Hydromorphology of Transitional and Coastal Waters

Task 5 Review of legislation and characterisation of pressures and sensitivity

Technical Note R3693/03

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1. Introduction

1.1 OBJECTIVES

Work Package 5 forms part of the work on development of Hydromorphological Classification for Transitional and Coastal (TRaC) Waters. Work Package 5 was originally titled "Development of decision Making Framework for Managing Alterations to the Morphology of TRaC Waters". The work was redefined during the Steering Group meeting on 6th December 2004, to include the following tasks:

Task 1 – **Preparation of a paper** that presents:
Clear consistency in terminology;
A review of thresholds used in Article 5 characterisation;
A review of thresholds used in FEPA licensing, EIA, etc.;
A review of habitats directive in terms of morphological pressures, in terms of the decisions made.

Task 2 – **Characterising sensitivity**. This will provide an initial view on habitat sensitivity, but would also need to address morphological sensitivity.

Task 3 – **Characterising hazards** of engineering works. This will indicate how hazards to ecology are manifest.

Task 4 – Development of national saltmarsh tile and incorporation within water body boundaries (not covered in this note).

In addition a working paper was produced outlining the development of a decision-making framework.

1.2 APPROACH

At the Steering Group meeting on 10Th February 2005, the approach agreed for task 1 was to identify morphological criteria that appear in legislation and guidance and to characterise these criteria using the following table.

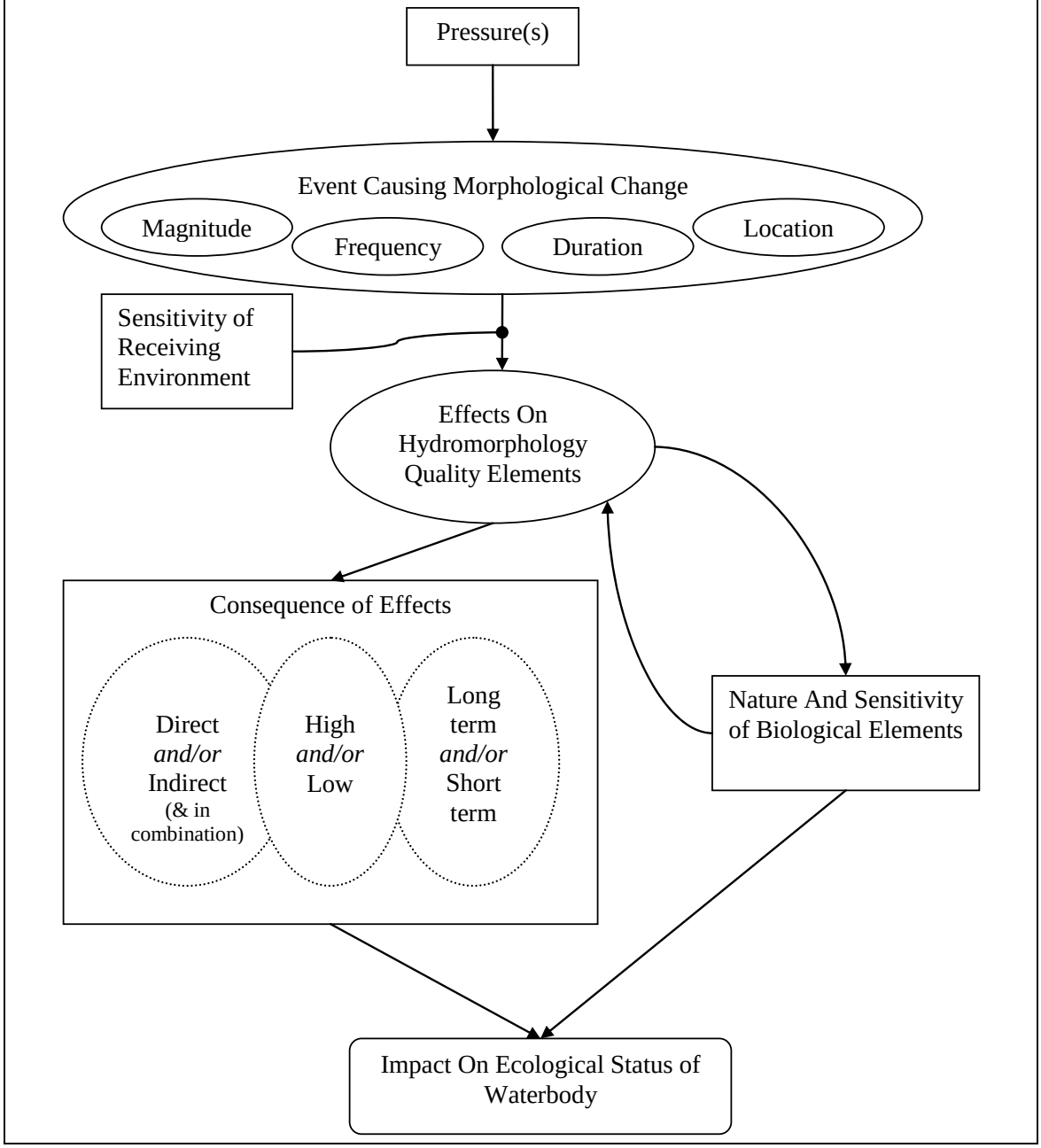
Legislation		Responsible Body		Stakeholders	
Parameter	Parameter value (threshold)	How threshold is applied	Tools/techniques used (in assessment)	Audit/control	Geographic extent

Once completed these tables could then be compared to identify: common features; gaps and overlaps using the following table.

	WFD Art 5	FEPA	EIA	Habitats Dir
Parameter X				
Parameter Y				
…..				
Threshold				
…..				

For tasks 2 and 3, the approach agreed at the Steering Group meeting was to describe the hazards and habitat sensitivity within a Driver, State, Pressure, Impact, Response (DSPIR) framework. In this context, Pressures could be based on those identified in the Technical Advisory Group on the Water Framework Directive: Guidance on Morphological Alterations and the Pressures and Impacts Analyses document and receptor sensitivity would define the Impact. The method for assessing potential morphological changes introduced by the pressures and the consequent impacts on ecological receptors has been divided into two key stages. The information required to assess the likely impact to the receiving environment is the degree of morphological change that is likely to arise from a particular pressure (Task 3, Section 4). The second stage in the process involves an assessment of the sensitivity of ecological receptors to those morphological changes (Task 2, Section 3.1). These can be combined in a risk assessment to identify the potential risks to environmental receptors associated with specific activities (see Box 1).

Box 1 Schematic of Assessment Approach



The approach taken for Tasks 2 and 3 is inevitably a simplification of many of the issues surrounding morphological change and impacts on habitat. Such simplification may not be appropriate for detailed assessment of impacts, but it proposed here in order to move towards a common understanding of the key pressures and impacts, which can be used for the purposes of a risk assessment within a consistent decision making framework.

2. Task 1 – Review of legislation and guidance

2.1 LEGISLATION AND GUIDANCE REVIEWED

A full list of the legislation and guidance reviewed is provided in Tables 2.1 and 2.2. The list is not exhaustive, but aims to cover the key documents identified by the steering group and project team and manageable within the time and budgetary constraints of the project.

Raw results of the review, including tables completed as outlined in section 1 above, are provided in Appendix 1. Part 1A provides the tables for legislation only, Part 1B covers guidance and practice in applying legislation, while Part 1C covers specific guidance notes.

In preparing the above, it was clear that using the tables in the intended fashion was difficult, because of the lack of overlap in terminology and approach between the different areas of legislation. Some examples of this are given below.

2.1.1 Town and Country Planning legislation

There are a number of legislative instruments involved under this heading, principally The Town and Country Planning Act 1990 and subsequently The Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999 and (amendment) 2000.

Such legislation provides the main vehicle for regulating development and land use above the mean low water mark in the UK. The same legislation applies to developments built on land below mean low water if connected to the land above that mark, e.g. “piers for loading and unloading connected to land and outside ports (excluding ferry piers) which can take vessels over 1,350 tonnes”, but not to “offshore” structures, e.g. artificial islands.

The 1999 legislation does not mention issues such as hydraulics or geomorphological processes, or seek to establish any relevant parameters or thresholds for these. It does however set “applicable thresholds and criteria” in Schedule 2 as part of the description of development and applicable thresholds and criteria for the purposes of Schedule 2 development:

Description of development	Applicable thresholds and criteria
10(g) Construction of harbours and port installations including fishing harbours (unless included in Schedule 1);	The area of the works exceeds 1 hectare.
10(k) Oil and gas pipeline installations (unless included in Schedule 1);	(i) The area of the works exceeds 1 hectare; or, (ii) in the case of a gas pipeline, the installations has a design operating pressure exceeding 7 bar gauge.
10 (m) Coastal works to combat erosion and maritime works capable of altering the coast through the construction, for example, of dykes, moles, jetties and other sea defence works, excluding the maintenance and reconstruction of such works;	All development.
12(b) Marinas;	The area of the enclosed water surface exceeds 1,000 square metres.

The Planning (Environmental Impact Assessment) Regulations (Northern Ireland) 1999, was reviewed and was found to contain the same descriptions and threshold and criteria as the England and Wales regulations in the above table.

The Water Resources (Environmental Impact Assessment) Regulations (Northern Ireland) 2005 states an EIA shall be carried out in accordance with those regulations in relation to a relevant project. In the context of the current study a relevant project is one that would be "likely to have significant effects on the environment by virtue, inter alia, of its nature, size or location."

2.1.2 Wildlife & Countryside Act 1981 (as amended)

Section 28 of the Wildlife & Countryside Act 1981 (WCA) provides for notification of Sites of Special Scientific Interest (SSSIs) for reason of their flora, fauna, geological or physiographical interest. In notifying a site, the conservation authority is also required to specify any operations (potentially damaging operations (PDOs)) appearing to the Joint Nature Conservation Council to be likely to damage that flora or fauna or those features and thereafter, particular procedures apply to owners or occupiers who wish to undertake such activities. The purpose of identifying PDOs is to provide a coarse filter for preventing damaging impacts to SSSIs. There are no thresholds identified, thus enabling a subsequent site specific judgment to be made on the risks of a defined activity affecting a particular site.

The condition of sites and progress to meeting these targets are monitored, in England, by English Nature (www.english-nature.org.uk), with aims such as the Government's Public Service Agreement (PSA) target to have 95% of the SSSI area in favourable or recovering condition by 2010. There are six levels of condition that can be reported: "favourable; unfavourable recovering; unfavourable no change; unfavourable declining; part destroyed and destroyed". Favourable condition is defined as the "SSSI land is being adequately conserved and is meeting its 'conservation objectives', however, there is scope for enhancement of these sites". Unfavourable no change condition is defined as "the SSSI unit is not being conserved and will not reach favourable condition unless there are changes to the site management or external pressures."

For the condition assessment, SSSIs are generally divided into a series of smaller management units. The assessments are based on a combination of monitoring data, expert judgement and evaluation of pressures affecting the individual management units to come to an overall judgement on condition.

2.1.3 Conservation (Natural Habitats, &c) Regulations

The Conservation (Natural Habitats, &c,) Regulations 1994 make provision for the purpose of implementing the Habitats and Birds Directives (92/43/EC and 79/409/EEC) in Great Britain.

The Regulations provide for the imposition of constraints both on "operations" and "plans and projects" where appropriate.

For example, Regulation 18 deals with the notification of potentially damaging operations in European sites, specifically applying the provisions of the Wildlife & Countryside Act 1981 (as amended) for the "Notification of Potentially Damaging Operations". As with the Wildlife & Countryside Act, the nature conservation bodies have latitude in determining what operations might be likely to damage flora, fauna or physiographical features and subsequently in determining whether a particular activity at a defined location is acceptable.

Regulations 48 to 53 set out the provisions that apply to the consideration of plans and projects. The legislation does not define absolute thresholds relating to the acceptability of projects but requires that an appropriate assessment of the implications for the site in view of that site's conservation objectives. Guidance is available both nationally and at European level on how to assess the significance of changes introduced by developments, but these do not provide any absolute thresholds.

Regulation 33 of the Habitats Regulations provides for the nature conservation bodies to establish conservation objectives for European marine sites. Regulation 33 advice is now available for virtually all European marine sites. The advice includes specific objectives for features and sub-features of conservation importance, including some morphological aspects. Again, no thresholds are established, with assessment of risks undertaken as part of a site specific assessment. Measures such as 'no decrease in extent' of a particular feature could be viewed as an absolute threshold, but are more usefully regarded as a filter to allow English Nature to protect the designated feature against significant adverse impact.

2.1.4 The Countryside and Rights of Way Act (CROW) 2000

Part III of CROW provides a statutory basis for biodiversity conservation in England and Wales, i.e. through the UK Biodiversity Action Plan. Schedule 74 of the Act places a duty on the Government to "take, or to promote the taking by others of, such steps as appear to the authority to be reasonably practicable to further the conservation of the living organisms and types of habitat included in any list published by the authority under this section" in accordance with the United Nations Environmental Programme Convention on Biological Diversity of 1992.

The Act refers to a large number of coastal and marine habitats, grouped into "broad habitats" which contain one or more "priority habitats" for which "action plans" have been developed. In this respect, the Act is relevant to the maintenance and improvement of the hydro-morphology of TraC water bodies that contain one or more of these habitats. The UK Biodiversity Action Plan (see http://www.ukbap.org.uk) has moved forward with the biodiversity initiative. As to parameters and thresholds, it is currently considered that these are at a generic level for TraC waters. For example, reporting on mudflats in the 2002 reporting round contained the target T1 for this habitat"Maintain at least the present extent and regional distribution of the UK's mudflats. This target will require compensating predicted losses to development by the restoration of mudflats. Whilst this may not be possible in the same location, it should be within the same littoral sediment cell."

2.1.5 Sea Fisheries (Shellfish) Act 1967)

This act was reviewed to assess what aspects of hydromorphological parameters might be referred in such legislation. Nothing specific was included other than those acting for the owner, grantee or agent have within the limits of the fishery, and subject to any restrictions or exceptions by order of the regulations, have the exclusive right of depositing, propagating, dredging or fishing for shellfish.

