenpoint to Heysham (Lancashire); this crosses the Lough following the navigational channel.

Shipping and navigation in the area, shown in Figure 8, include container services (three times a week to Bristol and Cardiff) and other cargo vessels, fishing vessels, recreational vessels (sailing and motorboats) and vessels associated with dredging or underwater activities (including diving). The majority of large commercial shipping passes through the navigational channel to Warrenpoint Harbour. Large ships manoeuvring in the turning circle can cause re-suspension of sediments and smothering events. High-speed shipping has the potential to generate a large wake which can cause, in shallow waters, sediment destabilisation and displacement of Sea-pens. The Lough has speed limits in place within the navigational channel, but the Department has received reports that these are not always adhered to and may require additional management measures to enforce this restriction.

There is overlap with the MCZ and navigation of fishing vessels involved in aquaculture operations and sailing (recreation). Certain activities associated with these smaller fishing vessels and recreational boats, particularly during summer season, have the potential to physically damage the feature inside the MCZ through anchoring.

Philine aperta and *Virgularia mirabilis* communities have a moderate vulnerability to the following pressure associated with transport: **overall abrasion** (surface and subsurface) by anchoring or mooring activities. The feature also has a low vulnerability to **siltation rate changes** (including smothering).

Anchoring or mooring activity associated with shipping within the MCZ should be removed or avoided to aid in the continued achievement of the conservation objectives.

Anchoring in emergency situations will not be restricted.

Any activities within the Harbour Authority limits are unlikely to affect the MCZ therefore the Department considers no additional management is required.

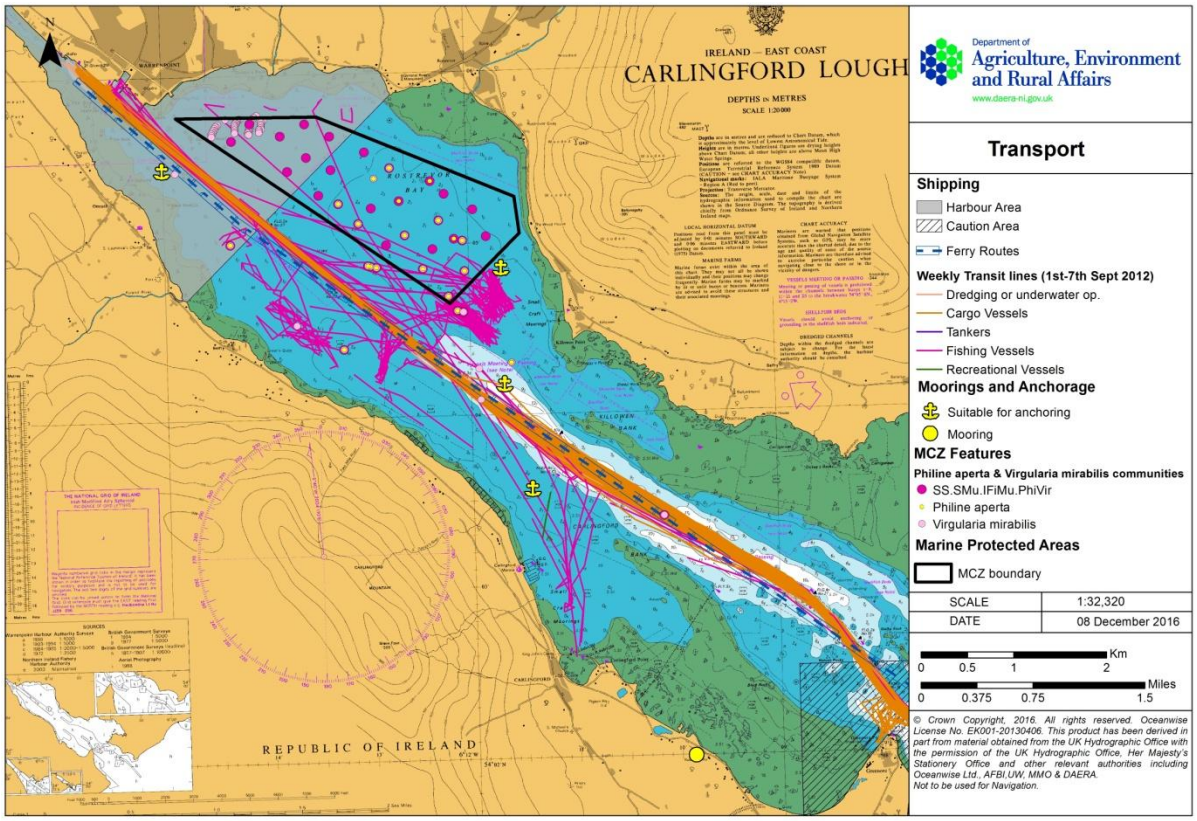

Figure 8 Location of transport in relation to Carlingford Lough MCZ

Table 7 Potential Management Options for transport

Potential Management Options	**Management measures are recommended to remove or avoid pressures associated with shipping – general at sea (anchoring and mooring) where they are likely to impact the MCZ feature.** **Anchoring in emergency situations will not be restricted.** **No additional management is required for shipping – port operations within Harbour Authority limits.**
Proposed way forward	The Department will continue discussions with those involved with marine traffic in Carlingford Lough to develop appropriate management measures.

Relationship with existing Management Options	The shipping industry is primarily regulated by the International Maritime Organization (IMO). The Maritime and Coastguard Agency (MCA) works closely with national and international partners in the shipping industry to promote the safe construction, operation and navigation of ships. Permanent moorings north of the dredged channel are usually licensed by the Crown Estate as owners of the seabed. However, there may be unlicensed moorings that the Crown Estate is unaware of. Any new moorings will require a marine licence from the Department, except those within the Harbour limits which are the responsibility of the Harbour Authority.

Recreation and leisure: ***Recreational activities – SCUBA diving, sailing, windsurfing, kayaking/canoeing, bird watching, recreational sea angling, recreational fishing***

There are numerous recreation and leisure activities along the shores and waters of Carlingford Lough, i.e. walking, beaches/bathing, water sports, adventure centres, yachting, sea angling and bird watching.

