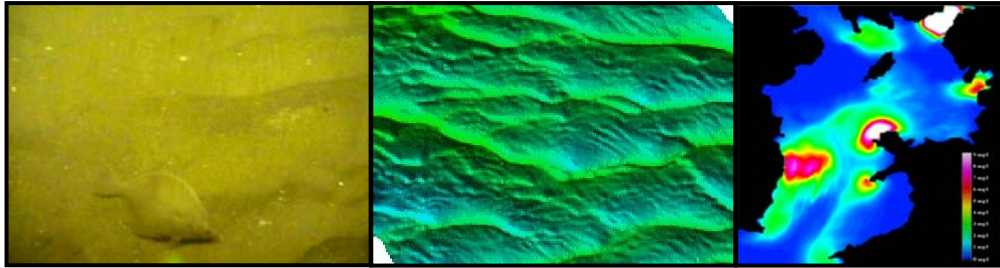


IRISH SEA MARINE AGGREGATE INITIATIVE (IMAGIN)

Policy Report

ISSUES AND RECOMMENDATIONS FOR THE DEVELOPMENT AND REGULATION OF MARINE AGGREGATE EXTRACTION IN THE IRISH SEA



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†Cover image depicts outputs from IMAGIN: video data showing Flounder (*Pleuronectes flesus*) on sand; multi-beam image of the seabed showing geomorphology; and predicted tidal amplitudes derived from modelling research for the Irish Sea.

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EXECUTIVE SUMMARY

This report details the work undertaken as part of the INTERREG IIIA Irish Sea Marine Aggregates Initiative (IMAGIN) project which aims “*to develop recommendations for a strategic policy framework for an administrative and regulatory process, and operational guidelines under which dredging for marine aggregates in the Irish Sea can be sustainably managed.*” It considers policy and regulatory issues from an Irish context.

Note: This Report should be read in conjunction with the supporting IMAGIN Technical Synthesis Report, 2008, which summarises the scientific findings from the IMAGIN work packages on the Geology, Environmental Assessment and Modelling aspects of Irish Sea aggregates and a Cost Benefit Analysis of land based v marine sources of aggregates in the Ireland/Wales area.

A complementary document entitled *Irish Sea Marine Aggregates Initiative Aggregate Resources and Markets – Wales* presents a view of the current Welsh situation, with particular reference to the area north of Pembroke.

Separate documents for Ireland and Wales were considered appropriate, due to the essential differences between the two jurisdictions both in terms of the nature and current status of mechanisms for the management and regulation of marine aggregate extraction. To date in Ireland, extraction has largely been permitted only for beneficial purposes e.g. beach nourishment, coastal protection and a clear policy regarding the commercial extraction has yet to be developed. In contrast, a highly evolved system exists in Wales, which links closely with the longstanding UK system. This has been further refined for the South Wales Bristol Channel area, where marine aggregate extraction is currently governed under the Marine Aggregate Dredging Policy (MADP) 1.

Aggregates in the form of sand and gravel deposits are a vital natural resource, providing essential material to support societal needs for infrastructure and the construction industry. Thus, the importance of aggregate supply to the economy of many nations cannot be understated – Ireland and Wales are no different in this sense. As a result of Ireland’s economic boom since the early 1990s, the national consumption of aggregates per head of population in Ireland has spiralled upward and is currently standing at four times the European average. At present, all aggregate used in the Irish market is extracted from terrestrial sources. This project set out to examine the marine extraction option for current supply and future Irish demand.

Potential Resource

The IMAGIN study has concluded that *a number of areas with potential to support marine aggregate extraction exist within the Irish Sea* and that *marine aggregates can contribute to the sustainable management of demand and future use of aggregates in Ireland and Wales*. Within the IMAGIN study area of the Irish Sea alone, the marine aggregates resource equates to approximately 5 to 7 billion m³.

Benefits of the use of the marine aggregate resource

Marine aggregates from the Irish Sea are attractive as an additional resource in terms of meeting current and future demand, as well as a reduction of CO₂ emissions in Ireland / Wales.

Policy Issues

At present, there is no policy in place for the commercial extraction of marine aggregates from Irish waters and it was in response to this identified gap that the IMAGIN project was initiated. The Project's goal was to *develop recommendations* for a strategic policy framework for an administrative and regulatory process under which dredging for aggregates in the Irish Sea can be sustainably managed.

To help achieve this, the IMAGIN work programme focused on key areas such as environmental and geological appraisal, provision of decision support mechanisms, hydrodynamic modelling, cost-benefit analysis and stakeholder participation – all of which will have a bearing on policy development and will be of value to policy-makers. As part of this process, the IMAGIN project partnership liaised regularly with the Department of Communications, Marine and Natural Resources (DCMNR) in Ireland.

Marine Spatial Planning

In preparing this document as a guide to policy development, the IMAGIN team were cognisant of the range of current and future marine activities in the Irish Sea area. Therefore, this project recommends, as the optimal framework, the use of marine spatial planning as an essential tool for managing interactions between the various marine activities, conservation needs and marine aggregate extraction.

To date, only non commercial marine aggregate extraction has occurred in Ireland. However, commercial extraction has taken place in other EU Member States for a number of decades and a considerable body of international experience exists. This provides an important source of information, practice, advice, research and learning which has informed the development of this document and can continue to assist in the process of policy development in Ireland.

As well as interactions with other marine activities, the extraction of marine aggregates could have a range of environmental impacts. Thus, it will be necessary to draw on current best practice, both from international and indigenous expertise, to identify appropriate models and protocols for regulating and mitigating these impacts.

While the utilisation of marine aggregates is both viable and timely, for it to proceed in an orderly manner, clear policy and guidance is required. Thus it is recommended that the competent authority, prioritise the establishment of a strategic policy framework to support the sustainable management of marine aggregate extraction in Ireland. This policy work can be supported by research and development programmes such as IMAGIN and by the INFOMAR (Integrated Mapping For the Sustainable Development of Ireland's Marine Resource) survey.

We recommend that the following prerequisites be considered in developing a framework for marine aggregates in Ireland:

- ***A clear national policy should be developed*** to promote and facilitate the sustainable development and use of Irish marine aggregates. This should be approached as part of an integrated National aggregates policy i.e. covering both marine and terrestrial extraction.
- ***A unified database of identified aggregate resources should be generated.*** This is imperative to quantify the resource and, where appropriate, to protect resources for

extraction, as outlined in the National Geoscience Programme for Ireland over the period of the National Development Plan (2007-2013);

- In *order to implement a national policy, a statutory framework for this sector should be created, that is consistent with the principles of marine spatial planning*. A number of inconsistencies have been identified with the current regulatory framework for licensing of marine activities in Irish waters. In order to facilitate development in the short-term, the existing regulatory framework could be employed. However, in order to enable a forward looking planned approach, modification of the current legislative and regulatory framework is needed. In developing this framework, the following features should be taken into consideration:
 - i) Plan-making within a national and regional hierarchy, to incorporate the following key steps: **plan preparation; zonation; statutory and public stakeholder participation; formal adoption of plan; periodic review; and amendment process**.
 - ii) A decision-making processes based on adopted plans, which is **transparent and clearly defines roles and responsibilities** of all parties of areas where marine aggregate extraction is permitted as an activity.

Given the Government Decision, in September 2007, regarding the transfer of executive functions for Foreshore regulation, including aggregate extraction, from DCMNR to the Department of Environment Heritage and Local Government, there is an opportunity for that Department to prepare and implement a marine aggregates policy linked with an integrated national framework on aggregates for Ireland and building on the insights from the IMAGIN project and international best practice.

SECTION 1

1.1 Introduction

The Irish Sea Marine Aggregates Initiative (IMAGIN), a collaborative project between Ireland and Wales, focused on the sustainable management of marine aggregate resources. The study area, in the southern Irish Sea, is bounded by the east coast of Ireland and the west coast of Wales, is shown in Figure 1.1.

This document contains details of the work carried out as part of IMAGIN Work Package 5, which aimed “to develop recommendations for a strategic policy framework for an administrative and regulatory process and operational guidelines under which dredging for marine aggregates in the Irish Sea can be sustainably managed.”

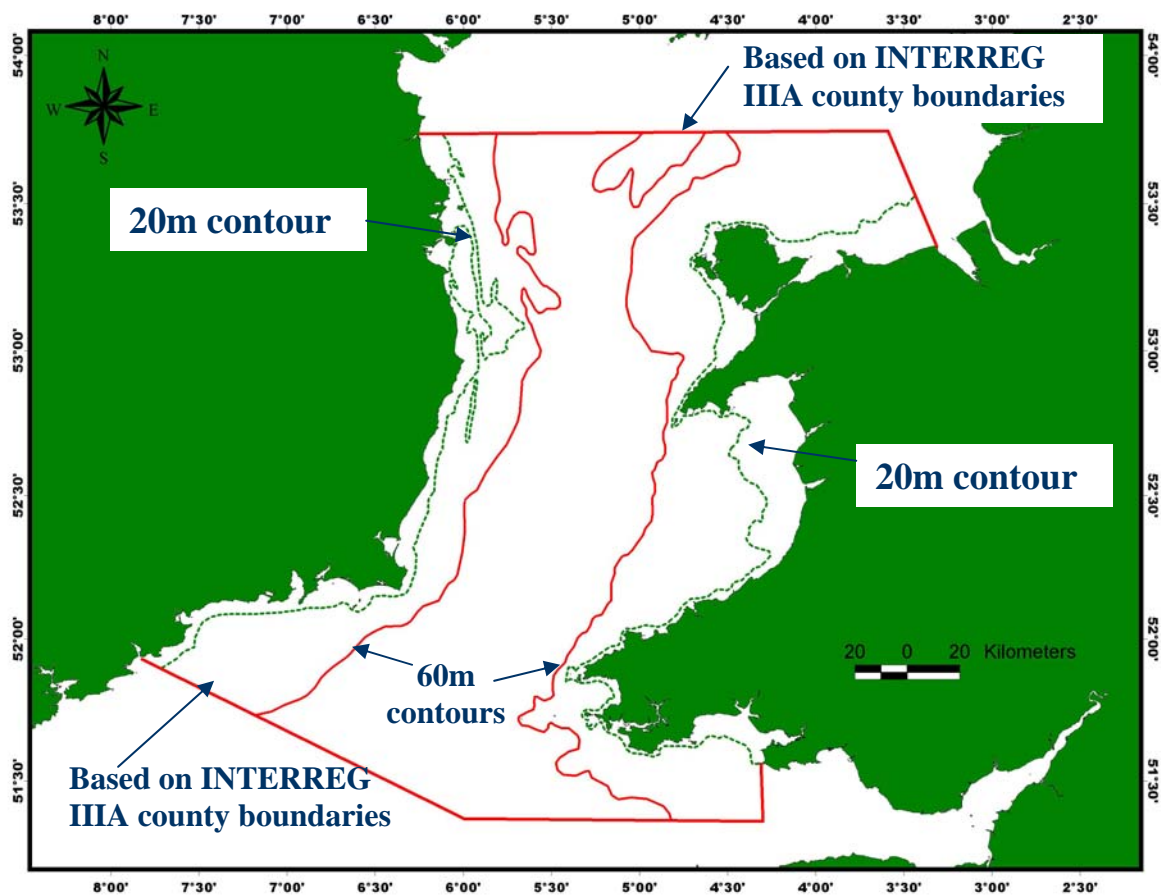


Figure 1.1. Map showing the overall study area bounded to the North and South by seaward extensions of the designated county divides. The area’s 20m and 60m depth contours (highlighted in red and green) were used to provide an additional focus for resource and environmental assessments.

The document is divided into four sections.

- **Section 1** provides background and contextual information on marine aggregates and extractive processes, the objectives and work programme of the IMAGIN project, with particular emphasis on Work Package 5 - Policy Framework on Marine Aggregate Dredging.
- **Section 2** examines the extant legislative framework under which marine aggregate extraction could operate in Ireland. The consultation processes associated with planning legislation and regulations are also outlined, as well methods and tools for stakeholder interaction.
- **Section 3** discusses the range of potential impacts and issues associated with marine aggregate extraction. These have been examined under each of the following headings: economic; environmental and risk assessment; monitoring; and, operations.
- **Section 4** of the report focuses on the development of zoned approach, based on the principles of marine spatial planning, to guide the potential extraction of marine aggregates in the Irish Sea. The rationale for such an approach, as well as examples from IMAGIN outputs and practices in other European Member States, are presented.

In addition to national agencies, information sources used in preparing this report include: International Council for the Exploration of the Seas (ICES); ongoing and completed research projects; non-government organisations; and state bodies from other countries with a remit for extraction of marine aggregates. The majority of the key references are published recently (within the past six years) and represent current thinking on best practice in the area of marine aggregate extraction (see Bibliography).

1.2 Irish Sea Marine Aggregates Initiative (IMAGIN)

IMAGIN was a 2-year project with a total budget of €1.1 million. IMAGIN was part funded (66%) under the Ireland/Wales Inter Regional (INTERREG) IIIA Community Initiative Programme 2000-2006. The remaining project budget was met by contributions from partner organisations (19%) and aggregate companies – CEMEX, Lagan Ltd., Kilsaran Concrete and Roadstone Ltd. (15%). The IMAGIN grouping was a collaborative partnership comprising experts in Ireland and Wales from 3rd level Institutes, State agencies and industry. The grouping included

- the Coastal and Marine Resources Centre – University College Cork,
- Marine Institute,
- Geological Survey of Ireland,
- Geoscience Wales and
- representatives from the aggregate companies.¹

The overall aim of the IMAGIN project is to facilitate the evolution of a strategic framework within which the exploitation of marine aggregate resources from the Irish Sea may be sustainably managed with minimum risk of impact on marine and coastal environments, ecosystems and other marine users.

¹ It should be noted that while IMAGIN is a collaborative initiative between Irish and Welsh partners, the outputs of IMAGIN do not represent the policy position of the Welsh Assembly Government with respect to marine aggregates.

IMAGIN was structured around a series of work packages (see Figure 1.2), each focusing on the different aspects of the marine aggregate question. The aim of Work Package 5 (Policy Framework on Marine Aggregate Dredging) was to develop:

- 1) recommendations for a strategic policy framework for an administrative and regulatory process; and,
- 2) operational guidelines under which dredging for marine aggregates in the Irish Sea can be successfully managed with minimum interactions with other marine users and minimum environmental impact.

