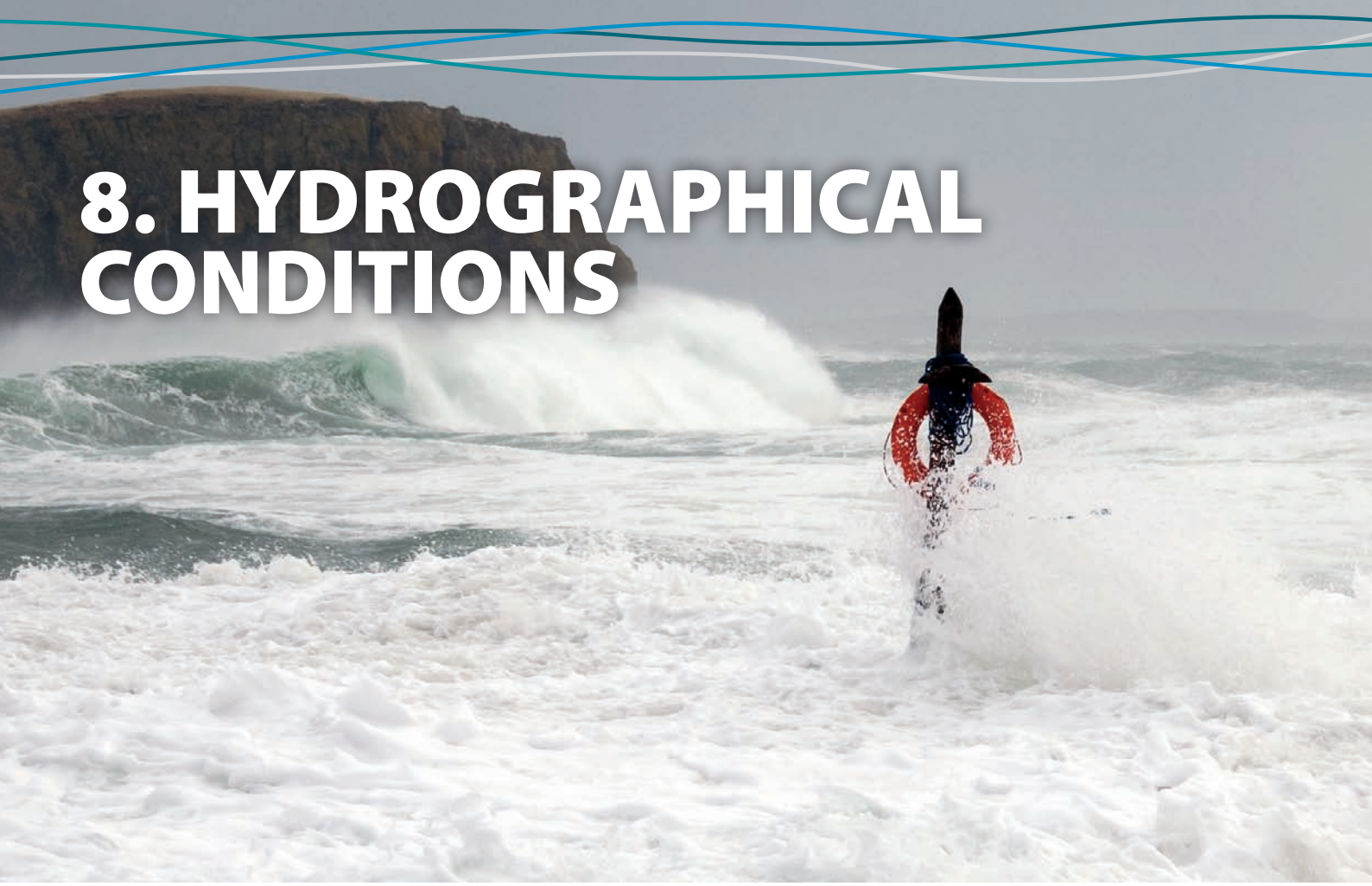

8. HYDROGRAPHICAL CONDITIONS

Key Messages

- A substantial proportion of the Northern Ireland coastline has been altered by coastal defence structures. This is particularly prevalent on soft coastlines. Its extent is estimated to be approximately 100 kilometres.
- There is a need to establish an accurate baseline of the nature and extent of coastal defence structures. In many places, coastal defences protect reclaimed land and open spaces as well as buildings and roads.
- Northern Ireland needs a strategic approach to shoreline management rather than an *ad-hoc* approach. The need for this is increasingly apparent given the onset of rising sea levels.
- Public awareness needs to be raised in relation to the impacts of coastal defences and the legal situation regarding building and maintaining coastal defences.
- The response to climate change and sea level may involve abandoning, maintaining or extending the current defences. An integrated approach to this issue is needed because of its impact on a diverse range of interests including housing, conservation, transport, tourism and recreation.
- Artificial shorelines typically have lower biodiversity than their natural counterparts.

