EUROPEAN COMMISSION
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ENVIRONMENT

ESTUARIES AND COASTAL ZONES WITHIN THE CONTEXT OF THE BIRDS AND HABITATS DIRECTIVES

TECHNICAL SUPPORTING DOCUMENT ON THEIR DUAL ROLE AS NATURA 2000 SITES AND AS WATERWAYS AND LOCATION FOR PORTS




Results of a Working group of the European Commission consisting of representatives of stakeholders, Member States and NGOs

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1 Introduction

Estuaries and coastal zones are among the most productive ecosystems of the world, with equally high ecological and economic values. They offer a wide variety of ecosystem services such as shoreline stabilization, nutrient regulation, carbon sequestration, detoxification of polluted waters and supply of food and energy resources (Millennium Ecosystem Assessment, 2005). They also offer amenity services such as tourism and recreation but above all they provide shelter for ships and access to inland areas from the sea.

Estuaries and coastal zones also comprise the most dynamic and complex ecosystems of the world forming a mosaic of a variety of habitats protected under the European environmental legislation. Typical habitats composing an estuary include sand banks, mudflats and sand flats, salt marshes and in coastal areas sand dunes, coastal lagoons, shallow inlets and bays, reefs, islets and small islands, sandy beaches, sea cliffs and other, all protected under the Council Directive (92/43/EEC) on the conservation of natural habitats and wild flora and fauna (Habitats Directive). Shorebirds are dependant on estuaries and coastal zones during migrations over long distances from breeding to wintering grounds. Furthermore, numerous bird species are breeding in estuarine and coastal habitats. They are protected under the Council Directive 79/409/EEC on the conservation of birds (Birds Directive).

On the other hand, the demand for marine transportation has been constantly increasing. The European Commission supports the concepts of motorways of the sea and short sea shipping. Moreover the European Commission has recognized through its Communication on *An Integrated Maritime Policy for the European Union* that seaports and shipping allow Europe to benefit from the rapid growth of international trade and to play a leading role in the global economy (EC, 2007). The fact that 90% of Europe's external trade and close to 40% of its internal trade passes through its ports demonstrates that Europe's ports face a great challenge if they are to deal with increasing demand (EC, 2007). Development of maritime ports, associated with inland waterways transports, will play a great role in the reduction of carbonic gas emissions but will also have to face the issue of climate change with a need of adaptation.

Natura 2000 sites overlap with areas suited for waterways or port expansion projects and conflict of interest or integrated planning needs are provoked by this plain and inevitable geographical fact. This creates a forum to discuss in an integrated manner the implementation of EU environmental law and essential questions of waterways and ports policies. Member States are under a duty both to ensure the protection of the environment, to promote sustainability of economic development, and to ensure implementation of transport policies adopted. The macro-environmental aspects as the environmental benefits of taking cargo off the roads can not overrule the provisions of nature and water directives and both economical stakeholders and environmental sector are claiming for a better guidance on the implementation of EC policies and the development of complementary concepts and approaches to combine maritime and fluvial transport with ecosystems needs and implementation of Natura 2000 or Water Framework Directive.

The European Commission has already published several guidance documents to support Member States in implementing the environment directives, and citizens and stakeholders in better understanding them (see references). However, there is a persistent need to issue further clarifications, explanations and even prospective views on the application of the Community nature legislation to port development.

The European Commission has published guidelines and recommendations that illustrate the European Commission’s view on this topic. It was done with the help of an EU working group. An expert “Working Group on Estuaries and Coastal Zones” was established (see annex 4) with the aim of enhancing exchange of information on existing experiences and best practice in relation to management of port related activities and Natura 2000, and providing general guidance on the application of the Nature Directives in these areas. The working group was chaired by the Commission (The Nature and Biodiversity Unit of DG Environment and the Maritime transport, ports policy and maritime security Unit of DG for Energy and Transport) and composed of experts from different Member States, scientific experts, representatives of key stakeholder groups (including European Sea Port Organisation and the European Dredging Association), NGOs, as well as Commission services (Directorate General of the Environment, Directorate General of Transport and

Energy, Directorate General of Maritime Affaires and Fisheries). The Working Group met several times to discuss the progress of this document within the 2007-2009 and significantly contributed to its elaboration. Principal communication and documentation exchange was carried out through the CIRCA platform[1]. It is foreseen to continue the dialogue between the European Commission and the Working Group on Estuaries and Coastal Zones with at least one meeting per year.

This Technical Supporting Document includes a general presentation on the study approach, general literature used and specific technical forms comprising the results of the know-how exchange between the Working Group and the consultancy firm which made the coordination. The principal aim of this Technical Supporting Document is to support the EC Guidelines on the dual role of estuaries and coastal zones as Natura 2000 sites and as waterways and location for ports. These guidelines published in 2009, are the EC views on this topic and include recommendations and main results of the work. The views expressed within this Technical Supporting Document do not necessarily reflect the official views of DG Environment. To get this view, please refer to the Guidelines.

2 List of Technical Supporting Documents (TSDs)

- TSD 1: How can the definition of the habitat type 1130-'Estuaries' be improved?
- TSD 2 : Getting to know the key environmental processes that form an estuary and a coastal zone
- TSD 3 : Species of estuarine and coastal habitats in consideration of the nature directives and the Water Framework Directive?
- TSD 4 : How can Climate change influence conservation objectives?
- TSD 5: How can the ecosystem approach assist on the management of estuarine and coastal systems?
- TSD 6 : How to set conservation objectives at national//local level? How to set conservation objectives for habitats and species through Natura 2000 management plans? How can economical objectives be integrated with Natura 2000 conservation objectives and management plans?
- TSD 7 : Water Framework Directive and Nature Directives
- TSD 8 What are the requirements for a Sustainable Dredging Scheme ?
- TSD 9: Appropriate assessment of land use plans, sectoral plans or integrated plans in estuaries and coastal areas and relations with strategic environmental assessments (SEA)
- TSD 10: Estuaries and specific key words of article 6.3 (appropriate assessment, significant impact)
- TSD 11: How to handle alternatives (article 6.4)
- TSD 12: How to consider integrated project design and accompanying measures?
- TSD 13: How is the value of damage assessed and how is it related to compensation? Aftercare?

[1] see: http://circa.europa.eu/Public/irc/env/estuary/home

2.1 TSD 1: How can the definition of the habitat type 1130-'Estuaries' be applied?

Explanation of the question and its pertinence

The definition for the habitat 1130 Estuaries in the Interpretation Manual of European habitats has not been revised since 1999 whereas some other definitions of habitat types were revised in 2007 (e.g. marine habitats 1110, 1170 and 1180). An analysis of the current definition and of other documents (e.g. an interpretation note published by the EC in 2005 or the article 17 reports by certain Member states) suggests that there is still a need for clarification of this definition. Eventually, a revision of the definition given in the Interpretation manual could be envisaged. The present TSD proposes possible elements for such a revision.

Current definition of the Interpretation Manual

The first definition for the habitat 1130 was adopted in April 1995 by the Habitats Committee with the EUR12 version of the 'Interpretation Manual of European Union Habitats'. At this stage the definition was considering mainly tidal estuaries encountered along the North-East Atlantic coast :

"Downstream part of a river valley, subject to the tide and extending from the limit of brackish waters. River estuaries are coastal inlets where, unlike 'large shallow inlets and bays' there is generally a substantial freshwater influence. The mixing of fresh water and sea water and the reduced current flows in the shelter of the estuary lead to deposition of fine sediments, often forming extensive intertidal sand and mud flats. Where the tidal currents are faster than flood tides, most sediments deposit to form a delta at the mouth of the estuary."

Following the accession of Austria, Finland and Sweden, descriptive sheets for new habitat types were added in a second version (EUR15 version adopted in October 1999). This version incorporates comments for some Annex I habitats occurring in those Member States, and corrects, or adds, newly acquired information. For the habitat type1130 'Estuaries' the following definition was added :

"Baltic river mouths, considered as an estuary subtype, have brackish water and no tide, with large wetland vegetation (helophytic) and luxurious aquatic vegetation in shallow water areas."

In fact these two definitions reflected an old debate in the scientific world on the definition of (Elliott & McLusky 2002) generally based on a "single factor view".

Some scientists were using a "brackish" definition proposed by Pritchard in 1967 based on the dilution of sea water with fresh water: "a semi-enclosed coastal body of water having free connection to the open sea and within which sea water is measurably diluted with fresh water deriving from land drainage".

Some other scientists were using the "tidal" definition proposed by Fairbridge in 1980: "an estuary is an inlet of the sea reaching into a river valley as far as the upper limit of tidal rise, usually being divisible into three sectors: (a) a marine or lower estuary, in free connection with the open sea; (b) a middle estuary subject to strong salt and freshwater mixing; and (c) an upper or fluvial estuary, characterized by freshwater but subject to strong tidal action. The limits between these sectors are variable and subject to constant changes in the river discharges".

Since then, several further developments on this issue influenced the current views on estuaries:

- The Water Framework Directive, which is applicable within estuaries, has defined transitional waters as "*bodies of surface water in the vicinity of river mouths which are partly saline in character as a result of their proximity to coastal waters but which are substantially influenced by freshwater flows*". This definition is valid for several Annex 1 habitats types e.g. estuaries (1130) or lagoons (1150*). The ecological status of these transitional waters is defined in the annex 5 of the WFD.
- Several Member States have published their own interpretation manual to fit the EU definition with national features.

- Most of Member States have published their article 17 report including a first evaluation of the conservation status of their estuaries. Even if a common framework was adopted for this reporting exercise, large interpretation differences for the habitat 1130 still persist, indicating that further clarification of the definition is needed.

Part 4 of the description of habitats in the Interpretation Manual normally refers to "*habitat types generally associated in the field (phytodynamic successions, zonations or mosaics)*". For the habitat 'estuaries', the following is stated: *"An estuary forms an ecological unit with the surrounding terrestrial coastal habitat types. In terms of nature conservation, these different habitat types should not be separated, and this reality must be taken into account during the selection of sites."*

There was, however, no reference to subtidal habitats or to the water column in this chapter and this aspect was also not dealt with in the main definition.

Further developments included:

- Difficulties in the selection and definition of sites for the habitat 1130 lead the EC in 2005 to publish an interpretation note. This note has so far not been formally endorsed by the Habitats Committee. This note was not only considering selection and definition of Natura 2000 sites for the Habitat type 'estuaries' but also addressing management aspects such as maintenance dredging. The present document will separate issues linked to the definition from management issues.
- During the latest revision of the Interpretation Manual for marine habitats, it was added for the habitat 1110 (Sandbanks which are slightly covered by sea water all the time) that "*sandbanks can be found in association with mudflats and sandflats not covered by seawater at low tide (1140), with Posidonia beds (1120) and reefs (1170). Sandbanks may also be a component part of habitat 1130 Estuaries and habitat 1160 Large shallow inlets and bays*." This last sentence shows that wide spectrum habitats including narrower spectrum habitats may exist in estuaries. For the Standard Data Form, a strong component of site designation, a general rule was used, that the more specific habitats will have to be entered under point 3.1 of the SDF, with the area of the full estuarine habitat given in the text field 4.1 (other site characteristics).

Finally, the Interpretation Manual of EU habitats provides an important reference for the assessment of specific structures and functions (see OJEU n° L 107 – 24/04/1997). According to Art 1(e) of the Habitats Directive, a condition for the conservation status of a habitat to be favourable is that "*the specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future*". It is clear that the various ecological processes essential for a habitat must be present and functioning if an habitat is to be considered to be in a favourable conservation status (EC, 2006).

EU Guidance already existing

The documents listed below have been developed from the EC and provide in some parts detailed guidance on how to apply the EU nature legislation and the WFD.

1. European Commission – 2007 - *Interpretation Manual of European Union Habitats*. DG Environment – Nature and biodiversity 142 pp. http://ec.europa.eu/environment/nature/legislation/habitatsdirective/docs/2007_07_im.pdf
2. European Commission, (unpublished) – 2005 – Draft interpretation note on "Estuaries" (habitat type 1130), with a view to aiding the selection/delimitation and protection/management of Sites Of Community Interest hosting this habitat type.
3. European Commission – 2003 - Common implementation strategy for the water framework directive (2000/60/EC), Transitional and coastal waters-Typology, Reference conditions and classification systems, Guidance Document No 5, Luxembourg: Office for official publications of the European Communities, 116 pp.
   http://circa.europa.eu/Public/irc/env/wfd/library?l=/framework_directive/guidance_documents&vm=detailed&sb=Title

4. European Commission -2006- Assessment, monitoring and reporting under Article 17 of the Habitat Directive : Explanatory Notes and Guidelines. Final Draft October 2006. European Commission, DG Environment, Nature and Biodiversity, 64 p. + annexes

Proposal of a new improved definition for the habitat 1130 Estuary

For many decades scientists have tried to define estuaries and the boundaries of the ecosystem itself. The word 'estuary' is of 16th century origin and derives from the Latin word *aestuarium* meaning marsh or channel, which itself derived from *aestus* meaning tide or billowing movement (Elliott and McLusky, 2002). Various definitions were adopted by scientists as they tended to focus on a single factor that would determine the limits of an estuary i.e. geomorphological factors (topography and shape), physical factors (tide), chemical factors (salinity) and biological factors (benthic communities). The EU definition of estuaries should ideally consider a combination of factors. After an analysis of different interpretations made by EC and Member States, a revised proposal for a common definition will be suggested.

Interpretation made by some Member States

Three cases will be described hereafter, Germany, France, United Kingdom and some comments with regard to other Member States will be made.

Germany

In Germany the implementation of the Habitats Directive is done at Länder level. In order to facilitate the interpretation of Annex I habitats, the Federal Agency for Nature Conservation issued a National German Interpretation Manual (Ssymank et. al 1998) which was already drafted and distributed in 1993 for German authorities, is widely used and was a good basis for drafting the EU Interpretation Manual for many habitats.

This definition focussed on an ecological complex unit with brackish water influence and tidal influence (North Sea only), including as specific habitat also the freshwater tidal areas. The estuary definition included the whole water body, the bottom, banks and the terrestrial areas as long as they are subject to tidal flooding and or brackish water influence. In seas without tide the influence of brackish water is limiting an estuary upstream

Against the background of public discussion the existing ecological interpretation of the habitat 1130 "Estuaries" was questioned and a specific meeting with Germany on this subject was organised with the EC, German authorities, stakeholders and experts on the 25th March 2004 (Mierwald, 2005 based on a note of DG ENV.B2 of 04.08.2004). A note for file /protocol was issued in August 2004 regarding the Elbe (including the tributaries Oste and Este), Weser, Ems and Trave sites with the following main conclusions:

- The estuary needs to be designated completely and continuously, over its full length and on a scientific basis. If sections of an estuary have been modified predominantly by industry, ports or other installations, it might be necessary to designate at least a water channel in those sections
- Occurrence of tidal influence without presence of brackish water is not sufficient for defining the habitat type 1130-estuaries. However it is possible, in the discretion of Member States, to designate such areas for the habitat type 1130.
- There are only two potential justifications for not designating parts of an estuary:
    - the concerned part of estuary has, due to existing installations, no ecological value
    - parts of the estuary are isolated spots, fully separated by dams or dikes from the main estuary and therefore no longer integral to the system

The logical consequence of these conclusions is that estuaries have to be considered as a complex of habitats gathered by ecological processes such as tide or salinity. Such a logic does not apply to all Annex I habitat types of the directive as some of them are mainly described by vegetal associations (e.g. 1320 "*Spartina* swards -*Spartinion maritimae*). But some other habitat types have a wider spectrum as they are described by specific ecological processes and include several narrower habitats. This is the case of estuaries (1130) and large shallow inlets and bays (1160), probably also for lagoons (1150*).

Consequently, when conservation objectives for the Elbe estuary were officially published by the '*Ministerium für Landwirtschaft, Umwelt und ländliche Räume'* of the Land Schleswig-Holstein, estuaries were defined as: *1130 Estuaries including the following habitat types:*

- *1110 Sandbanks*
- *1140 Mudflats*
- *1210 Annual vegetation of drift lines*
- *1310 Salicornia and other annuals colonizing mud and sand*
- *1330 Atlantic salt meadows (Glauco-Puccinellietalia maritimae)*
- *2120 Shifting dunes along the shoreline with Ammophila arenaria ('white dunes')*

The Natura 2000 site itself[2] comprises seven other types of habitats (+ species) and designates the whole estuarine system as habitat 1130.

Within the report[3] of German authorities on the implementation of the measures taken under this Directive (known as article 17 report), the assessment of the conservation status of the habitat 'estuaries' was prepared with the common methodology agreed in the Habitat committee (EC 2006). The three following features were noticed in Germany and will be compared with the results of the British and French assessments:

- The area covered by the habitat in Germany is much smaller than the potential range of this habitat. However this is no contradiction but a result of the methods used. Area is given in ha of mapped surface, while range is determined on the basis of a grid (approx. 10 x 11 km²) with occurrences of the habitat type within this grid. The favourable reference area in Germany is slightly bigger than the actual area, favourable and actual range are identical for estuaries.
- 46 typical species were proposed for the Atlantic biogeographical region including 16 birds, 7 fishes, 4 beetles, 1 mollusc and 18 plants[4]. It must be clearly noted, that only a selection of typical species was used for reporting purposes. As the big estuaries in Germany are quite different and unique ecological systems, individual large estuaries have a number of typical species which are not present in other estuaries. For reporting only those typical species have been listed that were indicated by several Länder authorities. Benthic and pelagic invertebrate communities are not well enough recorded, that they could be used for the indicative purpose of reporting.
- The overall assessment has given the result "unfavourable-bad" mainly due to the assessment of the structure and functions.

United Kingdom

In the United Kingdom, the scientific interpretation on the Estuaries was presented in the "Habitat Account", a handbook for United Kingdom Natura 2000 sites (JNCC[5]). Estuaries (1130) were defined as "*habitat complexes which comprise an interdependent mosaic of subtidal and intertidal habitats, which are closely associated with surrounding terrestrial habitats*". Mudflats and sandflats (1140), sand banks (1110), Reefs (1170) and salt marshes (1310, 1320, 1330) were mentioned as the estuarine habitats. However, the handbook also identified these habitats "*as Annex I habitat types in their own right*" and that occur extensively along the open coast and in lagoon inlets. Two added aspects are interesting for the EU level:

- "*the intertidal and subtidal sediments of estuaries support biological communities that vary according to the type of sediment and salinity gradients within the estuary, together with geographic location and the strength of tidal streams*".