A policy framework will aid strategic level decision-making and provide guidance for future site-specific assessments for marine aggregate dredging within the Irish Sea. The proposed policy framework will assist in identifying potential constraints on development and any data gaps, as well as the requirements for further detailed investigations which would be necessary to fulfil the requirement of EIA and / or Coastal Impact Studies process.

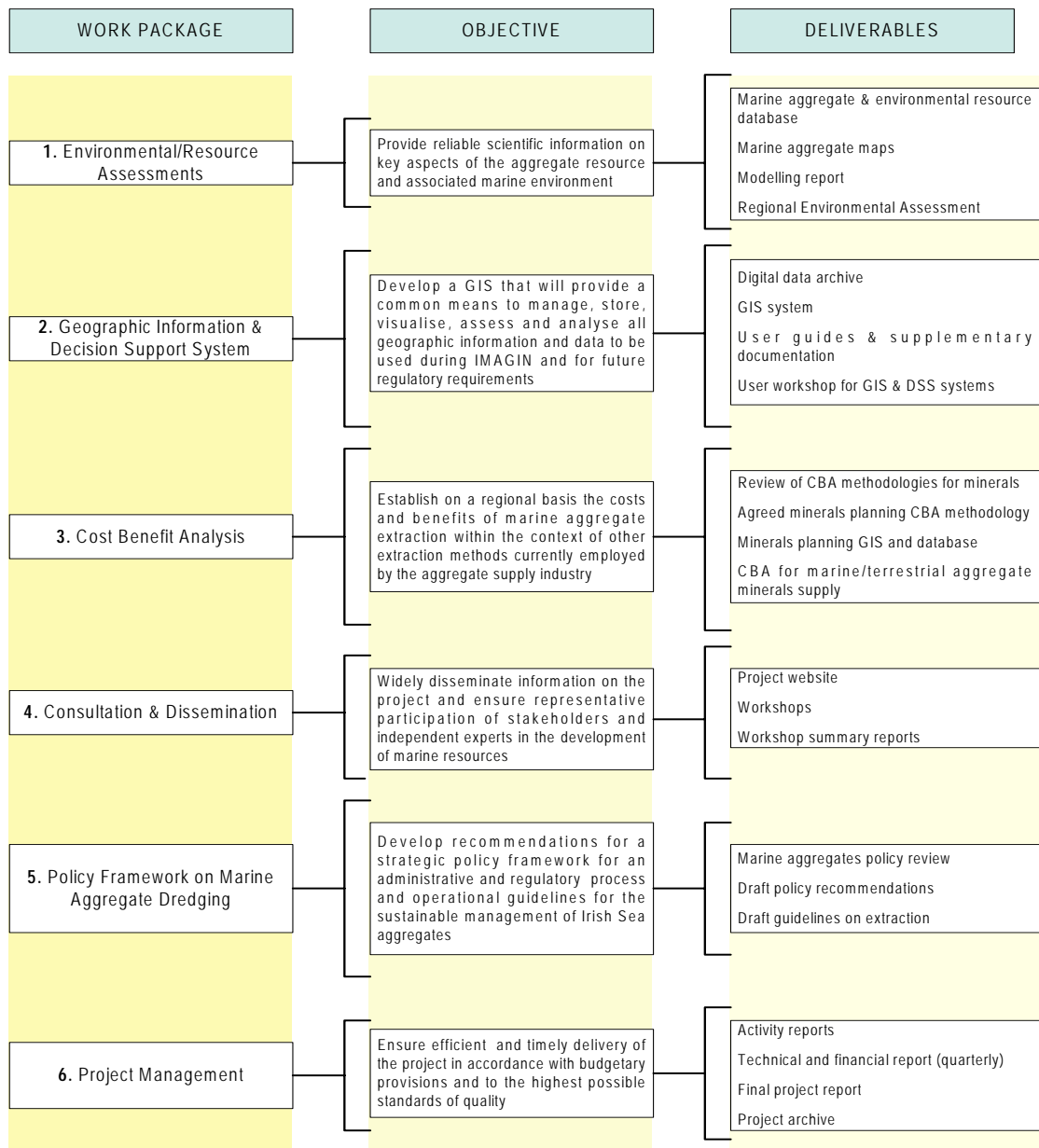


Figure 1.2. Summary description of IMAGIN work packages, outlining objectives and deliverables.

1.3 What are Marine Aggregates?

Marine aggregates can be defined as sedimentary material - sand or gravel of various grain and clast sizes (grades). Extraction of marine aggregates typically involves dredging of the deposit to remove it from the seabed. Aggregates may be screened at sea before being transported to a port or wharf facility for unloading and then further processing, if required, and subsequent transportation.

In common with terrestrial aggregates, sands and gravels sourced from the seabed are an important economic resource, which can contribute to the development and maintenance of infrastructure, e.g. buildings, roads and bridges. Marine aggregates are also used for beach nourishment and coastal defence purposes, the demands for which have become more pressing when set against the predicted implications of climate change, sea level rise and associated effects on low lying coastal areas. A number of countries have sought to meet the demand for aggregates by utilising sources from the seabed to replace or complement terrestrial sources. Belgium, the Netherlands and the United Kingdom are primary examples of countries within Europe that have a long established practice of marine aggregate extraction, providing an alternative to sole reliance on terrestrial sources. Table 1 contains a listing of European countries that extract marine aggregates.

1.4 Driving Factors for Extraction of Marine Aggregates in Ireland

It is clear that, in Ireland, land aggregates, and particularly sand grades, are now at a premium, although in the absence of official statistics we must rely on informed judgment to predict how long economically viable supplies can be maintained. The aggregate demand in 2005 was estimated by the Irish Concrete Federation (ICF) to be approximately **130 million tonnes**, which translates to circa 30 tonnes per person per annum (approximately four times the EU average per capita demand).

Currently, in Ireland, all primary aggregates required to meet existing and planned (e.g. NDP infrastructure requirements) are sourced from land-based quarries. The use of secondary / recycled aggregates is at a relatively low level, and whilst recycling capacity has expanded rapidly, the nature of our building stock will restrict this contribution to around 5% of requirement at best. The industry is increasingly turning to manufactured sand (from crushed rock) as a stopgap, but the medium to long-term viability and sustainability of this practice is questionable due to high energy consumption and associated environmental (e.g. CO₂ emissions) and economic costs. Nevertheless, land-based sources are likely to be the main supply option for primary aggregates in the short to medium-term.

In Ireland, marine aggregates have been utilised in the past for specific non-market purposes including beach nourishment, reclamation, backfill, and coastal defence. Whilst no commercial extraction is currently permitted in Ireland, the IMAGIN project has identified and highlighted marine aggregate resources in the Irish Sea that represent a future additional aggregate supply option. This applies in particular for the Greater Dublin area and other high demand coastal regions in which economies of scale can be achieved.

1.5 Benefits of the use of the marine aggregate resource

An initial comparison of land-based and marine-based aggregate supply options for the IMAGIN region indicates that the introduction of a marine aggregate supply option could provide significant benefits in terms of reduced environmental cost, compared to current land-based sources. These benefits in particular relate to:

- **Reduced CO₂ emissions** arising from both extraction and transport activities - the CO₂ emissions associated with extraction using marine dredging techniques are less than 50% of those associated with extraction from sand and gravel pits, and less than 15% of those associated with extraction from hard rock quarries. CO₂ emissions associated with the transport of marine aggregates are less than 15% of those associated with the transport of land sourced aggregates (for further details on CO₂ emissions associated with marine and terrestrial extraction please see Tables 3.2 and 3.3 in the IMAGIN Costs/Benefits Analysis Work Package 3 Report; Paul et al. 2007).

This aspect of reduced CO₂ emissions from the extraction of Marine aggregates is very significant in the light of the EU Commission's proposals for reduction in greenhouse gas emission by Member States - see http://ec.europa.eu/environment/climat/climate_action.htm

- **Reduced road transport requirements** – reduced heavy goods vehicle (HGV) traffic volumes on the national, regional and local road networks. For example, based on the land / marine aggregate resource areas identified within the project and considering aggregate supply to the Dublin market, the equivalent volume road transport associated with marine aggregates would be less than 25% of that arising from land-based aggregate supply options.

A more complete discussion of the costs/benefits of the marine aggregate supply option is contained in the IMAGIN Work Package 3 Report- Cost/Benefit Analysis (Paul et al. 2007).

1.6 Regulatory and Management Frameworks Internationally

The IMAGIN Project reviewed current policy on marine aggregate extraction in a number of countries. This report presents examples of best practice internationally and suggests these can best inform policy development for marine aggregates in Ireland.

The report also considers

- information requirements (e.g. content for EIS, environmental monitoring),
- institutional roles and responsibilities (e.g. evaluation of resource and determination of royalties), and
- potential application/modification of existing instruments are highlighted (e.g. Foreshore Acts).
- Current European policy drivers such as the EU Green Paper on Maritime Policy, Ireland's submission as part of the consultation process and the EU conclusions (COM (2007) 574) arising from this process.

Currently, extraction of marine aggregates from any EU waters is subject to a number of legal regulatory requirements, many of which are derived from the EU Directives or international and global conventions as outlined in Section 2. Within Europe, procedures and national regulations relevant to marine aggregate extraction vary greatly and no EU-wide uniform policy is in place. However, in all cases the regulatory framework relevant to the extraction of marine aggregates is multi-level and comprises a combination of commitments to international conventions and European Directives coupled with national legislation administered at a central, regional or local level. Some Member States, including UK, Belgium and the Netherlands have developed policy specific to marine aggregates, others, e.g. Poland and Germany have not. In all Member States EIAs and public access to information is assured. A summary of regulations, management and policy with respect to marine aggregate extraction in European countries is presented in Table 1 below.

Some of the key policy and regulatory issues identified during the review include the following:

- Seabed ownership rights;
- Seabed use rights;
- Consideration of non-market value, e.g. ecosystem goods and services;
- Access to environmental information;
- Discrimination between Prospecting/ Exploration and Extraction licenses;
- Economic valuation of resource for licensing purposes (securing a fair return from the State’s foreshore estate).

Much of the content of this document focuses on Countries that have been engaged in marine aggregate extraction for three decades or more and where marine aggregate policy and regulation is considered to be mature. Ireland can learn from the progress and experience of other countries when drafting marine aggregate policy, particularly in relation to regulatory procedures, development of monitoring regimes, baseline surveys and stakeholder involvement. These issues are explored in more detail in the following sections.

Table 1. Summary of regulations, management and policy with respect to marine aggregate extraction in European countries; modified from European Sand and Gravel Resources (EUMARSAND) and Radzevičius et al. (2007).

	UK	HOL	BEL	FRA	GER	POL	ESP	GRE	IRL
National Policy	Yes	Yes	Yes	No	No	No	Yes	No	No
Specific Regulation for Marine Aggregate Extraction	Yes	Yes	Yes	No	No		Yes	No	No
National Guidelines	Yes	Yes	No	No	No	No	No	No	No
Administration (Central, Local or Both)	Central			Both	Both		Both	Both	Central
Extraction (Commercial, Non-commercial or Both)	Both	Both	Both						Non-commercial
EIA Directive Implemented	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Public Access to Information Assured	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Environmental Monitoring Required	Yes		Yes		Yes		No	No	
Content and Type of Environmental Monitoring Specified	Yes	No	No	No	No	No	No	No	
Physical Monitoring Required	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	

SECTION 2

2.1 Irish and International Legislation on Extraction of Marine Aggregates

Key legislative instruments and conventions relevant to the authorisation of marine aggregate operations in Europe include:

- UNCLOS 1982;
- OSPAR,
- EU legislation, e.g. the Environmental Impact Assessment and Amendment Directives (85/337/EEC and 97/11 EC); the Freedom of Access to Environmental Information Directive (2003/4/EC) and national legislation or regulations. (Table 2)

In Ireland, coastal and marine activities are typically managed sectorally and currently there are no formal regulatory links between terrestrial planning (above mean high water mark) and foreshore planning (below mean high water mark). However, within the current legislative and regulatory framework, several items of legislation will have a significant bearing on potential marine aggregate extraction in Irish waters. These key regulatory mechanisms include the Foreshore Acts, 1933 to 1998 and the Statutory Instruments which transpose the Environmental Impact Assessment Directive and Strategic Environment Assessment Directive into Irish Law (Table 2).

Table 2. European legislation that will have a bearing on the regulation of marine aggregate extraction in Irish waters.

EU Directive	Principal Irish Legal Statute
Environmental Impact Assessment Directive (Directive 85/337/EEC)	EC (Environmental Impact Assessment) Regulations: 1989-1999 (SI 349 of 1989, SI 84 of 1994, SI 101 of 1996 and SI 351 of 1998)
Environmental Impact Assessment (EIA) Directive 97/11/EEC	EC (Environmental Impact Assessment) (Amendment) Regulations: SI 93 of 1999
SEA Directive 2001/42/EC	EC (Environmental Assessment of Certain Plans and Programmes) Regulations 2004 (SI 435 of 2004), and Planning and development (Strategic Environmental Assessment) Regulations 2004 (SI 436 of 2004)

2.2 Irish Legislation: Foreshore Acts

The Foreshore Acts, 1933 to 1998, comprise three Acts, namely:

- Foreshore Act, 1933 (No. 12)
- Foreshore (Amendment) Act, 1992 (No. 17)
- Fisheries and Foreshore (Amendment) Act, 1998 (No. 54) [section 5].

The Foreshore Acts, 1933 to 1998, require that a lease or licence must be obtained from the Minister for undertaking any works or placing structures or material on, or for the occupation of or removal of material from, State-owned foreshore which represents the greater part of the foreshore. The Foreshore, as defined under the Maritime Safety Act (2005), is the seabed and shore below the line of high water of ordinary or medium tides and extends outwards to the limit of twelve nautical miles (approximately 22.24km),

Leases are granted under the Acts for the erection of long-term structures (e.g. piers, marinas, bridges, roads, car parks) and licences are granted for other works (e.g. laying of submarine pipelines and cables) and purposes (e.g. aquaculture). Leases and licences are granted subject to the payment of fees and the term of any lease cannot exceed 99 years. Section 3: (1) of the Foreshore Act, which is of direct relevant to marine aggregate extraction activities, states that:

If, in the opinion of the Minister, it is in the public interest that a licence should be granted to any person in respect of any foreshore belonging to Saorstát Éireann authorising such person to place any material or to place or erect any articles, things, structures, or works in or on such foreshore, to remove any beach material from such foreshore, to get and take any minerals in such foreshore and not more than thirty feet below the surface thereof, or to use or occupy such foreshore for any purpose, the Minister may, subject to the provisions of this Act, grant by deed under his official seal such licence to such person for such term not exceeding ninety-nine years commencing at or before the date of such licence, as the Minister shall think proper.