2.2 ANALYSIS

The results of the review are presented in Appendix 1. While there are a large number of legislative instruments that are relevant to TRaC waters, few of these contain any direct requirements for maintaining or improving the quality of the water body from the viewpoint of its hydraulic or geomorphological status per se. Furthermore, few pieces of legislation contain anything in the way of specific morphological parameters against which the legislation is measured or through which it is applied. Where thresholds are identified, for example within the various EIA Regulations, these are based on some aspect of the size of the development, rather than on the possible morphological implications.

These differences in approach are illustrated in Table 2.3 which attempts to compare the references to morphological parameters in several pieces of legislation with terms which appear to have the same meaning in Article V of the Water Framework Regulations.

There is a considerable body of guidance, particularly in relation to nature conservation, that is relevant to the consideration of morphological impacts. For example, conservation objectives for European marine sites specify in some detail the requirements for the management of relevant features and sub-features. However, the approaches adopted for nature conservation have generally shied away from defining absolute thresholds, in recognition of the requirement to undertake a site and feature specific assessment of the potential impacts a given human activity.

Table 2.4 provides a summary of thresholds that have been applied in the Article 5 characterisation review for morphological pressures and compares these with the approaches adopted in relation to FEPA and the Habitats Regulations. The table shows clear differences in terminology and gaps (i.e. parameters in the WFD Article 5 guidance) which do not seem to appear explicitly in the Habitats or FEPA guidance.

On the basis of the above, we conclude that there is no existing framework that can provide a suitable basis for decision making in relation to the assessment of morphological pressures under WFD.

There are three clear messages from the review:

- Most legislation contains only minor reference to morphological criteria
- While guidance often includes morphological criteria, these are not expressed as thresholds
- Most existing assessments are based on expert judgement, are site specific and refer to deviation from a baseline or existing condition.

3. Task 2 – Characterising sensitivity

An approach to assessing sensitivity has been set out below based on information contained in the MarLIN database. A possible alternative approach could be based on English Nature's approach to condition monitoring of SSSIs. This approach has six levels of condition that can be reported: "favourable[1]; unfavourable recovering; unfavourable no change[2]; unfavourable declining; part destroyed and destroyed". However, this latter approach would not identify the absolute sensitivity of habitats; rather it identifies the condition of SSSI management units, which could be taken as a proxy for sensitivity, for example, a management unit in unfavourable condition might be regarded as more sensitive than a comparable management unit that was in favourable condition. Furthermore, this approach does not at present relate directly to the pressures identified within the Water Framework Directive, (though a translation could be made fairly simply) and is only applied to SSSI's and Natura 2000 sites.

3.1 SENSITIVITY OF RECEIVING ENVIRONMENT

In order to identify the impact of pressures on morphology, we have first considered the sensitivity of a range of intertidal and subtidal habitats, and taxonomic groups, to morphological change. Defining sensitivity as "the intolerance of a habitat, community or individual (or individual colony) of a species to damage, or death, from an external factor" (Hiscock, 1996). Morphological changes were described on the basis of those used in the MarLIN (Tyler-Walters, H. & Jackson, A. 1999. Assessing seabed species and ecosystems sensitivities. Rationale and user guide. *Report to English Nature, Scottish Natural Heritage and the Department of the Environment Transport and the Regions from the Marine Life Information Network (MarLIN)*. Plymouth, Marine Biological Association of the UK. (*MarLIN* Report No.4.). January 2000 edition.) report. It is important to note that the categories of morphological change as used here are not the only way in which such parameters can be defined, and indeed other methods of classification may prove more appropriate for use in the context of the Water Framework Directive.

The sensitivity of a number of habitats and taxonomic groups, to the various forms of morphological changes, has been summarised in Table 3.1a. A more complete assessment is presented in Appendix 2, which provides additional information on the confidence of the sensitivities that have been assigned. The sensitivity of each of the habitats/ species in Table 3.1a has been derived from the MarLIN database (www.marlin.ac.uk). Each of the ecological sub-categories contained within Table 3.1a incorporates a number of biotopes and species. An overall assessment of sensitivity has therefore been derived by pooling information for a number of biotopes that fall within each of these ecological sub-categories.

The relative sensitivity of fish in transitional waters and phytoplankton to the various morphological pressures is not available from the MarLIN database, and as such has been derived from expert judgement (Table 3.1b).

The key results from this analysis are that;

- substratum loss give the greatest impact across the range of habitats

[1] Favourable condition is defined as the "SSSI land is being adequately conserved and is meeting its 'conservation objectives', however, there is scope for enhancement of these sites"
[2] Unfavourable no change condition is defined as "the SSSI unit is not being conserved and will not reach favourable condition unless there are changes to the site management or external pressures."

- change in wave exposure can have the greatest impact of any change (though limited to only some habitats)
- changes in abrasion and physical presence generally have low impact and;
- coarse sediment intertidal habitats are in general, the least sensitive to morphological change.

In order to relate these sensitivities, or impacts to the drivers of morphological change it is also necessary to understand the actual ecological consequences of change and the factors affecting sensitivity to change. These are summarised in Appendix 2 for each type of morphological change.

4. Task 3 – Characterising hazards

Task 3 is designed to identify the types and extent of morphological changes that could potentially occur as the result of a particular pressure. The pressures that have been considered are those that are defined in the Technical Advisory Group on the Water Framework Directive: Guidance on Morphological Alterations and the Pressures and Impacts Analyses document and that habitat sensitivity would define the Impact.

The morphological changes that may arise as a result of these pressures are numerous and for the purposes of this project they have been summarised using the same headings as those derived from the MarLIN database (as detailed in Section 3.1). This also ensures consistency when assessing potential impacts on the receiving environment. Table 4.1 presents a summary of the potential morphological changes associated with the pressures that have been listed for both coastal and transitional waters, though clearly some morphological changes relate only to transitional waters. Furthermore, the table has been completed on the basis of the precautionary principle and as such indicates the highest possible impact of a particular pressure on a morphological element. Additional detail on how the degree of morphological change was derived is presented in Appendix 3.

The “pressures” may be long-term, recur regularly or only occur for a short time period depending on the particular activities involved. It is recognised that the effects on a water body will depend upon the scale of the “pressure”. This can usually be expressed in terms of an “area” or a “length” and hence related to the total “area” or “length (of shoreline)” for each coastal water body. Such an approach, with suggested thresholds for “Risk Category” and Confidence” is provided in the Technical Morphological Alteration v0.3 report provided under the River Basin Characterisation project (Draft Technical Assessment Method). This seems a sensible methodology. Note however that in some situations, it may be that the seabed in a water body only has a variety of “(biological or sedimentological substrates (or shorelines)” and a “Pressure” may affect a much larger percentage of a particular type of “substrate” than if the area of the whole water body. In this case it may be necessary to based the percentage area (or length) affected on the total area of that type of “substrate” (or shoreline).

The key points to note from this are that:

- Most pressures have potential to generate large changes to most morphological parameters
- Intensive use, modifications to sediment regime and fishing have the lowest average impact across all morphological changes

While Table 4.1 summarises the impacts of the various activities, the full version of the table (given in Appendix 3) carries notes and caveats for every entry and should be read in order to appreciate the context of the impact assessment.

5. Development of a decision-making framework

At the request of the Environment Agency HR Wallingford produced a working paper on the development of a decision-making framework. This document took on board comments from ABPmer and the Project board. The document issued is included as Appendix 4 to the present report.

6. Concluding Remarks

The review of legislation has so far found little common language between the WFD and other regulations as most directives, acts and regulations have little in the way of hard/firm criteria. Many give some reference to protection of the (marine) environment, but do not have specific morphological criteria. The types of criteria that do occur generally relate to Environmental Impact Assessment (EIA) thresholds, for example, sizes of development that require an EIA to be carried out.

Guidance for the implementation of legislation does include some relevant morphological criteria, but these tend not to be expressed in terms of absolute thresholds.

The concepts outlined in Tables 3.1 and 4.1 could be combined within a decision making framework in order to support a consistent approach to assessment of impact of morphological change and potentially to act as a screening tool for assessment. A working paper on the development of a decision-making framework has been presented.

Further work is required to account for different scales of pressure and the consequent impact. However, as described above, it may be possible to include the scale thresholds identified in UKTAG guidance. This could form a basis, but would need modification for use within a decision making framework for permitting of morphological modifications.

Finally, it should be noted that the tables presented here have been completed based on expert judgement alone, rather than a more formal process. Clearly others could make take different views on the content of some table cells, but they are presented here for discussion and to illustrate the approach, rather than as a definitive statement.

The use of the tables enables, for example, a preliminary identification of those ecological parameters which are sensitive to morphological change. For example, in Figure 3.1a it can be determined that Pioneer Saltmarsh has high sensitivity to substratum loss and moderate sensitivity to change in wave exposure.

Table 2.1 Legislation Reviewed

Document	Reviewed (section)	Table in App 1
The Water Environment (Water Framework Directive) (England & Wales) Regulations 2003	Y	Y
Conservation (Natural Habitats, &c.) Regulations 1994	Y (2.1.3)	Y
The Food & Environment Protection Act 1985	Y	Y
The Wildlife & Countryside Act, 1981	Y (2.1.2)	Y
The Countryside and Rights of Way Act (2000)	Y (2.1.4)	
The Town and Country Planning Act (1990)	Y (2.1.1)	
The Town and Country (Environment Impact Assessment) (England and Wales) Regulations 1999, (amendment 2000)	Y	
The Harbours Act 1964	Y	Y
The Harbour Works (Environmental Impact Assessment) Regulations (NI) 2003	Y	N
The Harbour Works (Environmental Impact Assessment) Regulations 1999	Y	Y
The Sea Fisheries (Shellfish) Act 1967	Y (2.1.5)	
The Prevention of Oil Pollution Act 1971	Y	N
The Protection of Wrecks Act 1973	Y	N
The Ancient Monuments and Archaeological Areas Act 1979	Y	N
The Wildlife and Countryside Act 1981	Y	N
The Telecommunications Act 1984	Y	N
The Protection of Military Remains Act 1986	Y	N
The Electricity Act 1989	Y	Y
The Transport and Works Act Applications and Objections Procedure (England and Wales) Rules 2000	Y	Y
The Merchant Shipping Act 1995	Y	N
The Land Drainage Act 1991, 1994	Y	N
The Water Resources Act 1991	Y	N
The Coast Protection Act 1949	Y	N
The Flood Prevention and Land Drainage (Scotland) Act 1997	Y	N
The Crown Estates Act 1961	Y	N
The Petroleum Act 1998	Y	N
EU Directive 2001/42/EC on the assessment of the effects of certain plans and programmes on the environment (SEA)	Y	N
The Environmental Assessment of Plans and Programmes (Scotland) Regulations 2004	Y	Y
The Environmental Assessment of Plans and Programmes Regulations 2004	Y	Y
The Environment Act 1990	Y	N
The Water (Northern Ireland) Order 1999	Y	N
The Water Resources (Environmental Impact Assessment) Regulations (Northern Ireland) 2005	Y	N
The Planning (Environmental Impact Assessment) Regulations (Northern Ireland) 1999	Y	N

Table 2.2 Guidance Reviewed

Document	**Reviewed Y/N**	**Table in App 1B**
The Conservation (Natural Habitats, &c.) Regulations 1994 **Regulation 33 advice**)	Y	Y
FEPA Part II FEES FOR LICENCES TO DEPOSIT MATERIALS AT SEA - Consultation Paper (from FRS Marine Laboratory)	Y	
FEPA Part II – MARINE ACTIVITIES REQUIRING A LICENCE FROM THE FRS MARINE LABORATORY, ABERDEEN	Y	
FEPA Part II -SEA DISPOSAL OPERATIONS (from FRS Marine Laboratory)	Y	
FEPA Part II- BEST PRACTICABLE ENVIRONMENTAL OPTION (BPEO) ASSESSMENT: SEA DISPOSAL OF BULKY WASTES (from FRS Marine Laboratory)	Y	
FEPA Part II - BEST PRACTICABLE ENVIRONMENTAL OPTION (BPEO) ASSESSMENT: SEA DISPOSAL OF SOLID MATERIALS (from FRS Marine Laboratory)	Y	
FEPA Part II - BEST PRACTICABLE ENVIRONMENTAL OPTION (BPEO) ASSESSMENT: SEA DISPOSAL OF FISH AND SHELLFISH WASTES (from FRS Marine Laboratory)	Y	
FEPA Part II - BEST PRACTICABLE ENVIRONMENTAL OPTION (BPEO) ASSESSMENT: SEA DISPOSAL OF LIQUID MATERIALS (from FRS Marine Laboratory)	Y	
FEPA Part II - BEST PRACTICABLE ENVIRONMENTAL OPTION (BPEO) ASSESSMENT: TEMPORARY DEPOSIT OF SOLID MATERIALS (from FRS Marine Laboratory)	Y	
FEPA Part II - GUIDELINES FOR THE RECLAMATION OF AREAS OF THE SEA BED (from FRS Marine Laboratory)	Y	
FEPA Part II SUPPLEMENTARY INFORMATION REQUIRED TO SUPPORT AN APPLICATION TO UNDERTAKE RECLAMATION WORK (from FRS Marine Laboratory)	Y	
FEPA Part II - SUPPLEMENTARY INFORMATION REQUIRED TO SUPPORT A SEA OUTFALL CONSTRUCTION LICENCE APPLICATION FOR DIRECTIONALLY DRILLED INSTALLATION (from FRS Marine Laboratory)	Y	
FEPA Part II SUPPLEMENTARY INFORMATION REQUIRED TO SUPPORT AN APPLICATION TO UNDERTAKE RECLAMATION WORK (from FRS Marine Laboratory)	Y	
FEPA Part II BEACH REPLENISHMENT/NOURISHMENT WORKS (from FRS Marine Laboratory)	Y	
FEPA Part II SUPPLEMENTARY INFORMATION REQUIRED TO SUPPORT AN APPLICATION TO UNDERTAKE COAST PROTECTION WORK (from FRS Marine Laboratory)	Y	
FEPA Part II MARINE BLASTING OPERATIONS (from FRS Marine Laboratory)	Y	
FEPA Part II MARINE CONSTRUCTION WORKS (SEA OUTFALLS) (from FRS Marine Laboratory)	Y	
Guidance Letter on Cable Installation (supplied by FRS Marine Laboratory)	Y	
Guidance note for Environmental Impact Assessment In respect of FEPA and CPA requirements – Offshore Windfarms (from CEFAS) (2004)	Y	
Draft Revised OSPAR Guidelines for the Management of Dredged Material Ref: BDC 04/5/13-E (L)	Y	
SPECIFIC GUIDELINES FOR ASSESSMENT OF DREDGED MATERIAL (under the purview of the London Convention 1972 and the 1996 Protocol). From CEFAS	Y	
Minimizing Impacts of Maintenance Dredged Material Disposal in the Coastal Environment: A Habitat Approach. (BOLAM & REES 2003) CEFAS	Y	
Maintenance dredging and the Habitats Regulations, 1994. A draft conservation assessment protocol. MCEU 2003	Y	
AE1224 – The Ecosystem Effects of Sediment Disturbance: Development and application of a GIS based disturbance impact assessment tool. Parker et al, 2004. CEFAS.	Y	