[2] DE-2323-392 -Schleswig-Holstein Elbe Estuary and adjacent areas.

[3] http://biodiversity.eionet.europa.eu/article17/habitatsprogress

[4] the same kind of approach was proposed by the Netherlands with 24 typical species or by Ireland with 24 birds and 3 mammals

[5] http://www.jncc.gov.uk/ProtectedSites/SACselection/SAC_habitats.asp

- "*In addition to the sedentary subtidal and intertidal communities, the water column of estuaries is an important conduit for free-living species, such as fish species, and juvenile stage of benthic plants and animals. In particular, it is the means by which migratory fish species make the transition between the marine and freshwater environments.*"

As a part of the UK article 17 report, an audit trail was proposed by the Joint Nature Conservation Committee (JNCC 2007) concerning estuaries. This report highlighted that estuaries, as a feature, *are defined by their physiographic sub-type rather than, by a specific biological community*. That is the reason why the range is determined by physical and geological processes and remain stable given their physiographic nature[6]. The current area of estuaries in UK, as well as the favourable reference area, have the same extent with the range area (3.083,55 km² vs. 3084 km²)[7]. At the same time it is considered that 41,910 hectares of the intertidal area of estuaries has been lost in historical times. The proposal is that the parameter "area" is considered as Favourable because "*losses of area have not led the feature to be unviable because the feature area is largely dependent on non-ecological process*". As Favourable Range Area and current area are identical this approach is comparable to the German one.

The specific structures and functions have been considered as Unfavourable (bad and deteriorating) mainly because of the bad conservation status of sand and mudflats which make a large proportion of the estuarine area (estimated at 61%)[8]. The reasoning is rather complex and at the same time totally coherent. That is the reason why, as stated in the same document:

- Unlike the Netherlands which have considered that estuaries have been lost over the last centuries mainly by enclosure dikes preventing flood entry, United Kingdom consider that "*while the physical area of some individual estuaries may have declined due to anthropogenic influences or through natural deposition/erosion, the geographic spread and distribution of this feature type has not declined*".
- Estuaries are not defined by the presence of particular species, nor are they structurally dependent upon particular species. UK lists no typical species for the purpose of reporting[9] whereas 46 species were used in Germany.

The use of typical species in reporting as a subset of indicator species for assessing structures and functions is not an issue related to the definition in the interpretation manual. This issue will be raised by specific EC working group for standardizing the future Art. 17 reports.

<u>France</u>

Referring to German and UK proposals, where estuaries are a complex of habitats, defined or not by physiographic feature, the French approach is rather different. As proposed in the "Cahier d'habitats" (Bensettiti & al. 2005), the habitat 1130 is considered as a specific form of sandflats/mudflats mainly characterized *Macoma baltica* communities in the Atlantic biogeographical area and by other invertebrates communities in the Mediterranean area.

In the Natura 2000 management plan proposed for the Seine estuary (DOCOB prepared by Maison de l'Estuaire, 2006), the site is divided in small ecological units identified by their characteristic species. All the subtidal and intertidal areas characterized by *Macoma baltica* are designated as belonging to habitat 1130. Within intertidal areas when *Macoma* community disappeared the sites were designed as habitat 1140 "Mudflats and sandflats not covered by seawater at low tide", whereas towards subtidal areas when *Macoma* was replaced by communities of *Abra – Pectarinaria* sites were designed as the habitat 1110 "Sandbanks which are slightly covered by sea water all the time"

[6] On the contrary, in Germany all large estuaries on the North-Sea coast are highly modified including a clear change in the physical and hydrological features, for example a large geographical shift of the zones of brackish water influence

[7] Reasoning seems to be the same in the Atlantic part of Denmark.

[8] At the same time sand and mudflats are evaluated on their own with an Unfavourable bad conservation status knowing that 60% of the resource in the UK occurs in estuaries.

[9] the same in Belgium

Consequently in the context of the French Article 17 report, the evaluation of the conservation status of the habitat type 'estuaries' concluded that, for the three features studied,

- The area covered by the habitat is much smaller than the potential range of the habitat because of the loss of the specific mudflats , and
- proposed 10 benthic invertebrates as typical species.

However, as for Germany and the UK, the overall conservation status of estuaries was considered as unfavourable-bad mainly due to the assessment of the structure and functions.

Other Member States

It would be far too long to describe all national interpretations of the habitat type 'estuaries', however the following issues were raised:

- In Ireland, until there is an evidence that the WFD has been fully implemented and good water quality status is achieved, the feature 'future prospects' is assessed as unfavourable-inadequate.
- In Poland there are complexes of estuaries and lagoons called "zalew". It was proposed to restrict the habitat type 1130 to the downstream part of the river where the wind is responsible for the mixture of saline and fresh waters[10]. On the contrary, the Greek authorities considered that the habitat type 1130 also occurs in semi-enclosed environment where there is a combination of fresh and saline waters (e.g. Amvrakikos Gulf).
- Even if the Interpretation Manual has not been developed for Mediterranean areas, all the Member States of the Mediterranean biogeographical region have proposed sites for the habitat type 1130 and provided an evaluation of its conservation status.
- The overall range and areas features were considered as favourable by the European Topic Centre on Biodiversity (ETC/BD). However, the conservation status was assessed as unfavourable-inadequate for other features.

EC Interpretation note from 2005

Interpretation on the delimitation of Estuaries has been given in the EC Interpretation Note of 2005. This note has not yet been formally endorsed by the Habitats Committee, hence not included in the 2007 version of the Interpretation Manual of EU habitats.

Concerning estuarine sites, the Interpretation Note states that "*the selection process should take into account not only the constituent biotopes but also relevant geomorphological features, dynamic ecological issues and hydrological processes"*. This position concerns the delimitation of Natura 2000 sites and not the interpretation of the habitat type 1130 itself.

Another important point of the interpretation note is that, "*no important part of the habitat complex should be excluded. This has consequences for determining the boundaries of the sites, which should not be limited to the intertidal areas, but which should also integrate the sub-tidal areas. Similarly, areas within estuaries beyond a certain depth of covered water should not automatically be excluded*". This recommendation could be restructured, by including two levels in the definition of the habitat type 1130 (see next chapter):

- As it was proposed by Germany and the UK, the spectrum or scope of the habitat type could be enlarged in order to integrate narrow spectrum habitats as 1110, 1140…
- In definition of the Interpretation Manual, the word subtidal could be added to the words "surrounding terrestrial coastal habitat types" when speaking of ecological unit

Another aspect raised in the interpretation note is related to navigation channels: "*shipping lanes should not be excluded from sites containing the "estuaries" habitat as they are an integral part of them. Shipping lanes and other sub-littoral channels play a role in the hydrological functioning of*

[10] Polish authorities have highlighted in their article 17 report that this anthropogenic habitat can not be restored in its natural state. A development on this issue is proposed by the EC Interpretation note of 2005.

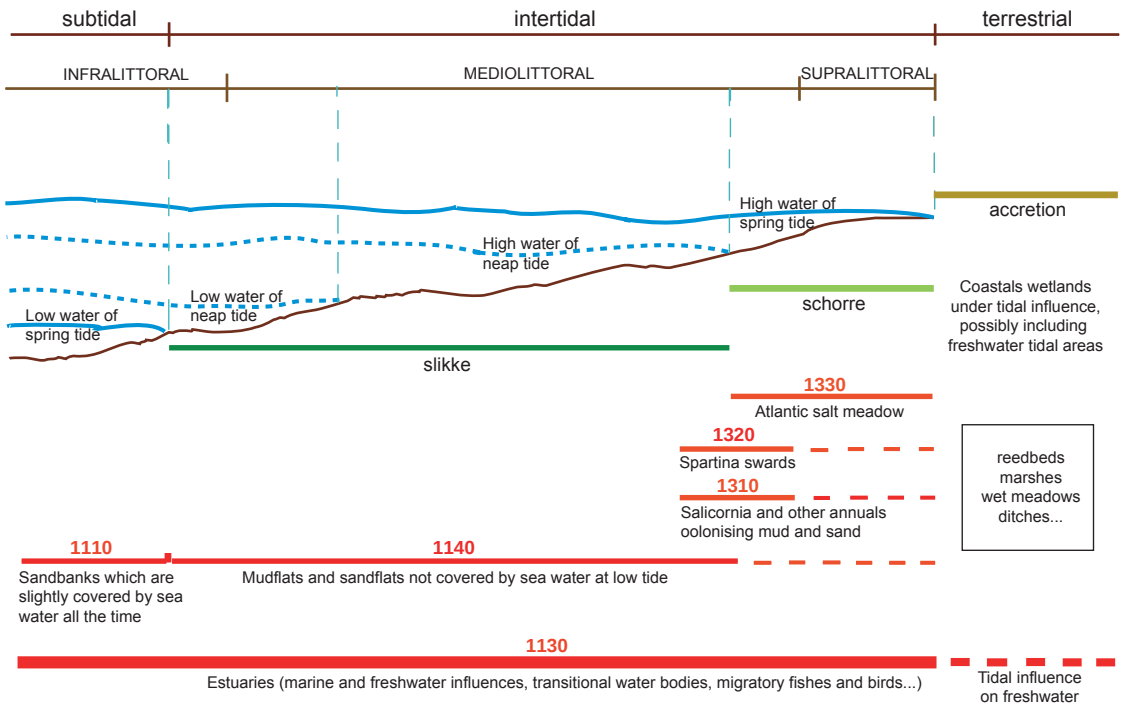
estuaries, including the circulation of water and the deposition of sediment. Furthermore, these channels may also form part of the estuarine migration routes of Annex II fish species".

This is confirmed by ABPmer (2008) by explaining that the main function of channel is the discharge of fluvial flows through the estuary to the marine environment. It also allows the transmission of energy and sediment throughout the estuary and provides the link between many of the geomorphic elements within the system. Changes to the form and behaviour of channels will be observed in corresponding changes to the sandflats, mudflats, saltmarsh, dunes and spits (sand barriers) as the migration of channels allows the release of sediment in a different direction. This sediment is then reworked by the prevailing processes (waves, tides, currents) and deposited elsewhere to contribute to these existing geomorphic elements or form new versions of the pre-existing elements. In addition to this direct impact on features from channel migration, the movement of the channel may also impact on adjacent features through changes to the degree of exposure to wave and tidal action.

If we consider the structures and functions of the habitat type 1130, then navigation channels are part of the definition of the habitat type 1130. They definitely have to be included in the habitat definition of estuaries. A proposal in this sense is made in the part 1 of the proposed revised definition of the habitat type 1130. This proposal is not adding any constraint to maintenance dredging.

A synthesis of dynamic relations between habitats is proposed in fig.1 for the North-East Atlantic area (including North sea and Channel)

Fig. 1: Estuarine areas of the Nort-East Atlantic seas : habitats dynamically associated



Van der Bergh *et al.* (2009) consider that the landward limit of estuaries has to be reconsidered. If the habitat type should include saline areas without tidal influence is should equally include tidal areas without salt influence, these habitats are rare, endangered and threatened. If 1130-estuaries is to be defined within the Interpretation Manual of European habitats, it could also be simply delimited as any inland habitat under tidal or seawater influence. This includes the brackisch habitats under seasonal flooding as in the Baltic sea and salt, brackish and fresh tidal waters, mudflats and marshes. In this case, complementary habitat types that can be found within 1130-estuaries are 3270 (Rivers with muddy banks with Chenopodium rubri p.p. and Bidention p.p. vegetation), 6430 (Hydrophilous tall herb fringe communities of plains), 6440 (Alluvial meadows of river valleys of the Cnidion dubii), 6510 (Lowland hay meadows) and 91E0 (Alluvial forests of Salicion albae).

Proposed modifications for the EC Interpretation Manual

To include the results of considerations developed above, it is proposed to modify the Interpretation Manual in a pragmatic way with in bold complementary descriptions.

N°	Current Interpretation Manual version (EUR 27)	Proposed modification (in bold)
0	Downstream part of a river valley… extending from the limit of brackish waters.	Downstream part of a river valley extending from the limit of brackish water **and/or tidal influence. The outer limit has to be defined at local level with the features of interest and if possible in coherence with the transitional water bodies identified during the WFD implantation**. **Estuaries are dynamic systems with their own conservation value but consisting at the same time of several habitat types and habitats of species**.
1	Downstream part of a river valley, subject to the tide and extending from the limit of brackish waters. River estuaries are coastal inlets where, unlike 'large shallow inlets and bays' there is generally a substantial freshwater influence. The mixing of fresh water and sea water and the reduced current flows in the shelter of the estuary lead to deposition of fine sediments, often forming extensive intertidal sand and mud flats. Where the tidal currents are faster than flood tides, most sediments deposit to form a delta at the mouth of the estuary.	In North-East Atlantic coast, estuaries are subject to the tide. River estuaries are coastal inlets where, unlike 'large shallow inlets and bays' there is generally a substantial freshwater influence. The mixing of fresh water and sea water and the reduced current flows in the shelter of the estuary lead to deposition of fine sediments, often forming extensive intertidal sand and mud flats. **Tidal estuarine ecosystems are characterized by subtidal and intertidal habitats (slikke) including salt marshes (shore). Some of them are identified as habitat types in their own right and occur in other coastal/inland areas.** Where the tidal currents are faster than flood tides, most sediments deposit to form a delta at the mouth of the estuary. **Channels and/or shipping lanes are part of the habitat in all geographical conditions as they play a crucial role in the hydrological functioning of estuaries, including the circulation of water and the deposition of sediments. Furthermore, these channels may also form part of the estuarine migration routes of Annex II fish species.** **If freshwater tidal areas form part of the estuary, the upstream boundary may be marked by the limit of tidal influence.**
1	Baltic river mouths, considered as an estuary subtype, have brackish water and no tide, with large wetland vegetation (helophytic) and luxurious aquatic vegetation in shallow water areas.	Baltic, **Mediterranean and Black sea** river mouths may be considered as estuary subtypes with brackish water and **nearly** no tide. **Their definition is made at Member States level if possible in coherence with the obligations of the annex 2 of the Water Framework Directive (typologies). When the distinction among habitat is uncertain, as between 1130 estuaries and 1150* lagoons, the choice made by the Member states in the Standard Data Form will be considered as accurate.** In Baltic estuaries, large wetland vegetation (helophytic) and luxurious aquatic vegetation in shallow water areas occur.
2	Plants: Benthic algal communities, *Zostera* beds e.g. *Zostera noltii* (*Zosteretea*) or vegetation of brackish	Some other annex II species as *Angelica heterocarpa* and *Oenanthe conioides* should be added as they occur only in estuaries. *Deschampsia wibeliana also* only occur in

	water: *Ruppia maritima* (= *R. rostellata* (*Ruppietea*)); *Spartina maritima* (*Spartinetea*); *Sarcocornia perennis* (*Arthrocnemetea*).	estuaries in the freshwater tidal area (optional part of the estuary selection). Phragmitetea and Asteretea tripolii should also be added as vegetation parts.
2	Both species of fresh water and brackish water can be found in Baltic river mouths (*Carex* spp., *Myriophyllum* spp., *Phragmites australis*, *Potamogeton* spp., *Scirpus* spp.).	Both species of fresh water and brackish water can be found in Baltic**, Mediterranean and Black sea** river mouths (*Carex* spp., *Myriophyllum* spp., *Phragmites australis*, *Potamogeton* spp., *Scirpus* spp.).
2	Animals: Invertebrate benthic communities; important feeding areas for many birds.	Animals: Invertebrate benthic and pelagic communities; **fish communities including migratory species**; important feeding **and resting** areas for many birds.
3	Corresponding categories German classification : "D2a Ästuare (Fließgewässermündungen mit Brackwassereinfluß u./od. Tidenhub eingeschlossen werden", "050105 Brackwasserwatt des Ästuare an der Nordsee", "050106 Süßwasserwatt im Tideeinfluß des Nordsee".	
4	An estuary forms an ecological unit with the surrounding terrestrial coastal habitat types. In terms of nature conservation, these different habitat types should not be separated, and this reality must be taken into account during the selection of sites.	An estuary forms an ecological unit with the surrounding terrestrial **and subtidal** coastal habitat types. In terms of nature conservation, these different habitat types should not be separated, and this reality must be taken into account during the selection of sites. **Estuaries are sometimes related to coastal lagoons (1150*) or to large shallow inlets and bays (1160).** **Sand banks (1110), sandflats and mudflats (1140), reefs (1170) and salt marshes (1310 to 1330) may e.g. also be a component part of habitat 1130 Estuaries. This also the case of the following habitats if we consider tidal freshwater areas: 3270 (Rivers with muddy banks with Chenopodium rubri p.p. and Bidention p.p. vegetation), 6430 (Hydrophilous tall herb fringe communities of plains), 6440 (Alluvial meadows of river valleys of the Cnidion dubii), 6510 (Lowland hay meadows) and 91E0 (Alluvial forests of Salicion albae).**
5	Brunet, R. et al. *Les mots de la géographie-dictionnaire critique*. Ed. Reclus. Gillner, W. (1960). Vegetations- und Standortsuntersuchungen in den Strandwiesen der schwedischen Westküste. *Acta Phytogeogr. Suec*. 43:1-198.	To be updated with less than 20 references including some Member states guidance documents for the habitat description

2.2 TSD n° 2: How to know the key environmental processes that form an estuary and a coastal zone.

Explanation of the question and its pertinence

In order to be able to understand how a natural system responds to change, whether this is humanly induced or naturally caused, the concerned authorities will first need to know, particularly for the area they manage, how their estuarine or coastal system is organised, from which physical elements it consists of, what are the dynamics of the interaction between them and how the current system and subsystems behave. This Technical Supporting Document intends to give a brief description of all these elements related to the system's dynamics. These environmental processes have to be taken into consideration when delineating Natura 2000 sites, when defining its conservation objectives (see TSD 6), when setting management objectives or when identifying management measures. The biological processes related to the estuarine and coastal systems are explained in detail in TSD 3.

EU Guidance already existing

1. European Commission, (2003), Common implementation strategy for the water framework directive (2000/60/EC), Transitional and coastal waters-Typology, Reference conditions and classification systems, Guidance Document No 5, Luxembourg: Office for official publications of the European Communities, 116 pp. http://circa.europa.eu/Public/irc/env/wfd/library?l=/framework_directive/guidance_documents&vm=detailed&sb=Title

Technical guidance proposed

The habitats examined in the current document are listed in table 1. Sea cliffs and shingle or stony beaches (habitats 1210 to 1240) were not taken into consideration as they are less dynamic environments with sparse port development apart of local marinas. Purely marine habitats (e.g. 1180 submarine structures made by leaking gases) were not considered as well as terrestrial habitats including dunes systems even if they have functional links with subtidal or intertidal habitats.