An increase in the population of the local area due to tourism and recreational activities may lead to an increase in the quantity of sewage discharged or increased disturbance to natural features and wildlife within the Carlingford Lough area.

Walking is a recreational activity that has increased in popularity in recent years. Cranfield West Beach is frequented by families and water sport enthusiasts and holds a Blue Flag, an indicator of excellent water quality. Water sports in the area include a coastal canoe trail (Killowen-Warrenpoint), windsurfing, pier jumping, SCUBA diving and sailing.

Sea angling occurs along the shoreline and from boats. Charter boat services are available from Warrenpoint, Carlingford and Greencastle. Spurdog and Dogfish are commonly caught while Tope fishing is popular during the summer months.

Mill Bay and the shoreline between Greenore and Carlingford are prime spots for bird watching.

Waste can enter the Lough from recreational vessels. Carlingford Marina is the only tourism based marina in the Lough and has in place waste disposal arrangements to prevent the contamination of water from vessel waste.

The main pressures associated with recreation and leisure to which the MCZ feature has a low vulnerability to are **overall abrasion** (surface and subsurface), **siltation changes** (including smothering) and **removal of non-target species.**

Figure 9 shows location of recreational activities in relation to the MCZ. Although there is spatial overlap between some of the activities such as canoeing, they are unlikely to adversely impact the MCZ due to the small scale of the activity and the depth at which the feature is located. However, any anchoring or mooring activity associated with recreational vessels should be reduced or limited within the MCZ as this can result in overall abrasion and may physically damage the feature.

There is a moderate risk of the conservation objectives not being met without management being introduced. Anchoring or mooring activity associated with recreation and leisure within the MCZ should be reduced or limited to aid in the continued achievement of the conservation objectives.
Anchoring in emergency situations will not be restricted.

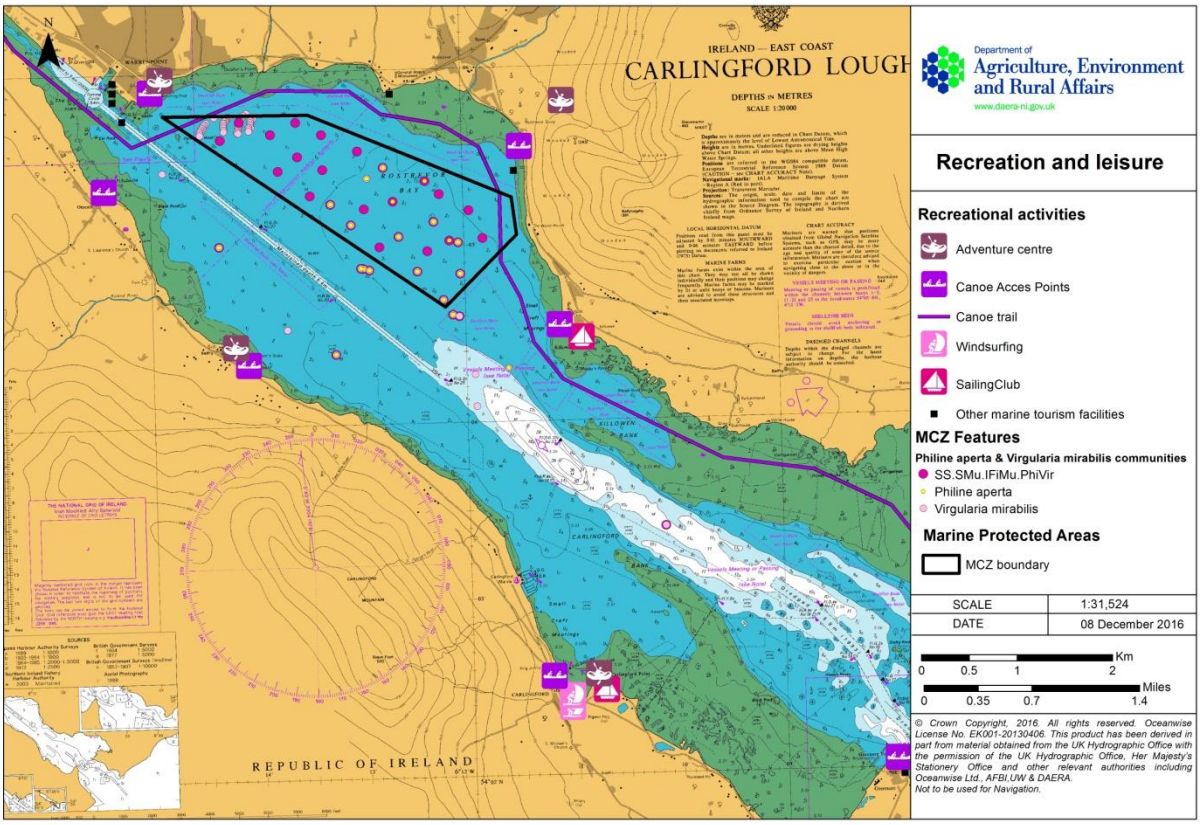

Figure 9 Location of recreation and leisure in relation to Carlingford Lough MCZ

Table 8 Potential Management Options for recreation and leisure

Potential Management Options	**Management measures are recommended to reduce or limit pressures associated with recreation and leisure (anchoring or mooring) where they are likely to impact the MCZ feature.** **Anchoring in emergency situations will not be restricted.**
Proposed way forward	The Department will continue discussions with those involved with recreation and leisure activities in Carlingford Lough to develop appropriate management measures.

Relationship with existing Management Options	DfE is responsible for tourism policy while District Councils have a role in promoting local tourism and recreation. Management of fisheries within Carlingford Lough comes under the auspices of the Loughs Agency (North/South Co-operation (Implementation Bodies) (NI) Order, 1999 and the Foyle Fisheries Act (NI) 1952 (as amended) DfC has a responsibility for arts, culture and sport, while DAERA is responsible for inland fisheries and DfI is responsible for inland waterways. Licences for angling (salmon and sea trout) are also issued by the Department.