Table 2.3 Summary of Parameters used in various relevant legislation

Other Legislation	**WFD Parameter**			
	Depth Variation	**Substrate Condition**	**Structure of Seabed**	**Structure or condition of intertidal zone**
Habitats	- Geological or physiographical features	- Geological or physiographical features	- Geological or physiographical features	- Geological or physiographical features
FEPA	- Description and quantity of material deposited/removed…	- Description and quantity of material deposited/removed…	- Description and quantity of material deposited/removed…	- Description and quantity of material deposited/removed…
Wildlife &Countryside/ CROW				
SEA	- Special natural characteristics	- Special natural characteristics	- Special natural characteristics	- Special natural characteristics
Harbour Works (EIA)	- size of project - characteristics of impact	- size of project - characteristics of impact - sensitivity of geographical areas likely to be affected	- size of project - characteristics of impact - sensitivity of geographical areas likely to be affected	- size of project - characteristics of impact - sensitivity of geographical areas likely to be affected
Harbours Act				
Electricity Act		- Effect on the physical environment - amenity of fisheries	- Effect on the physical environment	- Effect on the physical environment
Environment Act		- take account of actual or possible ecological change		- take account of actual or possible ecological change

Table 2.4 Summary of Parameters used in various relevant guidance

Parameter in WFD Article 5 Characterisation (Guidance)	Parameter Value in WFD	Habitats (Reg 33)	FEPA (guidance)
% of intertidal area affected by land claim	<5% - <15%	No decrease in extent from established baseline, subject to natural variation	Reclamation using inert natural materials or selected waste materials that contain significant quantities of fines may be permitted, providing the material is used to backfill behind an impermeable barrier constructed at the seaward face of the works
% bank/shoreline affected by Bank/shoreline reinforcement	<5% - <15%	No decrease in extent from established baseline, subject to natural variation	
% alteration of tidal range	Change from normal range		
% area affected by dredging	<5% - <15%	No decrease in extent from established baseline, subject to natural variation	Nature, volume and size range of material disturbed. Assessment of likely distribution of mobilised sediment
% area affected by deposition of dredged material	<5% - <15%	1. Depth should not deviate significantly from baseline, subject to natural change. 2. Average particle size parameters should not deviate from baseline, subject to natural variation.	
% area in which substratum structure changes as a result of deposition of dredged material	<5% - <15%	Range and distribution of habitats/communities should not deviate significantly from baseline, subject to natural variation.	
% channel affected by channel straightening	<5% - <15%		Nature, volume and size range of material removed and reused as backfill, volume and fate of surplus excavated material Nature & dimensions of structures, materials used
%intertidal area lost as a result of impounding	<5% - <15%	1. No decrease in extent from baseline, subject to natural variation. 2. Shore profile should not deviate significantly from baseline, subject to natural change 3. No increase in extent, subject to natural variation. 4. Average particle size parameters, organic content, depth of RPD layer and penetrability should not deviate from baseline, subject to natural variation. 5. Range and distribution of biotopes should not deviate significantly from baseline, subject to natural variation. Range and distribution should not deviate significantly from baseline, subject to natural variation	
% area directly affected by presence of structures	<5% - <15%		
Ratio of grazed/ungrazed areas	>90% - >70%		
Rate of sediment accretion vs historical rate	<10% - <15%		
% habitat lost due to smothering	<5% - <10%		
% bed affected by fishing	<5% - <15%		
Continuity of sediment transport process	Relative change vs existing situation		Nature, volume, size range (mm) and composition of beach replenishment/nourishment material Description of general area, distinguishing features such as sand dunes, outcrops, rock pools, etc
% seabed affected by fishing	<5% - <15%		

Table 3.1a Sensitivity of ecological parameters to morphological change

	Intertidal Mudflat/ Sandflat	**Subtidal Mudflat/ Sandflat**	**Intertidal Coarse sediment Shores**	**Subtidal Coarse sediment Shores**	**Pioneer Saltmarsh**	**Mature Saltmarsh**	**Eelgrass**	**Macroalgae**
Substratum loss	Moderate	Moderate	Low	Moderate	High	Moderate	High	Moderate
Deposition/ Smothering	Low	Very Low	Low	Very Low	Low	Very Low	High	Low
Changes in suspended sediment concentrations	Moderate	Very Low	Very Low	Low	Moderate	Moderate	Moderate	Low
Change in emergence regime	Moderate	Not Relevant	Low	Not Relevant	Moderate	Low	Moderate	Low
Change in water flow rate	Moderate	Moderate	Low	Low	Moderate	Moderate	Moderate	Low
Change in wave exposure	Moderate	Moderate	Low	Low	Moderate	Low	Very High	Moderate
Abrasion and physical presence	Low	Low	Low	Low	Low	Low	Moderate	Low

Table 3.1b Sensitivity of ecological parameters to morphological change

	Fish in Transitional Waters	**Phytoplankton**
Substratum loss	Low (To High)	Low
Deposition/ Smothering	Low (To High)	Low
Changes in suspended sediment concentrations	Moderate	Moderate
Change in emergence regime	Low (To High)	Low
Change in water flow rate	Low	Moderate
Change in wave exposure	Low	Low
Abrasion and physical presence	Low	Low

Table 4.1 Specific pressures on the morphology of transitional waters

Coastal and Transitional Waters	**Morphological Change - Direct & Indirect**						
	Substratum loss (Removal/ direct damage to substrate)	**Deposition/ smothering (Siltation Rate)**	**Changes in suspended sediment concentration**	**Changes in emergence regime**	**Change in water flow rates (currents**	**Change in wave exposure**	**Abrasion and physical presence**
Land claim	High	High	High	High	High	High	0
Bank reinforcement	High	Moderate	Moderate	High	Low	Low	0
Tidal river resectioning							
Channel or offshore dredging	High	High	High	High	High	High	High
Deposition of (dredged) material (assumed subtidal)	High	High	High	0	High	High	High
Tidal river channelisation/ realignment/ straightening	High	High	High	High	High	High	High
Flow manipulation	High	High	High	High	High	Low	0
Impounding	High	High	High	High	High	High	0
Construction e.g. jetties	High	High	High	High	High	High	High
Intensive use e.g. shell-fisheries	High	Moderate	Moderate	Moderate	Moderate	Moderate	High
Manipulation of sediment transport (e.g. groynes, breakwaters)	Moderate	High	Moderate	High	High	High	Low
Modifications to sediment regime (e.g. intertidal recharge, changes in soft cliff erosion rate)	Moderate	Moderate	High	High	Low	Low	Moderate
Fishing	Moderate	Low	Low	0	0	0	High

Appendices

Appendix 1 Summary of parameters relating to morphological resources in legislation and in guidance and practice

Appendix 1A Summary of Parameters relating to Morphological Change described in Legislation

Legislation	**The Water Environment (Water Framework Directive) (England & Wales) Regulations 2003 (Annex V)**				
Responsible Body(ies)	Secretary of State National Assembly for Wales (delegated to the Environment Agency)				
Stakeholders	Director General of Water Services, Appropriate nature conservation bodies (JNCC, English Nature, Countryside Council for Wales) Relevant: local authorities, local planning authorities, water undertakers, sewerage undertakers, and as appropriate: National Park Authority, Harbour Authority, Navigation Authority, local fisheries committee "such persons as appear to the Agency .. (i) to be representative of the interests of those carrying on any business which relies on the water environment, (ii) to have an interest in the protection of the water environment (iii) to have an interest in the promotion of flood management such persons as (I) the Agency thinks fit (ii) the appropriate authority may direct the public				
Parameter	**Parameter Value**	**How Threshold is applied**	**Tools/Techniques used**	**Audit/control**	Geographic extent
Depth variation	Totally or nearly totally undisturbed	To define water body status			Transitional & Coastal Waters High status
Substrate conditions	Totally or nearly totally undisturbed	To define water body status			Transitional & Coastal Waters High status
Structure of seabed	Totally or nearly totally undisturbed	To define water body status			Coastal Waters High status
Structure and condition of intertidal zone	Totally or nearly totally undisturbed	To define water body status			Transitional & Coastal Waters High status

Legislation	**The Conservation (Habitats, &c) Regulations1994**				
Responsible Body(ies)	UK Government				
Stakeholders	English Nature, CCW, SNH and Environment and Heritage Service (Northern Ireland**).**				
Geographic Extent of Legislation	Land mass of England, Scotland and Wales out to the 12 nautical mile limit				
Parameter (of Morphological Relevance in the Marine environment only)	**Parameter Value**	**How Threshold Applied**	**Tools/Techniques used**	**Audit/Control**	**Geographic extent (of Parameter**
Geological or physiographical features (by reason of which the land is of special interest).	Whether an operation is likely to "damage" or have a "significant effect" on the site.	Appropriate assessment of the implications for the site in view of that site's conservation objectives.	Condition assessment by conservation bodies.	Expert advice is taken from the conservation bodies.	European sites, marine sites, SAC, SPA.

Legislation	**Food and Environmental Protection Act (FEPA) 1985**				
Responsible Body(ies)	DEFRA, NAW, FRS Marine Laboratory on behalf of Scottish Ministers, DoE NI				
Stakeholders	English Nature, CCW, SNH and Environment and Heritage Service (Northern Ireland), Landowners, Local Authority				
Geographic Extent of Legislation	MHWS (or MHW) extending to 'anywhere at Sea (i.e. beyond 200nms) jurisdiction beyond 200nms under the Continental Shelf Act, 1964.				
Parameter (of Morphological Relevance in the Marine environment only)	**Parameter Value**	**How Threshold Applied**	**Tools/Techniques used**	**Audit/Control**	**Geographic extent (of Parameter**
Nature, volume and size range of material disturbed.					As per legislation
Assessment of likely distribution of mobilised sediment.					

Legislation	**The Environmental Assessment of Plans and Programmes (Scotland) Regulations 2004**				
Responsible Body(ies)	any body or person exercising functions of a public character				
Stakeholders	the Scottish Ministers; the Scottish Environment Protection Agency; and Scottish Natural Heritage				
Geographic Extent of Legislation	Scotland only				
Parameter (of Morphological Relevance in the Marine environment only)	**Parameter Value**	**How Threshold Applied**	**Tools/Techniques used**	**Audit/Control**	**Geographic extent (of Parameter**
Significant environmental effect	- Risks…to the environment - Special natural characteristics - Value and vulnerability of area likely to be affected by….exceeded environmental quality standards or limit values	Determined by responsible body to decide whether EA is required			

Legislation	**The Environmental Assessment of Plans and Programmes Regulations 2004**				
Responsible Body(ies)	Authority by which or on whose behalf a plan is prepared				
Stakeholders	a) the Countryside Agency; (b) the Historic Buildings and Monuments Commission for England (English Heritage); (c) English Nature; and (d) the Environment Agency				
Geographic Extent of Legislation	England only (includes the territorial waters of the United Kingdom that are not part of Northern Ireland, Scotland or Wales, and waters in any area for the time being designated under section 17(1) of the Continental Shelf Act 1964)				
Parameter (of Morphological Relevance in the Marine environment only)	**Parameter Value**	**How Threshold Applied**	**Tools/Techniques used**	**Audit/Control**	**Geographic extent (of Parameter**
Significant environmental effect	- Risks…to the environment - Special natural characteristics - Value and vulnerability of area likely to be affected by….exceeded environmental quality standards or limit values	Determined by responsible body to decide whether EA is required			

Legislation	**Harbour Works (Environmental Impact Assessment) Regulations, 1999** **And** The Harbour Works (Environmental Impact Assessment) Regulations (Northern Ireland) 2003				
Responsible Body(ies)	Individual Harbour Authority Secretary of State for Environment, Food & Rural Affairs, NAW, DEFRA, Scottish Ministers				
Stakeholders	Individual Harbour Authority, Local Authority, English Nature, SNH, CCW, Environment Agency				
Geographic Extent of Legislation	Port or Harbour limits				
Parameter (of Morphological Relevance in the Marine environment only)	**Parameter Value**	**How Threshold Applied**	**Tools/Techniques used**	**Audit/Control**	**Geographic extent (of Parameter**
Proposed harbour works	- physical characteristics of the whole project and the land-use requirements - nature and quantity of the material used	- size of the project - cumulation with other projects - existing land use - relative abundance, quality and regenerative capacity of natural resources - absorption capacity of the natural environment - extent, transfrontier nature, magnitude and complexity, probability,duration, frequency and reversibility of the impact	Applicant submits an ES	Reviewed by responsible body and consultees. Decision is publicly reported	

Legislation	**Harbours Act, 1964 Act**				
Responsible Body(ies)	Individual Harbour Authority Secretary of State for Environment, Food & Rural Affairs, NAW, DEFRA, Scottish Ministers				
Stakeholders	Individual Harbour Authority, Local Authority, English Nature, Environment Agency				
Geographic Extent of Legislation	Port or Harbour limits				
Parameter (of Morphological Relevance in the Marine environment only)	**Parameter Value**	**How Threshold Applied**	**Tools/Techniques used**	**Audit/Control**	**Geographic extent (of Parameter**

Legislation	**Electricity Act 1989**				
Responsible Body(ies)	Secretary of State for the Environment				
Stakeholders					
Geographic Extent of Legislation					
Parameter (of Morphological Relevance in the Marine environment only)	**Parameter Value**	**How Threshold Applied**	**Tools/Techniques used**	**Audit/Control**	**Geographic extent (of Parameter**
Effect on the physical environment		Secretary of State and Director General have a duty to take into account… the effect on the physical environment of activities connected with the generation, transmission or supply of electricity			
Amenity of fisheries		Preservation of….			