Under the Act “*beach material*” is defined as meaning *sand, clay, gravel, shingle, stones, rocks, and mineral substances on the surface of the seashore and includes outcrops of rock or any mineral substance above the surface of the seashore and also includes bent grass growing on the seashore and also seaweed whether growing or rooted on the seashore or deposited or washed up thereon by the action of tides, winds, and waves or any of them.*

“*Seashore*” is defined as meaning the foreshore and every beach, bank, and cliff contiguous thereto and includes all sands and rocks contiguous to the foreshore. Note the term “*minerals*” is not specifically defined within the Act.

2.3 Issues Relating to Current Foreshore Legislation

At present, the legislation governing the foreshore can accommodate applications for the extraction of marine aggregates within the twelve nautical mile limit. However, there are a number of issues relating to the current Foreshore Acts and their administration which will have a bearing on the licensing and potential development of an Irish marine aggregate sector:

- *Existence of Potential Resources Beyond the 12 Nautical Mile Limit* - For which there is currently no apparent legal basis for permitting under the Foreshore Acts. Extraction of marine aggregates is explicitly excluded under the Continental Shelf Act (1968) and Minerals Development Act (1979) which apply beyond the 12 mile limit;
- *Strategic Planning Approach* – The current licensing regime delivered via foreshore legislation has resulted in areas with high potential for marine aggregate extraction being used for other activities that restrict or prevent extraction. Furthermore, it has contributed to uncertainty in relation to the prioritisation of future licence areas and applications in Irish waters;
- *Transparent Decision Making* - Absence of guidance and criteria to be used in the decision-making process leading to a lack of transparency for applicants and other interested parties;

Whilst the issues above have been presented in the context of marine aggregates they equally apply to many other activities taking place within the foreshore zone.

Appeals Process

Currently, there is no appeals mechanism incorporated within the Foreshore Acts. Natural justice dictates that there should be a process of appeal against any decision made on foot of an application for a permit to extract marine aggregate. This should be open to the applicant, other users, and members of the public.

Foreshore Review

The DCMNR published a tender in April 2007 for consultants to undertake a review of the Foreshore Management Arrangements in Ireland. The original time scale envisaged was a draft report within 6 months of the commencement of the contract. The overall aim of the review was

"To undertake a strategic review of the legislative framework, structures, and procedures in place to manage the State owned foreshore. The object of the Review is to outline the options, informed by best international practice, for putting in place a modernised legislative framework and improved systems and procedures for Coastal Zone Management, which will best fit the medium to long term requirements in this area."

In the light of the transfer to regulatory function follow the Government Decision in June 2007, the Foreshore review process has not proceeded along the time scale planned. If and when this review proceeds, the outputs of IMAGIN, including this document, would be an important element that would merit consideration within the review.

2.4 Environmental Impact Assessment (EIA)

Certain developments on State-owned foreshore are subject to the European Communities (Environmental Impact Assessment) Regulations, 1989 to 1999, requiring the preparation of an Environmental Impact Statement which must be provided to the consultative organisations specified in the Foreshore (Environmental Impact Assessment) Regulations, 1990 (S.I. No. 220). As set out in the European Communities (Environmental Impact Assessment) Regulations, 1999 (S.I. No 93 of 1999) an Environmental Impact Statement must be provided in cases involving:

"Extraction of stone, gravel, sand or clay by marine dredging (other than maintenance dredging) where the area involved would be greater than 5 hectares or, in the case of fluvial dredging, (other than maintenance dredging) where the length of river involved would be greater than 500 metres."

In certain cases, the Minister may require a sub-threshold EIS to be prepared. Procedures for EIA are discussed further in Section 3.4.

2.5 Strategic Environmental Assessment (SEA)

Directive 2001/42/EC of the European Parliament and the Council on the Assessment of the effects of certain plans and programmes on the environment, commonly known as the SEA Directive, was transposed into Irish law by S.I. 435 of 2004 (see Table 2) and came into effect on 21st July 2004.

The SEA Directive requires that an environmental assessment must be carried out for all plans and programmes:

- Which are prepared for certain specified sectors and which set the framework for future development consents of projects listed in Annex I and Annex II of the EIA Directive (including marine aggregate extraction); or
- Which, in view of the likely effect on protected sites, have been determined to require an assessment under the Habitats Directive.

A policy decision to commence a system of licensing for marine sand and gravel extraction in Irish waters would constitute a plan or programme and the extraction activity would be likely to have significant effects on the environment. For these reasons it is very likely that an SEA will be required. A similar approach has been taken by the DCMNR in the case of licensing of hydrocarbon exploration in Irish waters. The work of IMAGIN, including outputs from WP1 on environment and resource assessment, can make a substantial contribution to such an SEA process, and in particular for the Irish Sea.

Under the SEA Directive, provision is made for consultation involving the general public (individuals and organisations), prescribed authorities, and where necessary, at transboundary scales. These provisions for consultation are set out in the Planning and Development (Strategic Environmental Assessment) Regulations 2004.

2.6 Stakeholder Participation

This section sets out some of the methodologies, tools and key concepts essential to achieving effective participation and consultation with stakeholders.

The marine environment is typically a multi-use environment. It incorporates numerous activities such as transport, communications, fishing, tourism and recreation, provision of energy and nature conservation. Many of these can overlap spatially and temporally. Thus, compared to the terrestrial environment, there is an increased likelihood of interaction between the various stakeholders that utilise the marine environment.

Early involvement of all stakeholders is accepted as good practice when developing strategies or progressing development applications. Provision for stakeholder involvement is also widely recognised as a key component of sustainable development. It is a fundamental principal of the ecosystem based approach to the management and use of resources.

Mechanisms to ensure resolution of interactions can be considered as falling into three main categories, each of which typically occurs at a different stage in the application process.

- The first, normally carried out by the applicant, deals with those issues identified prior to the application for a permit and would form part of a formal or statutory EIA consultation process.
- The second consultation is carried out by the regulatory authority after receipt of a license application and is part of the decision-making process.
- Finally, there should be an appeals process following the decision of the licensing authority.

An early engagement process with stakeholders can effectively contribute to the decision-making. Such a process can help avoid delays in the decision-making process as well as high costs (time and monetary) that may result in associated legal challenges. Delivering clear, transparent and effective decision-making processes will be of benefit to all users of the marine environment.

Under the current Foreshore Acts public participation is limited to a 1month period during which they can make submission to the Minister on applications for Foreshore Leases / Licences. It is likely that any review of the current regulation of activities on the foreshore will follow the trend in European Legislation e.g. Aarhus Convention, Directive on public access to environmental information (Directive 2003/4/EC), and will make proposals to strengthen public participation in the process.

To date, in Ireland, active public consultation has largely resulted from initiatives taken by project promoters e.g. The *Airtricity* consortium undertook a successful programme in relation to development of a wind farm on the Arklow Bank. Key elements of programme of interaction with stakeholders included:

- i) Open days held in both Arklow and Courtown, where national and local representatives, in addition to members of the public, were shown photo montages of the development, informed about progress, and advised of plans for its implementation by a team of informed professionals;
- ii) One month's public display of the EIS in Arklow in addition to a number of other strategic locations.

These events were well attended and accompanied by widespread public support, with no objections lodged against the project.

Another approach to public information and participation which provides useful insights is in the context of the **Water Framework Directive** (Dir 2000/60/EC). Article 14 of this Directive sets out procedures which EU Member States should follow to “*Encourage the active involvement of all interested parties in the implementation of the Directive*”

As part of implementing the Water Framework Directive (WFD) in the UK, 15 Pilot River Basins were selected for inclusion in a programme to test guidance on public participation and planning processes. The catchment of the River Ribble was selected as one of the 15 Pilot River Basins. The Ribble catchment drains an area of approximately 1,800km², contains a range of habitats, and settlements (from small villages to larger industrial towns) comprising a population of approximately 1.25 million people.

The Ribble Pilot applied, tested and evaluated a range of tools for stakeholder engagement with a view to establishing concepts of good practice. The lessons learned were widely accepted and were included within the national public participation strategy for England and Wales, as well as informing European and international practice in stakeholder engagement for river basin planning (Twyford and Baldwin, 2006; Carter and Howe, 2006). The study concluded that the range of approaches and techniques employed in the Ribble River Basin required minimal alteration; successful stakeholder engagement was more dependent on choosing the correct tool, or mix of tools, for different engagement situations (location, issue, audience) (Environment Agency, 2004).

Appendix 2 sets out the sequence of techniques for stakeholder engagement used during the Ribble Pilot River Basin Study and associated levels of involvement required in their application;

Box 1 below outlines the key principles of stakeholder engagement that are necessary to ensure the success of any method employed. Subsequent to implementation of the engagement process it is important that results and findings are put to beneficial use as they emerge. Finally, the engagement process should be evaluated and reviewed with the intention of identifying key lessons for future engagement and consider any necessary amendments to the process.

Box 1. Principles of good stakeholder engagement (Source: The Environment Council (2004) *Good Practice for Stakeholder Engagement in the Aggregates Sector*)

Inclusiveness - Encourage the participation of all stakeholders who have an interest in or who would be affected by a decision, and make particular efforts to involve the marginalised and the ‘silent majority’. Try to discover whether silence indicates apathy, indifference or consent.

Transparency, Openness and Clarity - Give stakeholders the information they need in a form they can afford and understand, tell them where information is lacking or things are uncertain, and indicate clearly what they can or cannot influence by contributing.

Independence - Using a neutral convener and independent facilitators, especially in highly polarised situations, helps to gain the confidence of stakeholders. It is difficult, and sometimes impossible, for a sponsoring organisation, whether local authority or private company, to facilitate an independent process, and the attempt to do so may in itself arouse suspicions.

Commitment - Show respect for stakeholders by giving engagement the priority and resources it deserves.

Accessibility - Provide different ways for people to be involved, it is essential that people from all parts of the community are able to participate.

Accountability - As soon as possible after the end of the engagement period, respond to participants with an account of how and why their contributions have - or have not – influenced the outcome, and ensure they are kept informed of final decisions and implementation plans.

Productivity - The ultimate purpose of all engagement is to improve things for all concerned to the maximum extent possible. Do not, however, be naïve about this: however good an engagement process is, there are usually, on the ground, some winners and some losers.

2.7 Consultation as part of the IMAGIN Project

This section summarises the consultative exercises undertaken as part of the IMAGIN project.

As part of IMAGIN Work Package 4 – Consultation and Dissemination, two Irish workshops were held in Arklow, Co. Wicklow in November 2005 and 2006. In both cases the audience consisted of representatives of various marine commercial sectors, community groups, non-governmental organisations, aggregate industries, enterprise and development agencies, statutory bodies, academic institutions, and the fisheries sector.

The workshops comprised work group and plenary sessions facilitating discussion on various issues and aspects relating to the extraction of marine aggregates from the Irish Sea. Irish participants also had the opportunity to interact with English and Welsh counterparts who have experience in marine aggregate extraction. Issues raised by the stakeholders included **impacts of dredging operations on fisheries and other sectors, roles of stakeholders within policy development, integrated approach to management and planning, scope of cost-benefit analysis, public access to data**. All of these are key topics that need to be considered when formulating any framework for marine aggregate policy. IMAGIN Work Package 4 outputs including summary reports for each of the workshops held in Ireland are available from <http://www.imagin-eu.org>.

A review of the literature including the current draft ICES WGEXT Cooperative Research Report (*in press*) shows that the process of public consultation processes in relation to marine aggregate extraction are highly variable in EU countries. The specific elements appear to be largely dictated by factors associated each country’s particular legal and permitting regimes.

SECTION 3

3.1 Impacts and Responses Associated with Marine Aggregate Extraction

There are a number of key impacts and possible management responses associated with the extraction of marine aggregate resources from the Irish Sea. This section draws upon guideline documentation from countries where marine aggregate extraction activities have been carried out for some time, e.g. United Kingdom and Belgium, and from material produced by ICES. The ICES guidelines (*Guidelines for the Management of Marine Sediment Extraction*) have been formally adopted by OSPAR, and hence are used to inform activities under the OSPAR Convention and by EU Member States with respect to marine aggregate extraction and its management. The ICES management framework for marine aggregate extraction is summarised in Table 4. The key topics covered within this section include:

- Economic Impacts;
- Environmental Impacts;
- Environmental Assessment;
- Operational Issues;
- Monitoring Requirements and Techniques.

The outputs of other IMAGIN work packages, namely Work Package 1 (Biotic Environment Assessment; and Geological Assessment) and Work Package 3 (Cost Benefit Analysis) should be consulted as reference material specific to Irish Sea region. However, in the case of all impact categories it should be noted that local conditions will dictate the extent and significance of the impacts listed below and prioritisation will vary from site to site. Note that the impacts are not presented in any rank order of significance – again this will be largely dictated by the prevailing local conditions in any one particular area.

3.2 Economic Impacts

In the absence of detailed and specific economic analytical forecasts on this topic it is difficult to encapsulate all economic impacts. Issues relating to the ability to meet aggregate demand in a cost effective way, permitting and royalty costs as well as economic impacts on other marine users will require consideration.

- *Future Aggregate Demand Scenarios* – The economic consequences of meeting Ireland's present and future aggregate demand can be considered in relation to two basic options: 1) maintain status quo (100% land-based supply); or 2) allow for marine aggregate extraction to contribute to supplying a proportion of the overall aggregate demand. Some of the main economic consequences of pursuing either scenario are further explored in IMAGIN Work Package 3 – Cost Benefit Analysis: Final Report (Paul et al. 2007).
- *Economic Indicators* - The development of a set of detailed integrated economic indicators (ideally to include long-term mineral reserve planning considerations) would serve to enhance decision support tools for policy makers. Such a set of indicators should be established in the context of societal and environmental costs and gains, thus facilitating an economic appraisal in the context of sustainability. For example, as previously outlined, the capacity of marine aggregate extraction to bring about a reduction in CO₂ emissions, (and, in turn, any associated carbon emission fines) has potential societal, environmental and economic benefits.