Marine research: *Scientific and Archaeological*

Carlingford Lough is subject to a variety of environmental monitoring programmes. The Joint Agency Monitoring Programme (Agri-food and Biosciences Institute (AFBI), Loughs Agency and the Department) deliver spatial water quality monitoring throughout Northern Ireland coastal waters as part of the Water Framework Directive classification programme. This is now a largely automated environmental monitoring system using moored monitoring stations/points (there are two in Carlingford Lough).

The Department, together with the National Museums of Northern Ireland (NMNI), completed a series of Sublittoral Dive Surveys (SSNI) over a number of years to collect data on the distribution and condition of Northern Ireland Priority Species (Figure 10). Drop-camera and grab surveys were also carried out by the Department within the MCZ area to assess the condition and extent of the MCZ features.

There are two recorded wrecks falling within the Carlingford MCZ boundary but their exact location needs to be confirmed. There are further wrecks assigned to the Rostrevor Bay area and, given the approximate nature of their location, they may fall within the MCZ boundary. Carlingford Lough has not been the subject of any concerted sub-tidal archaeological survey despite its archaeological potential.

The main pressure associated with Marine research to which *Philine aperta* and *Virgularia mirabilis* communities have a high vulnerability is **habitat structure changes**. The feature has a moderate vulnerability to **overall abrasion** (surface and subsurface) and a low vulnerability to **siltation rate changes (**including smothering). Strict guidelines and practices developed by JNCC for survey work are used to ensure that any impact on feature is minimised to the lowest possible levels and that the conservation objectives can be achieved.

It is considered that the risk of not achieving the conservation objectives of the protected feature is low since Marine research activities under the above mentioned surveys are performed by trained, qualified staff using non-invasive techniques (where possible) such as acoustic and video methodologies. In addition, the Department must be notified before any activities within the MCZ take place and will require the provision of detailed methodologies for all Marine research to assess if any impacts to the MCZ feature are likely to occur.

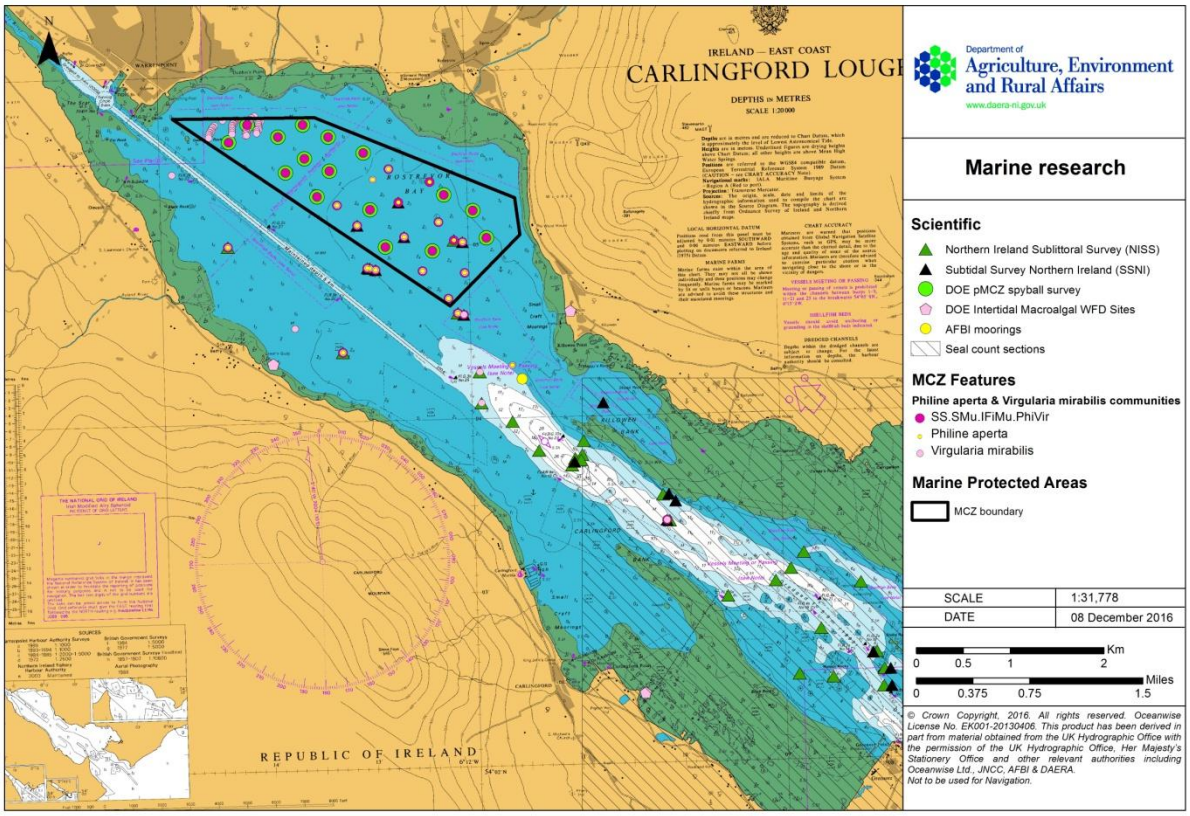

Figure 10 Location of marine research activities in relation to Carlingford Lough MCZ

Table 9 Potential Management Options for marine research

Potential Management Options	**No additional management is required.** **Anchoring in emergency situations will not be restricted.**
Proposed way forward	The MCZ feature will be monitored within a 6-yearly rolling cycle to assess biotope distributions and species abundances. This will determine whether the conservation objectives are being achieved. The Department must be notified before any research activities are carried out and will require the provision of detailed methodologies for all Marine research activities to assess if any impacts to the MCZ feature are likely to occur.

Relationship with existing Management Options	Delivered by the Department, Loughs Agency and AFBI under international, European and national legislation with marine components (Marine Strategy Framework Directive, Marine and Coastal Access Act (2009), The Marine Act (Northern Ireland) 2013 and OSPAR).

Other man-made structures: *Submarine cable & pipeline operations*

There are no known submarine cables in the vicinity of the MCZ.

There are five outfall pipes in Carlingford Lough; one to the north-west and one to the south-east of the MCZ (see Figure 11). Both of these pipelines are discharge pipes for sewage treatment works and the pressures associated with waste disposal have already been covered in the Waste management section.