Why are hydrographical conditions altered?

This chapter examines the way in which our coastal zone has been altered by man's activities.

Many of these changes can have a permanent effect on waves, tides and currents, and can be considered collectively as 'hydrographic conditions'. The main factors that have permanently altered our coast line and therefore the hydrographic conditions are; navigation, flood protection, reclamation, recreation and development. Renewable energy is likely to be a future pressure that needs to be considered.

In what ways have hydrographical conditions been altered around our coast?

Sea / flood defences

Protection of infrastructure by sea defences is widespread in Northern Ireland. Many major access roads and associated infrastructure follow the coast. Their position makes them vulnerable to periodic erosion and flooding and the Roads Service seeks to minimise these risks, chiefly by constructing sea defences. In parts, the railway line impinges on the coast and those stretches are managed by Translink.

Many public and privately owned properties threatened, or believed to be threatened, have been protected with various types of coastal defence structure.

The Rivers Agency is responsible for maintaining several stretches of 'statutory flood defences' along the coast including the major sea defence structures at Newtownards and in Lough Foyle. However there are only 36 kilometres of statutory sea defences. Two tidal barrages on the Lagan and Quoile estuaries provide flood protection to Belfast and Downpatrick.

Navigation

The need for safe navigation in our ports and harbours imposes maintenance obligations on our harbour authorities. In order to maintain shipping channels at the depths shown on navigation charts, harbour authorities have a duty to dredge within harbours. In addition to maintenance dredging, occasionally ports carry out capital dredging work where virgin material is removed to create deeper channels for bigger ships with a deeper draft. Dredged material of acceptable quality is disposed of at licensed disposal sites around the coast. These sites are accepted as sacrificial areas where material of an acceptable quality may be taken from and returned to the sea in order to keep our ports and harbours open. Existing disposal sites are shown in Figure 8.1.

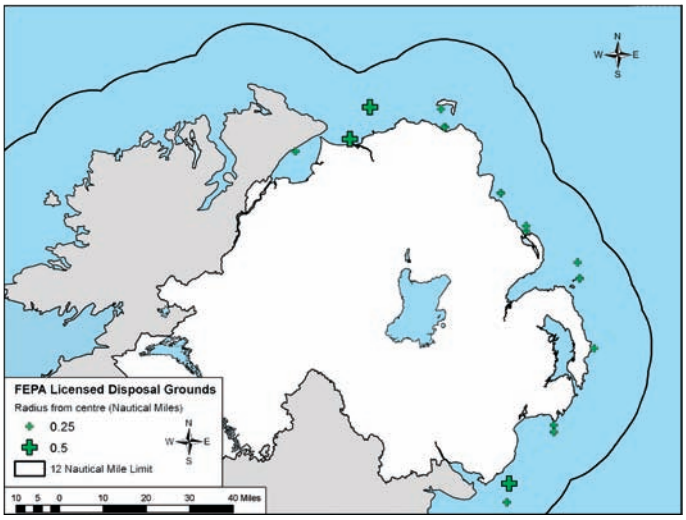

Figure 8.1 Dredged material disposal site locations licensed under the Food and Environment Protection Act.

Land reclamation

There is a legacy of the 'reclamation' of intertidal land for agriculture and for construction. During 19th century, much of the intertidal area of the sea loughs and estuaries were lost. Infill of Belfast Lough formed the inner port area and also provided a convenient site for disposal of waste, a practice which has only ceased in the last decade. These areas are defended by a variety of embankments and rock armouring in various states of repair. Belfast Harbour Commissioners recently reclaimed a major new area within the port creating a new berth for the Stena ferry.

Recreation

Recreation and tourism are increasingly important to society. Historically, several promenades were constructed to facilitate easy access along the coast. These continue to be maintained and altered as they are regarded as important elements of seaside resort tourism. In addition, coastal paths are defended in places with various forms of armouring. The coast is seen as a desirable place to live. In recent decades there has been a major phase of intensive coastal development with apartments replacing single dwelling units and construction of new buildings outside the existing urban footprint. A number of coastal developments have been accompanied by marina construction, for example, at Carrickfergus and Bangor.