- *Economic Models* – The development of economic models will be necessary to accommodate issues relating to costs associated with permitting and prospecting, and agreement on a royalty to be negotiated between industry and the State. Economic models incorporating a royalty on material extraction and/or levy on material extracted have been implemented in other EU countries. However, any model developed for extraction of aggregates from Irish waters will need to be commensurate with the strategic objective of securing :

“*a fair commercial return from the State's foreshore estate.*”

Thus, it will be necessary to ensure that any royalty allows for a balance to be struck between the need to ensure a maximum return to the State while at the same time allowing an economically viable industry to develop.

3.3 Environmental Impacts

The environmental impacts associated with the extraction of marine aggregates relate to the short-, medium- and long-term physical and ecological effects on the marine system. These may include impacts on sediment transport and coastal processes; benthic species and habitats; water quality; and commercial fisheries including spawning and nursery grounds.

It is important to acknowledge that each impact will have associated spatial and temporal characteristics and in many cases these characteristics will be site-specific. The significance and extent of environmental impacts will also depend upon factors such as: the nature of the surface and underlying sediment; coastal processes; the method, amount, duration and time of extraction; and, the sensitivity of the species and habitats in the locality. Thus, in evaluating the direct and cumulative impacts on the environment it is essential that baseline data are available and a dedicated monitoring programme tailored to the spatial and temporal characteristics of the extraction site is put in place.

- *Sediment Transport and Coastal Processes* – It is important that sedimentary processes operating in the Irish Sea region are well understood in order to predict any potential changes that may occur before and after planned extraction of aggregates, and the impact of any changes quantified.
- *Marine Benthic Ecosystems* – The benthic environment is directly impacted by the extraction of marine aggregates; the magnitude of this impact is closely linked to dredging intensity and timing of the extraction. Within the extraction area, and adjacent areas, impacts on the benthic fauna and sediments can persist over time and the period for benthic ‘recovery’ is inherently dependent on the dynamics of the local environment and the magnitude of disturbance. While material change is inevitable, temporal and spatial mitigating measures and remediation efforts can minimise impacts and lead to site recovery within an acceptable period of time. Similarly, appropriate mitigation measures can ensure that the extent and magnitude of changes do not substantially alter the hydrological and sedimentary regimes.
- *Water Quality* – Extraction of marine aggregates can have a number of potential impacts on various water quality parameters both during and after extraction activities. These include: impacts on water chemistry; effects associated with increased suspended sediment concentration; turbidity; and siltation. These impacts will in turn have implications for flora and fauna, e.g. blanketing of benthic communities, and potentially for other users of the marine environment, e.g. fisheries and recreation. Thus, effects on water quality must be considered as a component within an overall environmental assessment of sites designated for marine aggregate extraction.

- *Commercial Fisheries* – Interactions with fisheries operations and the natural resources upon which they depend can result from: reduction of access to area due to extraction activities; direct removal of pelagic species and of benthos on which fish feed; blanketing of adjacent areas by disturbed sediment; alteration of sediment substrate and associated changes in benthos; and removal or injury to fishery resource(s) at vulnerable stages of life cycle. Particular attention needs to be focused on potential impacts and interactions of extraction of marine aggregates at locations within or adjacent to any area deemed as important for the feeding, migration or spawning of fish or any other commercially exploited marine organisms, e.g. whelk (*Buccinum undatum*) fishery.
- *Marine Conservation* – The identification and designation of sites of ecological importance in the marine environment is ongoing at a pan-European level. There are already objectives set by the EU Water Framework Directive and being further developed under the Marine Strategy Directive. Key international commitments and European obligations include halting the decline of biodiversity across the EU by 2010, establishing an ecologically coherent network (through Natura 2000) of well managed Marine Protected Areas by 2010 and implementing an ecosystem approach to management of the marine environment. The potential impact of aggregate extraction within MPAs and SACs will need to be carefully assessed as part of the SEA process to ensure that the sites will not be significantly affected as measured against the established conservation objectives of the area. Prior to any extraction of marine aggregates that may be likely to have a significant effect on a Natura 2000 site, an appropriate assessment would need to be undertaken to assess the scale and magnitude of these impacts. Where appropriate such an assessment should be accompanied by recommendations on measures to ensure the ecological integrity of the site.

3.4 Environmental Assessment

Projects associated with extraction of marine aggregates are subject to environmental assessment as stipulated in Article 4(2) (Extraction of minerals by marine or fluvial dredging) of the EIA Directive (97/11/EC). This requires all such projects to be assessed by the relevant Member State to determine whether they are likely to have significant effects on the environment.

An Environmental Impact Statement (EIS) should normally be prepared for each extraction area, but the framework for assessment should be sufficiently adaptive to allow, if appropriate, a single impact assessment for the whole area where multiple operations in the same area are proposed. In such cases the impact assessment covering a number of operations would have to take account of cumulative and combined impacts, e.g. where sites are proximal or contiguous.

The following stages in the EIA process should be considered:

Screening – This should be carried out as the first step in the planning process in order to determine if the proposed activities, due to scale or other circumstances, are exempt from the environmental assessment process. In Ireland, as set out in the European Communities (Environmental Impact Assessment) Regulations, 1999 (S.I. No 93 of 1999) an Environmental Impact Statement must be provided in cases involving:

“Extraction of stone, gravel, sand or clay by marine dredging (other than maintenance dredging) where the area involved would be greater than 5 hectares or, in the case of fluvial dredging, (other than maintenance dredging) where the length of river involved would be greater than 500 metres.”

In certain cases, the Minister may require a sub-threshold EIS to be prepared.

Scoping - The specific issues that should be addressed in the EIS should be established by early consultation between the applicant, the regulatory authorities and where appropriate, other interested parties. A generic set of key topics is likely to be contained within all environmental assessments but is important that any site specific issues are scoped out for applications in each area.

The following subject areas should be considered mandatory for inclusion in an environmental impact statement for marine aggregate extraction:

- *Nature of the Deposit* – location and geographical extent, distance to coastline;
- *Sediment Characteristics* – stability, sediment type and particle size, thickness of deposit, relationship with underlying sediments and mobility of sediment;
- *Dredging Operations* – details on timing and scale of activity, as well information on ports for landing material (see Operational Issues);
- *Physical and Biological Impacts* – (see Environmental Impacts);
- *Interactions with Other Legitimate Uses of the Sea* - commercial fisheries; shipping and navigation lanes; military exclusion zones; engineering uses of the seabed (e.g. adjacent extraction activities, undersea cables and pipelines); location of areas of archaeological importance, wrecks and war-graves in the area and general vicinity; areas of natural beauty or of significant cultural or historical importance in or adjacent to the proposed extraction area; recreational uses; areas designated (licensed) for the disposal of dredged or other materials; location in relation to existing or proposed licensed aggregate extraction areas; and general planning policies for the area (international, national, and local).
- *Evaluation of Impact* - when evaluating the overall impact, it is necessary to identify and quantify the marine and coastal environmental consequences of the proposal. An impact hypothesis should summarise the environmental impacts. In areas of uncertainty it may be necessary to employ predictive techniques such as modelling to assess potential impacts. The impact hypothesis should also consider steps that might be taken to mitigate the effects of extraction activities.
- *Sensitivity and Legal Status of the Area in Question* – establish and clarify if the area is protected under national, EU or international legislation or would the activity have an impact on such an area; is the area particularly sensitive, e.g. fisheries nursery area.

3.5 Risk Assessment in Marine Aggregate Extraction

The identification of risk is of paramount importance for the regulation of marine aggregate extraction activities, both through the determination of consent to dredge and the identification of areas where monitoring and / or mitigation may be required. Although not yet mature, several frameworks for partial risk assessment have been developed for use by national regulatory authorities in some countries, however no common standard model has been adopted internationally. The system currently operated by the Centre for Environment, Fisheries and Aquaculture Science (CEFAS) in the UK is an example that provides a very useful set of protocols that help to ensure license applications are processed using a standard methodology (Rogers & Carlin, 2002). Another initiative that is currently at an advanced stage of research is the *Marine Aggregate Extraction Risk Assessment (MARA) Framework* (Bain et al. 2007). This framework is more sophisticated, incorporating a tiered approach that facilitates application at various spatial scales. The MARA approach is initially intended for use by consultants to the marine aggregates industry, where it will provide a standardised audit trail of the assumptions used and is expected to enhance transparency and consistency in approaches to EIS.

3.6 Operational Issues

To date, only non-commercial extraction of marine aggregates has taken place in Irish waters. Despite the lack of commercial operations it is important to consider operational factors that will influence any future model(s) of activity. Priority should be given to ensuring that Best Available Techniques (BAT) can continue to be readily and effectively incorporated into guidelines in the future through the establishment of a regular review process.

The following points introduce some of the main issues that need to be considered from an operational perspective when developing a policy and licensing framework for the extraction of marine aggregates in Irish waters.

- *Timing/coordination of License Permitting Steps* – The timing and duration of various permitting processes, i.e. from the initial application to issue of license is crucial. In the light of large scale capital investments that typify the industry, commercial realities call for a high level of confidence and predictability in the structure and duration of licensing processes. This issue is also important from the regulatory perspective in flagging the need for: a) advance planning to address potential increases in demand on administrative resources; and, b) consideration of the potential benefits that may stem from a system of prioritisation that could reduce the duration of license application, e.g. through a “planned licensing round.”
- *Operational Capacity Limits Associated with the Extraction Activity* - This refers to time and other limits associated with operational activity, for example: time-scale defining when operations within a given zone or permitted area should proceed following the granting of permission; time periods during which extraction activity may not be allowed to proceed. There may also be a requirement to place stipulations on the maximum number of operators permitted to extract marine aggregates from an area at any one time, the range of water depths within which extraction is permitted, and the maximum total volumes allowed to be removed within a given time period from a particular licenced area.
- *Working Practices* - Details of the working arrangements, as part of a marine aggregate extraction operation, should be elaborated, including: the number, type and size of vessel (or vessels) to be used; the sequence in which the site of extraction is to

be worked - the site may be quite large in size and all relevant parties should be notified of any re-location of effort; number of dredgers operating at a time; time required for dredgers to complete loading; number of days per year on which dredging will occur; and use of vessel tracking and electronic monitoring to be incorporated into operational activity (See Table 4 for further details).

3.7 Monitoring Requirements

Monitoring associated with any marine aggregate extraction activity will be dependent on the scale (temporal and spatial) and location of the operation. It is critical that clear monitoring objectives are defined. Monitoring activities will be required prior to the commencement of dredging in order to establish a baseline as well as during the extraction of marine aggregates. Monitoring programmes should be site appropriate and make provision for the analysis of both physical and biological parameters. The main purpose of monitoring programmes is to:

- Assess performance and monitor compliance with agreed conditions specified in operating licences;
- Test impact hypotheses and thus further understand and improve predictive capability for future extraction activities;
- Verify the effectiveness of mitigation measures;
- Provide early warning of undesirable change so that corrective measures can be implemented;
- Further the knowledge base relating to the actual effects of a particular activity.

3.8 Monitoring Techniques and Associated Expertise

Typical techniques and tools to be employed within the various stages of the monitoring programme include: bathymetric and side-scan sonar surveys; vibro-coring and video; seismic profiling; sediment sampling; analysis of water column suspended sediment concentration; and surveys specific to fish species and benthic assemblages. It should be recognised that in particularly sensitive situations it may be necessary to make provision for collection and delivery of monitoring data in near real-time or semi-real time. In practice this requirement is most often applied in relation to water quality parameters such as turbidity in particular situations where sensitive species may be at risk. It will also be vital that appropriate criteria and action plans are established that govern the action or responses that should ensue where established limits and thresholds are exceeded. With respect to the monitoring of archaeological heritage some of the provisions of existing codes of practice (Environmental Code of the Irish Concrete Federation and the Federation's Archaeological Code), may provide a useful reference point in the development of monitoring and other operational considerations. Within the last five years this topic area has been subject to a phase of intensive development and evolution in the UK resulting in a set of highly effective protocols, e.g. BMAPA / English Heritage / Wessex Archaeology (2003 and 2005). The following sections outline some of the key factors to be considered for monitoring protocols associated with the various stages of marine aggregate extraction.

- *Baseline Study and Pre-Extraction Monitoring* - Prior to any removal of marine aggregates, applicants granted permission to proceed with extraction should consult with all relevant agencies to formulate a pre-extraction monitoring programme, including details of dates, equipment and locations. The monitoring programme content and the details of how it will be carried out should be thoroughly considered in the EIS. Finalisation and agreement should be a condition of any permit issued. The monitoring programme should be designed to identify when key environmental target thresholds are being approached, and most importantly breached, and should outline a

procedure to be followed in such cases. The consultation process should be a co-ordinated procedure involving all relevant parties, and contribute to an integrated and consistent consenting regime for marine aggregate extraction.

- *In Situ Extraction Monitoring* - Analysis of pre-extraction survey data should inform the structure of the monitoring programme to be put in place during the extraction operation – such a programme should be tailored to the characteristics of the extraction site and should comprise surveys to examine as appropriate such issue as: plume dispersal; bathymetry; benthos; effects on fish and cetacean populations and should define targets / indicators / standards.
- *Post-Extraction Monitoring* – The details of the proposed post extraction monitoring programme should be submitted as a requirement within the permitting application as a recognised part of the overall extraction programme, i.e. extraction should be planned towards closure.
- *Ownership and Distribution of Monitoring Data* - Agreements relating to the ownership and distribution of data emerging as part of the monitoring programme need to be formulated. It will be important to clearly define criteria in order to establish conditions of availability, i.e. what determines which types of information can be made available publicly and by whom, and by what means should dissemination be undertaken. In some cases the confidentiality of commercially sensitive information may need to be protected, e.g. for a set time period prior to public release. Alternatively, a combined approach may be adopted where dissemination of individual data sets is negotiated between all parties concerned. The practices of any adopted procedure should aim to meet the requirements of the Aarhus Convention (Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters)
- *Review of Monitoring Programmes* - Periodic reviews of monitoring programmes and information requirements should be undertaken, e.g. at least every five years, to ascertain whether monitoring performance criteria are being met, and to examine long-term trends in order to identify unusual events, and to ensure integration of BAT. This process will require an iterative approach, and modification of the programme, if required, should be agreed between the operator and the regulator

Table 4. Criteria for inclusion in managing activities and assessing impacts associated with marine aggregate extraction; modified from International Council for the Exploration of the Sea (ICES) *Guidelines for the Management of Marine Sediment Extraction*.