Construction or maintenance activities of the outfall pipes have the potential to cause physical damage to habitats. *Philine aperta* and *Virgularia mirabilis* communities have a moderate vulnerability to **physical change** (to another seabed type) and **habitat structure changes**. The feature has a low vulnerability to **penetration and/or disturbance of the substrate below the surface of the seabed -** (Overall abrasion)**, abrasion/disturbance of the surface of the substratum or seabed** and **siltation rate changes** (including smothering - heavy)**.**

It is considered that the risk of not achieving the conservation objectives of the designated feature is low since all current activities have been licensed. Any future construction or maintenance activities associated with the submarine cable or pipeline may require a marine licence. At present no additional management is required. Emergency operations will not be restricted.

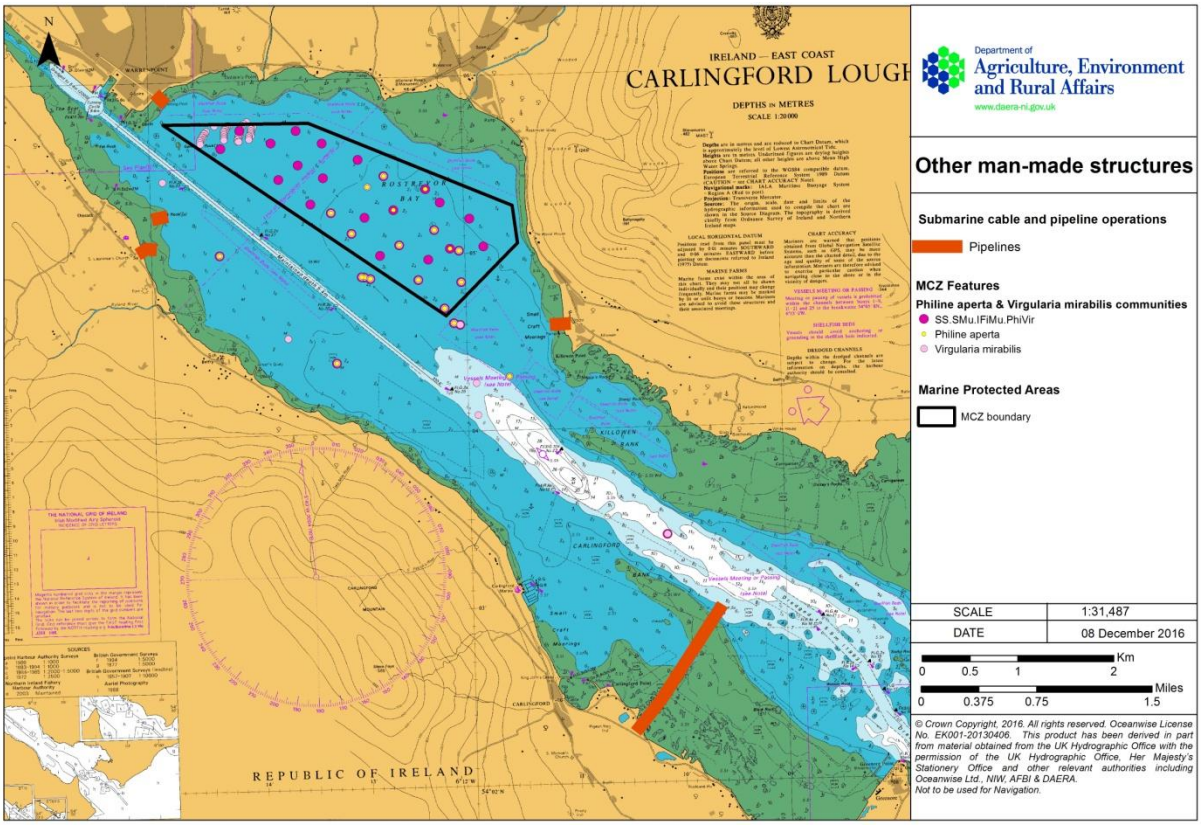

Figure 11 Location of other man-made structures in relation to Carlingford Lough MCZ

Table 10 Potential Management Options for other man-made structures

Potential Management Options	**No additional management is required.** **Emergency operations will not be restricted**.
Proposed way forward	Any proposed maintenance works (including construction) to the pipeline may require a marine licence from the Department. The potential impact to the MCZ feature will be considered during the assessment process.
Relationship with existing Management Options	NIW is responsible for waste water treatment and the construction, operation and maintenance of sewage outfalls. Water discharges are governed by requirements in European legislation (The Urban Waste Water Treatment Directive (91/271/EEC), Water Framework Directive (WFD) and Nitrates Directive and Water (Northern Ireland) Order 1999.

Summary of Potential Management Options

Table 11 Potential Management Options for Carlingford Lough MCZ

Production of living resources: *Aquaculture – shellfish*	**No additional management is required.**
Extraction of living resources: *Fishing – dredging*	**At present no additional management is required for dredging within the licensed areas for shellfish cultivation.**
Fishing – demersal trawling	**Management measures are recommended to remove or avoid pressures associated with demersal trawling where this is likely to impact the MCZ features.**
Fishing – traps (creeling/potting)	**Management measures are recommended to reduce or limit pressures associated with fishing with traps (pots/creels) within the MCZ.**
Coastal infrastructure: *Coastal docks, ports & marinas and Coastal defence & land claim*	**No additional management is required.**
Extraction of non-living resources: *Navigational dredging (capital & maintenance)*	**No additional management is required.**
Waste management: *Sewage and Dredge disposal*	**No additional management is required.**

Transport: *Shipping – general at sea (mooring, anchorage & vessel movements)* *Shipping – port operations within the Harbour Authority limits (mooring, beaching, launching etc)*	**Management measures are recommended to remove or avoid pressures associated with shipping – general at sea (anchoring and mooring) where they are likely to impact the MCZ feature.** **Anchoring in emergency situations will not be restricted.** **No additional management is required for shipping – port operations (mooring, beaching, launching etc).**
Recreation and leisure: *recreational activities – SCUBA Diving, sailing, windsurfing, kayaking/canoeing, bird watching, recreational fishing*	**Management measures are recommended to reduce or limit pressures associated with recreation and leisure (anchoring or mooring) where they are likely to impact the MCZ feature.** **Anchoring in emergency situations will not be restricted.**
Marine research: *Scientific and Archaeological*	**No additional management is required.**
Other man-made structures: *Submarine cable & pipeline operations*	**No additional management is required.** **Emergency operations will not be restricted.**

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Annex I

Conservation Objectives for Carlingford Lough MCZ

In general the conservation objectives for Carlingford Lough MCZ are that the protected features:

- where they are already in *favourable condition*, remain so, and
- where they are not in *favourable condition*, are brought into such condition and remain so.