Table 1: Habitats examined in the current document

Habitats listed in Annex I of the Habitats Directive that may be affected during port development	Relations with WFD categories
1. Coastal and halophytic habitats	
11. Open sea and tidal areas	
1110 - Sandbanks which are slightly covered by sea water all the time	Coastal or transitional waters
1120 – Posidonia beds *	Coastal waters
1130 – Estuaries	Transitional waters
1140 – Mudflats and sandflats not covered by seawater at low tide	Coastal or transitional waters
1150 - Coastal lagoons*	Transitional waters
1160 - Large shallow inlets and bays	Coastal or transitional waters
1170 – Reefs	Coastal or transitional waters
13 . Atlantic and continental salt marshes and salt meadows	
1310. *Salicornia* and other annuals colonising mud and sand	Coastal or transitional waters
1320. *Spartina* swards (*Spartinion maritimae*)	Coastal or transitional waters
1330. Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)	Coastal or transitional waters

14 . Mediterranean and thermo-Atlantic salt marshes and salt meadows	
1410. Mediterranean salt meadows (*Juncetalia maritimi*)	Coastal or transitional waters
1420. Mediterranean and thermo-Atlantic halophilous scrubs (*Sarcocornetea fructicosi*)	Coastal or transitional waters
16 . Boreal Baltic archipelago, coastal and landupheaval areas	
1610 Baltic esker islands with sandy, rocky and shingle beach vegetation and sublittoral vegetation	Coastal or transitional waters
1620 Boreal Baltic islets and small islands	Coastal or transitional waters
1630 * Boreal Baltic coastal meadows	Coastal or transitional waters
1640 Boreal Baltic sandy beaches with perennial vegetation	Coastal or transitional waters
1650 Boreal Baltic narrow inlets	Coastal or transitional waters
3. Freshwater habitats	
Standing waters or running waters habitats in relation with coastal and transitional waters	Surface waters

This document is also dedicated to species that could be affected by ports or port related activities development and especially birds in the framework of the Birds Directive.

Habitats and species are in many aspects determined by the geological setting, the morphology and the natural system processes of the coastal and estuarine ecosystems. They depend on numerous factors such as the location along the natural system and position in the salinity gradient, the area surface and elevation of the considered habitat, the duration and the degree of submersion of it, the flow intensity (velocity and turbulence) during the various phases of the tidal cycle, the sedimentary composition of morphological features such as the intertidal areas, shallow water zones, sandbars, salt marshes and others (Delft, 2007b)

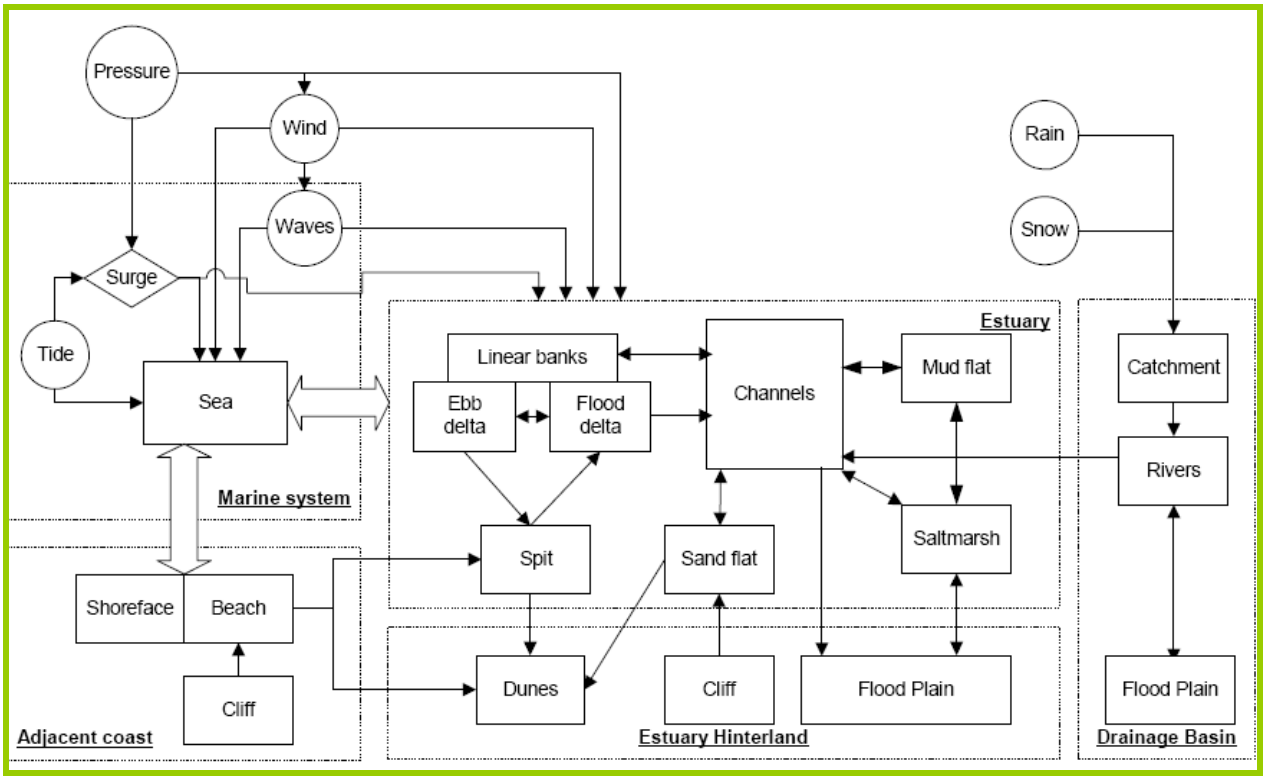
All these natural factors form a rapidly changing estuarine or coastal setting consisting of several sub-systems as described in figure 1. In order to be able to understand how a natural system responds to change, whether this is humanly induced or naturally caused, the concerned authorities should have a general understanding, particularly for the area they manage, how their estuarine or coastal system is organised, from which physical elements it consists of, what are the dynamics of the interaction between them and how the current system and subsystems behave.

Hydro-geomorphological changes to the river system and transitional waters may have an adverse effect on all levels of the food chain i.e. phytoplankton, benthos, fishes, plants etc. For example, phytoplankton populations in transitional waters, is mainly affected by the flushing rate of the estuary or delta, the turbidity of the water and the nutrient input (Elliott et al., 2008[11]). Flushing rate of water from the estuary is determined by the relative magnitudes of freshwater inflow and tidal regime (i.e. hydrographic processes) and determines the retention or removal of phytoplankton from the estuary. These processes also determine the salinity which has an effect through the differing tolerances of different species. Additionally, turbidity in the water column is the net result of erosion-deposition processes/ cycles in water bodies, which are especially notable in estuaries. Erosion of the bed occurs under increased flow conditions, for example during the strongest ebb and flood tide periods, during spring tide conditions and other high energy events such as periods of high freshwater run-off.

Similarly, fish are influenced by environmental factors that determine the resources of space, shelter and food. The key environmental factors can be separated into two groups: hydrographical factors and geomorphological factors. The primary hydrographical factors are those within the water column (e.g. turbidity, stratification and water movements, tidal regime, mixing, wave exposure, freshwater flow) whereas geomorphological factors are those based around the land forms of the estuary and coast (e.g. physical shape, relief and substratum), including their sensitivity and dynamic nature in time and space. These then affect the secondary hydrodynamical and physico-chemical features such as salinity, temperature, dissolved oxygen and other aspects of the water chemistry of importance to structuring the estuarine fish community.

[11] For the all this chapter

Figure 2: Systems map of the estuary within a coastal and catchment setting (ABPmer, 2008)



All the above demonstrate the importance of the understanding of an estuary, a delta or the adjacent coastal zone of an area and how human intervention can alter this whole system and lead to environmental deterioration. The following paragraphs give a brief overview of the functioning of estuaries and deltas and their relation to the rest of the coastal zone related to them.

Functioning of an estuary (from ABPmer, 2008)

Estuaries follow a natural process of infilling by sediment washed down the rivers, or carried in from the sea by the tide, and dropped in the more tranquil conditions of the estuary. Examining the amount of infilling that has taken place over the Holocene (approximately the last 10,000 years, going back to the last ice age) allows different types of estuary to be identified. The deep fjords and fjards are estuaries where infilling is not significant and their shape and size is entirely dependent on the shape carved out by earlier ice ages i.e. found in Scotland and Norway. They are usually deep with very steep rocky sides (Little, 2007). Another type of estuary called, rias is usually carved by rivers or ice melt waters, and now partially infilled. The most common estuaries entirely formed with Holocene sediments are divided in three groups. The “drowned river valleys” result from marine transgression with a spit enclosed of funnel-shaped mouth, sometimes forming interlinked estuaries or lagoons i.e. the Wadden Sea. The “embayments” are river or marine origins and occur when one or more rivers meet at the mouth. “The drowned coastal planes” are those formed from tidal inlets and often contain large areas of mudflats and salt marshes i.e. Severn Estuary in England.

The progressive infilling of estuaries (Figure 3) depends on the size of the initial basin and the amount of sediment available which is either supplied from erosion in the catchment, or from

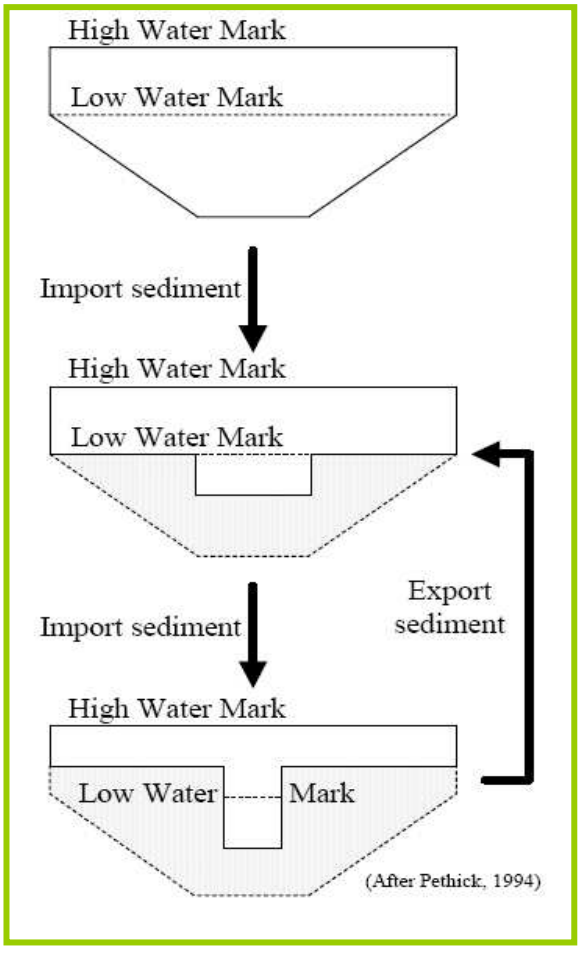


Figure 3: Estuary infilling and sediment balance (ABPmer, 2008)

the marine environment. Beyond a certain point, however, a sort of balance is reached and the estuary begins to release sediment, rather than retain it. As changes take place in the tides, the level of the sea, the flows draining from the rivers and the supply of sediment, then the balance will continuously adjust.

Evolution of an estuary to a delta (from Masselink and Hughes, 2003)

As estuaries infill, their morphodynamic behaviour evolves towards that of a coastal delta. The main difference between estuaries and deltas is the landward and seaward net sediment transport, respectively. Otherwise described, deltas are progradational systems that are presently extending the coastline, whereas estuaries occupy coastal embayments that are presently infilling. The key indicator for the switch from an estuary to a delta is the meandering tidal channel. The presence of tight meanders indicates that net bedload transport is landward in the channel seaward of the meanders, i.e. the system is behaving as an estuary. The absence of the meandering zone indicates that the net bedload transport is seawards through the system, i.e. the system is behaving as a delta.

Fluvial-dominated deltas are the only delta-type that is indisputably a delta. Wave-dominated deltas are rather classified as wave-dominated may be better classified as beach-ridge strand plains, since most of their sediment is supplied by littoral drift rather than river processes. Similarly many tide-dominated deltas should probably be considered estuaries since they are transgressive systems. Nevertheless, there are major deltas that meet the criteria of coastal progradation and yet are modified substantially by wave or tidal processes.

Estuary via delta basic morphological zonation (from Masselink and Hughes, 2003)

Estuaries can be divided in three zones which are unique with respect to their energy regime, sediment type and morphology. These zones are the inner zone, central zone and the outer zone. The energy regime in the inner zone is river dominated, in the outer zone is marine dominated (waves and tides) and in the central zone it is mixed (tide and river processes). The inner and the outer zones are most energetic and are predominately sediment transfer zones. For the system to be infilling, the net bedload transfer direction must be landward in the outer zone. This combined with the net seaward-directed transport in the inner zone results in sediment convergence in the central zone, which is a sediment sink. In keeping with the relative energy levels, the inner and outer zone generally contains the coarsest sediment and the central zone contains the finest sediment.

Delta morphology is a result of factors common to both river catchment and the receiving basin (coastal waters), as well as factors unique to each. Three morphological units are common to most deltas: the delta plain, delta front and prodelta. The delta plain is the sedimentary platform that mantles recent coastal progradation. The river continuously delivers sediment to the coastline and causes the delta front to prograde seaward through deposition of the relatively coarse sediments closest to the coast and the finer sediments further seaward. The finer sediments are deposited on the prodelta. As the delta front progrades horizontally the delta plain aggrades vertically. The resulting sediment distribution is then a general fining in the seaward direction and a general coarsening upwards in the vertical direction.

Tidal influence in estuaries and deltas (from Masselink and Hughes, 2003)

The movement of the tide wave in an estuary controls the vertical change in water level and the horizontal motion of the water column. For roughly half a tidal period, a horizontal current flows in the landward direction and is called the flood current. Similarly for the other half of the tidal period an ebb current flows in the seaward direction. Between the flood and ebb currents, when the flow direction reserves, the current is slack.

The sense of tide velocity-magnitude asymmetry can be consistent throughout an estuary or it can vary along the estuary channel. Estuaries or channel reaches that display a flooding tide that is larger in velocity-magnitude and short in duration than the ebbing tide are said to be flood dominant, whereas those that display an ebbing tide that is largest in magnitude and shortest in duration are said to be ebb-dominant. Flood or ebb dominance often translates directly to net landward or seaward sediment transport, respectively. A small difference in the velocity-magnitude between the flood and ebb tide can lead to a large difference in the total amount of sediment, transported be each and therefore a net sediment transport. In general, flood-dominant estuaries tend to infill their

entrance channels by continually pushing coastal sediment landward and as a result are often intermittently closed, whereas ebb-dominant estuaries tend to flush sediment seawards from their entrance channels and as a result are often stable.

The primary effect of tide on delta front processes is to cause strong mixing. The river effluent typically behaves as a plane jet that is interacting with strong tidal currents flowing roughly parallel to it. The result is elongated distributary mouth bars separated by tidal channels. The situation is made complex, however, by the fact that flooding tidal currents oppose the river effluent and ebbing currents flow with it. This results in mutually-evasive sediment transport zones in which one side of the channel conveys sediment mostly in the seaward direction. Despite some sediment being transported landward at specific sites in this system, on the whole, most sediment is being transported seaward to feed an actively prograding delta front.

When delta systems are connected to a steep shoreface the delta front may be exposed to high-energy waves. Waves also enhance mixing, hence any buyancy is destroyed and the river effluent again behaves as a modified plain jet.

Fresh and sea water mixing and sediment movement (from Little, 2007)

The most widely used classification of estuaries is based on the sea water and river water mix. “Salt-wedge” estuaries are found where a large river flows into an area with a small tidal range and where small mixing of salt and freshwater takes place. In such estuaries the dense fresh water flows floats on the denser sea water and as it moves seawards it spreads out forming a thinner layer, while the sea water beneath forms the shape of a wedge. Water flow usually determines sediment flow and in this particular type of estuary coarse sediments are deposited at the tip of the wedge as the river flow rises over the edge and lives the bed. This sediment may form a bar in the river where finer sediment is also accumulated. Salt-wedge estuaries form environments for organisms that show distinct transitions between regions. Sharp transitions in plankton may occur because of the sudden change from fresh water to salt water, whereas rapid transitions are also apparent at the benthos between sand fauna and barren regions of coarse shingle.

When there is more tidal action, more turbulence is produced and river flow is smaller. This is when an estuary is classified as “partially mixed” and the mixing of river water occurs downwards into the sea water in addition to the entrainment of salt upwards. The result is a gradual increase of salinity from surface to bottom the opposite effect from the salt-wedge estuaries. Fine sediment does not usually flow to sea as a plume and sinks to the bottom, aided by flocculation and is then returned upstream by the residual currents. Fine sediment therefore accumulates within the estuary and is most concentrated where upstream transport is balanced by the river’s seaward transport where is formed what is called the “turbidity maximum”. The turbidity maximum is extremely important for the estuary’s biota. Fine sediment clogs the filtering mechanisms of suspension feeders and more importantly cuts down the penetration of light through water. This means that algal growth is suppressed and as planktonic food chains mostly start with primary production they may be much reduced in turbid estuaries.

Where tidal currents are sufficient to remove all vertical salinity differences and tide dominates the estuaries these are classified as “fully mixed”. When the tide range is very high the turbidity maximum often spreads over great distances in fully mixed estuaries and moves horizontally. Phytolplakton growth in such estuaries is severely restricted despite high levels of nutrients that would in other circumstances produce eutrophication.

It is evident that estuaries are sediment traps and biota depends from the sediment behaviour within an estuary i.e. deposition, suspension and mobility. Besides this sediment oriented classification, estuaries also contain a number of other distinct features, which distinguish them from marine and terrestrial habitats. On the seaward side are banks, shoals, sand flats, mud flats and saltmarsh habitats, which link to fringing habitats such as sand-dunes, shingle ridges and coastal marshes, in turn linking to progressively less saline terrestrial habitats, such as freshwater marshes and coastal grassland, in a landward direction (ABPmer, 2008).