Legislation	**The Transport and Works (Applications and Objections Procedure) (England and Wales) Rules 2000**				
Responsible Body(ies)					
Stakeholders					
Geographic Extent of Legislation	England & Wales				
Parameter (of Morphological Relevance in the Marine environment only)	**Parameter Value**	**How Threshold Applied**	**Tools/Techniques used**	**Audit/Control**	**Geographic extent (of Parameter**
	description of the aspects of the environment likely to be significantly affected by the proposed project, including, in particular, population, fauna, flora, soil, water, air, climatic factors, material assets, including the architectural and archaeological heritage, landscape				

Appendix 1B Summary of Parameters relating to Morphological Change found in Guidance and Practice

Legislation	**The Water Environment (Water Framework Directive) (England & Wales) Regulations 2003 (Article 5 characterisation UKTAG Guidance)**				
Responsible Body(ies)	As for WFD regulations				
Stakeholders	As for WFD regulations				
Parameter	**Parameter Value**	**How Threshold is applied**	**Tools/Techniques used**	**Audit/control**	Geographic extent
% of intertidal area affected by land claim	<5% - <15%	To define water body morphological status			Coastal & Transitional Waters
% bank/shoreline affected by Bank/shoreline reinforcement	<5% - <15%	To define water body morphological status			Coastal & Transitional Waters
% alteration of tidal range	Change from normal range	To define water body morphological status			Transitional Waters
% area affected by dredging	<5% - <15%	To define water body morphological status			Coastal & Transitional Waters
% area affected by deposition of dredged material	<5% - <15%	To define water body morphological status			Coastal & Transitional Waters
% area in which substratum structure changes as a result of deposition of dredged material	<5% - <15%	To define water body morphological status			Coastal & Transitional Waters
% channel affected by channel straightening	<5% - <15%	To define water body morphological status			Transitional Waters
%intertidal area lost as a result of impounding	<5% - <15%	To define water body morphological status			Transitional Waters
% area directly affected by presence of structures	<5% - <15%	To define water body morphological status			Coastal & Transitional Waters
Ratio of grazed/ungrazed areas	>90% - >70%	To define water body morphological status			Transitional Waters
Rate of sediment accretion vs historical rate	<10% - <15%	To define water body morphological status			Transitional Waters
% habitat lost due to smothering	<5% - <10%	To define water body morphological status			Transitional Waters
% bed affected by fishing	<5% - <15%	To define water body morphological status			Transitional Waters
Continuity of sediment transport process	Relative change vs existing situation	To define water body morphological status			Coastal Waters
% seabed affected by fishing	<5% - <15%	To define water body morphological status			Coastal & Transitional Waters

Legislation	**The Conservation (Natural Habitats, &c.) Regulations 1994 (Table assembled from Regulation 33 advice)**				
Responsible Body(ies)	UK Government				
Stakeholders	English Nature, CCW, SNH and Environment and Heritage Service (Northern Ireland**).**				
Geographic Extent of Legislation	Land mass of England, Scotland and Wales out to the 12 nautical mile limit				
Parameter (of Morphological Relevance in the Marine environment only)	**Parameter Value**	**How Threshold is applied**	**Tools/Techniques used**	**Audit/control**	Geographic extent (of Parameter)
Estuaries Physical Loss: Removal (land claim, coastal development) Smothering (disposal, coastal development) Physical Damage: Siltation (dredging, outfall discharge, coastal development) Abrasion (land-based recreation, coastal development, bait-digging) Extraction (aggregates)	Extent (Area in ha). Morphological equilibrium (Intra- and Inter estuarine Tidal Prism/Cross Section Ratio).	No decrease in extent from established baseline, subject to natural variation. TP/CS relationship should not deviate significantly from baseline, subject to natural variation.	Periodic site survey/inspection.	Consultation with Stakeholder (nature conservation).	MHWS to seaward limit of ‘transitional water’ within extent of designated site
Subtidal Sediment Communities Physical Loss: Removal (land claim, coastal development) Smothering (disposal, coastal development) Physical Damage: Siltation (dredging, outfall discharge, coastal development) Abrasion (land-based recreation, coastal development, bait-digging) Extraction (aggregates)	Extent (Area in ha). Range & distribution of characteristic biotopes.	No decrease in extent from established baseline, subject to natural variation. Range and distribution of habitats/communities should not deviate significantly from baseline, subject to natural variation.	Periodic site survey/inspection.	Consultation with Stakeholder (nature conservation).	MLWS to 12nms within extent of designated site
Annual vegetation of drift lines Physical Loss: Removal (land claim, coastal development) Smothering (disposal, coastal development) Physical Damage: Siltation (dredging, outfall discharge, coastal development) Abrasion (land-based recreation, coastal development, bait-digging) Extraction (aggregates)	Extent Mobility Coastal processes Substrate composition Species Composition	No decrease in linear extent of drift-lines and geomorphological features that support them. No increase in extent constraint from structures, landforms or operations from baseline. No change in net balanced sediment budget, subject to natural variation. Maintain substrate composition (sand and shingle with organic content) with sufficiently low anthropogenic disturbance to allow vegetation cycle. Drift-line organic material present along 10% of length surveyed; site-specific target should not deviate significantly from baseline, subject to natural variation Maintain presence and distribution of key species. Vegetated area should not be less than 10% of area that could be colonised. No significant deviation from baseline, subject to natural variation	Annual Site Survey/Inspection Identification of constraints during baseline survey Assessment of number & location of coastal defence operations within sediment cell influencing coastal processes (once per reporting cycle) Site survey/inspection. Site survey/inspection (once per reporting cycle).	Consultation with Stakeholder (nature conservation	MHWS to limit of HAT within extent of designated site
Perennial vegetation of stony banks Physical Loss: Removal (land claim, coastal development) Smothering (disposal, coastal development) Physical Damage: Siltation (dredging, outfall discharge, coastal development) Abrasion (land-based recreation, coastal development, bait-digging) Extraction (aggregates)	Extent Mobility Coastal processes Substrate composition Species Composition	No decrease in linear extent of drift-lines and geomorphological features that support them. No increase in extent constraint from structures, landforms or operations from baseline. No change in net balanced sediment budget, subject to natural variation. Maintain substrate composition (sand and shingle with organic content) Maintain presence and distribution of key species.	Periodic site survey/inspection	Consultation with Stakeholder (nature conservation).	MHWS to limit of supralittoral zone within extent of designated site
Saltmarsh *Physical Loss*: Removal (land claim, coastal development) Smothering (disposal, coastal development)	Distribution and Extent (Area in ha) Species composition Algal Mat cover (for *Salicornia* (Pioneer) Saltmarsh (Area and	No significant deviation from baseline, subject to natural variation. (in case of *Spartina anglica*, specifically **no increase**). No significant deviation in characteristic species’ presence and abundance from baseline, subject to natural variation. No increase in algal mat cover from baseline	Periodic site survey/inspection.	Consultation with Stakeholder (nature conservation	MHWS to MLWS within extent of designated site

Legislation	**The Conservation (Natural Habitats, &c.) Regulations 1994 (Table assembled from Regulation 33 advice)**				
Responsible Body(ies)	UK Government				
Stakeholders	English Nature, CCW, SNH and Environment and Heritage Service (Northern Ireland**).**				
Geographic Extent of Legislation	Land mass of England, Scotland and Wales out to the 12 nautical mile limit				
Parameter (of Morphological Relevance in the Marine environment only)	**Parameter Value**	**How Threshold is applied**	**Tools/Techniques used**	**Audit/control**	Geographic extent (of Parameter)
Physical Damage: Siltation (dredging, outfall discharge, coastal development) Abrasion (land-based recreation, coastal development, bait-digging) Extraction (aggregates)	thickness)				
Intertidal Sand and Mud Flat *Physical Loss*: Removal (land claim, coastal development) Smothering (disposal, coastal development) *Physical Damage*: Siltation (dredging, outfall discharge, coastal development) Abrasion (land-based recreation, coastal development, bait-digging) Extraction (aggregates)	Extent (Area in ha) Topography Cover by algal mats Sediment Character Range & distribution of characteristic biotopes Extent of *Zostera* beds (Area m^2)	No decrease in extent from baseline, subject to natural variation. Shore profile should not deviate significantly from baseline, subject to natural change No increase in extent, subject to natural variation. Average particle size parameters, organic content, depth of RPD layer and penetrability should not deviate from baseline, subject to natural variation. Range and distribution of biotopes should not deviate significantly from baseline, subject to natural variation. Range and distribution should not deviate significantly from baseline, subject to natural variation	Periodic site survey/inspection	Consultation with Stakeholder (nature conservation).	MHWS to MLWS within extent of designated site
Intertidal mixed sediment communities *Physical Loss*: Removal (land claim, coastal development) Smothering (disposal, coastal development) *Physical Damage*: Siltation (dredging, outfall discharge, coastal development) Abrasion (land-based recreation, coastal development, bait-digging) Extraction (aggregates)	Range and distribution	Range and distribution should not deviate significantly from baseline, subject to natural variation	Periodic site survey/inspection	Consultation with Stakeholder (nature conservation	MHWS to MLWS within extent of designated site
Subtidal Sandbanks *Physical Loss*: Removal (land claim, coastal development) Smothering (disposal, coastal development) *Physical Damage*: Siltation (dredging, outfall discharge, coastal development) Abrasion (land-based recreation, coastal development, bait-digging) Extraction (aggregates)	Extent (Area in ha) Topography Sediment Character Range & distribution of characteristic biotopes Extent of *Zostera* beds (Area in ha)	No decrease in extent from baseline, subject to natural variation. Depth should not deviate significantly from baseline, subject to natural change. Average particle size parameters should not deviate from baseline, subject to natural variation. Range and distribution of biotopes should not deviate significantly from baseline, subject to natural variation. No decrease in extent from baseline, subject to natural variation	Periodic site survey/inspection	Consultation with Stakeholder (nature conservation	MLWS to extent of designated site
Reefs *Physical Loss*: Removal (land claim, coastal development) Smothering (disposal, coastal development) *Physical Damage*: Siltation (dredging, outfall discharge, coastal development) Abrasion (land-based recreation, coastal development, bait-digging) Extraction (aggregates)	Extent Range and distribution of characteristic species	No decrease in extent from an established baseline, subject to natural change. No deviation in characteristic species occurrence or abundance from baseline, subject to natural variation	Periodic site survey/inspection	Consultation with Stakeholder (nature conservation).	MHWS to extent of designated site
Coastal Lagoons *Physical Loss*: Removal (land claim, coastal development) Smothering (disposal, coastal development) *Physical Damage*: Siltation (dredging, outfall discharge, coastal development) Abrasion (land-based recreation, coastal development, bait-digging) Extraction (aggregates)	1. Extent Area (ha) of lagoon basin, 2. Characteristic Species	1. No decrease in extent from an established baseline, subject to natural change 2. No deviation in characteristic species occurrence or abundance from baseline, subject to natural variation.	Periodic site survey/inspection	Consultation with Stakeholder (nature conservation	Guideline geogr. extent; Midshore to MHWS within extent of designated site

Note: There are areas for which Reg 33 advice has been published where specific areas (ha or m^2) are reported for, for example, current extent of saltmarsh;, in such cases, 'no decrease' type statements will refer to reductions against these specific area estimates. Sand dune systems have not been included as they occur above HAT