Description of Physical Setting	Information Required for Physical Impact Assessment	Description of Biological Setting	Information Required for Biological Impact Assessment	Description of Proposed Aggregate Dredging Activity
<ul style="list-style-type: none"> • Bathymetry and topography • Distance from nearest coastline • Geological history of deposit • Source and type of material • Sediment particle size distribution • Extent and volume of the deposit • Stability and/or natural mobility of the deposit • Thickness of the deposit and evenness over the proposed extraction area • Nature of underlying deposit and any overburden • Local hydrography including tidal and residual water movements • Wind and wave characteristics • Average number of storm days per year • Estimate of bed load sediment transport • Existence of contaminated sediments and their chemical characteristics • Natural background suspended sediment load under both tidal currents and wave action 	<ul style="list-style-type: none"> • Implications of extraction for coastal and offshore processes, including possible effects on beach draw down, changes to sediment supply and transport pathways, changes to wave and tidal climate • Changes to the seabed topography and sediment type • Exposure of different substrates • Changes to the behaviour of bedforms within the extraction and adjacent areas • Potential risk of release of contaminants by aggregate dredging, and exposure of potentially toxic natural substances • Transport and settlement of fine sediment disturbed by the aggregate dredging equipment on the seabed, and from hopper overflow or on-board processing and its impact on normal and maximum suspended load • Effects on water quality mainly through increases in the amount of fine material in suspension • Implications for local water circulation resulting from removal or creation of topographic features on the seabed • Time scale for potential physical “recovery” of the seabed 	<ul style="list-style-type: none"> • Flora and fauna within the area likely to be affected by aggregate dredging (e.g. pelagic and benthic community structure), taking into account temporal and spatial variability • Information on the fishery and shellfishery resources including spawning areas, with particular regard to benthic spawning fish, nursery areas, over-wintering grounds for ovigerous crustaceans, and known routes of migration • Trophic relationships (e.g. between the benthos and demersal fish populations by stomach content investigations) • Presence of any areas of special scientific or biological interest in or adjacent to the proposed extraction area, such as sites designated under local, national or international regulations 	<ul style="list-style-type: none"> • Changes to the benthic community structure, and to any ecologically sensitive species or habitats that may be particularly vulnerable to extraction operations • Effects of aggregate dredging on pelagic biota • Effects on the fishery and shellfishery resources including spawning areas, with particular regard to benthic spawning fish, nursery areas, over-wintering grounds for ovigerous crustaceans, and known routes of migration • Effects on trophic relationships (e.g. between the benthos and demersal fish populations) • Effects on sites designated under local, national or international regulations • Predicted rate and mode of recolonisation, taking into account initial community structure, natural temporal changes, local hydrodynamics, and any predicted change of sediment type • Effects on marine flora and fauna including seabirds and mammals 	<ul style="list-style-type: none"> • Total volume to be extracted • Proposed maximum annual extraction rates and dredging intensity • Expected lifetime of the resource and proposed duration of aggregate dredging • Aggregate dredging equipment to be used • Spatial design and configuration of aggregate dredging (i.e. the maximum depth of deposit removal, the shape and area of resulting depression) • Substrate composition on cessation of aggregate dredging • Proposals to phase (zone) operations • Whether on-board screening (i.e., rejection of fine or coarse fractions) will be carried out • Number of dredgers operating at a time • Routes to be taken by aggregate dredgers to and from the proposed extraction area • Time required for aggregate dredgers to complete loading • Number of days per year on which aggregate dredging will occur • Whether aggregate dredging will be restricted to particular times of the year or parts of the tidal cycle • Direction of aggregate dredging (e.g. with or across tide)

Table 4. (continued)

Assessment of Interaction with other Legitimate Uses of the Sea	Measures to Mitigate Effects of Marine Aggregate Extraction	Authorisation Conditions	MINIMUM Requirements for Monitoring Compliance with Authorisation	Scope of Monitoring Programme
<ul style="list-style-type: none"> • Commercial fisheries • Shipping and navigation lanes • Military exclusion zones • Offshore oil and gas activities • Engineering uses of the seabed (e.g. adjacent extraction activities, undersea cables and pipelines including associated safety and exclusion zones) • Areas designated for the disposal of dredged or other materials • Location in relation to existing or proposed aggregate extraction areas • Location of wrecks and war-graves in the area and general vicinity • Wind farms • Areas of heritage, nature conservation, archaeological and geological importance • Recreational uses • General planning policies for the area (international, national, and local) • Any other legitimate use of the sea 	<ul style="list-style-type: none"> • Selection of aggregate dredging equipment and timing of aggregate dredging operations to limit impact upon the biota (such as birds, benthic communities, any particularly sensitive species and habitats, and fish resources) • Modification of the depth and design of aggregate dredging operations to limit changes to hydrodynamics and sediment transport and to minimise the effects on fishing • Spatial and temporal zoning of the area to be authorised for extraction or scheduling extraction to protect sensitive fisheries or to respect access to traditional fisheries • Preventing on-board screening or minimising material passing through spillways when outside the dredging area to reduce the spread of the sediment plume • Agreeing exclusion areas to provide refuges for important habitats or species, or other sensitive areas 	<p>Authorisation (in the form of a permit, licence or other regulatory approval) is an important tool for managing marine aggregate extraction and will contain the terms and conditions under which aggregate extraction will take place, and will provide a framework for assessing and ensuring compliance.</p> <p>Authorisation conditions should be drafted in plain and unambiguous language and will be designed to ensure that:</p> <ul style="list-style-type: none"> • The material is only extracted from within the selected extraction site • Any mitigation requirements are complied with • Any monitoring requirements are fulfilled and the results reported to the regulatory authority. 	<ul style="list-style-type: none"> • An automatic record of the date, time and position of all aggregate dredging activity • Position to be recorded to within a minimum of 100 metres in latitude and longitude or other agreed coordinates using a satellite-based navigation system • There should be an appropriate level of security • Frequency of recording of position should be appropriate to the status of the vessel, i.e. less frequent records when the vessel is in harbour or in transit to the aggregate dredging area e.g. every 30 minutes, and more frequently when dredging, e.g. every 30 seconds 	<ul style="list-style-type: none"> • What are the environmental concerns that the monitoring programme seeks to address? • What measurements are necessary to identify the significance of a particular effect? • What are the most appropriate locations at which to take samples or observations for assessment? • How many measurements are required to produce a statistically sound programme? • What is the appropriate frequency and duration of monitoring?

SECTION 4

4.1 Marine Spatial Planning

Ongoing improvements in management of the marine environment have necessitated the need to strengthen co-operation at national and trans-national (regional) levels, including the development of spatial planning processes for the marine environment. The concept of marine spatial planning (MSP) is becoming increasingly prominent internationally as a means of aiding effective management of marine resources and activities. Indeed the Irish Sea region and Welsh jurisdictional waters have already been the focus of an exercise in marine spatial planning (Irish Sea Pilot). Within the Irish Sea Pilot, marine spatial planning was defined as

an integrated, policy-based approach to the regulation, management and protection of the marine environment, including the allocation of space, which addresses the multiple, cumulative and potentially conflicting uses of the sea and thereby facilitates sustainable development (MSPP Consortium 2005).

Marine spatial planning promotes a framework that seeks to take account of the policy relationship between different human uses, minimise conflict and avoid potential conflict through appropriate ongoing management controls.

4.2 Rationale for Spatial / Zoned Approach

Integrated management of the marine environment is underpinned by improved co-ordination and access to spatial data and mapping of the marine environment, which can be formulated into a spatial plan for a specific marine area.

Adopting a zoned approach provides the option of introducing marine aggregate extraction to an existing multi-use environment in a strategic manner. The provision of well founded, scientifically robust data on relevant variables and interactions allows potentially unfavourable interactions to be considered prior to the receipt of application for particular activities within a specific area. By using a process of zonation it becomes possible to identify in an objective and transparent manner, areas where dredging for marine aggregates is likely to be more appropriate or acceptable. Such an approach would act as a steer for applicants for permits and help avoid the selection of less appropriate or contentious extraction areas.

A forward looking spatial planning framework, that is underpinned by sound environmental, social and economic data offers opportunities for transparency, adaptive management and well informed decision-making. Such an approach should embody the key principles of **sustainability, and ecosystem-based management including the precautionary approach.**

In the specific context of marine aggregate extraction and the Irish Sea, the broad purposes of a spatially orientated planning framework would be to:

- Protect the living and non-living constituents of the marine and coastal environment;
- Provide for harmonised operations between those involved with the extraction of marine aggregates and other users of the marine environment;
- Assist in managing and maintaining the impacts of marine aggregate extraction to within acceptable levels;

- Optimise options for the efficient and appropriate use of the marine space for all activities including marine aggregate extraction;
- Allow for strategic decision-making related to the marine aggregate extraction sector.

Much of the spatial data collated for a zoned approach to marine aggregate extraction also has the potential to serve a purpose beyond that specific to the sector, e.g. ecological data gathered through habitat surveys has been successfully used in England and Wales to support comprehensive education and outreach programmes; location of sites of archaeological importance through prospecting and trial surveys. The added value of these datasets can be realised through their use in MSP, SEA and EIA processes for the Irish Sea. Whilst the advantages and benefits of a marine spatial planning approach are clearly recognised internationally, current planning structures in Ireland do not yet comprise such an integrated approach (see Section 2).

In this regard, the IMAGIN project noted that in May 2007 in its response to the EU Maritime Green Paper “Towards a Future Maritime Policy for the Union”, the Irish Government stated that:

“Ireland believes that the further development of maritime spatial planning holds the potential to create an appropriate framework to coordinate and implement enhanced coastal and ocean governance in a transparent and comprehensive manner.”

This approach is closely aligned with the recommendations of the IMAGIN project for a zoning framework, based on MSP, as the basis for developing the marine aggregates sector. Furthermore, the Irish Government stated that

“Ireland supports the Commission proposal that the Thematic Strategy for the Marine Environment be the environmental pillar of the integrated maritime policy with a central aim of achieving good status of the EU’s marine environment by 2021, underpinned by the ecosystem approach to marine spatial planning.”

4.3 Marine Spatial Planning and Aggregate Extraction

The marine aggregate extraction industry is well established in various European countries, including the UK, the Netherlands, Denmark, and Belgium. Thus, in many of these countries, policy development for marine aggregate extraction is at a mature stage and has benefited from iterative refinement based on long-term experience and assessment of procedures. An example of a forward looking, indicative marine spatial plan is given in the Integrated Management Plan for the North Sea 2015 produced by the Dutch authorities (Figure 4.1).

In Wales, an evidence-based spatial policy, determined by discrete sediment environments, guides strategy for the extraction of marine aggregates in the Bristol Channel (MADP). Similarly, the Belgian authorities have adopted spatially discrete or zone based policy framework for the extraction of marine aggregates (a more comprehensive outline of the Belgian licencing and regulation procedures for marine aggregates, including use of zonation, is presented in Appendix 1).

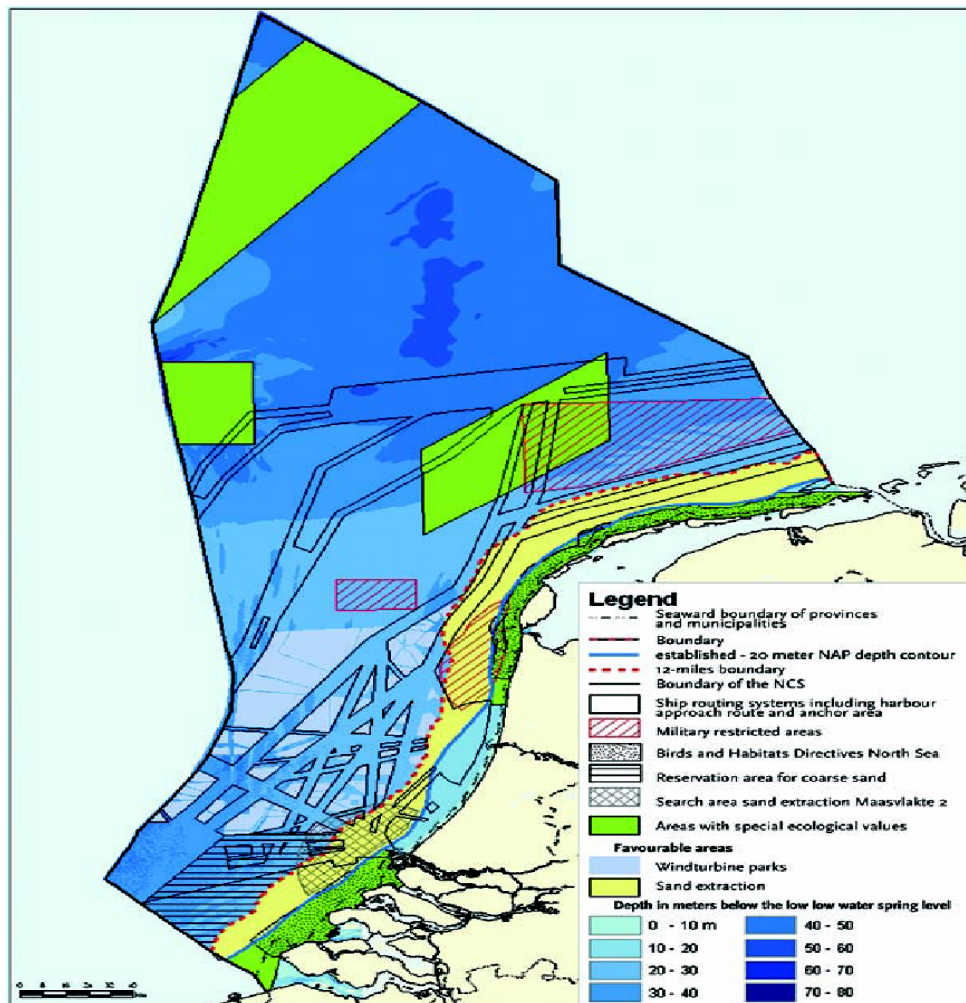


Figure 4.1. Marine Spatial Plan for the Dutch waters of the North Sea (Rijkswaterstaat Noordzee, 2005).

4.4 Criteria for Zoned Approach in Planning for Marine Aggregates

In adopting a spatial strategy, which identifies zones for the extraction of marine aggregates, a range of criteria must be brought forward for consideration. These can be broadly categorised as those associated with the sedimentary resource itself, and criteria linked to interactions stemming from utilisation of that resource.