'Favourable Condition' is defined as '*the target condition for a feature of interest in terms of the abundance, distribution and/or quality of that feature within the site*'. With respect to a marine habitat, *favourable condition* means that the habitat's extent is stable or increasing and its structures, functions, quality and the composition of its characteristic biological communities (including diversity and abundance) are such that it remains in a healthy condition, which is not deteriorating. Any temporary deterioration in condition is to be disregarded if the marine habitat is sufficiently healthy and resilient to enable its recovery from such deterioration.

'Favourable condition' in relation to marine species, means that the quality and quantity of the species habitat and the composition of its population in terms of number, age and sex ratio ensures that the population is maintained in numbers that enable it to thrive.

The conservation objectives have been drafted for the MCZ feature of *Philine aperta* and *Virgularia mirabilis* in soft stable infralittoral mud . The purpose of this is to provide some reference points, against which the success of the conservation objectives and the management plan can be measured.

By monitoring attributes of this feature and sub-feature, which have been identified to provide an indication of the condition of the feature, it should be possible to identify trends or changes in these habitats and whether or not these changes are natural or caused by human activities. This monitoring is essential in order to ensure that these habitats are being kept in (or restored to) favourable condition, i.e. the condition in which the habitat or species is capable of sustaining itself on a long-term basis.

Conservation Objective 1

To *maintain*[1] *Philine aperta* and *Virgularia mirabilis* communities in soft stable infralittoral mud in *favourable condition*, taking account of natural change such that:

- The natural environmental quality[2] is maintained
- The natural environmental processes[3] are maintained
- The extent[4], diversity[5], community structure[6] and typical species[7] representative of the habitat are maintained.

Explanation of terms used in the Conservation Objectives

1. Maintain or Recover/restore

Maintain implies that the feature is in favourable condition and will, subject to natural change, remain at its condition at designation. Any existing activities are deemed to be sustainable and will not adversely affect the condition of the feature *if current practices are continued at current levels.*

Recover/restore implies that the feature is degraded to some degree and that activities will have to be managed to reduce or eliminate negative impact(s). Restoration in the marine environment can refer to natural recovery through the removal of unsustainable physical, chemical and biological pressures, as well as intervention.

2. Natural environmental quality

e.g. chemical quality parameters of water, suspended sediment levels, radionuclide levels etc. should not deviate from baseline at designation (if available) or reference conditions.

3. Natural environmental processes

e.g. circulation, sediment deposition and erosion etc. should not deviate from baseline at designation (if available) or reference conditions.

4. Extent

The area covered by the habitat and communities.

5. Diversity

The number of different biological species and communities.

6. Community structure

e.g. age classes, sex ratios, distribution of species, abundance, biomass, reproductive capacity, recruitment, range and mobility.

7. Typical species

See Annex II

Monitoring Priorities

Monitoring will add to the existing baseline of information and where appropriate, existing survey work will be repeated in order to ensure that it conforms to the agreed monitoring methods.

The following table (Table 12) outlines the various types of monitoring that the Department considers are necessary in order to be able to assess the 'condition' of

the MCZ's interest features (habitats and species). By monitoring various aspects or attributes of these features, it is possible to build up a picture of what is happening to the site and whether or not there needs to be changes made to the ways in which it is managed. The aim is to ensure that the interest features remain in (or are restored to) a favourable condition which can be said to occur when the target for each attribute is reached.

Table 1 Favourable condition table for Carlingford Lough MCZ

Feature	Sub-Feature	Attribute	Measure	Target	Comments
Subtidal (sublittoral) mud		Extent	Area (ha) measured periodically (frequency to be determined).	No decrease in extent from an established baseline subject to natural change.	Extent of feature provides a long-term integrated measure of environmental conditions. Reduction in extent may indicate long term changes in the physical conditions influencing the feature.
		Sediment character	Particle size analysis (PSA). Parameters include percentage mud/silt/gravel, mean and median grain size, and sorting coefficient used to characterise sediment type. Sediment character to be measured during summer, once per reporting cycle.	Average PSA parameters should not deviate significantly from an established baseline, subject to natural change.	Sediment character defined by particle size analysis is key to the structure of the feature and reflects all of the physical processes acting on it. Particle size composition varies across the feature and can be used to indicate spatial distribution of sediment types this reflecting the stability of the feature and the processes supporting it.

Feature	Sub-Feature	Attribute	Measure	Target	Comments
	Philine aperta and *Virgularia mirabilis* communities	Distribution of *Philine aperta* and *Virgularia mirabilis* communities habitat	Distribution of the biotope SS.SMu.IFiMu.PhiVir measured once during the reporting cycle.	This habitat should be present in those areas of the Lough where they currently occur.	Baseline survey required. The density of *Philine aperta* can be highly variable and this should be considered when carrying out the survey. Changes in presence may indicate long term changes in the physical conditions at the site.
		Extent and percentage cover of Sea-pen and white sea slug communities habitat.	Extent and percentage cover occupied by the biotope SS.SMu.IFiMu.PhiVir measured once during the reporting cycle.	No decrease in extent or percentage cover from an established baseline, subject to natural change.	Baseline survey required. Changes in extent and percentage cover may indicate long term changes in the physical conditions at the site.