The role of mudflats, sandflats and sandbanks in estuarine and coastal systems (from ABPmer, 2008)

Sandflats are accumulations of non-cohesive sand sized sediments deposited in the intertidal areas of an estuary. On the other hand, mudflats are accumulations of cohesive sediments found along the

margins of estuaries where there is a sufficient supply of fine grained sediment and prevailing conditions that permit their deposition in intertidal areas. The function of both mudflats and sandflats is the dissipation of wave and tidal energy. Sandflats are also considered as a form of storage area of sediment within the estuarine system, whereas mudflats can act as a source or a sink for fine grained sediments. Sand flats may in certain situations be backed by beach and dune systems to the landward side and as mentioned in the following paragraph describing sand dune functions, the behaviour of these two elements can be closely linked. On the other hand, mudflats are linked to saltmarsh and comprise interdependent geomorphological elements as described in the following paragraph explaining in detail the role of salt marshes to system. Sandbanks are defined from the Habitats interpretation manual as elevated, elongated, rounded or irregular topographic features, permanently submerged and predominantly surrounded by deeper water. They consist mainly of sandy sediments, but larger grain sizes, including boulders and cobbles, or smaller grain sizes including mud may also be present on a sandbank.

The role of salt marshes in estuarine and coastal systems

Saltmarshes can be defined as accumulations of cohesive sediments vegetated by salt tolerant plant (halophytic) species found along the intertidal margins of estuaries (ABPmer, 2008). The establishment of halophytic plants on sheltered tidal flats is the first stage in the colonisation of this highly specialised community (Delft University, 2007b). The pioneer plants promote desiccation and consolidation of the sediment, and in between the plants drainage patterns become visible (Delft University, 2007b). These later develop into an intricate system of creeks, gullies and channels which are characteristic for a salt marsh (Delft University, 2007b). Sediment is trapped between the plants, the surface of the salt marsh is raised and the process of succession takes place (Delft University, 2007b). As vegetation becomes progressively covered by fewer and fewer tides, an increasingly diverse community of plants and animals develops, leading to sometimes complex stands of vegetation which develop out of reach of all but the highest tides (Delft University, 2007b). Within the overall estuary system areas of saltmarsh act to dissipate wave and tidal energy and hence afford protection to the adjacent hinterland, in addition a saltmarsh represents a significant sink for sediments within the estuary (ABPmer, 2008).

As indicated earlier, salt marshes and mudflats are interrelated sub-systems of an estuary. At its lower margins saltmarsh is likely to be bounded by mudflat. Mudflat development essentially creates a low energy environment at an elevation relative to the tidal frame that is conducive to saltmarsh development (ABPmer, 2008). As mudflats develop they are able to dissipate wave energy and as a result the upper mudflat will progressively become a low energy environment (ABPmer, 2008). Low energy environments encourage sediment deposition and mudflat elevation increases progressively providing a surface for saltmarsh colonisation at the correct elevation. Sediment exchange occurs at the limits of these two habitats where salt marsh vegetation is taking over, trapping the sediment and leading to the different plant succession stages. Exchanges from saltmarsh to mudflat can also occur during high magnitude events. Under these conditions, the saltmarsh acts as a temporary sediment supply to the mudflat. This supply is caused by the increased wave energy eroding the saltmarsh and transporting the material onto the neighbouring mudflat (ABPmer, 2008). In geomorphological terms, this supply of material allows the mudflat to adjust its profile to the applied forcing through widening and flattening (ABPmer, 2008).

The role of sand dunes in estuarine and coastal systems

Coastal sand dunes develop where there is an adequate supply of sand (sediment within the size range 0.2 to 2.0 mm) in the intertidal zone and where onshore winds are prevalent (UK BAP, 2008). The function of a dune system is both to provide protection to the adjacent landward hinterland and to provide a store of sediments available to the fronting foreshore (ABPmer, 2008). The critical factor is the presence of a sufficiently large beach plain whose surface dries out between high tides. The dry sand is then blown landwards and deposited above high water mark, where it is trapped by specialised dune-building grasses which grow up through successive layers of deposited sand (UK BAP, 2008).

If every estuary could be consider as different, the key question of their vanishing and their resilience remains the same. For the conservation objectives, authorities will have to deal with both dynamic processes and more static features as induced by the nature directives.

2.3 TSD n° 3: Species of estuarine and coastal habitats in consideration of the nature directives and the Water Framework Directive

Explanation of the question and its pertinence

Estuarine habitats are not only characterized by physical-chemical features since both the water column and the seabed (substratum) supports numerous species and processes of biological functioning including consumption, predation, competition, population control, etc.

Furthermore, there are legal obligations due to both the nature directives and the Water Framework Directive related to species. For nature directives, species are a key target (migratory birds and those listed on Annex I of the Birds Directive, and species from annex II and IV of the Habitats Directive) and Natura 2000 sites play a key role in helping to achieve favourable conservation status of those species. Moreover, the conservation status of habitats is partly linked to the conservation status of their typical species. In the WFD, the Good Ecological Status and the Good Ecological Potential in coastal and transitional waters are partly related to a group of species as listed in annex V:

- Composition, abundance and biomass of phytoplankton
- Composition and abundance of other aquatic flora
- Composition and abundance of benthic invertebrate fauna
- Composition and abundance of fish fauna for transitional waters only

In water bodies overlapping with Natura 2000 sites, mammals and birds, or even any specific single species, are not clearly targeted by the WFD which is considering groups of species (taxonomic composition) and their ecology. This is the reason why nature directives are sometime considered as more stringent for these Natura2000/water bodies. In the WFD, some species are used as indicators of a water body's ecological status but at the same time some of them are specifically targeted from the nature directives. This is probably a major difference as their life cycle is considered within nature directives, e.g. for birds feeding areas (in intertidal zones) but resting areas at high tide too (in terrestrial areas). In other cases, typical species of aquatic habitats focused by the Habitats directive are also considered and these typical species have to be determined by national authorities.

This guidance concept forms will briefly describe some key parameters of biological functioning within estuaries and give description, per group, of the main features.

EU Guidance already existing

1. European Commission (2007), Guidance document on the strict protection of animal species of Community interest under the Habitats Directive 92/43/EEC, 87 pp. http://circa.europa.eu/Public/irc/env/species_protection/library?l=/commission_guidance/english/final-completepdf/_EN_1.0_&a=d
2. See also guidance documents produced by European Commission on the WFD: http://circa.europa.eu/Public/irc/env/wfd/library?l=/framework_directive/guidance_documents&vm=detailed&sb=Title

Technical guidance proposed

Generally speaking transitional waters are characterized by a combination of marine species, fresh water species and specific brackish water species. It means that within an estuary a gradient in species distribution will be related to physico-chemical parameters, mainly salinity, but turbidity and as well as, oxygen quantity.

The curve of Remane (Mc Lusky 1989, see fig.4) illustrates this distribution and the fact that the biodiversity for brackish water species is relatively low. However, the productivity in estuarine habitat is very high (Marion 1998) and the species are adapted to changing conditions up to a certain extent

e.g. dystrophic crisis may kill invertebrates of mudflats. Intertidal mud flats are important in the functioning of estuarine systems and may have a disproportionately high productivity compared to subtidal areas (Elliott et al., 1998). In the contrary, coastal sand flats have a very poor productivity (Little, 2007).

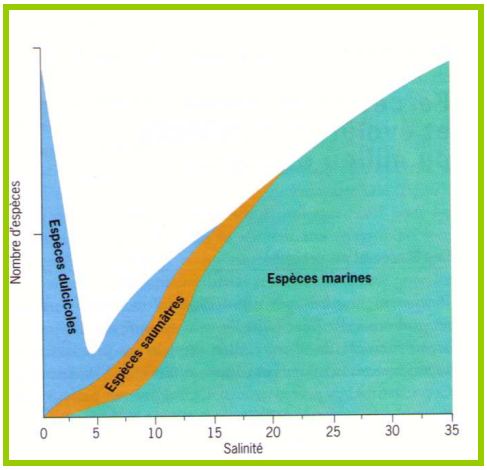


Fig. 4: Remane curve giving the proportion of river, estuarine and marine fauna in tidal estuaries (Mc Lusky 1989)

For the different groups of species focused, this Technical Supporting Document will:

- illustrate how the groups of species use the subtidal and intertidal areas and the trophic relations between species
- highlight species from annex II and IV of the habitat directive
- illustrate how the groups of species were used by Member states to define typical species of the habitat 1130 Estuaries
- illustrate how the groups of species are used within the WFD for coastal and transitional waters to define the ecological status

Phytoplankton and macroalgae

Muddy sediments harbour a large diversity of organisms, as well as supporting a very high biomass. Organisms include the macroalgae such as the green Enteromorpha, whole filaments bind surface mud and sand particles and micro-organisms consisting for the most part of diatoms, cyanobacteria (blue-green algae) and flagellates and are visible as brown green or golden-brown films (Little, 2007). Phytoplankton is the basis of all the food chain. The annex 5 of the WFD gives the definitions for the high and the good ecological status (see box A) concerning primary producers.

There are also other Member States (e.g. Belgium) who consider transitional waters as a death zone for phytoplankton. However this is only true for the mesohaline part of the estuary, where freshwater plankton and sea plankton are both flushed into water with the wrong osmotic pressure. Also the salinity is so variable that it is hard for any population to develop.

Within the assessment of the conservation status for the habitat 1130, at least Spain has used algae as typical species in Mediterranean areas (*Ulva curvata*, *Ulvaria oxysperma*). The Interpretation Manual gives benthic algal communities as characteristic species.

We can consider that the Good Ecological Status or Potential to be reached for phytoplankton and algae could be one of the key parameters for the Conservation Status at site level of the habitat 1130 estuaries and other coastal habitats as the species are the primary producers on which all the food chain will rely on. However transitional waters phytoplankton is not used in Germany as WFD quality target because German authorities consider that transitional waters are a death zone for phytoplankton, dominated by dying and dead planktonic algae.

Box A: Ecological Status of primary producers in WFD (annex 5)

General definition for maximum and good ecological potential for Heavily Modified Water Bodies are also given in general terms for biological quality elements

- High Status

The composition and abundance of the phytoplanktonic taxa are consistent with undisturbed conditions. The average phytoplankton biomass is consistent with the type-specific physico-chemical conditions and is not such as to significantly alter the type-specific transparency conditions. Planktonic blooms occur at a frequency and intensity which is consistent with the type-specific physicochemical conditions. The composition of macroalgal taxa is consistent with undisturbed conditions. There are no detectable changes in macroalgal cover due to anthropogenic activities.

- Good status

There are slight changes in the composition and abundance of phytoplanktonic taxa. There are slight changes in biomass compared to the type-specific conditions. Such changes do not indicate any accelerated growth of algae resulting in undesirable disturbances to the balance of organisms present in the water body or to the physico-chemical quality of the water or sediment. A slight increase in the frequency and intensity of the type specific planktonic blooms may occur. The composition and abundance of phytoplanktonic taxa differ moderately from type-specific conditions. Biomass is moderately disturbed and may be such as to produce a significant undesirable disturbance in the condition of other biological quality elements. A moderate increase in the frequency and intensity of planktonic blooms may occur. Persistent blooms may occur during summer months.

There are slight changes in the composition and abundance of macroalgal taxa compared to the type-specific communities. Such changes do not indicate any accelerated growth of phytobenthos or higher

Angiosperms

Some angiosperms occur on subtidal and intertidal areas as Zostera beds but most of the species occurs in the various forms of salt marshes. The nature of the plant communities in salt marshes is not only influenced by climate, sediment type and geographical location, but also by the frequency and duration of inundation and the degree of tidal influence.

The plants forming the salt marshes include genera such as *Salicornia*, the grassworts (also protected under the Habitats Directive - 1310), and *Spartina* the cordgrasses. This pioneer vegetation colonises intertidal mud and sand flats in areas protected from strong wave action and is an important precursor to the development of more stable salt marsh vegetation. It can also colonise open creek sides, depressions or pans within salt marshes, as well as disturbed areas of upper salt marshes (Delft University, 2007b).

The *Spartina* swards is flooded regularly and dominated by the vegetation of cord grasses, forming the middle reaches of salt marshes, where tidal inundation still occurs but with decreasing frequency and duration. *Spartina* colonises a wide range of substrates, from very soft muds to shingle, in areas sheltered from strong wave action and can be found on the seaward fringes of salt marshes and creek-sides (Delft University, 2007b).

As the marsh grows in height, conditions become suitable for other species to grow including a number of broadleaved herbaceous plants such as Limonium, the sea lavenders and *Aster tripolium*, protected from the habitats directive as Atlantic salt meadows. Nevertheless reed beds (*Phragmites, Schoenoplectus, Bolboschoenus*) form the dominant natural vegetation of mud and sand flats as well as of wet marshes in the estuaries. Salt meadows are in brackish marshes mostly dependent on grazing.

In the weakly brackish, fresh or dryer parts of the supralittoral the natural vegetation may be formed by willow woods. The semi-natural vegetation is here characterized by fresh grassland (*Cynosurion, Arrhenatherion, Calthion, Agrostietalia stoloniferae*).

Another annex II angiosperm species is endemic from French Atlantic estuaries: *Angelica heterocarpa*.

Most of Members States in Mediterranean area have used angiosperms in their national reports according to art. 17 as typical species for the habitat 1130 estuaries: *Ruppia maritima, Sarcocornia perenis, Zostera noltii*… following the proposal of the Interpretation Manual. This is not the case for Member states of the North-East Atlantic area apart of Germany where several angiosperms were proposed (*Angelica archangelica, Aster tripolium*…). It is uncertain why *Zostera* beds[12] were not considered as typical species, knowing that several bird species feed on them. Some Member States stated that the subset of typical species used for reporting under Art. 17 is only a selection of the whole range of typical species for a habitat type. This may explain why for example Zostera spp. were not mentioned, being a typical species, but often only present in small parts of estuaries or certain estuaries. For the Baltic areas, most of Member states have proposed angiosperm occurring in brackish waters as suggested in the Interpretation Manual (Myriophyllum spp., Phragmites australis, Potamogeton spp. …).

The annex 5 of the WFD gives the definitions for the high and the good ecological status concerning angiosperms (see box B).

Box B: Ecological Status of Angiosperms in WFD (annex 5)

General definition for maximum and good ecological potential for Heavily Modified Water Bodies are also given in general terms for biological quality elements

- High Status

The taxonomic composition corresponds totally or nearly totally to undisturbed conditions. There are no detectable changes in angiosperm abundance due to anthropogenic activities.

- Good status

There are slight changes in the composition of angiosperm taxa compared to the type-specific communities. Angiosperm abundance shows slight signs of disturbance.

We can consider that the Good Ecological Status or Potential to be reached for angiosperms will be a key parameter for the Conservation Status at site level of the habitat 1130 estuaries and other coastal habitats (for example 1330 salt meadows). WFD has a different approach and species proposed as characteristic ones by the Interpretation Manual could be an interesting target for composite indicators used for WFD. For the Conservation Status of transitional waters this is one key parameter but other parameters should be added. For the assessment of the conservation status of the habitat 1130 it is necessary to evaluate the occurring species in their entirety. So the characterisations according to WFD are valuable, but not sufficient and can only build a part within the assessment of the conservation status of habitat 1130.

Sometimes a location is so dynamic that, vegetation can not grow. In such a case angiosperms are not part of the classification.

Benthic invertebrate fauna

Sub tidal sandbanks support large populations of epifauna, particularly echinoderms such as *Asterias* rubens and brittle stars such as *Ophiura albida* (Elliott et al., 1998). Predatory fauna such as hermit crabs e.g. *Eupagurus bernhardus*, *Liocarcinus depurator* and the edible crab Cancer paguras may also be present. Sub tidal sandbanks act as refuge for shrimp at low tide when they escape predation and desiccation on the intertidal flats (Delft University, 2007b).

[12] mainly in large shallow bays

Epifaunal organisms associated with mudflats are predominantly mobile predatory species such as crabs e.g. *Carcinus mae*nus and shrimps e.g. *Crangon crangon*, which take infaunal populations of small bivalves, polychaetes and crustacean (Elliott et al., 1998). Polychaete worms are dominant predators within the substratum and their numbers may be closely related to those of their prey which includes other worms and crustaceans (Elliott et al., 1998). A great range of bivalves can be found on mudflats some of the most familiar being the cockles (*Cerastoderma*) (Little, 1997).

Most of Members States of the North East Atlantic area have considered benthic invertebrate species as typical species for the habitat 1130 estuaries. The annex 5 of the WFD gives the definitions for the high and the good ecological status concerning benthic fauna (see box C).

We can consider that the Good Ecological Status to be reached for benthic fauna will be one of the key parameters for the Conservation Status of the habitat 1130 estuaries and other coastal habitats. For the Conservation Status of transitional waters is this one key parameter but other parameters should be added. For the assessment of the conservation status of the habitat 1130 it is necessary to evaluate the occurring species in their entirety. So the characterisations according to WFD are valuable, but not sufficient and can only build a part within the assessment of the conservation status of habitat 1130. WFD has a different approach and species proposed as characteristic ones by the Interpretation Manual could be an interesting target for composite indicators used for WFD.

Box C : Ecological Status of Benthic invertebrate fauna in WFD (annex 5)

General definition for maximum and good ecological potential for Heavily Modified Water Bodies are also given in general terms for biological quality elements

- High Status

The level of diversity and abundance of invertebrate taxa is within the range normally associated with undisturbed conditions. All the disturbance-sensitive taxa associated with undisturbed conditions are present.

- Good Status

The level of diversity and abundance of invertebrate taxa is slightly outside the range associated with the type-specific conditions. Most of the sensitive taxa of the type-specific communities are present.

Fish fauna

The most important marine predators on intertidal sand and mudflats are particularly the flatfish *Solea solea* (sole), *Limanda limanda* (dab), *Platichthys flesus* (flounder) and *Pleuronectes platessa* (plaice) which feed on polychaetes and their tails (e.g. of *Arenicola* and *Nereis*), bivalve young and siphons (e.g. of *Macoma* and *Angulus*) and tidally active crustaceans such as *Bathyporeia* and *Eurydice* species (Elliott et al., 1998). Gobies e.g. *Pomatoschistus* spp. are another important predator on mudflats and prey heavily on *Corophium volutator* and they have a significant impact as both predator and prey in estuarine ecosystems (Elliott et al., 1998).Other fish such as eels (*Anguilla*) pass through estuaries and may be common on mudflats (Little, 1997). Migratory species such as salmon and shad can also be found in these areas on passage to other wetlands, e.g. saltmarshes and freshwater areas, although they appear to have no requirement for the mud and sandflats (Elliott et al., 1998).

Sub tidal sandbanks act as refuge for juvenile fish (e.g. plaice) at low tide when they escape predation and desiccation on the intertidal flats (Delft University, 2007b). Salt marshes give shelter for early stages in the development of a number of fish. They also provide vital food and habitat for animals like clams, crabs, and juvenile fish.