Legislation	**Food and Environmental Protection Act (FEPA) 1985**				
Responsible Body(ies)	DEFRA, NAW, FRS Marine Laboratory on behalf of Scottish Ministers, DoE NI				
Stakeholders	English Nature, CCW, SNH and Environment and Heritage Service (Northern Ireland), Landowners, Local Authority				
Geographic Extent of Legislation	MHWS (or MHW) extending to 'anywhere at Sea (i.e. beyond 200nms) jurisdiction beyond 200nms under the Continental Shelf Act, 1964.				
Parameter (of Morphological Relevance in the Marine environment only)	**Parameter Value**	**How Threshold Applied**	**Tools/Techniques used**	**Audit/Control**	**Geographic extent (of Parameter**
Increase in Depth/Alteration of seabed profile Maintenance Dredging of navigation channels Maintenance Dredging of berths Capital Dredging for deepening/enlargement of existing channel or Port areas (or creation of new ones)	Nature, volume and size range of material disturbed. Assessment of likely distribution of mobilised sediment.)	Assessment of the acceptability of works in specific area – physical attributes of seabed disturbed and determination of potential impacts	Geotechnical Survey and/or Seabed sampling & analysis.	Consultation Application of licence conditions, eg bathymetric/SSS surveys to determine extent of scour around new structures; monitoring of effects through seabed sampling	As per legislation
Temporary Increase in Depth/Alteration in seabed profile Capital Dredging for laying of pipelines /cables	Nature, volume and size range of material disturbed. Assessment of likely distribution of mobilised sediment.	Assessment of the acceptability of works in specific area – physical attributes of seabed disturbed and determination of potential impacts	Site specific assessment Seabed sampling, modelling	Consultation Application of licence conditions, eg requirement for surveys to validate sediment dispersion as predicted during modelling; .monitoring of effects through seabed sampling	As per legislation
Alteration of seabed profile Placement of structure on seabed (eg Outfall Pipeline & diffuser section)	Nature, volume and size range of material removed and reused as backfill, volume and fate of surplus excavated material Nature & dimensions of structures, materials used	Assessment of the acceptability of works in specific area – physical attributes of seabed disturbed and determination of potential impacts. Determination of hydrological or geomorphological effects of structure on seabed.	Site specific assessment Seabed sampling, modelling,	Consultation Issuing of licence conditions, eg bathymetric/SSS surveys to determine extent of scour around new structures; monitoring of effects of any sediment transport through seabed sampling; timing of works	As per legislation
Temporary Decrease in Depth/Alteration of seabed profile temporary stockpiling /sidecasting of materials during 'construction'	Nature, volume and size range of excavated materials and materials removed for reinstatement or materials imported to site for subsequent use which require temporary placement on the seabed	Assessment of the acceptability of works in specific area – physical attributes of seabed used for placement and materials stockpiled. Determination of potential impacts	Geotechnical Survey and/or Seabed sampling & analysis	Consultation Application of licence conditions, eg requirement for seabed re-instatement following completion of construction scheme. Surveys to validate seabed condition post-construction. Monitoring of effects through seabed sampling	As per legislation
Alteration of shore profile Reclamation Below the Tidal Level of Mean High Water Springs (progressive tipping) Reclamation Below the Tidal Level of Mean High Water Springs Behind a Temporary or Permanent Barrier (Beneficial Use)	Reclamation using inert natural materials or selected waste materials that contain significant quantities of fines may be permitted, providing the material is used to backfill behind an impermeable barrier constructed at the seaward face of the works	Acceptability of dredged material – physical attributes Determination of impacts Normally only be permitted if the works are undertaken using inert natural materials such as quarried rock or dredged aggregate. The inert materials used for infill should normally have a minimum particle size of 2 mm. However, the size range of acceptable infill will depend, to a great extent, upon the local conditions (eg topography and hydrography).	Seabed sampling & analysis. Topographic (shoreline) profiles.	Application of licence conditions, eg bathymetric/SSS surveys to determine extent of scour around new structures; monitoring of effects through seabed sampling The seaward face of the reclaimed area must be protected to an appropriate tidal level, to prevent relocation, or wash-out, of the infill Monitoring of effects Barriers should be constructed to an appropriate tidal level, and designed to prevent relocation, or wash-out, of the backfill. Bunds may be used to create the permanent barrier at the seaward limit of the reclamation works. The seaward face of the bund may need to be protected using appropriate materials, such as quarried rock armouring or prefabricated concrete units. Protection of the seaward face of the bund will not normally be permitted using waste materials Bund cores are normally constructed using inert natural materials such as quarried rock or dredged aggregate (nominal minimum particle size 2 mm	As per legislation
Alteration of shore profile **Beach Nourishment** (Beneficial Use)	Nature, volume, size range (mm) and composition of beach replenishment/nourishment material Description of general area, distinguishing features such as sand dunes, outcrops, rock pools, etc	Confirmation, preferably supported by Particle Size Analysis data, that material to be removed is comparable with the material within the area of deposition	Sampling of sediment	Application of licence conditions, eg bathymetric/SSS surveys to determine extent of scour around new structures; monitoring of effects through seabed sampling	As per legislation

Legislation	**Harbour Works (Environmental Impact Assessment) Regulations, 1999**				
Responsible Body(ies)	Individual Harbour Authority Secretary of State for Environment, Food & Rural Affairs, NAW, DEFRA, Scottish Ministers				
Stakeholders	Individual Harbour Authority, Local Authority, English Nature, SNH, CCW, Environment Agency				
Geographic Extent of Legislation	Port or Harbour limits				
Parameter (of Morphological Relevance in the Marine environment only)	**Parameter Value**	**How Threshold Applied**	**Tools/Techniques used**	**Audit/Control**	**Geographic Extent**
Alteration of seabed profile Construction of Port infrastructure falling under Annex I developments (as defined in directive 85/337/EEC and 97/11/EC) .	Through construction of Trading ports, piers for loading and unloading connected to land and outside ports (excluding ferry piers) which can take vessels of over 1,350 tonnes	Annex I project – EIA requirement automatic. Assessment of nature, size and/or location of development. Determination of impacts.	Consultation, sampling, assessment, predictive modelling	Consultation, monitoring of effects.	Port or Harbour Limits
Alteration of shoreline Reclamation of land from the sea.	No threshold – all projects require assessment (EIA).	EIA requirement automatic. Assessment of nature, size and/or location of development. Determination of impacts.	Consultation, sampling, assessment, predictive modelling	Consultation, monitoring of effects	
Increase in Depth/Alteration of seabed profile Maintenance Dredging of navigation channels Maintenance Dredging of berths **Capital Dredging for deepening/enlargement of existing channel or Port areas**	No Thresholds, though consideration must be given to the dredging and disposal of the excavated material, with disposal requirement likely to be governed under FEPA.	Site-specific, though likely to involve assessment of the acceptability of works – physical attributes of seabed disturbed and determination of potential impacts	Geotechnical Survey and/or Seabed sampling & analysis	Consultation, monitoring of effects	
Alteration of seabed profile Construction of harbours and port installations including fishing harbours (unless included in Annex 1); and Marinas	The area of the works exceeds 1 hectare OR the works are undertaken within a 'sensitive' area**.**	Assessment of nature, size and/or location of development. Determination of impacts.	Consultation, sampling, assessment, predictive modelling	Consultation, monitoring of effects	
Alteration of shore profile Coastal work to combat erosion and maritime works capable of altering the coast through the construction, for example, of dykes, moles, jetties and other sea defence works, excluding the maintenance and reconstruction of suh works.	No threshold – all projects require assessment (EIA).	EIA requirement automatic. Assessment of nature, size and/or location of development. Determination of impacts.	Consultation, sampling, assessment, predictive modelling	Consultation, monitoring of effects	

Legislation	**Harbours Act, 1964 (and various specific (often historic) Acts for individual Harbours**				
Responsible Body(ies)	Individual Harbour Authority Secretary of State for Environment, Food & Rural Affairs, NAW, DEFRA, Scottish Ministers				
Stakeholders	Individual Harbour Authority, Local Authority, English Nature, Environment Agency				
Geographic Extent of Legislation	Port or Harbour limits				
Parameter (of Morphological Relevance in the Marine environment only)	**Parameter Value**	**How Threshold Applied**	**Tools/Techniques used**	**Audit/Control**	**Geographic extent (of Parameter**
Increase in Depth/Alteration of seabed profile Maintenance Dredging of navigation channels Maintenance Dredging of berths Capital Dredging for deepening/enlargement of existing channel or Port areas (or creation of new ones)	Harbour authority consents work, no stipulated parameters, although Port may have a 'duty of care' for impacts under other legislation. If works require disposal of material or seabed disturbance outside port boundaries, other legislation (eg FEPA) will apply.	None	None beyond any potential impacts occurring outside Port boundaries which could require consideration under other legislative tools.	Consultation within the Port & with for example English Nature to address potential impacts occurring to any features of importance within the Port boundaries, as well as beyond these limits which may require consideration under other legislative tools.	Within Harbour Limits
Alteration of seabed profile Placement of structure on seabed (eg piers, jetties etc)	Harbour authority consents work, no stipulated parameters, although Port may have a 'duty of care' for impacts under other legislation.	None	Site specific assessment Seabed sampling, modelling,	Consultation within the Port & with for example English Nature to address potential impacts occurring to any features of importance within the Port boundaries, as well as beyond these limits which may require consideration under other legislative tools.	Within Harbour Limits
Temporary Decrease in Depth/Alteration of seabed profile temporary stockpiling /sidecasting of materials during 'construction'	Harbour authority consents work, no stipulated parameters, although Port may have a 'duty of care' for impacts under other legislation.	None	Site specific assessment Seabed sampling, modelling,	Consultation within the Port & with for example English Nature to address potential impacts occurring to any features of importance within the Port boundaries, as well as beyond these limits which may require consideration under other legislative tools.	Within Harbour Limits

Legislation	**The Wildlife & Countryside Act, 1981**				
Responsible Body(ies)	English Nature, CCW, SNH (though excluded from CROW amendments of Section 28)				
Stakeholders	Landowners (and occupant), Local Authority				
Geographic Extent of Legislation	Land Mass of England, Wales & Scotland to limit of territorial waters (3nms) note: historically assumed that legislation extent limited to areas above MLWS, but recent developments have disproved this assumption (eg Humber Estuary SSSI designation). Designations in NI governed under separate legislation (Nature Conservation and Amenity Lands (Northern Ireland) Order, 1985 (amended 1989) and SI 2002/3153 Environment (Northern Ireland) Order 2002.				
Parameter (of Morphological Relevance in the Marine environment only)	**Parameter Value**	**How Threshold Applied**	**Tools/Techniques used**	**Audit/Control**	**Geographic extent (of Parameter**
Alteration of shore/ seabed profile **Dumping, Spreading or Discharge of any materials**	No thresholds, site-specific assessment	Site-specific assessment*	Consultation, potentially site survey	Consultation, potentially monitoring of impacts	Within designated site boundaries
Alteration of shore/ seabed profile **Infilling or digging of pools, marshes or pits**	No thresholds, site-specific assessment	Site-specific assessment*	Consultation, potentially site survey	Consultation, potentially monitoring of impacts	Within designated site boundaries
Alteration of shore/ seabed profile **Reclamation of land from sea, estuary or marsh**	No thresholds, site-specific assessment	Site-specific assessment*	Consultation, potentially site survey	Consultation, potentially monitoring of impacts	Within designated site boundaries
Alteration of shore/ seabed profile **Bait digging**	No thresholds, site-specific assessment	Site-specific assessment*	Consultation, potentially site survey	Consultation, potentially monitoring of impacts	Within designated site boundaries
Alteration of shore profile **Erection of sea defences**	No thresholds, site-specific assessment	Site-specific assessment*	Consultation, potentially site survey	Consultation, potentially monitoring of impacts	Within designated site boundaries
Alteration of shore/ seabed profile **Extraction of minerals**	No thresholds, site-specific assessment	Site-specific assessment*	Consultation, potentially site survey	Consultation, potentially monitoring of impacts	Within designated site boundaries
Alteration of shore/ seabed profile **Erection of permanent or temporary structures or undertaking of engineering works, including drilling**	No thresholds, site-specific assessment	Site-specific assessment*	Consultation, potentially site survey	Consultation, potentially monitoring of impacts	Within designated site boundaries
Alteration of shore/ seabed profile **Modification of natural or man-made features and clearance of boulders, large stones, loose rock and battering, buttressing or grading of geological exposures and cuttings and infilling of pits and quarries.**	No thresholds, site-specific assessment	Site-specific assessment*	Consultation, potentially site survey	Consultation, potentially monitoring of impacts	Within designated site boundaries

Appendix 1C Summary of Parameters relating to Morphological Change found in Guidance Notes

Document	Comment	Reviewed Y/N	Table in App 1
The Conservation (Natural Habitats, &c.) Regulations 1994 **Regulation 33 advice**)	Comprehensive list of criteria for physical loss and physical damage – see separate table.	Y	Y
FEPA Part II FEES FOR LICENCES TO DEPOSIT MATERIALS AT SEA - Consultation Paper (from FRS Marine Laboratory)	Applications for licences are assessed on the basis of Scientists at the FRS Marine Laboratory undertaking a multi-discipline assessment of proposals to determine whether there are likely to be adverse effects on the marine environment, the living resources it supports, or other legitimate users of the sea. Particular regard is paid to schemes proposed in areas designated as being of scientific or conservation importance and where there is a likelihood of interference with commercial fishing interests including fish farms. For disposal applications, assessment takes account of the type and quantity of material, its physical and chemical composition, the method of disposal and characteristics of the disposal site; the latter include hydrography, bathymetry, potential for relocation of deposited materials, biology of the area and commercial fishing interests	Y	Key info
FEPA Part II – MARINE ACTIVITIES REQUIRING A LICENCE FROM THE FRS MARINE LABORATORY, ABERDEEN	Advice states the following type of information is to be provided, but gives no criteria on which any assessment is based • Weight of metal or timber in tonnes. • Volume (m^3) and diameter (mm) of stone, rock, gravel, etc. • Nature, length (m) and diameter (mm) of pipes. • Number and dimensions (m) of concrete blocks, gabion baskets and mattresses. • Nature, volume, size range (mm) and composition of dredged spoil, reclamation, beach replenishment/nourishment, infill and backfill material. • Quantity (m^2) of geotextile or filter fabric	Y	
FEPA Part II -SEA DISPOSAL OPERATIONS (from FRS Marine Laboratory)	These require a BPEO (see below) and needs to describe the “environmental impact” – NO definitive criteria	Y	
FEPA Part II- BEST PRACTICABLE ENVIRONMENTAL OPTION (BPEO) ASSESSMENT: SEA DISPOSAL OF BULKY WASTES (from FRS Marine Laboratory)	Only advises that “general ecological implications” should be considered	Y	
FEPA Part II - BEST PRACTICABLE ENVIRONMENTAL OPTION (BPEO) ASSESSMENT: SEA DISPOSAL OF SOLID MATERIALS (from FRS Marine Laboratory)	Only advises that “general ecological implications” should be considered	Y	
FEPA Part II - BEST PRACTICABLE ENVIRONMENTAL OPTION (BPEO) ASSESSMENT: SEA DISPOSAL OF FISH AND SHELLFISH WASTES (from FRS Marine Laboratory)	Only advises that “general ecological implications” should be considered	Y	
FEPA Part II - BEST PRACTICABLE ENVIRONMENTAL OPTION (BPEO) ASSESSMENT: SEA DISPOSAL OF LIQUID MATERIALS (from FRS Marine Laboratory)	Only advises that “general ecological implications” should be considered	Y	
FEPA Part II - BEST PRACTICABLE ENVIRONMENTAL OPTION (BPEO) ASSESSMENT: TEMPORARY DEPOSIT OF SOLID MATERIALS (from FRS Marine Laboratory)	Only advises that “general ecological implications” should be considered	Y	
FEPA Part II - GUIDELINES FOR THE RECLAMATION OF AREAS OF THE SEA BED (from FRS Marine Laboratory)	No morphological references	Y	