Feature	Sub-Feature	Attribute	Measure	Target	Comments
	Subtidal (sublittoral) mud communities	Characteristic biotopes at sites chosen so as to provide some indication of the distribution and extent of the sub-feature.	Presence of selected biotopes at selected sites measured once during the reporting cycle.	Presence of selected biotopes should not deviate significantly from an established baseline, subject to natural change.	Species composition is an important contributor to the structure of the biotopes within the sub-feature. The presence and relative abundance of characterising species gives an indication of the quality of the biotopes and change in composition may indicate cyclic change/trend or long-term changes in the physical conditions at the site.
		Species composition of characteristic biotopes at monitoring sites.	Presence and abundance of composite species, measured during summer, once per reporting cycle.	Presence and abundance of composite species should not deviate significantly from an established baseline, subject to natural change.	Species composition is an important contributor to the structure of the biotopes within the sub-feature. The presence and relative abundance of characterising species gives an indication of the quality of the biotopes and change in composition may indicate cyclic change/trend or long-term changes in the physical conditions at the site.

Annex II

Priority Marine Features (PMFs)

Table 1 List of Priority Marine Features recorded within the MCZ

Habitats	
Subtidal (sublittoral) mud	
Philine aperta and *Virgularia mirabilis* communities in soft stable infralittoral mud	
Low mobility species	
Common name	**Latin name**
Plaice	*Pleuronectes platessa*
High mobility species	
Common name	**Latin name**
Nudibranch	*Embletonia pulchra*

Annex III

Sensitivity, exposure and vulnerability Matrix for Carlingford Lough MCZ

Vulnerability Key: High vulnerability Moderate vulnerability Low vulnerability No vulnerability Unknown

Table 1 Subtidal (sublittoral) mud (SM): *Philine aperta* and *Virgularia mirabilis* communities (PAVM) Vulnerability Assessment

The vulnerability to each pressure is derived from the sensitivity of the feature to the activity combined with its current exposure to that activity (i.e. to what degree the activity is occurring). The vulnerability rating/score provides a 'snapshot' of what is occurring at the time of the assessment – when considering new activities the exposure will be reassessed to give a new vulnerability rating.

Pressure category	Pressures	Activities associated in the area	SM: PAVM		
			Sensitivity	Exposure	Vulnerability
Hydrological pressures	**Temperature changes - local**		○		**No**
	Salinity changes - local	Waste management: *Sewage disposal*	●●●	●	**Moderate**
	Water flow (tidal current) changes (including sediment transport considerations)	Coastal infrastructure: *Coastal docks, ports & marinas. Coastal defence & land claim*	●●●	●	**Moderate**
		Extraction of non-living resources: *Navigational dredging (capital & maintenance)*		●●●	**High**
	Emergence regime changes (includes tidal level change considerations)			○	**No**
	Wave exposure changes		○		**No**

Pollution and other Chemical pressures	**Non-synthetic compound contamination - Transition elements & organo-metals**		○		**No**
	Non-synthetic compound contamination - Hydrocarbon & PAH Contamination		○		**No**
	Synthetic compound contamination		○		**No**
	Radionuclide contamination		?		**Unknown**
	Introduction of other substances (solid, liquid or gas)		○		**No**
	De-oxygenation	Production of living resources: *Aquaculture – shellfish*	●●●	●●●	**High**
		Extraction of living resources: *Fishing – dredging*		●●●	**High**
		Coastal infrastructure: *Coastal docks, ports & marinas. Coastal defence & land claim*		●	**Moderate**
		Extraction of non-living resources: *Navigational dredging (capital & maintenance)*		●●●	**High**
		Waste management: *Sewage disposal*		●	**Moderate**
		Waste management: *Dredge disposal*		●	**Moderate**
	Nutrient enrichment		○		**No**

	Organic enrichment	Production of living resources: *Aquaculture – shellfish*	●●	●●●	**High**
		Coastal infrastructure: *Coastal docks, ports & marinas. Coastal defence & land claim*		●	**Low**
		Extraction of non-living resources: *Navigational dredging (capital & maintenance)*		●●●	**High**
		Waste management: *Sewage disposal*		●	**Low**
		Waste management: *Dredge disposal*		●	**Low**
Physical loss	**Physical loss (to land or freshwater habitat)**	Coastal infrastructure: *Coastal docks, ports & marinas. Coastal defence & land claim*	●●●	●	**Moderate**
		Waste management: *Dredge disposal*		●	**Moderate**
	Physical change (to another seabed type)	Production of living resources: *Aquaculture – shellfish*	●●●	●●●	**High**
		Extraction of living resources: *Fishing – dredging*		●●●	**High**
		Coastal infrastructure: *Coastal docks, ports & marinas. Coastal defence & land claim*		●	**Moderate**
		Other man-made structures: *Submarine cables & pipelines operations*		●	**Moderate**

Physical damage	**Habitat structure changes**	Production of living resources: *Aquaculture – shellfish*	●●●	●●●	**High**
		Extraction of living resources: *Fishing – dredging*		●●●	**High**
		Coastal infrastructure: *Coastal docks, ports & marinas. Coastal defence & land claim*		●	**Moderate**
		Extraction of non-living resources: *Navigational dredging (capital & maintenance)*		●●●	**High**
		Waste management: *Dredge disposal*		●	**Moderate**
		Marine research: *Scientific and Archaeological*		●●	**High**
		Other man-made structures: *Submarine cables & pipelines operations*		●	**Moderate**
	Penetration and/or disturbance of the substrate below the surface of the seabed - (Overall abrasion)	Production of living resources: *Aquaculture – shellfish*	●●	●●●	**High**
		Extraction of living resources: *Fishing – dredging*		●●●	**High**
		Coastal infrastructure: *Coastal docks, ports & marinas. Coastal defence & land claim*		●	**Low**

		Extraction of non-living resources: *Navigational dredging (capital & maintenance)*		●●●	**High**
		Waste management: *Dredge disposal*		●	**Low**
		Transport: *Shipping – general at sea (moorings, anchorage & vessel movements)*		●●	**Moderate**
		Transport: *Shipping – port operations (mooring, beaching, launching, ferry route etc.)*		●	**Low**
		Recreation and leisure: *Recreational activities*		●	**Low**
		Marine research: *Scientific and Archaeological*		●●	**Moderate**
		Other man-made structures: *Submarine cables & pipelines operations*		●	**Low**
	Abrasion/disturbance of the surface of the substratum or seabed	Production of living resources: *Aquaculture – shellfish*	●●	●●●	**High**
		Extraction of living resources: *Fishing – dredging*		●●●	**High**
		Coastal infrastructure: *Coastal docks, ports & marinas. Coastal defence & land claim*		●	**Low**