Some Members States of the North East Atlantic area, e.g. Germany, and the Mediterranean area, e.g. Spain, have considered fish species as typical species for the habitat 1130 estuaries. This is

logic as they are crucial for the food chain, with a high productivity and sensitive to the variation of ecological features. Generally angiosperms were preferred in Mediterranean and Baltic areas. The annex 5 of the WFD gives the definitions for the high and the good ecological status concerning fish fauna (see box D).

If the Good Ecological Status or Potential to be reached for fish fauna is probably one of the key parameters for the Conservation Status at site level of the habitat 1130 estuaries, several differences have to be highlighted:

- Fish fauna is not considered for coastal waters in the annex 5 of the WFD
- Migration routes of Annex II fish species are related to processes and functioning of estuaries and species composition (see box D) is probably not enough to consider that the Good Ecological Status /Potential will give a good Conservation Status on the Natura 2000 sites to the fish species targeted by the Habitat Directive. It has to be highlighted that channels may also form part of the estuarine system (see TSD 1).

Box D : Ecological Status of fish fauna in WFD (annex 5)

General definition for maximum and good ecological potential for Heavily Modified Water Bodies are also given in general terms for biological quality elements

- High Status

Species composition and abundance is consistent with undisturbed conditions.

- Good status

The abundance of the disturbance-sensitive species shows slight signs of distortion from type-specific conditions attributable to anthropogenic impacts on physicochemical or hydromorphological quality elements.

Birds

Estuaries have a crucial role as breeding, wintering and staging (passage) areas for birds. This importance is recognised by specific reference in Article 4 Birds Directive to the need to pay particular attention to the protection of wetlands for migratory birds.

In subtidal areas, birds such as the guillemot, razorbill, puffin and the terns will feed on the fish such as sandeels (*Ammodytes* spp.) which are found in mobile subtidal sands (Elliott et al., 1998). Both the arctic tern and the puffin rely on populations of sandeel as their predominant food source. The sandeel is also an important food source for wintering birds such as scoters, little terns and the red-throated diver (Elliott et al., 1998).

Shorebirds form important predators on NW European intertidal mud and sandflats during long migrations over long distances from breeding to wintering grounds. Particularly dependent species are brent geese, shelduck, pintail, oystercatcher, ringed plover, grey plover, bar-tailed and black-tailed godwits, curlew, redshank, knot, dunlin and sanderling, whilst grey geese and whooper swan may use this habitat for roosting (Jones & Key, 1989; Davidson et al, 1991). Different bird species exploit different areas of an intertidal area, for example the redshank and the shelduck feed on the intertidal area at low water or the water's edge, usually on *Macoma*, *Hydrobia* and other small invertebrates such as *Corophium*. Waders such as sanderling are efficient croppers of macrofauna at the low tide waters' edge both in summer and winter (McLachlan, 1983). Eider ducks, however, feed in the shallow water at low tide on species such as Mytilus edulis. The diet of the black-tailed godwit consisted mainly of the bivalve mollusc Scrobicularia plana with a small proportion of ingested biomass being Nereis and Hydrobia (Moreira, 1994).

Some Members States, e.g. Germany, have considered bird species as typical species for the habitat 1130 estuaries. The WFD is not considering bird species as a key feature for the ecological status of transitional or coastal water bodies and this means that nature directives are the only ones to take them into consideration. Specific needs of birds could be illustrated by two examples of their ecological functioning:

- When the high tide covers the mud flats birds such as Curlew, Godwits, Redshank or Dunlin will feed on creatures in the mud and will need the saltmarsh or an islet to roost, rest and preen.
- Because of their adaptive strategies, birds species will not all of them use the same preys and the same areas of the estuary to feed as illustrated by figure n°5

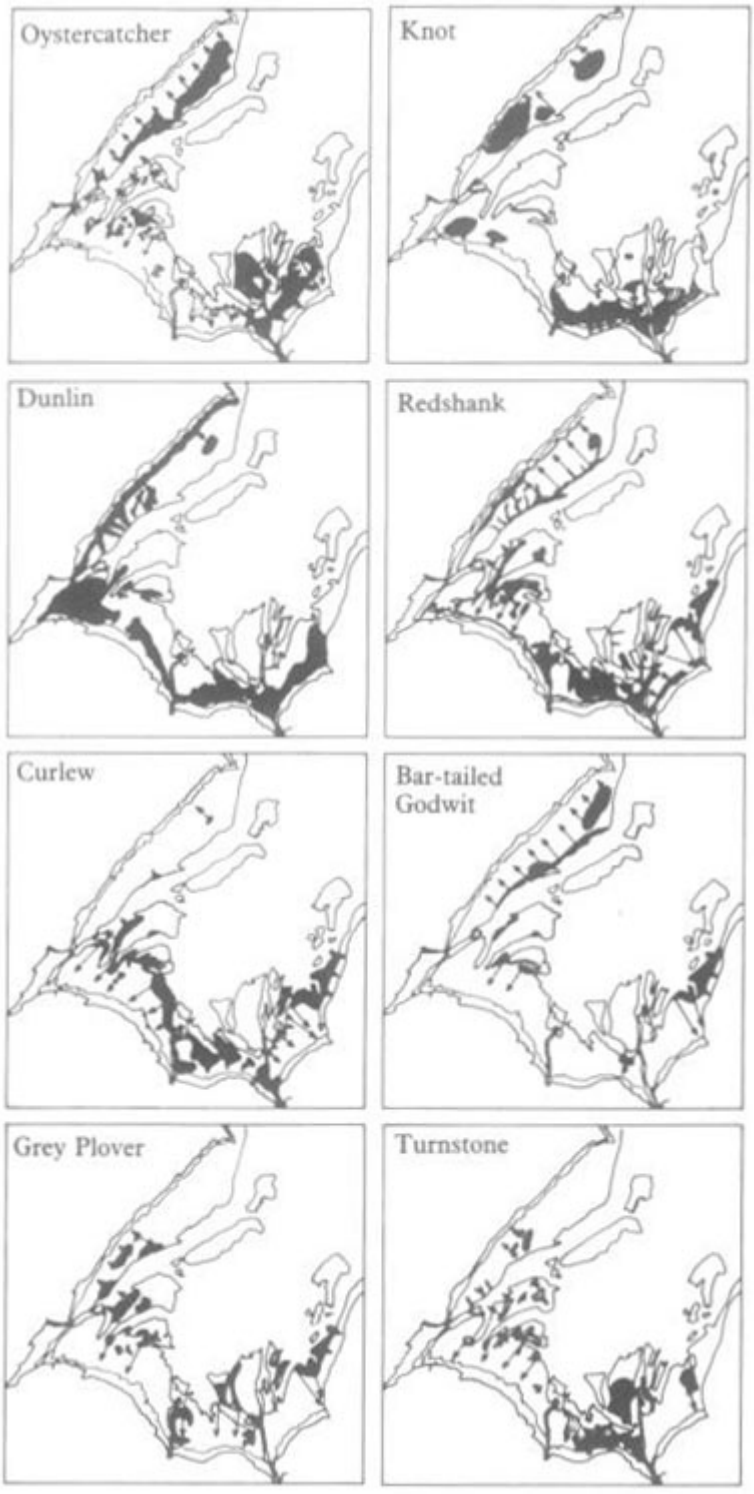


Figure 5: Feeding areas of several bird species on the Wash, UK (Fuller R.J., 1982).

Mammals

Several mammal species from annex II and IV of the Habitat directive occur in coastal areas and/or estuarine ecosystems. Concerning transitional waters, common seal, *Phoca vitulina*, is occurring in both subtidal areas for feeding and in intertidal areas for resting on sand flats. Common seal may even go back upstream in the river up to 200 km. Harbour Porpoise, *Phocoena phocoena*, occurs in subtidal areas (North-East Atlantic and Black sea), and is threaten by pollution and fishing activity. It means that if this species could benefit from the implementation of the WFD with the good ecological status objective, other threats may remain and have to be tackled with nature directives. Other terrestrial mammals as otter (*Lutra lutra*) will use intertidal areas as feeding zones.

Some Members States, e.g. Germany, have considered mammal species as typical species for the habitat 1130 estuaries. The WFD is not considering mammal species as a key feature for the ecological status of transitional or coastal water bodies and this means that nature directives are the only ones to take them into consideration. As for the birds, mammal species have specific needs to be taken into consideration.

To conclude, it seems that criteria proposed by the annex 5 of the WFD are compatible with some of the needs of estuaries and coastal areas as far as conservation status is concerned. In this sense, the Water Framework Directive may contribute towards the achievement of the objectives in the nature directives. However, for the assessment of the conservation status of the habitat 1130 it is necessary to evaluate the occurring species in their entirety. So the characterizations according to WFD are valuable, but not sufficient and can only build a part within the assessment of the conservation status of habitat 1130.

Moreover some aquatic vertebrate species as bird and mammal species were not considered by the WFD and their local conservation status may rely on complementary criteria. Furthermore, other vertebrate species, as birds or otter, occurring outside water bodies but feeding on sub-tidal or intertidal areas were not considered by the WFD and their local conservation status may rely on complementary criteria. The Water Framework Directive applies to all water bodies and the Nature Directives only to some of them. In the water bodies part of the Natura 2000 areas, both directives are complementary and the respective objectives are set at the level of the River Basin Management Plan and the Natura 2000 site itself. These objectives are specific and contribute to sound estuaries and coastal areas.

The assessment of conservation status of the habitat estuary under the Habitats Directive has to consider the full complex of benthic, aquatic to supralittoral and (semi)terrestrial communities. This includes parameters that will not be taken into account by the WFD. Thus WFD assessments will provide primary data that can feed into the assessment of conservation status of the Habitats Directive.

Cases studies:

1. The plant that feeds fish and shellfish

The French Scientific Council for the Natural Heritage and Biodiversity has published a brochure to illustrate the topic of biodiversity through example (CSPNB, 2007, http://www.ecologie.gouv.fr/Biodiversity-illustrated.html). The following one occurring in a large bay where a large restoration project is currently undertaken, is a very good illustration of food chain and ecological processes.

“The Mont Saint Michel maritime character restoration project raised the question of the utility of the salt marshes. Indeed, natural environments requiring protection had to be identified in order to define the work programme.

The usefulness of the salt meadows is known and acknowledged by many stakeholders. For farmers, it is a place where the famous salt meadow sheep are raised. Hunters find widgeons there that feed on alkali grass (*Puccinellia maritima*), a small favourite grazing plant, in winter. For naturalists, it is the favourite spot of a protected goose called the Brent goose.

Non-grazed 'natural' salt meadows initially seem altogether less remarkable. Large areas in the middle of the salt marshes in particular, are occupied by a very common species, the sea purslane (*Atriplex portulacoides*) which forms dense vegetation apparently of no interest.

After ten years of research in the bay, this environment is being seen in a different light. Sea purslane is very productive: an average of over 20 tonnes of dry organic matter per hectare per year and even up to 36 tonnes without labour, fertiliser or pesticides. In comparison, maize uses 140 to 180 kg of nitrogen per hectare for a usable production of 10 to 13 tonnes of dry matter.

Most of the organic matter produced by sea purslane is very rapidly decomposed on the spot, in particular by bacteria and a small 'shredder' shellfish of the genus Orchestia. Thus, organic matter is produced both in dissolved form and as fine particles, together with nutrients (nitrogen and phosphorous) which, once exported to the marine environment, enrich the neighbouring mud flats of the salt marshes. This enrichment explains the capacity of these mud flats to produce micro algae known as diatoms. Dead or alive, these diatoms and organic detritus transported by the tides are part of the reason why the Bay of Mont Saint-Michel is capable of producing an average of 10,000 tonnes of commercialised mussels (the leading French centre for mussel farming), and 4 to 6,000 tonnes of oysters per year – not to mention the invertebrates eaten by migratory birds.

In addition, if we look at how these 'natural' salt marshes - which are incidentally flooded by less than 40% of the tides during the course of a year - function, we can see that when they are submerged (for less than one hour per tide), they are visited by fish such as mullet and young bass during their first year of life. They often arrive with empty stomachs. The mullet gorge on diatoms which they find at the bottom of the channels. The young bass leave with their stomachs full of Orchestia; the capture of these little shellfish is responsible for up to 90% of the growth of the bass during their first year of life. This new insight led to the protection of the salt marshes in the context of the bay development project.

To find out more: Lefeuvre J.C. 2000. La Baie du Mont Saint-Michel (The Bay of Mont-Saint Michel) Actes Sud. 45p. »

2.4 TSD n°4: How can climate change influence conservation objectives?

Explanation of the question and its pertinence

Global changes or climatic changes could influence conservation planning in several ways. This is because climate change can affect all the features of the coastal and estuarine habitats including the anthropogenic features such as port infrastructure and shipping channels. This Technical Supporting Document intends to provide a review of the last results of climate change in Europe recently published from the European Environment Agency, the impacts of these changes to biodiversity and hydromorphology of estuarine and coastal areas, as well as to human activities such as port development and operation. Adaptation measures that will have to be implemented in order to minimise the cost and unfavourable effects of climate change are also listed for future consideration to the development of conservation objectives.

EU Guidance already existing

1. European Commission, (2004a), Coastal Erosion - Evaluation of the need for action, EUrosion, Luxembourg: Office for official publications of the European Communities, 27 pp.
2. European Commission, (2007a), Adapting to climate change in Europe-options for EU Action, Green Paper, 27 pp. COM (2007)354
   http://eur-lex.europa.eu/LexUriServ/site/en/com/2007/com2007_0354en01.pdf

Technical guidance proposed

It is problematic to deliver an overall guidance for all EU Member States when dealing with the consequences of the climate change. It will affect the Member states in very different ways and it will require constant monitoring to determine the consequences and the needs in relation to conservation objectives.

Climate change: temperature increase, sea-level rise and changes in the hydrological cycle (mainly from EEA, 2008)

According to the recent report published from the European Environment Agency, the global mean temperature has increased by 0.8 ℃ compared with pre-industrial times for land and oceans, and by 1.0 ℃ for land alone. Europe has warmed more than the global average (1.0 and 1.2 ℃, respectively), and projections suggest further mean temperature increases in Europe between 1.0–5.5 ℃ by the end of the century, which is also higher than projected global warming (1.8–4.0 ℃). The rate of global mean sea-level rise has increased to 3.1 mm/year in the past 15 years (compared with a global average of 1.7 mm/year in the 20th century) and this is worrying because it can cause flooding, coastal erosion, the loss of flat and low-lying coastal regions and even a change in the tidal regime, such as an increase in tidal range. Sea level-rise also increases the likelihood of storm surges, enforces landward intrusion of salt water and endangers coastal ecosystems and wetlands. Furthermore, changes in temperature, precipitation, glaciers and snow cover, is intensifying the hydrological cycle. For example, annual river flows have been observed to increase in the north and decrease in the south, a difference projected to exacerbate and increase the impact of other stresses (such as land-use and socio-economic changes) on water availability, freshwater ecosystems, energy production, navigation, freshwater supply and use (in agriculture, households, industry) and tourism. Also the annual and spatial distribution of precipitation could vary increasingly leading to dryer summers and wetter winters in certain catchment areas which can have a significant impact on sedimentation.

Climate change impacts on biodiversity of coastal and estuarine areas

Sea-level rise is likely to have major impacts on biodiversity. Examples include flooding of haul-out sites used for breeding nurseries and resting by seals (IPCC, 2007). Increased sea temperatures may also trigger large scale disease-related mortality events of dolphins in the Mediterranean and of seals in Europe (IPCC, 2007). Sea-level rise will reduce habitat availability for bird species that nest or forage in low-lying coastal areas (IPCC, 2007). This is particularly important for the populations of shorebirds that breed in the Arctic and then winter on European coasts (IPCC, 2007). According to the latest report of the EEA (2008) there is a northward movement of marine fishes. Increases in regional sea temperatures have triggered a major northward movement of warmer water plankton in the NE Atlantic and a similar retreat of colder water plankton to the north. This will have an impact on the distribution of fish in the region and may affect both the management of fisheries and the availability of fish prey to marine predators such as seabirds and marine mammals. IPCC's ability to assess biodiversity impacts, ecosystem effects and socioeconomic costs of climate change in coastal and marine ecosystems is still limited but is likely to be substantial for some highly dependent communities and enterprises. The overall interactions and cumulative impacts on the marine biota of sea-level rise (coastal squeeze with losses of nursery and spawning habitats), increased storminess, changes in the NAO (North-Atlantic Oscillation), changing salinity, acidification of coastal waters, and other stressors such as pollutants, are likely but little known (IPCC, 2008).

Climate change and coastal erosion

Although a large part of Europe's coastline is relatively robust to sea-level rise, exceptions are the subsiding, geologically 'soft', low-lying coasts with high populations, as in the southern North Sea and coastal plains/deltas of the Mediterranean, Caspian and Black Seas (IPCC, 2007). The EC published the Eurosion study (EC, 2004b) in order to guide Member States on how to deal with sea-level rise in coastal areas and manage coastal erosion. According to Eurosion study, coastal erosion is usually the result of a combination of factors - both natural and human induced - that operate on different scales:

- Natural factors are: winds and storms, near shore currents, relative sea level rise (a combination of vertical land movement and sea level rise) and slope processes.
- Human induced factors include: coastal engineering, land claim, river basin regulation works (especially construction of dykes and dams), dredging, vegetation clearing, gas mining and water extraction.

All European coastal states are to some extent affected by coastal erosion. About 20% of European coasts face serious impacts (EC, 2004b) the area lost or seriously impacted by erosion is estimated to be 15 km^2 per year. Given the predictions for climate change, the erosion and flood risk to urban, tourism and industrial facilities, agricultural lands, recreational areas and natural habitats increases every year (EC, 2004b). As indicated in the previous sections coastal squeeze occurs due to fixed dykes and hard port infrastructure this could lead to irreversible habitat loss.

Climate change impacts on port infrastructure and operation (mainly from PIANC 2008)

PIANC is a global organisation providing guidance for sustainable waterborne transport, ports and waterways and has recently published a report on the effects of climate change on navigation. PIANC's findings demonstrate that maritime navigation is sensitive to storminess and wind/wave conditions, and also to sea level in ports and waterways. The industry needs to be prepared to adapt sea waterways and sea ports, infrastructure and facilities, as well as the ships and navigational equipment, to be able to continue to operate successfully in future.