- *Resource Criteria* –The types of criteria to be contained in a sediment / resource based strategy include:
 - *Geological controls* – an identification of significant geological features that influence the local morphology and sediment regime;
 - *Form* – a description of the profile of the local seabed morphology;
 - *Sedimentology* – a summary of the main sediment types distributed through each sediment environment;
 - *Bedform* – an interpretation of macro-bedform features, e.g. sandbanks, sand waves and sand ribbons, in relation to sediment dynamics;

- *Conceptual sediment transport model* – a synthesis of the present understanding to describe the behaviour of sediments in each sediment zone and in respect to the coastal process mechanisms involved;
- *Resource potential* - actual or predicted resource potential.

Whilst information on the above criteria should be included in any sediment / resource based strategy it is important to ensure that the data are of appropriate quality / reliability to allow a sufficient understanding of the various sedimentary processes at play.

- *Interaction Criteria* – As stated previously, the Irish Sea is similar to many other regional seas in that the majority of its waters and seabed area is already subject to one or more uses. IMAGIN has collated information on a variety of relevant activities (Figure 4.2). The relationship and interaction between multiple users of a shared resource, as well as the provision of areas for future use / activities, is a challenge to management. Activities within the Irish Sea include:
 - *Energy* – at present an offshore wind farm operated by Airtricity and GE Energy, is located on the Arklow Bank, an area approximately 10km off the east coast of Ireland. Additionally, Codling Wind Park Ltd have been granted a lease to construct a wind farm on the Codling Bank. An electricity inter connector cable between Ireland and the UK has been proposed;
 - *Fisheries and aquaculture* – the Irish Sea contains a number of regionally and locally important fisheries, and seed mussel areas that support aquaculture activities;
 - *Telecommunications* – a number of submarine telecommunications cables are positioned in the Irish Sea area;
 - *Recreation and leisure* – water based recreation and leisure is a growth industry and the associated user group is likely to increase;
 - *Transport* – considerable volumes of freight traffic and car and passenger ferries operate to and from ports in the Irish Sea, e.g. Dun Laoghaire, Dublin, Rosslare, Fishguard and Pembroke;
 - *Hydrocarbons* – a number of gas inter connectors linking Ireland and the UK traverse the Irish Sea;
 - *Ecology and conservation* – the Irish Sea contains a number of sites of national and international ecological importance.

4.5 Use of Spatial / Zoned Approach

By combining spatial inventories, e.g. those developed by IMAGIN for the Irish Sea and those to emerge from Ireland's national seabed mapping project INFOMAR, it would be possible to identify likely areas of high or low interaction. This in turn can be used by regulators to categorise areas where extraction is viewed more favourably / less favourably. This will enable advice to be issued that can be used to steer industry towards areas where the extraction option would be considered. This approach is mutually beneficial to both regulator - in terms of guidance in the decision-making process, and the developer - by reducing uncertainty in relation to their future investment planning.

Provision should be made for the inclusion of zones of compatible mixed uses in any eventual management plan or strategy for marine aggregate extraction. The designation of zones would accompany a management plan or strategy which would allow for adaptive management including a process of amendment and review of the zones. On cessation of the activity for which an area has been zoned, the site could become available for previously incompatible uses.

Many of the criteria that will inform and support management decisions regarding the zonation of areas are discussed in Section 3. In addition to the criteria influencing the zoning and de-zoning of areas, it is important to consider the issue of scale – as some criteria will be more significant at certain scales e.g. spatial - site specific, regional and national; and temporal – long, mid and short-term.

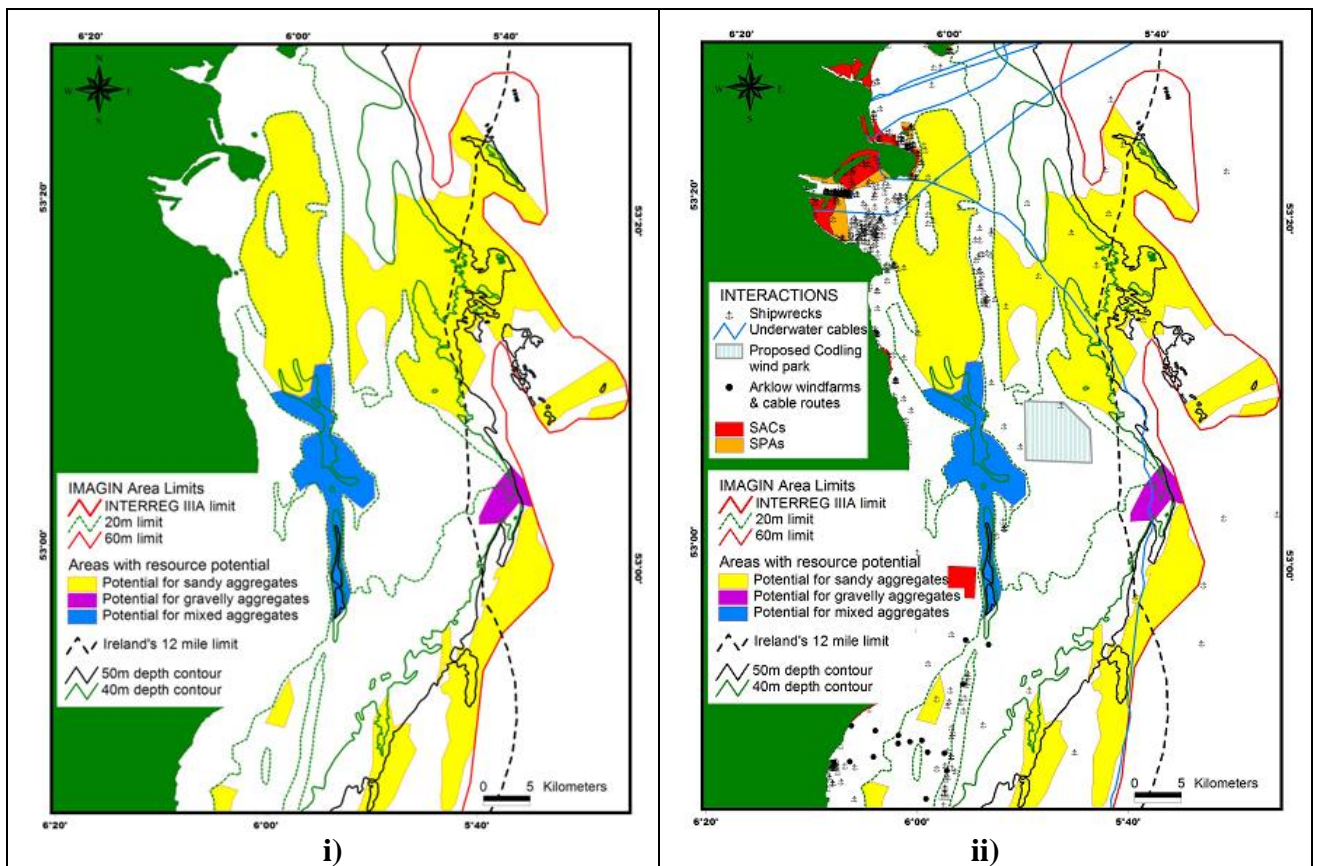


Figure 4.2. Sub-section of IMAGIN study area showing examples of: (i) identified areas of resource potential; and, (ii) identified areas of resource potential and interactions.

SECTION 5

5.1 Conclusions and Key Recommendations

A key objective of the overall IMAGIN project was to develop a strategic framework and scientific rationale to underpin future policy development for Irish Sea. The specific aim of IMAGIN Work Package 5 was to produce a set of recommendations for policy development. This was achieved in part by drawing on experience from other countries where marine aggregate extraction is well established. We have also combined the most appropriate international practices and protocols with the datasets and information emerging from the IMAGIN programme of work. This process was conducted in the context of the existing national marine licensing system but has been strongly influenced by the incorporation of best practice guidance issued by international bodies of expertise such as the International Council for the Exploration of the Sea, and by forthcoming policy drivers as outlined in the EU Green Paper on Maritime Policy and EU Marine Strategy Directive (as well as the Ireland's responses to these policy instruments).

The conclusions and recommendations have been divided into those with a more generic or trans-national dimension that may be considered for application across the whole IMAGIN domain (Ireland & Wales) , and those that have specific relevance to the Irish situation.

5.2 Generic Conclusions and Recommendations

- *The Irish Sea has a number of areas suitable for marine aggregate extraction.* As detailed in IMAGIN Work Package 1 – Resource Assessment, the potential resource within the IMAGIN study area of the Irish Sea alone equates to approximately 5-7 billion m³.
- Sustainable development of *marine aggregates in the Irish Sea is realistically achievable in the short to medium-term.*
- *Development of Irish Sea marine aggregates would provide an important contribution to sustaining economic development in both Ireland and Wales, whilst contributing to a reduction in CO2 emissions and environmental costs.*

5.3 Conclusions and Recommendations Specific to Ireland

While IMAGIN has demonstrated that the marine option is both viable and timely, appropriate utilisation of the resource in Ireland will not progress without a policy framework being put in place. In view of the Government Decision in September 2007 regarding the transfer of executive functions for Foreshore regulation, including aggregate extraction, to the Department of Environment Heritage and Local Government, there is an excellent opportunity for that Department to develop and implement a marine aggregates policy for Ireland which would incorporate the insights from the IMAGIN project and international best practice.

We recommend that

- the Department of Environment Heritage and Local Government, with advice from the Coastal Zone Management team in DAFF and aided by agencies such as the Marine Institute and GSI and by research such as IMAGIN, maintain the progress in recent years towards establishing a strategic policy framework and regulatory processes to enable the successful management of marine aggregate extraction in Ireland.

To achieve this goal, the following should be considered:

- A ***national policy should be developed*** to promote and facilitate the sustainable development and use of Irish marine aggregates, with careful environmental assessment and monitoring to minimize interactions and environmental impacts;
- A ***unified database of identified aggregate resources should be generated***. This baseline data would quantify the resource and, where appropriate, identify suitable resources for extraction as outlined in the National Geoscience Programme for Ireland, which forms part of the National Development Plan (2007-2013);
- A ***national statutory framework for this sector be created, that is fully consistent with the principals of marine spatial planning***. A number of issues have been identified with the current regulatory framework for licensing of marine activities in Irish waters (see Section 2). In order to facilitate development in the short to medium term, the existing regulatory framework can be adapted. However, in order to enable a forward looking planned approach, a more far reaching modification of the current legislative and regulatory framework is required. In developing this framework, the following features should be taken into consideration:
 - iii) Plan-making within a national and regional hierarchy, to incorporate the following key steps: **plan preparation; zonation; statutory and public stakeholder participation; formal adoption of plan; periodic review; amendment process.**
 - iv) A decision-making processes based on adopted plans, which is **transparent and clearly defines roles and responsibilities** of all parties and areas where marine aggregate extraction is permitted as an activity.
- IMAGIN recommends that preliminary draft ***technical guidelines*** for marine aggregate extraction in Irish waters be developed. These should incorporate the principles of best practice for monitoring and operational activities, as outlined in Section 3.
- Once a policy framework for the development of marine aggregates is put in place, a full ***SEA should be prepared*** for marine aggregate extraction in the Irish Sea. The steps in this process are spelt out in the diagram, Figure 5.1, below.
- This SEA could be integrated with other activities in the Irish Sea, however in the interest of progressing this sector it is recommended that an SEA be prepared on a sectoral basis, e.g. as has been the case for offshore oil and gas. A large portion of the environmental report which will be required for the SEA can be provided by the outputs from the IMAGIN project (see section 2.5).

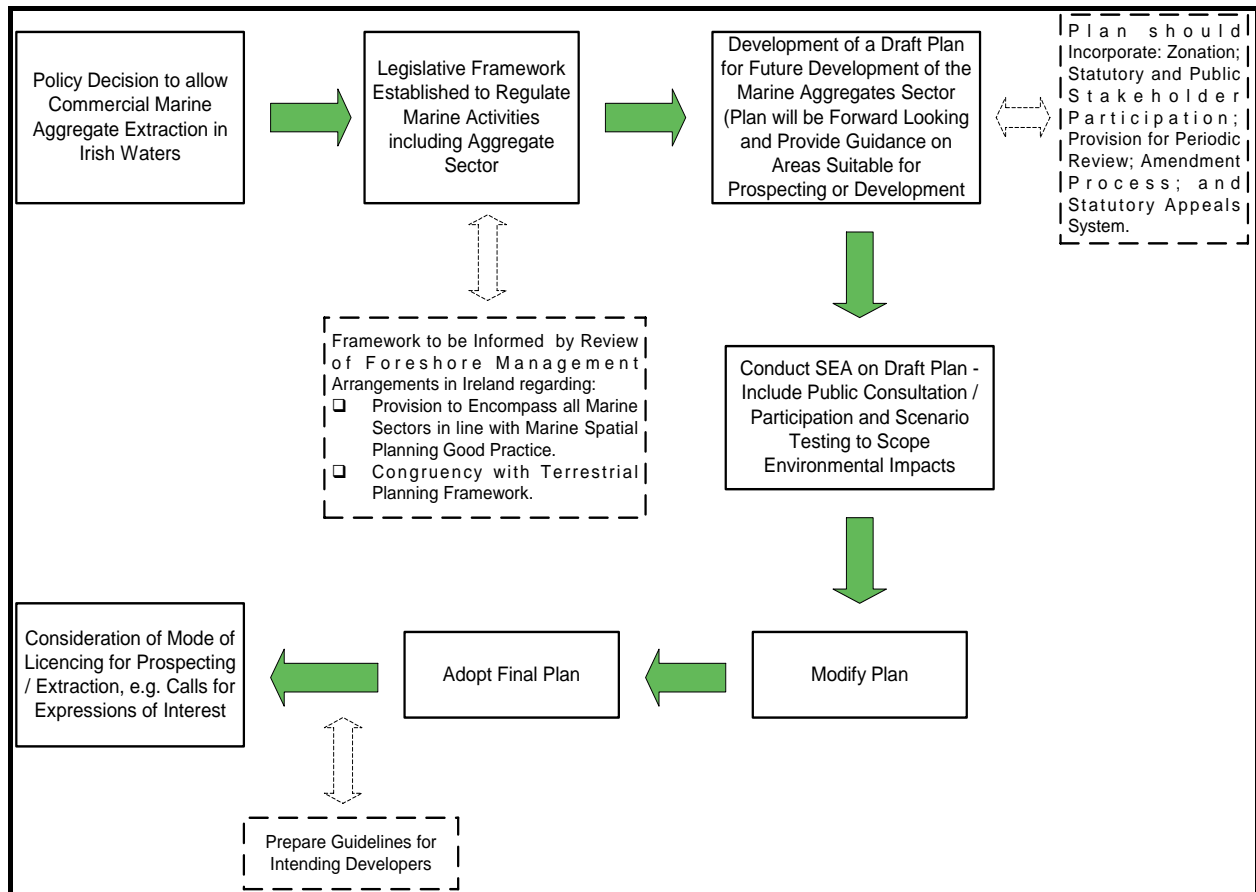


Figure 5.1. Outline of key regulatory steps to be undertaken for the development of an Irish marine aggregate industry.