Document	Comment	Reviewed Y/N	Table in App 1
FEPA Part II **SUPPLEMENTARY INFORMATION REQUIRED TO SUPPORT AN APPLICATION TO UNDERTAKE RECLAMATION WORK** (from FRS Marine Laboratory)	Not clear how this relates to the above guidelines, but has no relevant info	Y	
FEPA Part II - SUPPLEMENTARY INFORMATION REQUIRED TO SUPPORT A SEA OUTFALL CONSTRUCTION LICENCE APPLICATION FOR DIRECTIONALLY DRILLED INSTALLATION (from FRS Marine Laboratory)	Nature volume and size range of material to be deposited/removed – to be identified in application – no limits set For anti scour mats – nature, dimension and quantity to be deposited – to be identified – no limits set	Y	
FEPA Part II **SUPPLEMENTARY INFORMATION REQUIRED TO SUPPORT AN APPLICATION TO UNDERTAKE RECLAMATION WORK** (from FRS Marine Laboratory)	Nature, volume, size range and in some cases dimensions of reclamation are required – no limits set	Y	
FEPA Part II **BEACH REPLENISHMENT/NOURISHMENT WORKS** (from FRS Marine Laboratory)	Licence requires information on • Nature, volume, size range (mm) and composition of beach replenishment/nourishment material. • Description of general area, distinguishing features such as sand dunes, outcrops, rock pools, etc • Description of past dredging activities, details to include: quantities and nature of material removed and deposited, dates of removal operations and how the work was undertaken Only criteria expressed is "Confirmation, preferably supported by Particle Size Analysis data, that material to be removed is comparable with the material within the area of deposition"	Y	
FEPA Part II **SUPPLEMENTARY INFORMATION REQUIRED TO SUPPORT AN APPLICATION TO UNDERTAKE COAST PROTECTION WORK** (from FRS Marine Laboratory)	Nature volume and size range of material to be used – to be identified in application – no limits set, but encouragement to use "existing material"	Y	
FEPA Part II **MARINE BLASTING OPERATIONS** (from FRS Marine Laboratory)	FRS undertakes "desk assessment "on impact of blasting on marine fisheries. Considers topography, type and structure of the rock formation, average water depths. FRS also comments on potential environmental impacts associated with blasting, and notes mentions Disturbance and damage to benthic and shore habitats and, cetaceans and seals; disturbance and mobilisation of anoxic water/sediment; increased suspended solids; alterations to the bathymetry and hydrography; and noise and vibration – but gives no values	Y	
FEPA Part II MARINE CONSTRUCTION WORKS (SEA OUTFALLS) (from FRS Marine Laboratory)	No relevant criteria	Y	
Guidance Letter on Cable Installation (supplied by FRS Marine Laboratory)	FRS Marine Laboratory (FEPA Disposals at Sea regulator in Scotland) does not require FEPA except for deposition of material to protect cables or if cable is trenched. So no real morphological criteria	Y	

Document	Comment	Reviewed Y/N	Table in App 1
Guidance note for Environmental Impact Assessment In respect of FEPA and CPA requirements – Offshore Windfarms (from CEFAS) (2004).	All wind farm developments are considered on a site-specific basis and no actual thresholds are detailed. However morphological impact considerations are required including: Assessment of the magnitude and significance of impacts on sediments (composition, geochemical properties, contaminants, particle size); Hydrodynamics (eg waves, tidal flows); sedimentary environment (e.g. sediment re-suspension, sediment transport pathways, patterns and rates, and sediment deposition); sedimentary structures (e.g. channels, banks, large-scale bedforms, bioturbation, depth of mixed layers); and suspended sediment concentrations. Specifically, the assessment must include a description of baseline against which assessment of effects (eg increased scour, changes in depth profiles etc) may be made. This baseline description includes the identification of the processes controlling temporal and spatial morphological change (e.g. longevity and stability of bedforms), the identification of sediment sources, pathways and sinks, and quantification of transport fluxes; Identification of the inherited geological, geophysical, geotechnical and geochemical properties of the sediments at the site, and the depth of any sediment strata.		
Draft Revised OSPAR Guidelines for the Management of Dredged Material Ref: BDC 04/5/13-E (L)	Assessment of the need for dredging (capital, maintenance or 'clean-up' dredging works). The guidelines in particular address the disposal of dredged material by dumping in the maritime area and the relocation of sediments, due to hydrodynamic and sidecast dredging as well as its subsequent deposition. Morphological criteria include Physical characterisation of the dredged material·(grain size, percent solids (dry matter), density/specific gravity, organic matter), and various criteria attached to the identified disposal site including; physical nature of the seabed (eg topography) to determine the transport and fate of the disposed material i.e. is the area a retentive or a dispersive site. If the latter, assessment of the extent of the area likely to be altered directly by the disposal operation and the likely extent of long-term transport of material from this area and what this flux represents in relation to existing transport fluxes in the area. No actual thresholds cited, although it is stated that 'The infilling of depressions, deliberate capping or other contained methods of disposal of dredged material deposits may be appropriate in certain circumstances to avoid interference with fishing or other legitimate activities'.		
SPECIFIC GUIDELINES FOR ASSESSMENT OF DREDGED MATERIAL (under the purview of the London Convention 1972 and the 1996 Protocol) From CEFAS	Same criteria as OSPAR guidelines above in terms of morphological impact considerations related to the nature of the material dredged and the nature of the seabed and properties of the disposal site. Required information includes the nature of the seabed, its topography, geological characteristics, its biological composition and activity, and prior dumping activities affecting the area; the physical nature of the water column, including temperature, depth, possible existence of a thermocline/pycnocline and how it varies in depth with season and weather conditions, tidal period and orientation of the tidal ellipse, mean direction and velocity of the surface and bottom drifts, velocities of storm-wave induced bottom currents, general wind and wave characteristics, and the average number of storm days per year, suspended matter; and the chemical and biological nature of the water column. Specific morphological issues noted in the guidelines include the shoreline and the capacity of the dumpsite to contain the bulk of the material disposed (determination of retentive/dispersive nature). No actual thresholds are set, though in cases where it is predicted that dumping will substantially augment existing fluxes associated with natural processes, dumping at the site under consideration should be deemed inadvisable.		
Minimizing Impacts of Maintenance Dredged Material Disposal in the Coastal Environment: A Habitat Approach. (BOLAM & REES 2003) CEFAS	Deals with benthic response to dredged material disposal. No thresholds set, though effects on benthic communities are lower in areas subject to natural disturbance regimes with longer recovery periods in stable seabed areas. Suggestions for 'Best Practice' made in terms of consideration of benthic community in addition to physico-chemical parameters in dredge site selection.		
Maintenance dredging and the Habitats Regulations, 1994. A draft conservation assessment protocol. MCEU 2003	Details need for provision of a 'baseline Document' with details of need, volumes, frequencies and duration of dredging, together with locations, methods, dredge material characterisation, dredging history and disposal, previously imposed monitoring requirements, beneficial use and sediment cell maintenance schemes. This provides a background for subsequent monitoring and assessment. No thresholds given.		
AE1224 – The Ecosystem Effects of Sediment Disturbance: Development and application of a GIS based disturbance impact assessment tool. Parker *et al*, 2004. CEFAS.	Provides a comparison between natural and anthropogenic (trawling, aggregate dredging, spoil disposal, dredging, construction) impacts on the seabed. The paper discusses the use of GIS based disturbance information and impact models for impact assessment. No relevant thresholds given for assessment of morphological change.		

Appendix 2 Assessment of sensitivity of habitats and other biological or ecological elements to hydromorphological pressures

Assessment of sensitivity of habitats to physical changes with estimated confidence in that assessment

	Intertidal Mudflat/ Sandflat		Subtidal Mudflat/ Sandflat		Intertidal Coarse sediment Shores		Subtidal Coarse sediment Shores		Pioneer Saltmarsh		Mature Saltmarsh		Eelgrass		Macroalgae	
	Sensitivity	Confidence	Sensitivity	Confidence	Sensitivity	Confidence	Sensitivity	Confidence	Sensitivity	Confidence	Sensitivity	Confidence	Sensitivity	Confidence	Sensitivity	Confidence
Substratum loss	Moderate	High	Moderate	Moderate	Low	Moderate	Moderate	High	High	Very low	Moderate	High	High	High	Moderate	High
Deposition/ Smothering	Low	Moderate	Very Low	High	Low	Moderate	Very Low	Low	Low	Very Low	Very Low	Moderate	High	High	Low	Low
Changes in suspended sediment concentrations	Moderate	Moderate	Very Low	Moderate	Very Low	Very Low	Low	Low	Moderate	Low	Moderate	Moderate	Moderate	High	Low	Low
Change in emergence regime	Moderate	High	Not Relevant	Not Relevant	Low	Low	Not Relevant	Not Relevant	Moderate	Moderate	Low	Moderate	Moderate	Low	Low	Moderate
Change in water flow rate	Moderate	High	Moderate	Moderate	Low	Low	Low	Low	Moderate	Low	Moderate	Low	Moderate	Low	Low	Moderate
Change in wave exposure	Moderate	Moderate	Moderate	Moderate	Low	Low	Low	Low	Moderate	Low	Low	Low	Very High	Low	Moderate	Moderate
Abrasion and physical presence	Low	Low	Low	Moderate	Low	Moderate	Low	Moderate	Low	Very Low	Low	Low	Moderate	Moderate	Low	Low

Sensitivity of fish and phytoplankton has been inferred from existing knowledge and judgement - it has not been derived from Marlin.

	Fish in Transitional Waters		Phytoplankton	
	Sensitivity	Confidence	Sensitivity	Confidence
Substratum loss	Low (To High)	Low	Low	Low
Deposition/ Smothering	Low (To High)	Low	Low	Low
Changes in suspended sediment concentrations	Moderate	Low	Moderate	Moderate
Change in emergence regime	Low (To High)	Low	Low	Low
Change in water flow rate	Low	Low	Moderate	Low
Change in wave exposure	Low	Low	Low	Low
Abrasion and physical presence	Low	Low	Low	Low

Summary of implications of morphological change on ecological parameters

Morphological Change	**Ecological consequences**	**Things to consider when assessing sensitivity**
Substratum Loss	Direct removal of habitat and associated species, resulting in a change in habitat extent and species composition. Indirect consequences on food availability for birds (where losses are from intertidal) and fish. Consequential changes in composition, density and abundance of phytoplankton and fish.	Proportion and type of habitat removed. Initial extent of habitat. Functionality of habitat. Species diversity and composition in area lost. Recoverability.
Deposition	Can result in smothering of intertidal and subtidal species. This can affect both plant and animal species, resulting in stress, reduced growth/ reproduction rates and death in extreme instances. Can smother eggs and larvae of fish and other marine animals. Change in sediment characteristics can affect community types.	Rate and duration of deposition and ultimately the depth of material. Sediment type that is being deposited and at the receptor site. Sensitivity and recoverability of receptor site and associated species. Area of impact. Natural variability. Relative change in water depth.
Changes in suspended sediment concentration	Changes in suspended sediment concentration can affect light penetration which can lead to changes in algal zonation and/ or the loss of some species. Can reduce algal productivity. Can clog respiratory / feeding apparatus of some intertidal invertebrates. Elevated concentrations of suspended sediment in the water column have the potential to interfere with fish respiration and impair osmoregulatory function. Can result in fish avoidance of the affected area.	Sensitivity of receptor. Relative increase in relation to background variation. Duration of change. Recoverability.
Change in emergence regime	Inundation period - affects distributions of invertebrates, macroalgae, saltmarsh, eelgrass, resulting in changes in extent. Can result in a shift in habitat type and extent e.g. mudflat to saltmarsh. Associated changes with species composition. May affect duration of exposure and subsequent feeding times for birds and fish. Consequential changes in composition, density and abundance of phytoplankton and fish.	Relative change in emergence regime. Sensitivity of species present to changes in inundation period. Background variation. Recoverability.
Change in water flow rate	This can cause changes in bed form depending on the extent of the changes and the nature (hardness) of the bed. Areas of enhanced accretion will potentially experience the same consequences as described under the heading of deposition. Areas of enhanced erosion will potentially experience the same consequences as described under the heading of substratum loss. Areas of enhanced erosion may support less diverse and abundant biological communities/ habitats.	Erosion thresholds of substrate. Sediment types. Sensitivity of receptor site and associated species. Natural variability. Relative rates of change. Duration of change. Recoverability.

Morphological Change	Ecological consequences	Things to consider when assessing sensitivity
Change in wave exposure	Animals and plants can be directly removed from the substratum. Can result in erosion of the substratum and associated species. Change in sediment characteristics can affect habitat types and result in a shift in species composition. Can cause morphological changes in a number of organisms.	Sensitivity of receptor site and associated species. Natural variability. Relative rates of change. Duration of change. Recoverability.
Abrasion and physical presence	Change in habitat extent. Disturbance to habitats and species which can have a positive or negative effect depending on the degree of exposure and relative sensitivity. Can result in a shift in species composition.	Rate and extent of disturbance. Sensitivity of receptor. Proportion of habitat area affected. Recoverability.

Ecological Sensitivity

In relation to sensitivity - sensitivity has been defined as the intolerance of a habitat, community or individual (or individual colony) of a species to damage, or death, from an external factor (Hiscock, 1996)

Sensitivity assessments made in Regulation 33 Advice are based primarily upon a number of UK Marine SACs Life Project Task Reports (Davison & Hughes, 1998; Elliott et al, 1998; Cole et al, 1999; ABP, 1999; Fowler, 1999; Gubbay & Knapman, 1999; Jones et al, 2000).

Appendix 3 Specific pressures on the morphology of coastal and transitional waters

Morphological pressures on transitional and coastal water bodies have been identified in UKTAG Guidance. Morphological changes that may arise as a result of these pressures can be summarised under a number of subheadings. Pressures that result in each of these types of changes are identified below.