Table 2 illustrates the drivers and impacts of climate change to maritime navigation. According to PIANC, sea-level rise would affect harbour infrastructure and the standard of service of coastal and port structures. It may allow greater penetration of wave energy to the coastline and into harbours, causing increased coastal erosion in areas with a soft coastline and higher wear of infrastructure. Extreme sea levels may cause an increased number of incidents of overtopping and lowland flooding and an increased exposure of decks of wharfs and piers. Changes in wind patterns may also affect navigation i.e. increase berthing time for ships at terminal necessitating larger areas for anchoring. Changes in wave action may have potential impacts at the coastal and on port structures i.e.

changes in overtopping, stability of breakwaters and changes in sediment movement. Changes in coastal hydrodynamics might include narrowing or widening of navigation channels, changed dredging requirements and erosion or accretion of beaches protecting port structures and/or changes current velocities.

In some estuaries (e.g. Elbe) climatic induced increase of tidal range and lower freshwater runoffs lead to significant higher sedimentation rates and dredging necessities.

Table 2: Drivers and impacts of climate change to maritime navigation (PIANC, 2008)

Drivers	**Potential Impact**	**Port**	**Coastal area**	**Offshore structure**	**Vessels**
Increase in power and reach of storm surge, coastal flooding, spray zone and erosion patterns	Degradation, failure and replacement	X	X		
	Changed dredging requirements	X	*		
Change in magnitude and duration of storm surges and incidents of water over sea wall structures	Low land flooding	X	X		
Wave attack at a higher water level reducing the energy loss of breaking	Increased vulnerability of structures	X	X	X	
Changes in frequency, duration and intensity of storms	Permanent loss of sand offshore and onshore	X	X	X	
	Degradation of structures	X	X	X	
	Retreat of coastal landscapes		X		
	Problems in maneuvering				X
	Reduced regularity of the port				X
	Reduced capacity of natural systems to recover		X		
Change in the sea level range (and other sea state parameters)	Degradation of materials over time	X	X	X	
	Exposure of decks of wharfs and jetties (corrosion)	X		X	

* not in PIANC table: in the coastal zone there are fairways with big depth because of large vessels. Due to climate change there are more storms and in the fairways there will be more sediment, so there should be more dredging necessary.

The most recent (fourth) report of the Intergovernmental Panel on Climate Change documents that for Central Europe, several large knowledge gaps need to be closed. Due to this and the fact that effects of climate change have already become evident on the sea, coastal and inland waterbodies that could have an influence on navigation and waterways, the German Federal Ministry of Transport, Building and Urban Affairs has commissioned its scientific and technical authorities – i.e. the German Meteorological Service, the German Maritime and Hydrographic Agency, the German Federal Institute of Hydrology and the German Federal Waterways Engineering and Research Institute – to investigate the bases of climate research and to interpret them as regards potential consequences for sea and inland navigation. The first report (Bundesministerium für Verkehr, Bau und Stadtentwicklung, 2007) is a basis for the necessary studies regarding climate change and its

impacts in Germany. It informs interested experts on climate projections and possible changes in the waterbodies.

What adaptation measures will have to be taken into consideration when listing the conservation objectives?

1. Coastal erosion and coastal squeeze

Adaptation strategies on low-lying coasts have to address the problem of sediment loss from marshes, beaches and dunes (IPCC, 2007). Many countries in north-west Europe have adopted the approach of developing detailed shoreline management plans that link adaptation measures with shoreline defence, accommodation and retreat strategies (IPCC, 2007). The EUrosion study promotes the need for a more proactive and strategic approach to coastal erosion management giving priority to the increase of coastal resilience by providing space for coastal processes to operate and by maintaining a good sediment balance in the coastal system.

2. Species movements and habitat changes

According to IPCC (2007) conservation experts have concluded that an expansion of reserve areas will be necessary to conserve species in Europe. European protected areas – sensu lato - will need to be increased by 18% to meet the EU goal of providing conditions by which 1,200 European plant species can continue thriving in at least 100 square km of habitat (IPCC, 2007). It would be more cost effective to expand protected areas proactively rather than waiting for climate change impacts to occur and then acting reactively. Although in highly populated areas this will not always be possible. Dispersal corridors for species are another important adaptation tool, although large heterogeneous reserves that maximise microclimate variability might sometimes be a suitable alternative.

3. Port infrastructure and operation

PIANC prepared a list with the necessary measures to consider when proceeding with the port development and operation planning (Table 3).

Table 3: Range of responses of navigation to climate change (PIANC, 2008)

Area of intervention	Response (measures)
Maritime infrastructure operation and maintenance	Increased maintenance and replacement costs of port, coastal and sea platform infrastructure
	Increased maintenance due to increased storm surge damage to coastal protection infrastructure, seawalls, dunes, breakwaters etc.
	More sedimentation at river outlets, increasing dredging need
Maritime navigation practice	Adapting to fish migration, changes in fishing fleet design and harbour location
	Fishing fleets needs bigger boats to maintain activity if wave height increases, or else the work time is changed
	Change in beach erosion may require new or changed beach nourishment
	Terminals for smaller passenger boats may need to be relocated; use of ‘quieter’ parts of the coastline
	Lift-on lift-off replaced by roll-on roll-off
Vessel operation	More submerged reefs that need to be marked for avoidance
	Relocation of navigation fairways to less exposed areas; increased need for protected transportation channels
	Increased waiting time requiring larger areas for anchoring of vessels (vacant area is often very limited)
Ecological	Changed designation of environmentally protected areas
Risk communication	Increasing shipping to reduce greenhouse gas emissions

Germans authorities consider that this list should be complemented by active measures aiming at the sustainable development of estuaries which can also mitigate the effects of climate change. For the Elbe estuary the Hamburg Port Authority and the Federal Waterways and Shipping Administration of Germany have developed such a concept (*A concept for a sustainable development of the Tidal Elbe River as an artery of the metropolitan region Hamburg and beyond*, *2006*) which, amongst others contains river engineering measures dedicated to the dissipation of tidal energy. This concept, primarily developed under the objective of reducing the upstream transport of marine sediments (tidal pumping) will also be suitable for the mitigation of climate change induced increase of tidal hub, current velocities and sedimentation in the estuary.

Case study: ESSEX ChaMP (abstract from English Nature, 2002)

Hard structures and sea-level rise resulting in coastal squeeze: the example of the Essex estuaries

Much of the Essex coastal intertidal area was subjected to extensive reclamation (approximately 42% of the area that existed some 2000 years ago was reclaimed) between the 15th and the 19th Centuries. Integral to this phase of extensive reclamation was the construction of coastal defences in order to protect the fertile agricultural land from flooding. The presence of these man-made defences has constrained the ability of intertidal habitats (notably salt marsh) to move landward in response to sea level rise. This inevitably results in habitat loss; the term 'coastal squeeze' has been coined for this effect. With a predicted significant increase in sea level due to climate change this process is likely to continue, resulting in the loss of greater areas of intertidal habitat.

The Essex Estuaries support significant assemblages of habitats and species which are recognised for their ecological and nature conservation importance through designation as Natura 2000 sites and Ramsar sites. The Essex Estuaries cSAC contains the major estuaries of the Colne, Blackwater, Crouch and Roach and the open coast tidal flats at Foulness, Maplin and Dengie. The Essex Estuaries have been recommended as Natura 2000 site as they contain the following six Annex I habitat features listed under the EU Habitats Directive: Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*, estuaries, mediterranean and thermo-Atlantic halophilous scrubs (*Sarcocornetea fruticosi*), mudflats and sandflats not covered by seawater at low tide, *Salicornia* and other annuals colonising mud and *Spartina* swards (*Spartinion maritimae*)**.**

Predicted impact in designated features

The history of the Essex Coast and the information derived from the results of the predictive regime modelling both indicate that profound changes could occur in the distribution and extent of coastal habitat over the next 50 years and beyond. These changes include:

- Significant loss of salt marsh within the estuaries;
- Concomitant increase in the area of mudflats;
- Landward transgression of habitat throughout the estuaries;
- Increased width of open coast intertidal areas and slight recovery of salt marsh areas;
- Further ecological isolation of freshwater/estuarine habitats landward of flood defences from the main estuaries.

These changes are all based on the assumption that sea level rise will accelerate to 6mm per year over the next 50 years and that existing flood defences would be maintained on line for that period. As with the physical change, predicted changes on habitats and species at a broad, system level can be made. For this purpose the main designated interest features of the Essex Estuaries have been grouped into three broad categories reflecting their position and role within the overall system.

Management techniques and options

The changes envisaged over the next 30-100 years on the Essex Coast can be summarised as continued coastal squeeze in the estuaries but a trend towards equilibrium on the open coast. This generalisation is, however, complicated by the existence of areas of natural coastal squeeze, in which geological constraints will continue to cause loss of intertidal habitat as sea levels rise. Any overall strategy for the management of the Essex coastal habitat must therefore consider:

- The differences between estuarine and open coast responses to sea level rise;
- The variation in response to sea level rise within each estuary (the roll-over effect);
- The differences between estuaries due to variations in geological and reclamation history (natural versus artificial coastal squeeze); and,
- Interaction between estuarine and terrestrial/freshwater habitats.

Faced with the continued loss of salt marsh habitat on the Essex Coast and estuaries, management strategies can incorporate a number of techniques designed to reduce, halt or even reverse the process. These include:

- Managed re-alignment (or managed retreat) which involves the restoration of reclaimed intertidal areas by the partial or complete removal of the existing flood embankment.
- The erosion of salt marsh or mudflat intertidal areas can be offset by sediment nourishment. The direct placement of sediment on intertidal areas has the effect of restoring the morphology of the area but without modifying the processes that caused erosion to occur.
- The more traditional approach to intertidal erosion is to provide some form of hard defence. These may include nearshore wave breaks, shore normal groynes, upper shore embankments or channel training walls. In all cases the hard defence resists the natural coastal processes often resulting in deflection of the erosion to adjacent areas.
- Regulated Tidal Exchange is a technique to develop intertidal habitats behind permanent sea defences, particularly where walls will remain in place and/or as part of a phased realignment strategy.

Within the estuaries, the twin processes of natural and artificial coastal squeeze are predicted to result in the almost total loss of salt marsh in the Blackwater and Crouch and major loss of salt marsh in the Colne and Hamford Water. The most sustainable option to counteract predicted salt marsh loss would be to undertake managed re-alignment, possibly incorporating some form of sediment nourishment. However, this would need to be carefully designed in order to prevent collateral damage to the existing habitat in the estuary. The two major problems facing this option are:

- Restoration of inner estuary sites can result in major channel widening throughout the estuary to its mouth involving loss of existing salt marsh.
- Restoration of outer estuary sites results in sediment release which, without suitable inner estuary depositional sites can result in increased subtidal deposition and impacts on water quality, navigation, fisheries etc.

This means that location is perhaps the most critical issue facing any restoration scheme.

Four major management options for the Essex Estuaries.

Holistic restoration would represent the restoration of reclaimed marshland along the entire length of an estuary in order to accommodate the morphological changes associated with sea level rise. This option depends upon the existence of suitably located sites for restoration and could present major problems of land acquisition. In practice, to restore an estuary length in its entirety may involve a sequential operation over a period of years, so that this option would be indistinguishable from the progressive restoration option.

Progressive restoration is defined here as the sequential restoration of reclaimed marshlands over a period of years beginning in the outer estuary and progressing landward. This would aim to provide a channel width capable of accommodating tidal prism impacts once more landward sites are restored and ultimately achieving a morphology in equilibrium with sea level. This option involves similar problems of land availability and location as for the Holistic Option and the ecological issues associated with this option are similar. However, with a progressive programme of restoration the overall rate of loss of salt marsh vegetation within an estuary could be reduced due to the effects of the tidal prism being effectively confined to the immediate area of the realignment site.

Opportunistic restoration is the restoration of reclaimed marshland as and where sites become available. However, opportunistic re-alignment has to be viewed within the wider context (both physical and ecological), in that the changes in estuarine processes associated with re-alignment may have adverse impacts on the wider estuarine system through changes in tidal prism.

Compensatory restoration assumes the maintenance of estuarine flood defences on line with associated loss of existing marshland due to coastal squeeze, and would involve the restoration of open coast or outer estuary reclaimed marshlands in order to provide compensatory habitat.

The proposed management options are ‘designed’ around a number of significant issues or considerations, notably the ‘conflict’ between the landward and the seaward components of European sites, and secondly, the value (in ecological terms) of replacement habitat. The first issue may be solved by either maintaining the landward component *in situ* and restoring the intertidal habitat in other parts of the area (or potentially further afield), or by re-align over the landward component and recreate the landward features elsewhere.

2.5 TSD n° 5: How can the ecosystem approach assist on the management of estuarine and coastal systems?

Explanation of the question and its pertinence

One of the commitments made in 2002 at the World Summit on Sustainable Development, in order to highlight the issues on which action is most urgently needed, was " encouraging the application by 2010 of the ecosystem approach". This is now a recognised concept, initially launched within the framework of the Convention on Biological Diversity, used in the work of several international conventions or international projects, such as the Interreg projects Harbasins or New Delta. The pertinence of this concept, already studied for estuarine and coastal systems, is not familiar to the stakeholders involved with the nature directives.

This ecosystem approach is not mandatory for the application of the nature directives or the Water Framework Directive. The Marine Strategy Directive introduces this concept (articles 1.3, 3.5) however methodologies to apply may be diverse. Some illustrations are proposed below.

EU Guidance already existing : None

Technical guidance proposed

The balance between the different components (physical, chemical, biological and hydromorphological) of the estuarine and coastal ecosystems is very fine and can be easily affected by human activities such as port related activities, dredging and building activities. Figure 6 below illustrates the connectivity of both the ecologic and socio-economic factors defining an estuarine and coastal system.

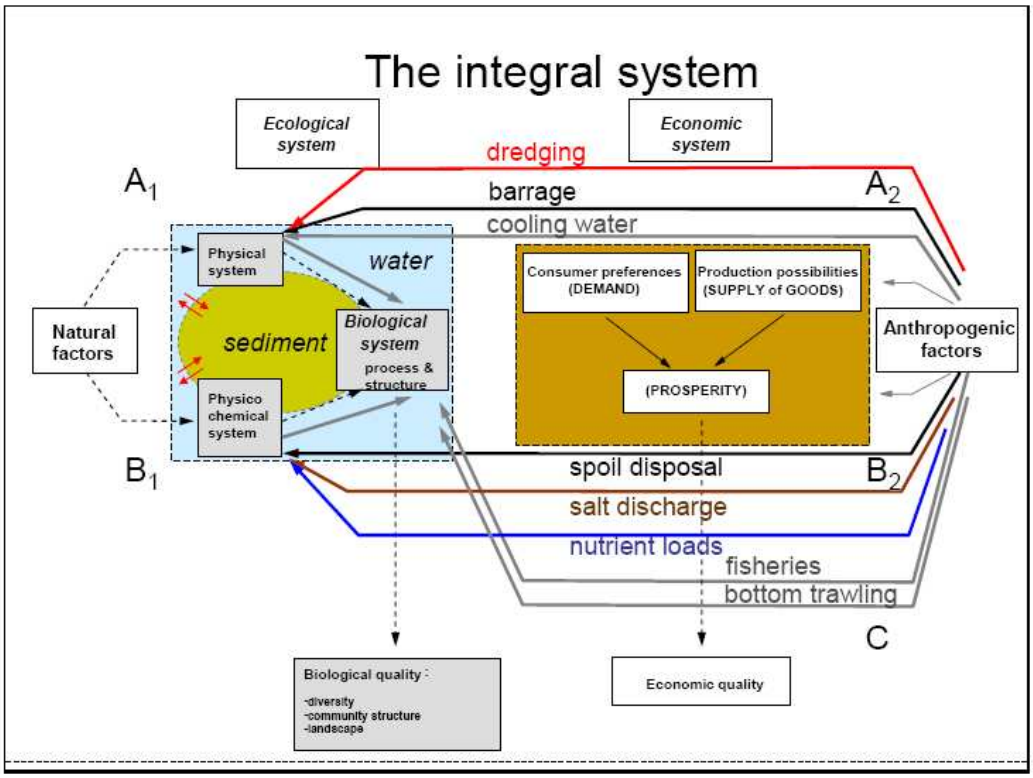


Figure 6: Structure of an integral system presented from the Harbasins project when using the estuarine and coastal zones as an example (after Elliott et al., 2008).

Both ecological and economic values of such ecosystems will have to be maintained in order to satisfy societal needs expressed by both the Nature and Water Framework Directives and the Ports and Integrated Maritime Policy. This is also related to national interests (renewable energy, oil and gas exploration, mining, coastal defence…).

One approach that could satisfy such needs was suggested during the fifth meeting of the Conference of the Parties (COP), to the Convention on Biological Diversity (CBD)[13]. This was called the Ecosystem Approach and referred to as "*an ecosystem–based strategy for the integrated management of land, water, and living resources that promotes conservation and their sustainable use in an equitable manner*". The CBD's ecosystem approach calls for multidisciplinary thinking among a variety of actors to develop a collaborative vision of a desired future. The approach is goal and policy driven and is applied within a geographic framework defined primarily by ecological boundaries such as different land use conditions, watersheds, and groundwater system units. It also recognizes that humans, with their cultural diversity, are an integral component of many ecosystems. The ecosystem approach consists of 12 principles presented in Box E.

Box E: Principles of the Ecosystem Approach (CBD, 2000)

Principle 1: The objectives of management of land, water and living resources are a matter of societal choice.

Principle 2: Management should be decentralized to the lowest appropriate level.

Principle 3: Ecosystem managers should consider the effects (actual or potential) of their activities on adjacent and other ecosystems.

Principle 4: Recognizing potential gains from management, there is usually a need to understand and manage the ecosystem in an economic context. Any such ecosystem-management programme should: (a) Reduce those market distortions that adversely affect biological diversity; (b) Align incentives to promote biodiversity conservation and sustainable use; (c) Internalize costs and benefits in the given ecosystem to the extent feasible.

Principle 5: Conservation of ecosystem structure and functioning, in order to maintain ecosystem services, should be a priority target of the ecosystem approach.

Principle 6: Ecosystems must be managed within the limits of their functioning.

Principle 7: The ecosystem approach should be undertaken at the appropriate spatial and temporal scales.

Principle 8: Recognizing the varying temporal scales and lag-effects that characterize ecosystem processes, objectives for ecosystem management should be set for the long term.

Principle 9: Management must recognize that change is inevitable.

Principle 10: The ecosystem approach should seek the appropriate balance between, and integration of, conservation and use of biological diversity.

Principle 11: The ecosystem approach should consider all forms of relevant information, including scientific and indigenous and local knowledge, innovations and practices.

Principle 12: The ecosystem approach should involve all relevant sectors of society and scientific disciplines.