		Extraction of non-living resources: *Navigational dredging (capital & maintenance)*		●●●	**High**
		Waste management: *Dredge disposal*		●	**Low**
		Transport: *Shipping – general at sea (moorings, anchorage & vessel movements)*		●●	**Moderate**
		Transport: *Shipping – port operations (mooring, beaching, launching, ferry route etc.)*		●	**Low**
		Recreation and leisure: *Recreational activities*		●	**Low**
		Marine research: *Scientific and Archaeological*		●●	**Moderate**
		Other man-made structures: *Submarine cables & pipelines operations*		●	**Low**
	Changes in suspended solids (water clarity)		○		**No**
	Siltation rate changes, including smothering (light)		○		**No**
	Siltation rate changes, including smothering (heavy)	Production of living resources: *Aquaculture – shellfish*	●	●●●	**Moderate**
		Extraction of living resources: *Fishing – dredging*		●●●	**Moderate**

		Coastal infrastructure: *Coastal docks, ports & marinas. Coastal defence & land claim*		●	**Low**
		Extraction of non-living resources: *Navigational dredging (capital & maintenance)*		●●●	**High**
		Waste management: *Sewage disposal*		●	**Low**
		Waste management: *Dredge disposal*		●	**Low**
		Transport: *Shipping – general at sea (moorings, anchorage & vessel movements)*		●●	**Low**
		Transport: *Shipping – port operations (mooring, beaching, launching, ferry route etc.)*		●	**Low**
		Recreation and leisure: *Recreational activities*		●	**Low**
		Marine research: *Scientific and Archaeological*		●●	**Low**
		Other man-made structures: *Submarine cables & pipelines operations*		●	**Low**
Other physical pressures	**Litter**		?		**Unknown**
	Electromagnetic changes		?		**Unknown**
	Underwater noise changes			○	**No**

	Introduction of light		○		**No**
	Barrier to species movement			○	**No**
	Death or injury by collision			○	**No**
	Visual disturbance (behaviour)			○	**No**
Biological pressures	**Genetic modification & translocation of indigenous species**		?		**Unknown**
	Introduction or spread of non- indigenous species		?		**Unknown**
	Introduction of microbial pathogens		?		**No**
	Removal of target species			○	**No**
	Removal of non- target species	Production of living resources: *Aquaculture – shellfish*	●●	●●●	**High**
		Extraction of living resources: *Fishing – dredging*		●●●	**High**
		Extraction of living resources: *Fishing – traps (creeling & potting)*		●	**Low**
		Extraction of non-living resources: *Navigational dredging (capital & maintenance)*		●●●	**High**
		Waste management: *Sewage disposal*		●	**Low**
		Waste management: *Dredge disposal*		●	**Low**
		Recreation and leisure: *Recreational activities*		●	**Low**

Risk of Damage Assessment for Carlingford Lough MCZ

Level of risk Key: High risk Medium risk Low risk

Table 2 Subtidal (sublittoral) mud (SM): *Philine aperta* and *Virgularia mirabilis* communities (PAVM) Risk of Damage Matrix

This is based on the feature Vulnerability identified in Table 1 and takes into consideration any current management measures in place which may reduce the risk of damage being incurred. This table does not cover new activities as these will not have been taken into account in the Vulnerability assessment.

SM: SPWS						
Activity	**Pressures associated with activity**	**Vulnerability**	**Is the current management adequate?†**	**Comments**	**Level of Risk**	**Action Advised**
Production of living resources: *Aquaculture – shellfish*	**De-oxygenation**	**High**	Yes	There are licensed sites surrounding the MCZ, however, new applications require future management action (licensing/permits). A buffer zone between the MCZ features and the two	**Low**	- No additional management is required
	Organic enrichment	**High**			**Low**	
	Physical change (to another seabed type)	**High**			**Low**	
	Habitat structure changes	**High**			**Low**	

† This does not refer to any future activities or situations where active management is not required.

	Penetration and/or disturbance of the substrate below the surface of the seabed - (Overall abrasion)	**High**		adjacent aquaculture sites was set to reduce the effects of sedimentation and organic enrichment. This buffer zone was integrated into the MCZ boundary. The buffer will not have an impact on the farms as it lies outside the licensed area for shellfish cultivation and still enables normal operations associated with the farms to continue.	**Low**	
	Abrasion/ disturbance of the surface of the substratum or seabed	**High**			**Low**	
	Siltation rate changes, including smothering (heavy)	**Moderate**			**Low**	
	Removal of non-target species	**High**			**Low**	
Extraction of living resources: *Fishing – Dredging (mussels)*	**De-oxygenation**	**High**	Yes	There are licensed sites surrounding the MCZ, however, new applications require future management action	**Low**	- No additional management is required
	Physical change (to another seabed type)	**High**			**Low**	
	Habitat structure changes	**High**			**Low**	

	Penetration and/or disturbance of the substrate below the surface of the seabed - (Overall abrasion)	**High**		(licensing/permits).	**Low**	
	Abrasion/ disturbance of the surface of the substratum or seabed	**High**			**Low**	
	Siltation rate changes, including smothering (heavy)	**Moderate**			**Low**	
	Removal of non-target species	**High**			**Low**	
Extraction of living resources: *Fishing – demersal trawling*	**Physical change (to another seabed type)**	**Moderate**	No	No site specific management of this activity in place.	**Moderate**	- Remove or avoid pressures associated with demersal trawling within the MCZ
	Habitat structure changes	**Moderate**			**Moderate**	
	Penetration and/or disturbance of the substrate below the surface of the seabed - (Overall abrasion)	**Low**			**Moderate**	