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REFERENCES

- Bain V, Sayers P, Adnitt C, Walkden M, John S & Hall J (2007) Marine Aggregate Extraction-Risk assessment (MARA) framework. In: RC Newell & DJ Garner (eds.) Proceedings of Aggregate Levy Sustainability Fund (ALSF) Conference: Helping to Determine Good Practice. Sept 2006.
- Bellec V, Van Lancker V, Degrendele K, Roche M & Le Bot S (2007) Geo-Environmental Characterisation of the Kwinte Bank. *Journal of Coastal Research*, *in press*.
- BMAPA & English Heritage (2003) Marine Aggregate Dredging and the Historic Environment: guidance note. British Marine Aggregate Producers Association & English Heritage, London. 28 pp.
- BMAPA & English Heritage (2005) Protocol for Reporting Finds of Archaeological Interest. Report prepared by Wessex Archaeology for British Marine Aggregate Producers Association & English Heritage. 25 pp.
- Bonne W, Garel E, Kortekaas S, Brière C, Bellec V, Manso F, Radzevicius R, Blažauskas N, Ballay A & Bagdanaviciut I (2006) EUMARSAND (European Marine Sand and Gravel Resources: Evaluation and Environmental Impact of Extraction). Paper presented at the European marine sand and gravel – Reeling in the experts, EMSAGG Conference, 20th-21st February 2006, London, England.
- Bonne W, Collins M, Van Lancker V & Uriarte A (Eds) (2006) EUMARSAND, European Sand and Gravel Resources: Evaluation and Environmental Impact of Extraction (HPRN-CT-2002-00222). Final Report submitted to European Commission, 5th Framework Community Research, AZTI Foundation, Pasaia, Spain: 419 pp.
- Boyd SE & Rees HL (2003) An examination of the spatial scale of impact on the marine benthos arising from marine aggregate extraction in the central English Channel. *Estuarine, Coastal and Shelf Science*, Vol. **57**, No. 1-2, pp. 1–16.
- Boyd SE, Cooper KM, Limpenny DS, Kilbride R, Rees HL, Dearnaley MP, Stevenson J, Meadows WJ & Morris CD (2004) Assessment of the re-habilitation of the seabed following marine aggregate dredging. Science Series Technical Report No. 121, CEFAS Lowestoft, 154pp.
- Boyd SE, Limpenny DS, Rees HL & Cooper KM (2005) The effects of marine sand and gravel extraction on the macrobenthos at a commercial dredging site (results 6 years post-dredging). *ICES Journal of Marine Science*, Vol. **62**, No.2, pp. 145-162.
- Calewaert JB & Maes F (eds.) (2007) Science and Sustainable Management of the North Sea: Belgian case studies. Academia Press, Gent. 328 pp.
- Carter JG & Howe J (2006) Stakeholder Participation During River Basin Planning In England And Wales: The Case Of The Ribble Pilot. *Local Environment*, Vol. **11**, No. 2, pp. 217-233.
- Cayocca F & du Gardin B (2003) Assessing the impact of sand extraction on the shore stability: project for a methodological framework. Paper presented at the European marine sand and gravel – shaping the future, EMSAGG Conference 20th-21st February 2003, Delft University, The Netherlands.
- CEFAS (2001) A Workshop to Discuss the Feasibility and Practicality of Developing Ecological Quality Objectives for Aggregate Extraction Areas. Final Report of Workshop held CEFAS Lowestoft Laboratory, 11th and 12th October 2001. 82 pp.
- Cole S, Codling ID, Parr W and Zabel T (1999) Guidelines for Managing Water Quality Impacts within European Marine Sites. Prepared for the UK Marine SACs Project, October 1999. 448pp.
- Committee of North Sea Senior Officials (2002). Progress Report to the 5th International Conference on the Protection of the North Sea – The Bergen Declaration. Report arising from Conference on the Protection of the North Sea, Bergen, Norway, 20th-22nd March

2002. [Online]. Available: <http://www.odin.dep.no/md/nsc/report/022001-990321/index-dok000-b-n-a.html>.
- Cooper KM (2005) Cumulative effects of marine aggregate extraction in an area east of the Isle of Wight – a fishing industry perspective. Science Series Technical Report No. **126**, CEFAS Lowestoft, 28pp.
- Cooper KM, Eggleton JD, Vize SJ, Vanstaen K, Smith R, Boyd SE, Ware S, Morris CD, Curtis M, Limpenny DS & Meadows WJ (2005) Assessment of the re-habilitation of the seabed following marine aggregate dredging – part II. Science Series Technical Report No. **130**, CEFAS Lowestoft, 82pp.
- Degrendele K, Roche M, Schotte P, Van Lancker V, Bellec V & Bonne W (2007) Morphological Evolution of the Kwinte Bank Central Depression Before and After Cessation of Aggregate Extraction. Journal of Coastal Research, *in press*.
- Department of the Environment, Transport and the Regions (2001) Draft Marine Minerals Guidance Note 2: Guidance on the Extraction by Dredging of Sand, Gravel and Other Minerals from the English Seabed. The Stationary Office, Norwich, 42 pp.
- Department of Marine and Natural Resources (2000). Extraction of Marine Sand and Gravel- The Case for a Policy Decision. Briefing document released by the DOMNR, July 2000.
- Desprez M (2000) Physical and biological impact of marine aggregate extraction along the French coast of the Eastern English Channel: short- and long-term post-dredging restoration. ICES Journal of Marine Science, Vol. **57**, No.5, pp. 1428–1438.
- Emu Ltd. (2004) Marine Aggregate Site Restoration and Enhancement – Strategic Policy Overview. Report no. 04/J/01/06/0548/0437 prepared by Emu Ltd. on behalf of The British Marine Aggregates Producers Association, The Crown Estate and English Nature. 85 pp.
- Environment Agency (2004) Ribble Pilot River Basin: Public Participation and River Basin Planning - Early Experiences, Environment Agency, Preston.
- Environment Council (2004) Good Practice for Stakeholder Engagement in the Aggregates Sector. The Environment Council. 55 pp.
- Garel E (2007) Short-term Hydrodynamics and Sediment Transport on the Kwinte Bank, Southern North Sea. Journal of Coastal Research, *in press*.
- Gubbay S (2005) A Review of Marine Aggregate Extraction in England and Wales, 190-2005. Report prepared for the Crown Estate. 36 pp. [Online]. Available: http://www.thecrownestate.co.uk/1401_sue_gubbay_report.pdf.
- Hitchcock DR, Newell RC & Seiderer LJ (2002) Integrated Report on the Impact of Marine Aggregate Dredging on Physical and Biological Resources of the Sea Bed U.S. Department of the Interior, Minerals Management Service, International Activities and Marine Minerals Division (INTERMAR), Washington, D.C. OCS Report Number 2000-054. 241 pp.
- Hitchcock DR, Newell RC & Seiderer LJ (1999) Investigation of Benthic and Surface Plumes associated with Marine Aggregate Mining in the United Kingdom – Final Report. Contract Report for the U.S. Department of the Interior, Minerals Management Service. Contract Number 14-35-0001-30763. Coastline Surveys Ltd Ref. 98-555-03 (Final).
- ICES (2003) Working Group on the Effects of Extraction of Marine Sediments on the Marine Ecosystem. Final Report of Meeting held in Ostend, Belgium, 1st-5th April 2003.
- ICES (2005) Report of the Working Group on the Effects of Extraction of Marine Sediments on the Marine Ecosystem (WGEXT), 5th – 8th April 2005, San Sebastian, Spain. 104 pp.
- Irish Concrete Federation (2002) Code of Practice between the Irish Concrete Federation and the Minister for Arts, Heritage, Gaeltacht and the Islands. Department of Arts, Heritage, Gaeltacht and the Islands / Dúchas. 8pp.

- Krause JC, Diesing M & Arlt G (2007) The Physical and Biological Impact of Sand Extraction: a Case Study of a Dredging Site in the Western Baltic Sea. *Journal of Coastal Research*, *in press*.
- Manso F, Radzevicius R, Blažauskas N, Balay A & Schwarzer K (2007) Nearshore dredging on the Baltic Sea. State after cessation of activities and regeneration assessment. *Journal of Coastal Research*, *in press*.
- Marine and Coastal Environment Group (2004) Marine Aggregate Dredging – Legislation Briefing Paper No. 2. Cardiff University, 12pp.
- Marker BR (2006) The Administration of Marine Minerals Dredging in English Waters. Paper presented at the European marine sand and gravel – Reeling in the experts, EMSAGG Conference, 20th-21st February 2006, London, England.
- MSPP Consortium (2005) Irish Sea Pilot Regional Plan– Final Report. [Online]. Available: <http://mspp.abpmer.co.uk/mspp/index.asp>. 109pp.
- National Assembly for Wales (2001) Marine Aggregate Dredging Policy South Wales – Summary Consultation Document. [Online]. Available: <http://www.wales.gov.uk/subiplanning/content/consultationpapers/marinesummary-e.pdf>.
- National Assembly for Wales (2004) Interim Marine Aggregate Dredging Policy. [Online]. Available: <http://new.wales.gov.uk/topics/planning/?lang=en>.
- Newell RC, Seiderer LJ, Robinson JE, Simpson NM, Pearce B & Reeds KA (2004) Impacts of overboard screening on seabed and associated benthic biological community structure in relation to marine aggregate extraction. Technical report to the Office of the Deputy Prime Minister (ODPM) and Minerals Industry Research Organisation (MIRO). Project No. SAMP.1.022. Marine Ecological Surveys Limited, St. Ives. Cornwall. 152 pp.
- Nicoll C (2007) Irish Sea Marine Aggregates Initiative (IMAGIN) Aggregate Resources and Markets – Wales. IMAGIN project report by Geoscience Wales.
- Oakwood Environmental Ltd. (1999) Strategic Cumulative Effects of Marine Aggregates Dredging (SCEMAD). Final Report prepared for US Department of the Interior, Minerals Management Service under contract no. 1435-01-98-CT-3089. 182 pp.
- Office of the Deputy Prime Minister (2002) Marine Minerals Guidance Note 1: Guidance on the Extraction by Dredging of Sand, Gravel and Other Minerals from the English Seabed. The Stationary Office, Norwich, ISBN 0 11 753634 2, 32 pp.
- Paul T, Kinghan P & Glanville P (2007) Irish Sea Marine Aggregates Initiative (IMAGIN) Work Package 3- Cost Benefit Analysis Final Report. Prepared by John Barnett and Associates, Dublin.
- Posford Duvivier Environment & Hill MI (2001) Guidelines on the impact of aggregate extraction on European Marine Sites. Countryside Council for Wales (UK Marine SACs Project). 126 pp.
- Posford Haskoning Ltd. (2003) Eastern English Channel Regional Environmental Assessment. Report on behalf of the East Channel Association. 163 pp.
- Posford Haskoning Ltd (2004) Marine Aggregate Extraction: Approaching Good Practice in Environmental Impact Assessment. Report prepared, under management by the Mineral Industry Research Organisation, for the Office of the Deputy Prime Minister.
- Radzevicius R, Velegrakis AF, Bonne W, Kortekaas S, Garel E, Blažauskas N & Asariotis R (2006) Marine Aggregate Extraction: Regulation and Management in EU Member States. *Journal of Coastal Research*, *in press*.
- Rogers S & Carlin D (2002) A Procedure to Assess the Effects of Dredging on Commercial Fisheries. Final report of CSG Contract A0253. Defra, Nobel House, London.
- Scott P & Marsden C (2003) Development of Strategic Environmental Assessment (SEA) Methodologies for Plans and Programmes in Ireland (2001-DS-EEP-2/5) - Synthesis Report. Document prepared by ERM Environmental Resources Management Ireland

- Limited for Environmental Protection Agency. ISBN: 1-84095-124-9. Environmental Protection Agency, Wexford. 36pp.
- Sheils J & Paul T (2002) Valuation of Quarries and Mineral Bearing Lands – An Overview. Paper presented to the Society of Chartered Surveyors in Dublin on the 6th December 2002.
- Smyth L (2006) Need for Aggregate Planning Policy. Paper presented at Institute of Geologists of Ireland Conference – Ireland’s Natural Resources 2006-2020: Developing Our Assets, 15th November, Dublin Castle, Ireland.
- Steadman EJ, Mitchell P, Highley DE, Harrison DJ, Linley KA, MacFarlane M & McEvoy F (2004) Strategic Environmental Assessment (SEA) and future aggregate extraction: in the East Midlands Region. British Geological Survey Commissioned Report, CR/04/003N. 105pp.
- Sutton G (2002) Irish Offshore Aggregate Resources: Context, Appraisal and a Geographical Information System (GIS) as a Resource Mapping Tool. MSc. thesis submitted to the National University of Ireland, Cork.
- Twyford V & Baldwin C (2006) United Nations Environment Programme Dams and Development Project Compendium of Relevant Practices - Stakeholder Participation. Report prepared on behalf of International Association for Public Participation. 53 pp.
- Van Lancker V, Deleu S, Bellec V, Du Four I, Schelfaut K, Verfaillie E, Fettweis M, Van den Eynde D, Francken F, Monbaliu J, Giardino A, Portilla J, Lanckneus J, Moerkerke G & Degraer S (2007). Marebasse: bridging gaps towards other disciplines and end users. In: F Maes & JB Calewaert (Eds), Science and Sustainable Management of the North Sea: Belgian case studies. Academia Press, Gent. 328 pp.

APPENDIX 1: LICENSING AND REGULATION OF MARINE AGGREGATES IN BELGIUM

The law of June 13, 1969 amended by the law of January 20, 1999 and the law of April 22, 1999 regulates the exploration and exploitation of sand and gravel in certain areas on the Belgian Continental Shelf. Two implementing decrees were published (BS 07.10.04):

- Royal Decree (RD) of September 1, 2004 (Belgian Official Journal of 10 October 2004) as regards conditions, geographic limits and procedures for granting licenses, "Procedure decree".
- Royal Decree (RD) of September 1, 2004 (Belgian Official Journal of 10 October 2004) as regards rules for environmental impact assessment.