Marine Renewable Energy

In recent years, renewable energy has become an emerging issue and is likely to increase as a pressure in the future. The pilot tidal turbine in Strangford Lough is currently the only installation but the Department of Enterprise, Trade and Investment (DETI) has a duty to increase our use of renewable energy and Northern Ireland has a rich resource in both wind and tidal energy (Figure 1.4).

What impact do these alterations make to the marine environment?

Many of the features and activities described above, including sea defences, impoundments, coastal paths, dredging and reclamation will remove intertidal habitats. In some instances, new habitats are formed like coastal lagoons

Millisle, Co Down

(e.g. Whiteabbey, Anne's Point) or the brackish water at the Quoile Pondage. These new habitats can be unique in character and can become important wildlife reserves.

Dredging has direct impacts on the organisms living in the sediment and on sedimentation patterns at the dredging and disposal sites. It can also alter circulation, tidal patterns and water chemistry.

Weirs remove much of the tidal variation in water level and may mean that some habitats are now permanently submerged, circulation is modified and the salinity may be changed.

Land claim directly removes intertidal habitat. Significant areas of intertidal habitat have been lost in all of the sea loughs. Reclamation also reduces the tidal prism of coastal water bodies. This means that less water flows in and out, tidal currents change and if there are sediment deposits at the estuary mouth they may change shape by erosion and accretion. This is most likely to happen in areas like Dundrum Bay and Lough Foyle which have mobile sand banks at their inlets.

Groynes, harbours and training walls all alter the patterns of wave movement and therefore affect the patterns of erosion and deposition. Portballintrae is a good example where construction of a small pier at the western side of the bay focused wave action and led to erosion of the beach. This in turn led to increased wave attack on the soft cliffs behind the beach which was addressed by a scheme of dewatering and stabilisation of the cliffs and construction of sea defences. More recently, the sea defences have been extended and a series of groynes emplaced to try to trap sand in the bay.

Seawalls and rock armour have both direct and indirect effects. They cause loss of habitat over the area they occupy. The seawall fronting the Newcastle Centre, for example, occupies a substantial area of former beach. This prevents waves dissipating their energy through erosion and breaking. Instead the waves are reflected back to sea. This can cause greater turbulence in adjacent sand and mud habitats and promote erosion of the remaining sand or mud. These structures can also reduce sediment supply that would formerly have existed through the erosion of soft sediments or sand dunes.

Coastal reinforcement, Strangford Lough

On the outer Ards peninsula there are many raised beaches. They contain sand that under natural conditions would sustain modern beaches as they are eroded. Coastal defences have now cut off that supply. Seawalls on beach-dune systems cut the link between the two and destroy the natural sedimentary system. At a time of rising sea levels, coastal defences prevent the landward migration that would otherwise occur, thus intertidal habitats (beaches, tidal flats and salt marshes) become steeper and are eventually 'squeezed out'. In Strangford Lough, a National Trust report concluded that 50% of the tidal flat could be lost by coastal squeeze during sea level rise[1]. Furthermore, the reduction in sediment supply may alter the sedimentary system both in the immediate area and alongshore.

Hard coastal defences lack the flexibility of natural defences, like beaches and dunes, that can change shape to accommodate storm waves and then recover after the storm has passed. Hard defences require constant maintenance and can fail, as in the case of the Slieve Donard Hotel seawall in February 2002.

All types of solid structures in the coastal zone create artificial habitats. Harbour walls, for example, are different to natural cliffs and rock armour is different to sand dunes or soft cliff habitat. There are few studies on the relative biodiversity of artificial and natural shorelines but those that have been carried out indicate lower biodiversity on artificial shorelines compared to their natural counterparts.

How are these alterations regulated?

New deposits in the sea, like construction works, land reclamation or the disposal of dredged material are controlled by a licensing system under the Food and Environment Protection Act. The licensing authority is NIEA and the system operates from the mean high water spring tide out to the limit of our territorial waters (12 nautical miles). Existing structures like sea defences are exempted from requiring a new licence. However, major upgrade projects are subject to environmental controls.

The licensing system seeks to ensure that construction or disposal works have a minimal impact on the marine environment. This is achieved largely through mitigation measures, such as restrictions in the times of year, or the requirement that suspended solids are limited through monitoring.

The EC Water Framework Directive recognises that altering the physical regime in the coastal zone has the potential to adversely impact the ecology. It requires an assessment to be made of hydromorphological (shape and flow) alterations to ensure these do not compromise the ecology. However the Water Framework Directive recognises that in certain areas, like ports, modifications are inescapable to allow necessary commercial activities. The Directive allows these areas to be designated as heavily modified and for alternative objectives to be set in these areas. For example, a normal sediment biology will not be expected in a dredged channel.