Both the Water Framework Directive (WFD) and the Marine Strategy Framework Directive (MSFD) are based on systems ecology as these directives refer to basic system elements (structure) and, to a lesser extent, basic system processes (functioning) of our aquatic systems (Elliott, et al., 2008). The MSFD is even completely based on/ in line with the ecosystem approach.

Similarly, for the NE Atlantic, the OSPAR Convention, has progressed from the consideration of pollution from land-based and vessel discharges (Paris and Oslo conventions which merged in 1992 to the new OSPAR Convention) to adopting an ecosystem-based approach to environmental protection and management through its Annex V (Elliott et al., 2008). Annex V was adopted to the convention in 1998 and extends the cooperation of the Contracting Parties to cover all human activities that might adversely affect the marine environment of the North-East Atlantic. OSPAR has

[13] Convention on Biological Diversity, (2002), http://www.cbd.int/

no competence in fisheries, but the *EU Common Fisheries* Policy and the FAO *Code of Responsible Fisheries* also now both refer implicitly to the Ecosystem Approach (Elliott et al., 2008).

In the declaration of the first joint ministerial meeting of the Helsinki and Ospar Commissions (Bremen, 2003), it was proposed to apply and further develop by 2010 the measures necessary to implement an ecosystem approach. HELCOM and OSPAR have jointly adopted at this occasions the statement "*Towards an ecosystem approach to the management of human activities*"[14], setting out their common vision of an ecosystem approach to managing human activities impacting on the marine environment in their maritime areas. In this document, the ecosystem approach was defined as "the comprehensive integrated management of human activities based on the best available scientific knowledge about the ecosystem and its dynamics, in order to identify and take action on influences which are critical to the health of marine ecosystems, thereby achieving sustainable use of ecosystem goods and services and maintenance of ecosystem integrity". To apply this in their frameworks, parties suggested that: "*Only by considering together the ecosystem structures, processes, functions and interactions relevant to the development of policies on the different issues arising in the North East Atlantic and the Baltic Sea Area can management measures be developed that will ensure the sustainable use of the Atlantic ocean and its adjoining seas, and the balance of the interests of different sectors*".

The ecosystem approach should be implemented in Europe in such a way that it contributes[15] directly to obligations under the nature and water Directives, the European Community Biodiversity Strategy and its Biodiversity Action Plans, and the Pan-European Biological and Landscape Diversity Strategy. Furthermore this ecosystem approach is really adapted to cross border issues as it was demonstrated in the Scheldt estuary.

However some stakeholders, as RSPB/Birdlife International are asking (in litt.) how the ecosystem approach squares with the objectives of the Nature Directives and in particular the protection and conservation of Natura 2000 sites. One would hope they are in sympathy with each other but it is worth identifying where they might conflict so that those areas can be looked at more closely and solutions found e.g. the requirement to avoid adverse effect on Natura 2000 sites unless satisfy Article 6(4) might present a slightly different value set than a pure ecosystem approach as it places high value on conservation of Natura 2000 interests in order to help deliver Favourable Conservation Status.

The answer is probably related to the identification of conservation objectives at the Natura 2000 sites with two questions:

- Which level of anthropogenisation or naturalness is acceptable to reach the Favourable Conservation Status of estuarine and coastal zones ?
- How to tackle favourable reference value for both nature and water framework directives knowing that climate change, exotic species or human activities will have an impact on the conservation objectives as well?

Case study: Harbasins Approach

Some good recommendations to the ecosystem approach to an estuarine and coastal area were presented from the HARBASINS (Harmonised River Basins Strategies North Sea) INTERREG IIIB European project. The project aimed to enhance the compatibility of the EU Water Framework Directive (WFD) and international cooperation on integrated management of estuaries and coastal waters in North Sea Region (HARBASINS, 2008). One of its objectives was to formulate recommendations based on technical work in the field of ecosystem functioning, restoration and health, trans-river basin pollution and morphological pressures and impacts. HARBASINS reinforced the fact that the ecosystem approach is a precondition for successful harmonized implementation (HARBASINS, 2008). The ecosystem approach considered the ecosystem as an interconnected entity, taking it to a higher spatial level than just the site-scale/ water body approach. Integrated management plans for estuaries were also considered as an important instrument to protect critical processes, areas and species (HARBASINS, 2008). Finally, the Ecosystem Approach requires a combination of scientific and socio-economic aspects in understanding and managing the environment (HARBASINS, 2008).

[14] http://www.helcom.fi/stc/files/BremenDocs/JointEcosystemApproach.pdf

[15] in combination with sustainable human activities

2.6 TSD n° 6: How to set conservation objectives at national//local level? How to set conservation objectives for habitats and species through Natura 2000 management plans? How can economical objectives be integrated with Natura 2000 conservation objectives and management plans?

Explanation of the question and its pertinence

The word “conservation” is one of the key words of the Habitats directive. It is defined in article 1 of the Directive as “*a series of measures required to maintain or restore the natural habitats and the populations of species of wild fauna and flora at a favourable status as defined*…”. The word conservation is very often used in the concept of 'Favourable Conservation Status' but this concept will not be the subject of this guidance concept form. The word conservation is used in three other contexts within the directive: the Special Areas of Conservation (SAC), the conservation measures (art. 1.l, 6.1, 12 & 17) and the conservation objectives (art. 6.3). If the meaning of a SAC is relatively well known, the concepts of conservation objectives and conservation measures were more rarely explained in guidance documents. Furthermore the establishment of priorities by Member states, as foreseen in the article 4.4 of the Directive, has so far not been commented in existing guidance documents.

Some economical stakeholders consider the conservation objectives as an outstanding issue on which additional interpretation is desirable. The European Sea Port Organisation (ESPO) highlighted in a note prepared for the working group that conservation objectives should preferably be as clear and straight forward as possible and functional in practice. Therefore, where possible, clear conservation objectives in concrete terms such as numbers and/or size are desirable. ESPO considers that conservation objectives such as for example “the site should enable the functioning of the habitat for which it has been designated” are inappropriate as insufficiently specific and clear.

The development of conservation objectives for estuaries and coastal areas is a real challenge as these areas are very complex and dynamic ecosystems.
Many tidal estuaries used as waterways have been morphologically modified for many decades. A restoration of habitat type 1130 to a near-natural site specific status (which might be an adequate site specific conservation objective for some other habitat) might imply enormous economic costs including loss of economic perspectives for whole regions. The scope for restoring natural processes will have to be assessed on a site-specific benefits, along with the costs and benefits (e.g. improved flood risk management and resilience to climate change) of doing so.
For developing recommendations on this issue, a case by case basis completed by general principles, as those exposed with regard to the Ecosystem approach will be used.
The primary aim in setting site conservation objectives is to identify the contribution of that site to the achievement of favourable conservation status for the habitats and species for which the site is classified. This will involve an assessment of the degree to which that requires maintenance or, where necessary, restoration of the habitat or species concerned to a particular state on that site. Defining site specific conservation objectives for any given estuary has to take into account economic, social and cultural requirements as required by Article 2.3 of the Habitats Directive. The present Technical Supporting Document will recall the principles as defined by the Habitats Directive or contained in guidance documents published by the Commission. It will propose advice on how to deal with conservation objectives, management plans and priorities. However, the final responsibility for developing appropriate objectives, priorities and instruments that are adopted to national, regional and local context will always remain with the Member States.

EU Guidance already existing

The documents listed below have been developed by the EC and provide detailed guidance on how to implement the EU nature legislation and the WFD.

1. European Commission (1997): Commission Decision n° 97/266/EC of 18 December 1996 concerning a site information format for proposed Natura 2000 sites – Official Journal L 107 published on 24/04/1997, 156 p.
2. European Commission, (2003), Implementation of Directive 2001/42 on the assessment of the effects of certain plans and programmes on the environment
   http://ec.europa.eu/environment/archives/eia/pdf/030923_sea_guidance.pdf
3. European Commission, (2000), *Managing Natura 2000 sites: the provisions of Articles 6 of the habitats directive 92/43/EEC*. Luxembourg: Office for official publications of the European Communities.
   http://ec.europa.eu/environment/nature/natura2000/management/docs/art6/provision_of_art6_en.pdf
4. European Commission, (2002), Assessment of plans and projects significantly affecting Natura 2000 sites. Methodological guidance on the provisions of articles 6(3) and (4) of the Habitats Directive 92/43/EEC. Luxembourg: Office for official publications of the European Communities.
   http://ec.europa.eu/environment/nature/natura2000/management/docs/art6/natura_2000_assess_en.pdf
5. European Commission (2007), Guidance document on article 6(4) of the 'Habitats Directive'92/43/EEC. Clarification of the concepts of: alternative solutions, imperative reasons of overriding public interest, compensatory measures, overall coherence, opinion of the Commission.
   http://ec.europa.eu/environment/nature/natura2000/management/docs/art6/guidance_art6_4_en.pdf
6. European Commission -2006- Assessment, monitoring and reporting under Article 17 of the Habitat Directive : Explanatory Notes and Guidelines. Final Draft October 2006. European Commission, DG Environment, Nature and Biodiversity, 64 p. + annexes

New guidance proposed

Use of the word "Conservation" in the Habitats Directive (apart of favourable conservation status)

As referred to in the article 1 of the Habitats Directive, conservation "*means a series of measures required to maintain or restore the natural habitats and the populations of species of wild fauna and flora at a favourable status as defined…*". Related to the definition of the conservation status and to the territory described in article 2 (European territory of the Member States), the word conservation is used here in relation to the general objective and the general policy proposed in the directive (article 2.1).
The word conservation is used in three other contexts within the directive:

- Special Areas of Conservation
- Conservation measures (art. 1.l, 6.1, 12 & 17)
- Conservation objectives (art. 6.3)

Furthermore, the concept "conservation objectives" is used twice in the preambles of the directive:

- "Whereas it is appropriate, in each area designated, to implement the necessary measures having regard to the conservation objectives pursued": here, the objectives are related to the general conservation goal for the territory of the Member State and to the specific targets for the site
- "Whereas an appropriate assessment must be made of any plan or programme likely to have a significant effect on the conservation objectives of a site which has been designated or is designated in future": Here the conservation objectives meant are the specific objectives that have been established for a given site.

With regard to Article 6(3) of the Habitats Directive it appears that conservation objectives are related to the individual sites (the special areas of conservation): "…*shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives*". However,

additional reading could be done at Member state level in relation to the obligation of "**establishing priorities in the light of the importance of the sites"** as foreseen in Article 4.4.

The concept "conservation measures" is clearly related to individual sites (see article 1.l) and is explained in article 6.1 through several examples: management plans and appropriate statutory, administrative or contractual measures. Conservation measures are mandatory but no specific method or tool is imposed.

The report foreseen by article 17 shall include in particular information concerning:

- "the conservation measures referred to in Article 6.1"(at site level)
- "the evaluation of the impact of those measures on the conservation status of the natural habitat types of Annex I and the species in Annex II" (at Member State level[16]).

Conclusion

If the conservation measures according to Article 6.1 are always applied at site level, conservation objectives have to be defined and assessed both at Member State level, to apply the article 2.1 and 4.4 of the Habitats directive, and at site level where they will help to determine specific site-related conservation measures.

Conservation objectives at Member state level and site level have a complementary nature because Natura 2000 is a network where each site will have a specific function in contributing to the global coherence of the system.

Defining a reference conservation status at site level

As defined by the guidance document "Managing Natura 2000 sites" (EC 2000), *"the fulfilment of the aim laid down in Article 2(1) largely depends on conservation measures that the Member States have to take in order to maintain or restore the natural habitat types and species at a favourable conservation status. These measures are implemented through the Natura 2000 network defined in Article 3(1), taking into account economic, social and cultural requirements and regional and local characteristics…. The favourable conservation status of a natural habitat or species has to be considered across its natural range, according to Articles 1(e) and 1(i), i.e. at biogeographical and, hence, Natura 2000 network level. Since, however, the ecological coherence of the network will depend on the contribution of each individual site to it and, hence, on the conservation status of the habitat types and species it hosts, the assessment of the favourable conservation status at site level will always be necessary"*.

It means that any management plan, conservation objectives or other specifications for the sites have to be based on the knowledge of the conservation status of the habitats and species of the site. Furthermore this information will be required if it has to be assessed whether there is a deterioration or not (article 6.2). The favourable conservation status must also be known as a reference value concerning the integrity of the site (art.6.3). So far no detailed guidance has been produced on how to assess the conservation status at site level. However:

- The EC already recommended in 2000 that the conservation status of natural habitat types and species present on a site should be assessed while using a number of criteria established by Article 1 of the directive:
  - With general concepts such as "the *sum of influences acting on*" the habitat or the species concerned that may affect its long term status
  - With specific criteria such as "the natural range" or "population dynamics" (which might be difficult to apply at site level)
  - With specific criteria such as areas covered, viability of the local population (in relation with the concept of metapopulation), long term maintenance of the species habitat or the habitat, structure and functions…(easier to apply at site level)
- Based on article 4.1 and annex III, the decision n° 97/266/CE on the Standard Data Form (SDF) includes information on the conservation status of the habitats and species at site level (including representativity, relative surface, conservation status and global

[16] By biogeographical areas, but this not a matter of debate for this text

assessment for the habitats and populations, conservation, isolation and global for species). This SDF still remains an important reference document even if it is sometimes considered as insufficient.

- Complementary information was proposed by the explanatory notes and guidelines provided by the EC in 2006 for the assessment, monitoring and reporting under Article 17 of the Habitat Directive.
- Further guidance was proposed on the concept of ecological requirements defined in article 6.1 (EC 2000)

After the inclusion of a site on the list of Sites of Community Importance, the Member State shall designate the site as a Special Area of Conservation (SAC) "*establishing priorities in the light of the importance of the sites for the maintenance or restoration, at a favourable conservation status, of a natural habitat type in Annex I or a species in Annex II and for the coherence of Natura 2000, and in the light of the threats of degradation or destruction to which those sites are exposed*". (Habitats directive article 4.4)

Conservation objectives at site level

Three kinds of obligations can be described for the Natura 2000 sites:

1. **Positive measures** as foreseen by article 6.1 involving e.g. management plans and statutory, administrative or contractual measures[17],
2. **Preventive measures** as foreseen by article 6.2 to avoid the deterioration of natural habitats (as well as disturbance of species) and by article 6.3 to accept new plan and projects that avoid adverse effects
3. **Exception/exemption** regime as foreseen by article 6.4 where adverse effects are deemed unavoidable and **compensation measures** required to maintain the coherence of the Natura 2000 network.

The third point is not the subject of this Technical Supporting Document dedicated to conservation objectives which includes both positive and preventive measures. Positive measures are not automatically mandatory at each of the sites. Their implementation depends on the priorities established by the Member State to fulfil its obligation related to the general objective of the directive which is to maintain or where necessary restore a favourable conservation status of all species and habitat types of Community interest as listed in the Annexes I and II of the directive. This question of priority is also addressed in Article 3 which stipulates that a "*coherent European ecological network …shall enable the natural habitat types and the species' habitats concerned to be maintained or, where appropriate, restored at a favourable conservation status*".

The decision as to whether restoration work is required for a particular species or habitat on a specific Natura 2000 site will depend on:

- the assessment of the contribution that site should make to achieving favourable conservation status for the species or habitat at a national level;
- how that is described in the site specific conservation objectives in terms of the site's contribution to favourable conservation status; and
- an assessment of whether the site is meeting that contribution already or needs to be restored in order to do so.

Furthermore, the obligation to avoid deterioration remains for all the sites. Management decisions are complemented by ongoing monitoring to ensure that management measures are working and to identify additional problems that had not been anticipated when the conservation objectives were established. This suggests the need for periodic review of site conservation objectives.

[17] For SPAs, obligations of article 4.1 and 4.2 of the birds directive will apply and there are considered as positive measures also in the context of ensuring the SPA contributes to meeting the obligation arising from Article 2 of the Birds directive for the relevant Annex I or migratory species.

Box F: Conservation objectives for an habitat or a species in the SAC		
	Improvement of the conservation status **not** set as a requirement for this SAC in the national conservation objectives	Improvement of the conservation status set as a requirement for this SAC in the national conservation objectives
No risk of deterioration of the conservation status	A. neither preventive measures nor positive measures needed. Only monitoring is mandatory	C. Only positive measures have to be defined and implemented
Risk of deterioration of the conservation status (maintenance work needed)	B. Only preventive measures have to be defined and implemented	D. Preventive and positive measures have to be defined and implemented

So, we have the following situation at site level (see box F):

- Case A: if there is no risk of deterioration for the conservation status of habitat or species focused at the site there is no need of conservation measures, only monitoring remains mandatory. This situation is encountered when no management requirements have been identified on the basis of scientific knowledge for the habitat types and for the species present on the site (case-by-case basis), or that monitoring results indicate that the ecological requirements are met. In fact this involves a kind of measure requiring no new actions but only maintenance of current management (including non management as in the case of virgin forest)
- Case B: to avoid deterioration of the conservation status of habitat or species in the site there is a need of preventive measures and they have to be foreseen within the conservation objectives of the site (to be delivered in relation with the designation of the SAC- article 4.4[18]). However the site is not considered as a target in the national conservation objectives to improve the situation of the conservation status of the habitats or the species at national level (per biogeographical region) and there is no need for additional measures over and above those needed to maintain the site in a favourable status;
- Case C: to improve the situation of the conservation status of the habitats and the species at national level (per biogeographical region), it was decided in the national conservation objectives to include the site in the Member state priorities (application of the article 4.4). Then, there is a need of additional management measures and they have to be foreseen within the conservation objectives of the site (to be delivered in relation with the designation of the SAC- article 4.4).
- Case D: to improve the situation of the conservation status of the habitats and the species at national level (per biogeographical region), it was decided in the national conservation objectives to include the site in the Member state priorities (application of the article 4.4). Furthermore there is a risk of deterioration of this habitat or species in the site; Then there is a need of preventive AND positive measures and they have to be foreseen within the conservation objectives of the site (to be delivered in relation with the designation of the SAC- article 4.4).

This assumes you can identify all these issues when you set the conservation objectives. However you might identify some potential problems that need addressing, but given the dynamic nature of ecosystems and human influence on those systems, it is probable that new issues will emerge over time that were not predicted at the time conservation objectives were first established.

[18] "… *establishing priorities in the light of the importance of the sites for the maintenance or restoration, at a favourable conservation status, of a natural habitat type in Annex I or a species in Annex II and for the coherence of Natura 2000, and in the light of the threats of degradation or destruction to which those sites are exposed*".