Coastal and Transitional Waters	**Morphological Change - Direct & Indirect**						
	Substratum Loss (Removal/ direct damage to substrate)	**Deposition/ Smothering (Siltation Rate)**	**Changes in suspended sediment concentration**	**Changes in emergence regime**	**Change in water flow rate (currents)**	**Change in wave exposure**	**Abrasion and physical presence (1)**
Land claim	H (2)	H (3)	H (4)	H (5)	H (6)	H (7)	0
Bank reinforcement (8)	H (9)	M (10)	M (11)	H (12)	L (13)	L (14)	0
Tidal river resectioning	This is not clearly applicable to transitional waters. Where it applies to transitional waters the morphological change will be as for tidal river channelisation/ realignment/ straightening						
Channel or offshore dredging	H (16)	H (17)	H (17)	H (18)	H (19)	H (20)	H (21)
Deposition of (dredged) material (assumed subtidal)	H (22)	H (23)	H (24)	0	H (25)	H (26)	H (27)
Tidal river channelisation/ realignment/ straightening	H (28)	H (28)	H (28)	H (28)	H (28)	H (28)	H (28)
Flow manipulation	H (29)	H (29)	H (29)	H (29)	H (29)	L (30)	0
Impounding	H (31)	H (31)	H (31)	H (31)	H (31)	H (31)	0
Construction e.g. jetties	H (32)	H (33)	H (34)	H (35)	H (36)	H (37)	H (38)
Intensive use e.g. shell-fisheries	H (39)	M (40)	M (41)	M (42)	M (43)	M (44)	H (45)
Manipulation of sediment transport *(e.g. groynes, breakwaters)*	M (46)	H (47)	M (48)	H (49)	H (50)	H (51)	L (52)
Modifications to sediment regime (e.g. intertidal recharge, changes in soft cliff erosion rate)	M (53)	M (54)	H (55)	H(56)	L (57)	L (58)	M (59)
Fishing	M (60)	L (61)	L (62)	0	0	0	H (63)

The above table indicates the highest ranking of potential effects for each “Pressure” on each type of “Morphological change”, i.e. taking a precautionary standpoint. The notes for most table entries explain the likely effects of the “Pressures” on the hydro-morphology of a coastal water body. H = High, M = Moderate, L = Low, 0 = No effect.

Such “Pressures” may be long-term, recur regularly or only occur for a short time depending on the particular activities involved. Further, the effects on the water body will depend upon the scale of the “pressure”. This can usually be expressed in terms of an “area” or a “length” and hence related to the total “area” or “length (of shoreline)” for each coastal water body. Such an approach, with suggested thresholds for “Risk Category” and Confidence” is provided in the Technical Morphological Alteration v0.3 report provided under the River Basin Characterisation project (Draft Technical Assessment Method). This seems a sensible methodology. Note however that in some situations, it may be that the seabed in a water body only has a variety of “(biological or sedimentological substrates (or shorelines)” and a “Pressure” may affect a much larger percentage of a particular type of “substrate” than if the area of the whole water body. In this case it may be necessary to base the percentage area (or length) affected on the total area of that type of “substrate” (or shoreline).

The “Pressure” of modification to the sediment regime is not mentioned in the UK TAG Guidance but can occur in transitional waters due, for instance, to intertidal recharge and or altering the erosion rate of cliffs (particularly by removing protection to a soft rock cliff) and hence has been included.

Notes to Table

1. Assessed using MARLIN definition of “abrasion”.
2. Depends on percentage of seabed type covered – note the important of “type” – a land claim could affect all of a particular type of seabed (and associated habitat) in a water body but still occupy less than 1% of the total seabed area.
3. Potential short-term effects during “fill” operations may extend over a large area of seabed. In the longer-term the effects depend on specific situation, which could result in local erosion/deposition or in estuary-wide morphological change.
4. Potential short-term effects during “fill” operations may extend over a large area. In the longer-term the effects depend on specific situation, e.g. increased turbidity to seaward, less suspended sediment to leeward, or even substantial changes to the sediment transport regime through estuary-wide morphological change.
5. Most land claim is in inter-tidal areas, and effect can be gauged by percentage of inter-tidal area covered. Offshore “islands” may increase “emergence area” of water body.
6. Effects depend on specific situation but usually will extend over significantly larger area than that of land claim itself, principally in the directions of main tidal streams.
7. Effects depend on specific situation and may extend over a larger area than that of land claim itself, e.g. landwards of an offshore island. Reclamations along coasts typically only affect waves a short distance to seaward of structure.
8. Assumed to mean shoreline strengthening, e.g. revetments, seawalls etc.
9. Effects dependent on percentage of shoreline reinforced (or perhaps of shoreline type – see comment 1).
10. Potential short-term effects during reinforcement operations may extend over part of the nearshore seabed. Unlikely to result in any long-term changes except within c20m from shoreline.
11. Potential short-term effects during reinforcement operations may extend over part of the nearshore seabed. Unlikely to result in any long-term changes except within c20m from shoreline.
12. Will usually produce steeper inter-tidal slopes, reducing area emerged at low water. Effects dependent on percentage of shoreline reinforced - (or perhaps of shoreline type – see comment 1).
13. Site specific but usually unlikely to result in noticeable changes in currents except within c20m of shoreline.
14. Site specific but usually unlikely to result in noticeable changes in waves except within c50m of shoreline.

15. Uncertain as to meaning or relevance to “coastal waters”
16. Effects depend on percentage of seabed type dredged – note the important of “type” – dredging could affect all of a particular type of seabed (and associated habitat) in a water body but still affect less than 1% of the total seabed area. Note that navigation channel dredging can affect the wider transitional water system and potentially create areas of enhanced erosion which might remove substrate.
17. Potential short-term effects during dredging operations may extend over significant area of the nearby seabed. Note that navigation channel dredging can affect the wider transitional water system, potentially changing sediment supply and/or erosion/deposition in some areas or throughout the estuary system.
18. Potential short-term effects during dredging operations may extend over significant area of the nearby seabed. Note that navigation channel dredging can affect the wider transitional water system, potentially changing sediment supply and/or erosion/deposition in some areas or throughout the estuary system. In such circumstances the morphology of the system, particular on intertidal areas, would be expected to change.
19. Changes are related to scale of change and relative depths of dredged area and surrounding seabed but can in some circumstances affect a large proportion of the transitional water system.
20. Typically small changes restricted to dredged area and immediately adjacent waters, but can be major and affect large areas for deep inshore navigation channels.
21. Restricted to area actually dredged, and to be assessed based on percentage area of seabed type/ habitat affected.
22. Effects, including smothering, may extend to adjacent areas of seabed particularly along directions of tidal streams. Effects dependent on percentage area of seabed type/ habitat affected.
23. Tautology.
24. Effects may extend over significant area of the nearby seabed, depending on size of material involved. Likely to be greatest initially, but site and operation specific.
25. Restricted to deposition area and immediately adjacent waters. Changes are related to depths of seabed before and after deposition – so typically greater for inshore deposits.
26. Restricted to deposition area and immediately adjacent waters. Changes are related to depths of seabed before and after deposition – so typically greater for inshore deposits.
27. Potential for abrasion damage if coarse sediment (e.g. gravel) or heavier materials are deposited, but in this case probably restricted to deposition area.
28. As for channel dredging.
29. Potential impacts are related to scale of change – large scale flow manipulation could cause system-wide hydrodynamics and mixing of the transitional water to significantly change which would lead to significant effects on any or all of sediment substrate, deposition, suspended sediment concentration and emergence regime.
30. Flow manipulation could result in changes in water level in the upper estuary which could potentially affect wave action at these locations.
31. Potential impacts are related to scale of change but could affect any or all of flows, waves, deposition, suspended sediment concentration and emergence regime. Impounding will result in a reduction in flow and wave energy leading to morphological change within and in the vicinity of the impoundment. This may result in significant change in sediment type and therefore damage to substrate.
32. Depends greatly on particular circumstances. Adjacent areas of seabed to those directly involved are often be affected, e.g. by dispersion of sediments disturbed.
33. Depends greatly on particular circumstances. Disturbance of seabed sediments due to construction may result in increased siltation on adjacent areas of seabed. Large scale changes could result in disturbance over a wider area.
34. Depends greatly on particular circumstances. Disturbance of seabed sediments due to construction may result in increased turbidity on adjacent areas of seabed.
35. Depends greatly on particular circumstances. Temporary stockpiles may cover inter-tidal areas, piles or breakwaters may increase inter-tidal areas/ habitats.
36. Depends greatly on particular circumstances, e.g. coffer dams or piles may affect currents locally, breakwaters or training walls may affect currents over much larger areas.
37. Depends greatly on particular circumstances, e.g. coffer dams or piles may affect waves locally, breakwaters may affect waves over large areas to leeward.
38. Depends greatly on particular circumstances, e.g. anchoring of barges.
39. Operations are aimed at managing substrate for a particular purpose, and in so doing will affect “natural seabed” and associated habitat – assess by percentage area of water body.
40. Operations may disturb sediment and hence cause increased siltation rates in, and for a small strip around the area of operations, c20m –50m wide?
41. Operations may disturb sediment and hence cause increased turbidity in, and for a small area around, area of operations, c20m –50m wide?
42. Inter-tidal operations may slightly change seabed levels (up or down) within area of operations – assess on basis of percentage area of water body emergence zone affected.
43. May be some local changes to currents especially if operations are in the inter-tidal area.
44. May be some local changes to waves especially if operations are in the inter-tidal area.
45. Effects limited to operation area and perhaps access routes.
46. Operations may cover or disturb inter-tidal, rarely sub-tidal, seabed areas. Additionally groynes may be applied with the purpose of increasing current speeds in a navigation channel resulting in erosion of the substrate.
47. Operations may disturb sediments leading to siltation in nearby inter-tidal, rarely sub-tidal, seabed areas.
48. Operations may disturb sediments leading to changes in turbidity in nearby inter-tidal, rarely sub-tidal, seabed areas.
49 Depends greatly on particular circumstances. Some degree of emergence change should be expected for structures/operations located on/adjacent to intertidal areas.
50. Depends greatly on particular circumstances/scale. Small-scale manipulation will have a local effect. Large-scale changes would have a wider effect.
51 Depends greatly on particular circumstances/scale. Small-scale manipulation will have a local effect if there are direct changes to morphology. Large-scale changes may induce longer-term significant change sin morphology which in turn affect wave action.
52. Habitats on intertidal areas and adjacent seabed may be damaged by mooring of dredgers, truck movements etc.
53. Short- to medium-term changes in substrate may occur on beaches and nearshore seabed due to changes in sediments by recharge. Possibly long-term following changes in rates of erosion of cliffs.
54. Changes in siltation rates on nearshore seabed may occur on beaches and nearshore seabed due to changes in sediments by recharge or changes in rates of erosion of cliffs.
55. Changes in turbidity over nearshore seabed may occur on beaches and nearshore seabed due to changes in sediments by recharge or changes in rates of erosion of cliffs.
56. Changes in cliff erosion rate and especially beach recharge schemes can change height of inter-tidal zone over length of coastline involved plus some downdrift shoreline.
57. Changes in currents are likely to be small and localised to narrow strip along shoreline (c50m wide).
58. Changes in waves are likely to be small and localised to narrow strip along shoreline (c100m wide).
59. Beach recharge operations may cause abrasion in the short-term.
60. Some fishing operations, e.g. repeated beam trawling, can damage surface of seabed and habitats.
61. Some fishing operations, e.g. repeated beam trawling, can increase turbidity and hence siltation of seabed.
62. Some fishing operations, e.g. repeated beam trawling, can increase turbidity.
63. Fishing of various types can damage seabed organisms.

Appendix 4 Working paper on a decision-making framework

HYDROMORPHOLOGICAL CLASSIFICATION FOR TRANSITIONAL AND COASTAL (TRAC) WATERS

Work Package 5 extension – working paper on the development of a decision-making framework

Rev2.0 issued 22nd September 2005

This document has been prepared to build on the ideas in the earlier document P2237a. It has taken on board comments received on that document and re-focussed the approach following the Project Board meeting on 19th July 2005.

Contents

1. Requirements

1.1 KEEP IT SIMPLE

The decision-making framework must not be too prescriptive or over-complicated. The decision-making process needs to be transparent, straightforward and hence auditable, so that decisions made by the Environment Agency and other Agencies are defendable and the time involved in the process is not too onerous.

1.2 LEARN FROM OTHERS

It is beneficial to take advantage of the advances in decision-making already being developed or used in different contexts and to learn from the experience gained in implementation. This would include the approaches being adopted in areas such as flood risk management and coastal zone management.[1] The Centre for Environment, Fisheries and Aquaculture Science (CEFAS) is also looking to produce a framework based on their work, which should come into the public domain in the not to distant future.

1.3 STAKEHOLDERS

Key organisations that would benefit from the decision-making framework need to contribute to its development:

- To ensure relevance to their needs
- To ensure practicality and usability
- To consider the implications of adoption (see below)
- To provide funding

There is also a need to include stakeholders in the decision-making process so that buy-in is achieved, ideally to agree criteria and classifications at the start of the decision-making process.

1.4 USER FOCUS

Guidance to accompany the decision-making framework (and any associated training packages) needs to be developed for different users, primarily regulators and developers. In particular , the framework will need to be applied by a number of different regulators with responsibility for licensing developments that could potentially affect the hydromorphology of surface waters. This is especially the case for TRaC waters where the Environment Agency has only a minor role in regulating such pressures. Because of the broad range of different users, this has important implications for the nature of the framework and how it might be made available to users.

1.5 IMPLEMENTATION

The implications of adopting the decision-making framework need to be taken into consideration during the development of the framework to enable effective implementation. Issues to be considered include changes in policies and practices, training needs of staff and

[1] Such as Defra's current development of a new strategy for flood and coastal erosion risk management in England, *Making space for water*, and the Scottish Executive Environment and Rural Affairs Department's strategy for Scotland's coast and inland waters.

other knock-on effects. This may be achieved through the use of pilot studies to test the framework.