Applications have to be sent to the Minister of Economic Affairs. At the same time the environmental impact report has to be sent to the Management Unit of the North Sea Mathematical Models (MUMM), who prepares an environmental assessment for the Minister responsible for the marine environment. The application will not proceed without a positive indication from this Minister.

The decree for Environmental Impact Assessment foresees the possibility that an integrated EIA can be produced. The reason that this is possible is that in Belgium the extraction zones are defined by RD and all permit holders have access to these zones. An integrated EIA is valid for three years and can be used by all permit holders who have to renew their permit within that time frame. Any new applicator cannot make use of this EIA and will have to fill the gaps identified by the administration that has judged the EIA and is responsible for the environmental impact assessment. In the procedure decree, there are three control zones defined, divided in sectors for which a concession can be issued (Figure A. 1).

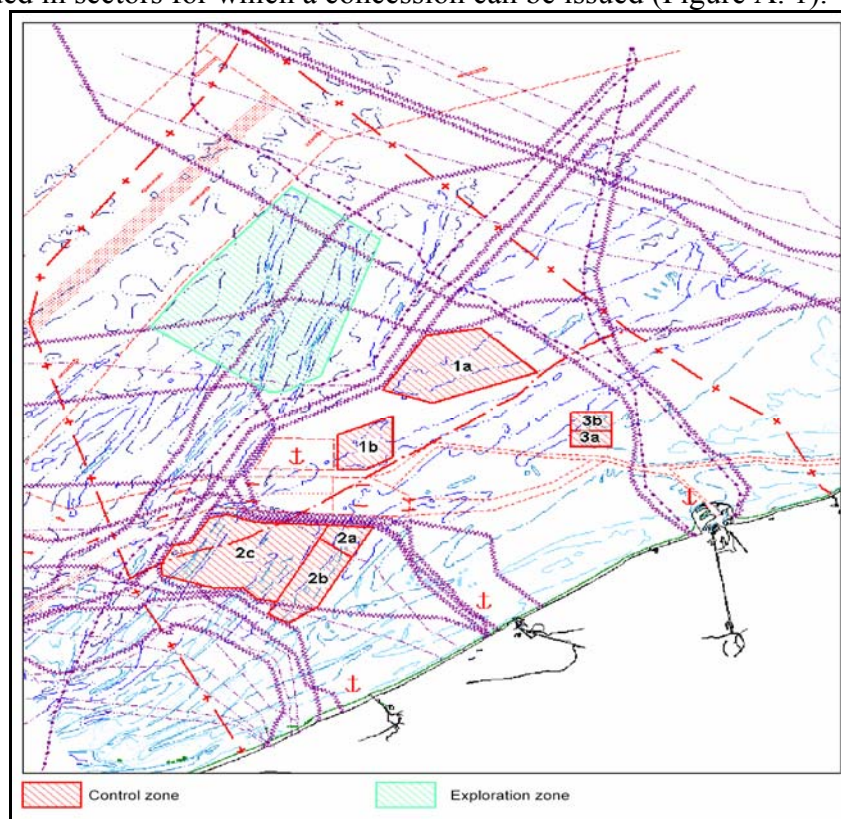


Figure A.1. Map showing the recently developed marine sediment extraction zones on the Belgian continental shelf.

The accessibility for the control zones is defined as follows:

- Sectors 1a, 2c and 3a are open for exploitation all year round;
- Sector 1b is only open for exploitation during the months March, April and May;
- Sectors 2a and 2b are open for exploitation alternately for a period of three years. The Advisory Committee, established by RD of August 12th 2000 (B.S. 27.09.00) opened sector 2a from March 15th 2005 and so sector 2b is closed for exploitation;
- Sector 3b is closed for exploitation as long as the sector is still being used as a dumping site for dredged material.
- Besides the control zones there is an exploration zone defined: zone 4
-

An Advisory Committee has been installed to ensure coordination between administrators involved with the management of the exploration and exploitation of the continental shelf. One of the specific tasks of that committee consists of evaluating a 3-yearly review report with the results of the ongoing research. Figures A.2 and A. 3 show flowcharts of the procedures for granting licences, and the regulation of environmental impact assessment.

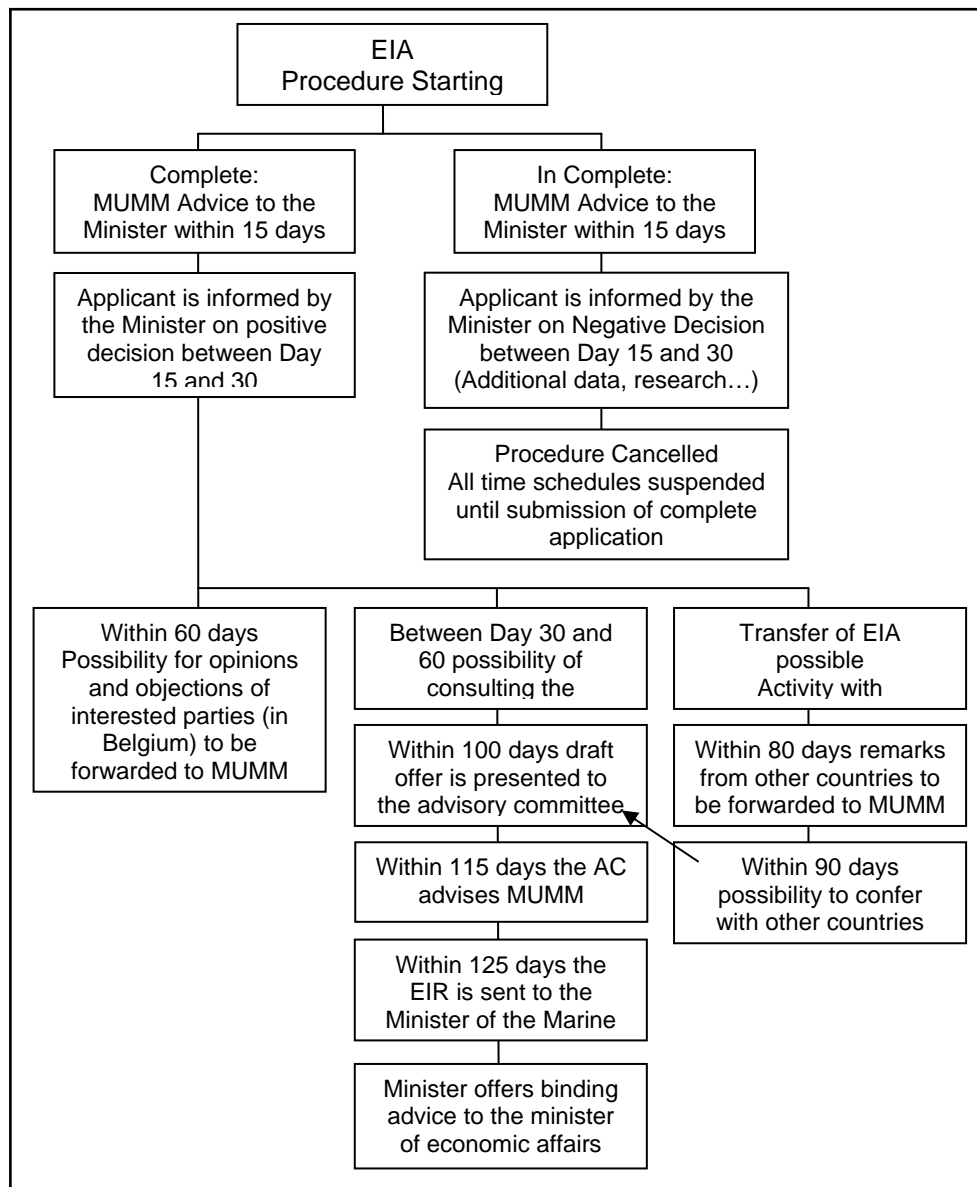


Figure A.2. Procedures for implementation of EIA application for marine aggregate extraction in Belgium; Source: Cooperative Research Report of ICES WGEXT (in press)

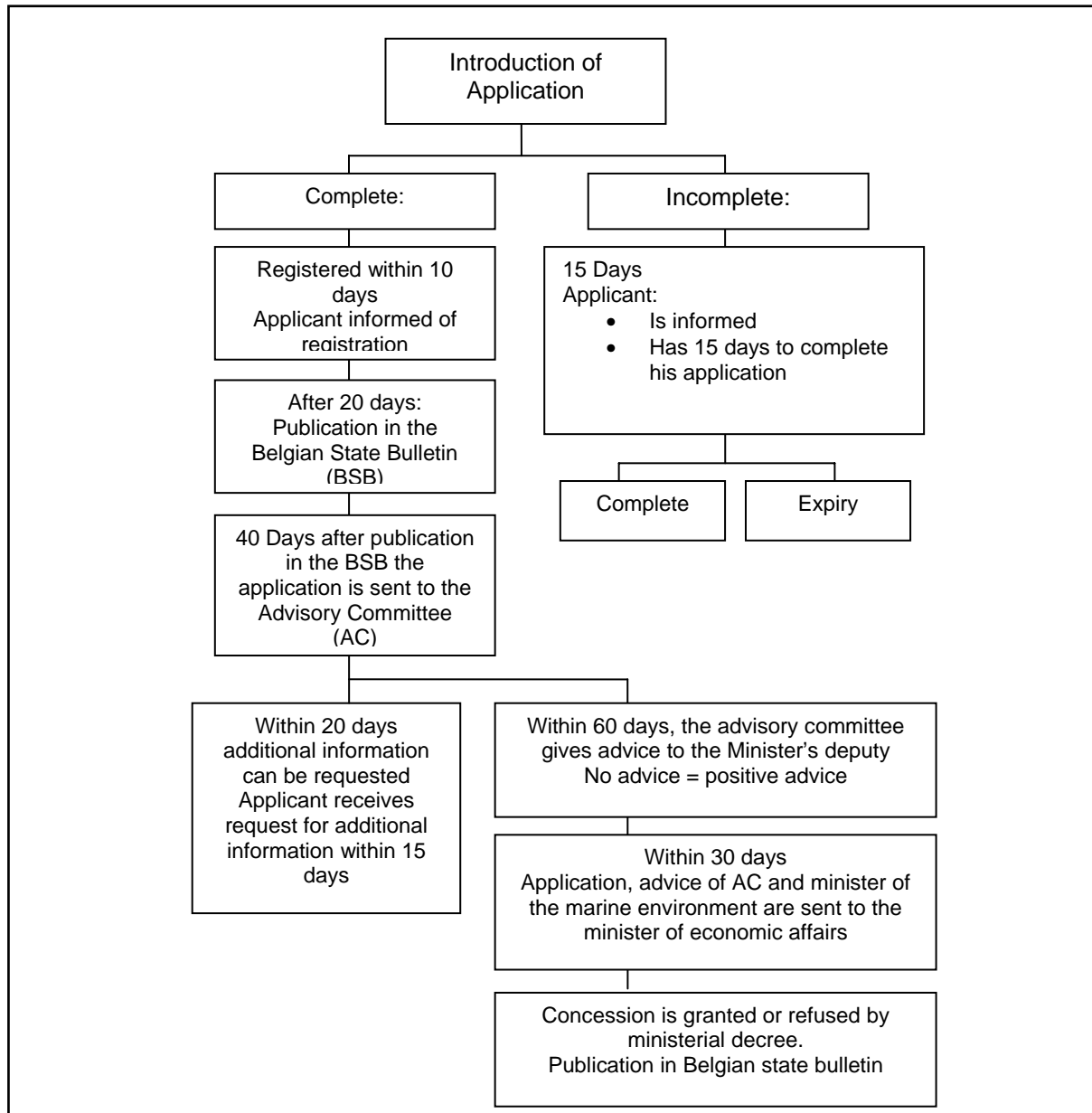


Figure A.3. Procedures for implementation of licence application for marine aggregate extraction in Belgium; source: Cooperative Research Report of ICES WGEXT (*in press*)

APPENDIX 2 - TOOLS FOR STAKEHOLDER ENGAGEMENT, AS APPLIED IN THE RIVER RIBBLE, A PILOT PROJECT UNDER THE WATER FRAMEWORK DIRECTIVE, UK

Technique	Summary of Technique Application	Type of Involvement
Project Team and Testing Group	A lead-agency project team, with a team leader, was established to co-ordinate the work. A working group (including external partners) was brought together by the Project Manager to support and advise on the testing work.	Active Involvement Listening Learning
Stakeholder Mapping	A survey of 370 identified relevant stakeholders were sent background information including a questionnaire.	Learning Consulting Informing
Stakeholder Forum	A group of key stakeholders were brought together into a forum to follow the policy and process closely, and to learn about the Water Framework Directive and support decision-making.	Active Involvement Informing Listening Consulting
Meetings in Person	The project team conducted a number of meetings with individual key stakeholders, especially during the first months of testing. This gave people the feeling that someone was listening, and provided direct input during project planning. An in-depth conversation was considered a valuable investment.	Active Involvement Informing Listening Consulting
Presentations	A series of presentations for formal committees and other groups were undertaken to communicate the key messages, raise awareness of the project and increase the chance that key stakeholders took note of it.	Informing
Scenario / Vision Building	Facilitated meetings were conducted with small numbers of participants to deepen the insight in perceptions and challenges and to map possible solutions.	Active Involvement Informing Listening Consulting
Expert Meetings and Workshops	Meetings were held with groups of experts to provide an opportunity for specialist input to assist with developing solutions to technical problems. For example, a series of four meetings were conducted to support the development of the proposed planning process.	Active Involvement Informing Listening
Website	Project pages were established within a website to focus initial enquiries for advice and to support the provision of basic understanding of the work. It developed an additional role as the primary route for dissemination of information about forum meetings.	Informing
Electronic Newsletter	Summary information of key milestones provided on approximately two sides of A4, updated every 8 weeks. It was directed at led-agency staff, those people more deeply involved in the subject or the project and organisations contributing to the Stakeholder Map that expressed an interest in knowing more. The newsletter was posted on the website and recipients were sent an email containing the web-link.	Informing
Perceptions Study – Questionnaire Survey	A survey of random selection of 1,001 households in the basin was conducted to identify citizens’ values, perceptions and interests in becoming involved in river basin planning.	Learning Listening