How have these alterations been monitored?

As part of the implementation of the Water Framework Directive, NIEA needed to understand how much of the coastline had been modified. The distribution of coastal structures, where hydrodynamic conditions are altered, was derived from visual classification using a series of oblique aerial photographs. In this exercise, various types of structure were mapped including seawalls, rock armour, 'piled structures', groynes, training walls and marinas. This method was useful in deriving approximate lengths of modified coastline. There are, however, several areas where the photography was not sufficiently detailed to enable coastal defences to be recognised or categorised. It is estimated that seawalls and rock armour cover 55 and 22 kilometres of our coast, respectively. 'Piled structures' are present on 7 kilometres and 'breakwaters' are present on a further 7 kilometres. These areas of armoured coast include significant stretches in the upper reaches of Carlingford Lough, inner Dundrum Bay, Strangford Lough, Larne Lough, Belfast Lough and Lough Foyle. In many instances the defences protect reclaimed land.

On the open coast, coastal defences are present along much of the areas that are not composed of solid rock (i.e. beaches and soft cliffs). Substantial areas are armoured along the southern part of the Mourne Plain from Annalong to Cranfield, around Newcastle, on the outer Ards Peninsula and along the Antrim Coast Road.

In parts of the Mourne Plain around Annalong, for example, defences have been put in place to support a footpath. Elsewhere individual stretches of armour have been used to protect roads, private property (houses, gardens and farmland) and public land (including buildings, parkland and car parks). On the north coast, armour is mainly confined to resort beaches at Portrush and Portballintrae. Four kilometres of coast are identified as being fronted by groynes at Newcastle (where they are in disrepair), Ballyholme and Portballintrae. Training walls fix the position of the channel at the mouth of the River Bann. Field examination of the coast suggests that these figures are underestimated, as many small areas of armouring have not been mapped.

Harbours, quays and jetties are present at numerous locations around the coast and vary in scale from major systems of quays and wharfs to small harbours and slipways.

What is needed in the future?

Under existing arrangements, the approach to managing alterations of hydrographic conditions is piecemeal. This has been highlighted in a recent report by DARD Rivers Agency[2]. Responsibility for coastal defences is split between Government Departments, with DARD having a statutory responsibility for some sea defences and DRD being responsible for protecting road and rail infrastructure.

Elsewhere, responsibility for coastal defences is based on the 'Bateman formula' which assigns responsibility to various Government Departments in a poorly defined way. Unlike the situation in England and Wales, there are currently no plans for Northern Ireland that permit a strategic approach to shoreline management.

Food and Environment Protection Act licences are currently determined on an individual basis with no overview as to how a construction in one area will impact on another area. A new licensing system is due to be introduced in April 2011 under the UK Marine and Coastal Access Act and the proposed Northern Ireland Marine Bill will introduce marine planning by 2014.

This will enable cumulative impacts to be considered. However, more information is required on the movement of sediments around our coastline both now and into the future. This is needed to inform a strategic approach to managing physical changes to our coastline.

Sea level is projected to rise in the coming years and this will have major implications. As the sea encroaches further on the land it will reach sources of sediment previously outside the limit of wave action.

Areas of sand dune, raised beach and glacial sediments are particularly important sediment sources in this regard and they will be needed to maintain the coastal habitats and ecosystems. Further work is required in this area to inform good management and licensing decisions.

Legislation	
Marine Framework Strategy Directive Descriptor 7 Permanent alteration of hydrographical conditions does not adversely affect marine ecosystems	
Other relevant EC Directives (full references and corresponding regulations – Appendix II)	
Water Framework Directive	Driving overall improvements in water quality incorporating hydromorphological changes in estuarine and coastal waters
Habitats Directive	To protect, maintain and restore natural habitats and species of European importance, in favourable conservation status
International Agreements	
OSPAR Convention for the protection of the marine environment of the North-East Atlantic	Biodiversity and ecosystems strategy
Local legislation	
Food and Environment Protection Act, (1985) Part II	This allows NIEA to regulate deposits like dredged material or construction works in the sea. The licensing process can set conditions to ensure that environmental damage is limited in marine construction projects. New marine licensing legislation is due to be introduced in April 2011
The Drainage (Northern Ireland) Order 1973	Giving Rivers Agency, an Executive Agency of DARD, a duty to maintain statutory sea defences

References

(1) The National Trust 2007 Shifting Shores – living with a changing coastline.

(2) DARD Rivers Agency 2009 Living with Rivers and the Sea.