	Abrasion/ disturbance of the surface of the substratum or seabed	**Low**			**Moderate**	
	Siltation rate changes, including smothering (heavy)	**Low**			**Moderate**	
	Removal of non-target species	**Low**			**Moderate**	
Extraction of living resources: ***Fishing – traps (creeling/ potting)***	**Removal of target species (lethal)**	**Low**	No	No site specific management of this activity in place.	**Moderate**	- Reduce or limit creeling and potting activities within the MCZ
Coastal infrastructure: ***Coastal docks, ports & marinas***	**Water flow (tidal current) changes (including sediment transport considerations)**	**Moderate**	Yes	New developments require future management action (licensing/permits).	**Low**	- No additional management is required
	De-oxygenation	**Moderate**			**Low**	
	Organic enrichment	**Low**			**Low**	
	Physical loss (to land or freshwater habitat)	**Moderate**			**Low**	
	Physical change (to another seabed type)	**Moderate**			**Low**	

	Habitat structure changes	**Moderate**			**Low**	
	Penetration and/or disturbance of the substrate below the surface of the seabed - (Overall abrasion)	**Low**			**Low**	
	Abrasion/ disturbance of the surface of the substratum or seabed	**Low**			**Low**	
	Siltation rate changes, including smothering (heavy)	**Low**			**Low**	
Coastal infrastructure: *Coastal defence & land claim*	**Water flow (tidal current) changes (including sediment transport considerations)**	**Moderate**	Yes	New developments require future management action (licensing/permits).	**Low**	- No additional management is required
	De-oxygenation	**Moderate**			**Low**	
	Organic enrichment	**Low**			**Low**	
	Physical loss (to land or freshwater habitat)	**Moderate**			**Low**	
	Physical change (to another seabed type)	**Moderate**			**Low**	

	Habitat structure changes	**Moderate**			**Low**	
	Penetration and/or disturbance of the substrate below the surface of the seabed - (Overall abrasion)	**Low**			**Low**	
	Abrasion/disturbance of the surface of the substratum or seabed	**Low**			**Low**	
	Siltation rate changes, including smothering (heavy)	**Low**			**Low**	
Extraction of non-living resources: *Navigational dredging (capital & maintenance)*	**Water flow (tidal current) changes (including sediment transport considerations)**	**High**	Yes	New applications require future management action (licensing/permits).	**Low**	- No additional management is required
	De-oxygenation	**High**			**Low**	
	Organic enrichment	**High**			**Low**	
	Habitat structure changes	**High**			**Low**	
	Penetration and/or disturbance of the substrate below the surface of the seabed - (Overall abrasion)	**High**			**Low**	

	Abrasion/ disturbance of the surface of the substratum or seabed	**High**			**Low**	
	Siltation rate changes, including smothering (heavy)	**High**			**Low**	
	Removal of non-target species	**High**			**Low**	
Waste management: *Sewage disposal*	**Salinity changes - local**	**Moderate**	Yes	New developments require future management action (licensing/permits).	**Low**	- No additional management is required
	De-oxygenation	**Moderate**			**Low**	
	Organic enrichment	**Low**			**Low**	
	Siltation rate changes, including smothering (heavy)	**Low**			**Low**	
	Removal of non-target species	**Low**			**Low**	
Waste management: *Dredge disposal*	**De-oxygenation**	**Moderate**	Yes	New applications require future management action (licensing/permits).	**Low**	- No additional management is required
	Organic enrichment	**Low**			**Low**	
	Physical loss (to land or freshwater habitat)	**Moderate**			**Low**	
	Habitat structure changes	**Moderate**			**Low**	

	Penetration and/or disturbance of the substrate below the surface of the seabed - (Overall abrasion)	**Low**			**Low**	
	Abrasion/ disturbance of the surface of the substratum or seabed	**Low**			**Low**	
	Siltation rate changes, including smothering (heavy)	**Low**			**Low**	
	Removal of non-target species	**Low**			**Low**	
Transport: *Shipping – general at sea (moorings, anchorage & vessel movements*	**Penetration and/or disturbance of the substrate below the surface of the**	**Moderate**	No	No management of this activity in place.	**Moderate**	- Remove or avoid anchoring and moorings within the MCZ
	Abrasion/ disturbance of the surface of the substratum or seabed	**Moderate**			**Moderate**	Anchoring in emergency situations will not be restricted
	Siltation rate changes, including smothering (heavy)	**Low**			**Moderate**	

Transport: ***Shipping – port operations (mooring, beaching, launching, ferry route etc.)***	**Penetration and/or disturbance of the substrate below the surface of the seabed - (Overall abrasion)**	**Low**	Yes	New activities inside the MCZ require future management action (licensing/ permits).	**Low**	- No additional management is required Anchoring in emergency situations will not be restricted
	Abrasion/ disturbance of the surface of the substratum or seabed	**Low**			**Low**	
	Siltation rate changes, including smothering (heavy)	**Low**			**Low**	
Recreation and leisure: ***Recreational activities***	**Penetration and/or disturbance of the substrate below the surface of the seabed - (Overall abrasion)**	**Low**	No	No management of this activity in place.	**Moderate**	- Reduce or limit recreation and leisure pressures within the MCZ
	Abrasion/ disturbance of the surface of the substratum or seabed	**Low**			**Moderate**	
	Siltation rate changes, including smothering (heavy)	**Low**			**Moderate**	

	Removal of non-target species	**Low**			**Moderate**	
Marine research: ***Scientific and Archaeological***	**Habitat structure changes**	**High**	Yes	New activities inside the MCZ require future management action (licensing/ permits).	**Low**	- No additional management is required
	Penetration and/or disturbance of the substrate below the surface of the seabed - (Overall abrasion)	**Moderate**			**Low**	
	Abrasion/ disturbance of the surface of the substratum or seabed	**Moderate**			**Low**	
	Siltation rate changes, including smothering (heavy)	**Low**			**Low**	
Other man-made structures: ***Submarine cables & pipelines operations***	**Physical change (to another seabed type)**	**Moderate**	Yes	New developments require future management action (licensing/permits).	**Low**	- No additional management is required
	Habitat structure changes	**Moderate**			**Low**	
	Penetration and/or disturbance of the substrate below the surface of the seabed - (Overall abrasion)	**Low**			**Low**	

	Abrasion/ disturbance of the surface of the substratum or seabed	**Low**			**Low**	
	Siltation rate changes, including smothering (heavy)	**Low**			**Low**	

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