2. Project links

2.1 HYDROMORPHOLOGICAL DEVELOPMENT AND CLASSIFICATION SCHEME FOR TRANSITIONAL AND COASTAL (TRAC) WATERS

The tools being developed to date as part of the ongoing project will feature as best practice approaches within the framework.

2.2 ENVIRONMENT AGENCY'S HYDROMORPHOLOGY PROJECT

The Environment Agency project has come about from a realisation of the importance of hydromorphological pressures in relation to the Water Framework Directive (WFD). The scope of the work package extension needs to reflect the activities that will be undertaken as part of this hydromorphology project.

The project will be looking across all types of water bodies (rivers, lakes, TRaCs, etc.), all types of hydromorphological pressures and potential metrics. There is already a list of metrics that can be used as a starting point.

The project, although led by the Environment Agency, looks at UK-wide issues and aims to link key organisations together. It is particularly important that the work undertaken by SNIFFER[2] is taken into consideration to enable a UK-wide view and this would also be the case for development of the decision-making framework.

Various related initiatives have already been identified and this is being explored further. Hence, this accounts for part of the early stages of the proposed scope.

The project will also be looking to the Streamlining Project bringing Catchment Flood Management Plans (CFMPs), Shoreline Management Plans (SMPs), Coastal Habitat Management Plans (CHaMPs), etc. into the Water Framework Directive (WFD) context.

It was suggested at the Project Board meeting on 19th July 2005 that the existing projects would provide all the regulatory links and the decision-making framework should concentrate on the "technical" aspects of the decision-making only. This makes sense in relation to producing something that can have a long shelf-life and applicability throughout the UK without being too cumbersome, but to really deliver what is needed a clear understanding of the "hoops" that need jumping through is still needed and therefore close collaboration with the present project is essential.

2.3 UNITED KINGDOM TECHNICAL ADVISORY GROUP (UKTAG)

Development of the framework should link into the UKTAG work on environmental standards for the WFD. There is a phased approach to this work. The first report is due September 2005 for consultation during October 2005 with the intention to publish in January 2006. This report will provide a first view of what some of the standards might look like, recognising that these might change with further analysis. The intention is also to include testing of cost-benefit analysis.

[2] Scottish and Northern Ireland Forum for Environmental Research

2.4 ERAD DATABASE

The principal aim of the Defra funded research project (AE1025) was to develop a management tool that could be used to assist Defra/CEFAS in carrying out their regulatory function of assessing FEPA licence applications for the disposal of dredged material to sea. The project was entitled 'Environmental Risk Assessment Management Tool for Dredgings Disposal' (ERAD) and the outcome of the project is the ERAD Assessment Database.

The intention is for the ERAD database to be routinely used by CEFAS for the assessment of licence applications. Whilst the documentation of the licensing process is seen as a significant step forward for both CEFAS and Defra it remains only part (albeit the most significant part) of a complete system to provide a fully objective and transparent risk assessment. The two remaining components of the system are:

1. The need to further develop and implement the objective rule base knowledge system based upon the documented experience within the ERAD database, something which should evolve as the number of cases and the use of ERAD increases over time, and;

2. The risk assessment methodology (that is the way the evolved knowledge is cumulatively assessed for each new application) must be further developed and implemented.

The development of the decision-making framework for hydromorphological classification for TRaC waters will be able to build on the technical approach and experience gained from the ERAD project and potentially provide feedback to the development of the above outstanding components.

3. Framework design

KEY QUESTIONS

Prior to developing the decision-making framework, it is essential to obtain agreement regarding the intention of the framework. Is the intention to:

a) Have a decision-making process that fundamentally results in the same decision being made whoever undertakes the assessment, or
b) Provide accountability in the decision-making process?

Option (b) would take advantage of the best available science at that given moment in time, whilst Option (a) runs the risk of getting into difficulties as and when new science, legislation or policy appears. Therefore, the remainder of this note assumes that Option (b) would be implemented.

An outstanding question remains regarding the provision of a framework covering the biological and ecological criteria, as well as the hydromorphological criteria, so that the inter-relationships can be identified fully. We think that at some level it will be necessary to relate hydromorphological change to the consequential ecological changes and that the decision making framework will need to take this link into account.

3.1 EXAMPLE FRAMEWORK STRUCTURE

The following figure provides a simplified representation of how the decision-making framework might look. The advantage of adopting this type of decision-making framework is

that it is entirely consistent with the approaches adopted for Environmental Risk Management[3], Climate Adaptation[4] and Flood Risk Management including the Flood and Coastal Defence Project Appraisal Guidance (FCDPAG)[5], the Risk Assessment for Strategic Planning (RASP) methodology[6] and FD2320[7]. Therefore, streamlining this into other decision-making activities will be easier as well as being familiar.

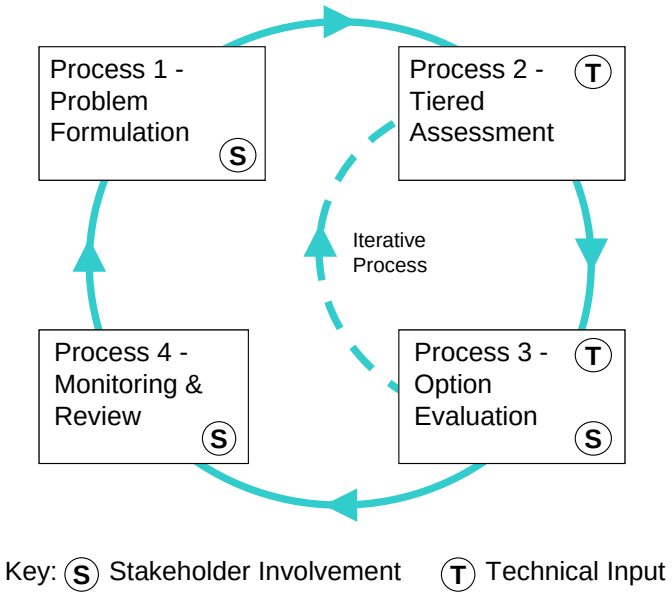


Figure 3.1 Simple representation of a decision-making framework

3.1.1 Process 1 – Problem Formulation

This stage answers the following questions:

1. What is the direct purpose of the decision-making?
2. What are the secondary benefits from undertaking this decision-making process?
3. Who are the regulatory authorities involved and what are their requirements?
4. What controlling factors will limit the assessment approach (e.g. data availability, time, money)?
5. What controlling factors will influence the options evaluation and ultimately the decisions made?

At this stage the stakeholders are involved to agree the above criteria and classification process.

[3] DETR (2000) *Guidelines for Environmental Risk Assessment and Management, 2nd edition*, The Stationary Office, London, Institute of Environmental Health.
[4] Willows, R.I. and Connell, R.L. (Eds.) (2003) *Climate adaptation: Risk, uncertainty and decision-making*, UKCIP Technical Report, UK Climate Impacts Programme, Oxford.
[5] See Figure 1.1 in MAFF (2000) *Flood and Coastal Defence Project Appraisal Guidance, Approaches to Risk (FCDPAG4)*, MAFF. http://www.defra.gov.uk/environ/fcd/pubs/pagn/fcdpag4.pdf
[6] Sayers, P, Gouldby, B, Simm J, Meadowcroft, I, Hall, J (2002) *Risk, Performance and Uncertainty in Flood and Coastal Defence – A Review*, Defra/EA R&D Technical Report FD2302/TR1.
[7] *Framework for Assessing and Managing Flood Risk for New Development*, Defra/EA R&D project FD2320 Flood Risk Assessment Guidance for New Development, http://www.hrwallingford.co.uk/projects/flood_risk_assessment/index.html

3.1.2 Process 2 – Tiered Assessment

This is the classification process. The level of detail undertaken will depend amongst other things on data availability and the type of decision being made. This should be undertaken in a tiered approach, so that detail can be avoided where it is not necessary. This allows both qualitative and quantitative approaches to be used, as appropriate.

The possibility of using thresholds should be considered for triggering further levels of assessment. A review of uncertainty may prove the most useful mechanism for deciding if a more detailed tier of assessment is needed. This should be investigated during the development of the framework. The possibility of relating this to spatial scale should also be investigated during the development of the framework (e.g. high-level would be water body-wide, but if appropriate more detailed assessments could be undertaken on smaller sections as required).

3.1.3 Process 3 – Option Evaluation

This is the process of evaluating measures and links back to the classification process, as it is necessary to understand how the measures will impact on the classification. Depending on the measures proposed, the level of detail of the assessment process will be decided. Again, a review of uncertainty may prove the most useful mechanism for deciding if a more detailed tier of assessment is needed. This should be investigated during the development of the framework.

Use of cost-benefit analysis and risk models should be reviewed and recommendations made as part of the guidance accompanying the framework (see below).

3.1.4 Process 4 – Monitoring & Review

This would incorporate the monitoring and review of:
1. The measures undertaken
2. The decision-making process and technical outputs
3. The hydromorphological change and other WFD indicators

This should be planned over suitable timescales with buy-in from stakeholders and responsibilities clearly defined. This also enables lessons to be learnt for future decision-making.

3.1.5 Process development

Each process can be developed in detail by using the five principles of information management.[8] These are:
- Data and Information - Recognise and understand all types of data and information.
- Roles and Responsibilities - Understand the legal issues (such as statutory requirements) and execute "duty of care" responsibilities.
- Processes and Procedures - Identify and specify all processes and procedures (whether assessment, business or policy based).

[8] As defined in McCue J, Millard K, von Lany P, Clark M (2004) *Position Review of data and information issues within Flood and Coastal defence*, R&D Technical Report FD2314/TR1, Environment Agency. This approach was devised by the London School of Economics in conjuncture with HR Wallingford. Original references include the BSI standards publications: BSI-DISC PD 0008:1999, *Code of Practice for Legal Admissibility of Information Stored on Electronic Document Management Systems* (Second Edition – subsequently updated in 2004), BSI-DISC PD 0009:1999, *Compliance Workbook* (Second Edition), BSI-DISC PD 0010:1997, *Principles of Good Practice for Information Management.*

- Tools and Technologies - Identify tools and enabling technologies to support processes and procedures.
- Audit and Control - Monitor and audit processes and procedures and set in place remedial actions should they be required.

3.2 SUPPORTING DOCUMENTATION AND TOOLS

All four processes should be supplemented by a series of supporting documents and tools. This might include:

- Technical guidance, including
  - How to undertake the decision-making
  - How to undertake assessments
  - How to review the decision-making
  - How to review assessments

- Audit procedures, including
  - Assessment check-lists
  - Process "health checks" (e.g. performance targets)

- Tools, including those being developed as part of the Hydromorphological Classification for Transitional and Coastal (TRaC) Waters project

- Examples of best practice, which may include assessments already undertaken, but also pilot studies used to test the decision-making framework.

A distinction needs to be made between technical guidance and other guidance. In order to develop a framework that is applicable across the UK and useable within different organisations, guidance should avoid details of policy, legal obligations, organisational process, etc. and these are not necessarily UK-wide and may change relatively regularly. Technical guidance on the other hand will only change when new science becomes available.

3.3 FORMAT AND DELIVERY OF FRAMEWORK

As stated in the requirements of the framework, it is important that it is simple and useable. Therefore, it must also be navigable and easy to update should it be necessary to do so. This means that the framework needs to be a "live" document and delivery of this is probably most easily achieved through the use of a website.

An example of a potential website structure is provided below. Guidance documents and tools would be provided in a modular format to allow for easy updates. Hyperlinks would be used to navigate between the framework, documents, tools and examples as appropriate.

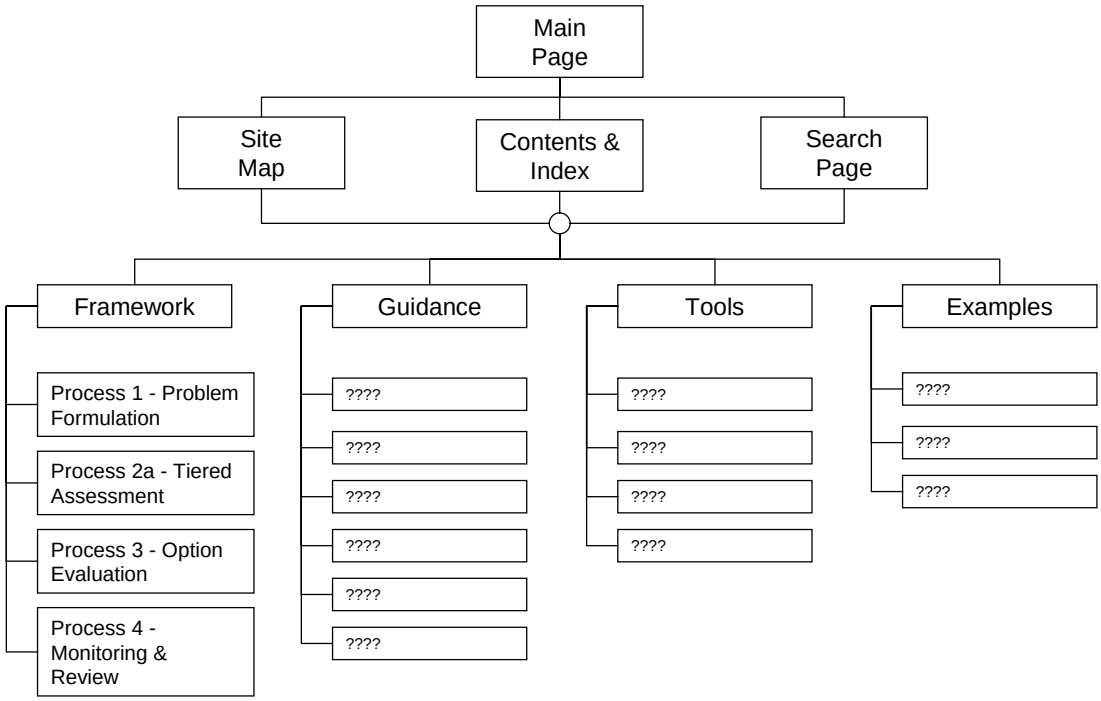


Figure 3.2 Example website structure