Box G: Conservation objectives and measures for the Natura 2000 sites		
Is there a risk of deterioration of the conservation status of habitats and species at site level ?	Is the site considered within national priorities for the improvement of the conservation status of habitat and/or species ?	Recommendation for the habitat or the species targeted
NO	NO	Monitoring only
NO	YES	Need to take positive measures at site level to improve the conservation status
YES	NO	Need to take preventive measures at site level to avoid deterioration
YES	YES	Need to take preventive and positive measures at site level to avoid deterioration and to improve the conservation status

When the habitat or the species has been evaluated as being in a favourable conservation status at national level (per biogeographic region), the case C should not be so common because efforts and funds should be dedicated to the priorities. If we study reports prepared for the article 17[19], this seems to be currently the case for the habitat estuaries (1130) in Denmark, Estonia or Lithuania, or for the habitats mudflats/sandflats (1140) in Belgium, Germany. However, risk of deterioration has to be evaluated and if needed preventive measures have to be taken.

In others cases, when a site is considered as marginal for the coherence of the network, it is probable that it will not be considered within priorities. Another concept related to the WFD could be taken into consideration when elaborating priorities: cost effectiveness or disproportionate cost. Article 8.5 of the Habitats directive introduces even another concept with the capability to postpone some necessary measures because of the lack of funds.

The intensity of positive measures has to be determined at local level through the conservation objectives which themselves are related to national priorities. This has not to be opposed to the preventive measures which have always to be considered, even if the result is no action.

Concerning preventive measures, the guidance document “Managing Natura 2000 sites” (EC 2000) has already proposed some indicators of disturbance and deterioration. It was defined that “*habitat deterioration occurs in a site when the area covered by the habitat in this site is reduced or the specific structure and functions necessary for the long-term maintenance or the good conservation status of the typical species which are associated with this habitat are reduced in comparison to their initial status. This assessment is made according to the contribution of the site to the coherence of the network*”. Review of existing practices from port, dredging, other industrial areas or other uses are generally needed to elaborate preventive measures for the site. If current activities, in or around the site, are not in line with the identified conservation objectives some proposals to eliminate/reduce their negative effects should be proposed. The assessment of monitoring data may show the necessity of regulation of some activities or improvement of other ones.

Preventive measures will constitute the baseline of conservation objectives and the “no deterioration” concept has to be detailed at local level for each of the habitat or species focused by the site. To define the preventive measures, it may be needed to determine methodologies using classes, time period, compartments or sections…

It has to be highlighted that pro-active objectives, encompassing positive and preventive measures, are a basic approach of the sustainable development proposed within the habitats directive. A defensive approach, with exceptions as foreseen in article 6.4, does not correspond to the general objective of the directive. Any sustainable development policy will prefer mitigation/avoidance of damage to compensation.

[19] http://biodiversity.eionet.europa.eu/article17/habitatsprogress

Taking into account economic requirements

Article 2.3 of the Habitats Directive stipulates that measures taken pursuant to this Directive shall take account of economic, social and cultural requirements and regional and local characteristics. As already highlighted by the European Commission (EC, 2000), conservation measures foreseen by article 6.1 relate to this article 2.3 and allow for consideration of economical activities. There are at least two steps in the implementation of the Habitats Directive where this can be taken into consideration:

- When establishing priorities in relation with the obligations of article 4.4
- When determining the intensity or location of conservation objectives at site level (including avoidance of contradictions or adaptation of current practices)

On the opposite, the appropriate assessment for plan or projects, when preparing e.g. a port master plan, a land use plan or the development of an industry within an estuary, will have to consider not only the preventive measures foreseen to avoid deterioration but also the positive measures to improve the conservation status of the habitat/species on the site. It means that if, according to the site's conservation objectives, it is foreseen to increase sand flats or salt marshes in an estuary by 10%, the plan or the project will have to consider this conservation objective and not only the current area of the salt marsh or the mudflats. Article 6.3 of the Habitats Directive requires, before authorising a plan or a project to ascertain that it will not adversely affect the integrity of the site. This was better defined by the European Commission in the guidance document on article 6.4 (2007): "Biological integrity can be defined as all those factors that contribute to the maintenance of the ecosystem including structural and functional assets. In the framework of the Habitats Directive, the biological integrity of a site is linked to the conservation objectives for which the site was designated as part of the Natura 2000 network".

Sometimes economic stakeholders consider that it is not possible to undertake an appropriate assessment because the conservation objectives of a site have not yet been identified. This argument is not valuable as the implementation of preventive measures cannot wait for the SAC designation (this has been the conclusion of several court rulings). The reference value set up in the Standard Data Form remains a central element against which to compare any deterioration that has to be avoided.

Management plan

A management plan has always been considered as a key instrument by the European Commission and some of the Member states. A seminar was organised by the EC in 1996 in Galway to make some proposals concerning the structure, content and aims of Natura 2000 site management plans (see Box H). ESPO gave also the advice to ports to participate in the elaboration process (ESPO 2007) of management plans.

Management plans are not mandatory as stipulated by article 6.1 ("*if need be*") and they can be integrated into other development plans, keeping in mind that they have to be in compatibility with conservation objectives. However, the definition of statutory, administrative or contractual measures is mandatory (EC, 2000) and has to be described somewhere.

Box H: Galway seminar, suggested structure of a Natura 2000 management plan

An ideal management plan should contain the following elements (EC 2005):

- Policy statement with reference to article 6 of the Habitats directive
- Site description, including a historical land use analysis
- Statement of objectives, including long term and short term goals
- Statement of the constraints, including identification of the actors involved
- Realistic list of actions to be implement, with time schedules and financial planning
- A detailed consultation process
- Monitoring and evaluation

Even in the case of the absence of a management plan, some specific conservation objectives or expected results (surfaces, quantities, ecological processes, ecosystems services…) have to be determined.

For both preventive and positive measures some reference values have to be determined: minimum/maximum areas, minimum/maximum size of populations, maintenance of (dynamic) ecological processes… These reference figures, if needed with limits of acceptable fluctuation, should be communicated to the stakeholders. Their elaboration is related to the priorities established by member states, to the knowledge on the current conservation status of habitat and species on the site (existing average numbers for species, quantities for sediments, size for habitats…) and to the importance of the site for the coherence of the Natura 2000 network. When complex concepts as gradient or thresholds are considered, the precautionary principle should be applied.

Management plans, even if not mandatory, appear to be the best solution to establish quantitative conservation objectives based on the system's processes and their monitoring. It is the occasion to find a good balance for an estuary between human activities, safety, accessibility and nature conservation. Implementation of the Ecosystem Approach and involvement of stakeholders and general public will help to determine local conservation objectives, conservation measures and ecological processes to be monitored. Management plans can be used for site, or specific habitat maintenance schemes and foster financial agreements on habitat restoration projects. The plan can also help to determine the spatial context of the conservation objective at stake.

A workshop organised by the Paralia initiative in Riga (2007) concluded that it could be of interest that in the management plan for the Natura 2000 sites, also economic aspects are considered: the interest of integrative management plans cannot be sufficiently underlined. Preferably management plans should not only regulate nature but also regulate if necessary economic activities. They should address all ongoing and foreseen activities, including maintenance dredging, while unforeseen/new activities need anyway to be dealt with article 6.3-6.4.

The River Basin Management Plan and the programme of measures related to the WFD will have to act in synergy with local Natura 2000 management plans, e.g. they may determine specific features such as sedimentation transport (Sednet, 2006).

Specificity of estuarine ecosystems

The dynamic nature of estuaries should be considered in the conservation objectives for both preventive or positive measures. It means that concepts developed in TSD n° 2 (environmental processes), n° 3 (species needs) and n° 4 (global c hanges) have to be taken into consideration. Ecosystem dynamics have to be taken into consideration when establishing conservation objectives. When such dynamics are too complex to be determined, then conservation objectives at site level, i.e. the set of conservation measures decided upon as described in Box F, cases A –D, may have to be reviewed in light of additional information and better understanding from monitoring, e.g. every 6 years in relation with reporting periods, when re-assessing the conservation status of species and habitat types of Community interest (see art.17). Conservation objectives have not to be seen as a static approach, on the contrary they need to be adapted to the actual evolution of the conservation status of species and habitats and to the evolution of other ecological factors. Conservation objectives may even accept changes in the location of some of the constituent elements. Long term dynamic evolution leads to a dynamic management and planning with possibilities to modify targets.

To elaborate conservation objectives or to prepare management plans for estuaries and adjacent coastal areas, specific factors will have to be taken into consideration. Those factors were presented in other technical supporting documents. As proposed in a prospective study carried out in France for the Seine estuary (AESN, 2004), this can be summarized as such:

- In an estuary, there is a natural "engine" described through the features creating natural dynamics of the estuary: geomorphology, tide, sediment and biological cycles…;
- This natural "engine" delivers ecosystem services and environmental functions that are essential also for socio-economic activities.

- Some local decisions such as infrastructure developments and land use policies will constitute internal factors which will modify the natural "engine"
- External factors to the site such as climate change or societal choices (evolution of the international trade of containers, wetland reclamation in the last centuries, publication of WFD and nature directives…) will drive the evolution of the internal factors and also modify the natural "engine".

The local management plan has to find a balance between the natural functioning of the estuaries and coastal zones and the internal and external factors. As indicated in the TSD n°2, one of the factors to consider was for example sediment circulation/ re-distribution in the system. This is why management plans should have a long-term vision, at least over 50 years, taking into consideration sea level rise. Within such a long-term perspective revisions with shorter intervals should be foreseen in order to leave room for adjustments and redirection, if needed with reference to new knowledge and experiences and having in mind the unpredictability linked to several factors of concern. A good example of a management plan with long-term vision is presented in TSD n°9 through the Schelde case study.

Case study: Natura 2000 targets in the Netherlands

Natura 2000 targets in the Netherlands: setting conservation objectives for the Natura 2000 network in the Netherlands

http://www.minlnv.nl/portal/page?_pageid=116,1640360&_dad=portal&_schema=PORTAL&p_file_id=19683

In 2006 the Netherlands have adopted conservation objectives for the Dutch Natura 2000 network (an English summary was used to describe this case study - see the web link).

This policy document sets out the framework for the designation decisions for the 162 Natura 2000 sites and lays down guidelines for the Natura 2000 management plans to be drawn up subsequently. It sets out the approach used to formulate conservation objectives at both national and site level.

The basic philosophy of the 'Natura 2000 targets document' is threefold: clarity, guidance and room to manoeuvre. The details of conservation objectives, in term of extent, location and time schedules are defined at site level, in interaction with users and site managers, within the management plans. However, in order to ensure cohesion between the contribution made by individual sites and the contribution made by the Netherlands Natura 2000 network to European biodiversity a number of choices have been made at the level of this "Natura 2000 targets document".

Concerning clarity, eight guiding principles are used to formulate Natura 2000 targets and determine the Netherlands' contribution to the Natura 2000 network:

1. Harmony with existing policies wherever possible
2. practically and financially feasible
3. maintain and, where necessary, improve conservation status
4. more efforts engaged where the Netherlands play a more crucial role at the biogeographical level
5. do what can reasonably be expected from the Netherlands
6. anticipate natural dynamics and climate change
7. guide conservation and management efforts
8. take into account existing budgets

Guidance is proposed on several key issues as:

- the core tasks should indicate the most important contributions that a specific site makes or can make to the Natura 2000 network
- information is on whether the target is directed solely at maintaining the existing situation or at improving the situation
- "sense of urgency" is used to guide the pace of realisation

- in a limited number of situations, “credit formulation” have been used, which means that a slight reduction has been permitted for a particular species or habitat type to the credit of a different species or habitat types to which higher priority was given at the particular sit level(e.g. alluvial meadow used as foraging areas for birds versus alluvial forests)

Room to manoeuvre is related to the local flexibility on the extent, the location and time schedules of the conservation objectives. This is worked out in more details in the Natura 2000 management plans. These plans state the timeframe in which a maintenance or improvement target is to be achieved. This will have consequences for the nature and intensity of measures. The approach also gives scope for adjusting the pace of realisation or the content of nature development measures to take account of new developments.

2.7 TSD n°7: FAQs on Water Framework Directive and Nature directives

Explanation of the question and its pertinence

Together, the 'Birds' and 'Habitats' Directives (BHD) are the cornerstones of the EU's biodiversity policy as they protect Europe's most valuable species and habitats. Water Framework Directive aims to ensure the health of EU aquatic ecosystems. Several questions arose during the meetings of the working group on the common implementation of these directives.

The following sources of information, easy to find on the WEB, have illustrated the frequently asked questions:

- Workshop Eurosite/Natural England Peterborough, United Kingdom. 17-18 September 2008: '*Integration of the Water Framework Directive and Natura 2000'*
- Workshop Paralia Nature, Brussels. 9-10 April 2008: '*Natura 2000 Management plans in development: timing, nature restoration measures and project licensing*'
- Workshop Paralia Nature, Brussels. 7-8 October 2008: '*Natura 2000, the Water Framework Directive and the EU Marine Strategy*'
- Paralia Nature, Brussels. 18 November 2008, meeting with DG-ENV Nature unit
- Synergies in WFD implementation in the Wadden Sea - Report from the trilateral workshop, Hamburg; 24 –25 October 2007 VERSION 31.10.2007, Prepared by: Common Wadden Sea Secretariat, Wilhelmshaven.
- Harbasins Interreg project
- Workshop Eurosite/ Landeslehrstätte für Naturschutz und Landschaftspflege, Lebus (Brandenburg State "Education Centre for Conservation") (8-11/05/2005). Integration of the Water Framework Directive and Natura 2000
- Miscellaneous EC sources as the WISE Water Note or guidance documents

The consultant has prepared a 15 pages note to analyse these frequently asked questions and has organised a meeting with three units of DG ENV (nature and biodiversity, water and legal unit) and it was decided to present this issue to a meeting of the Common Implementation Strategy. Apparently it was decided in the March 2009 CIS meeting to launch a guidance document on this subject. Our preliminary note will be one of the basis of this work but several issues will be solved/raised later in the process and it was decided that it is too early to present the work done

It has also to be stressed that river basin management plan is a tool that can help to make clear the role and commitments of Port Authorities in achieving environmental targets.

2.8 TSD n° 8: What are the requirements for a Sustainable Maintenance Dredging Scheme?

Explanation of the question and its pertinence

Definition of dredging

The International Association of Dredging Companies (2008) define dredging as the ''*relocation of underwater sediments and soils for the construction and maintenance of waterways, dikes and transportation infrastructures and for reclamation and soil improvements*''. This definition has been used, although there are several aspects of the definition which do not pertain specifically to maintenance dredging. There are different types of dredging each one serving a different purpose (Delft University of Technology, 2007), whereas synergies between different purposes are often possible.

- Capital dredging involves the excavation of sediments to increase depths in an area, usually but not always for the first time, to accommodate the draft of vessels (to a depth that also allows for a sedimentation buffer zone - ABP research, 1999).
- Maintenance dredging can be defined as ''*the routine periodic removal of material in approach channels to port and harbour basins to maintain widths and depths in previously dredged areas to ensure the safe access for vessels*'' (ABP research, 1999). As an example, this is the case in the Kiel channel at the connection to the Elbe river estuary.
- Remedial or clean-up dredging (environmental dredging) takes place for cleaning the dredging location from heavily contaminated sediments
- Aggregate dredging (sand mining or extraction) is for the resource value of the dredged material.
- Dredging can also take place for flood control purposes in order to improve drainage or sea defence and for beach nourishment where material is supplied to improve the services of a beach as a sea defend or amenity (ABP research, 1999).

This Technical Supporting Document will only be focused on maintenance dredging since capital dredging is normally linked to new projects. Any potential issue related to contamination or to waste legislation is out of the scope of this guidance document.

Maintenance dredging

Maintenance dredging is a continuous activity that has to be undertaken because of continuous sedimentation to maintain the easiness and safety of navigation in ports and waterways. It is often done either throughout the year, infrequently or only once every few years. In some European countries, according to the laws and regulations of the Member State, a consent, a permit or permit renewal has to be obtained on a regular basis from the competent authorities for dredging and/or relocation schemes (Denmark, France, Netherlands…).

Usually Port Authorities, or Waterway and Shipping Authorities, are in charge of the maintenance works of ports or coastal and estuarine fairway channels and are therefore the ones applying for permits or agreements when it comes to maintenance dredging in case it is required by the regulations of the Member State.
Maintenance dredging is undertaken in most European seaports and waterways but is particularly necessary in the North-East Atlantic area, which is strongly influenced by a tidal regime, especially in the Channel and the North Sea (sea table 3). In some of the larger estuaries (e.g. the Humber, Elbe, Rhine and Schelde), maintenance dredging can amount to as much as 10-20 Million m^3 per year.

Table 3. Overview from 2005 in Million m^3. Data collected by Central Dredging Association (CEDA)			
Country	Sea	Inland	Total
Belgium/Flanders	5	9,2	14
Denmark	4,5		5
France	50	6	56
Germany	41	5	46
Ireland	0,8		1
Italy	4		4
Netherlands	19	9	28
Portugal	4		4
Spain	8,5		9
Sweden	1,38	0,1	1
UK	30[20]	0,7	31
Total			198

EU Nature Directives

Capital and maintenance dredging have been subject to environmental screening process from 1985 onwards, as required by the EIA Directive on the assessment of the effects of certain public and private projects on the environment. In the case of capital dredging, the resulting maintenance dredging is regularly assessed during this process. When the EU nature Directives were introduced, the consents process incorporated a further stage when considering dredging activities within or near a Natura 2000 site.

At least one European Court of Justice (ECJ) ruling cases will have to be taken into consideration when envisaging long term activities as maintenance dredging: the ECJ ruling on Case C-127/02 "Waddenvereniging and Vogelbeschermingsvereniging" (EC 2006a). This case was considered in respect of licences which the Dutch authorities issued to the Cooperative producers' association of Netherlands cockle for mechanical fishing of cockles. The activity has been carried on periodically for several years on the site concerned and a licence has to be obtained for it every year. Each new licences issuance requires an assessment both of the possibility of carrying on that activity and of the site where it may be carried on, does not in itself constitute an obstacle to considering it, at the time of each application, as a distinct plan or project within the meaning of the Habitats Directive. It means that authorization renewal of recurring activities with a likely significant effect on a Natura 2000 site have to subject to appropriate assessment of their implications for Natura 2000 sites in accordance with Article 6(3) and, where necessary, 6(4) of the Habitats Directive.

Before a decision can be taken with respect to a plan or a project it is necessary to screen the proposals to determine the effects of dredging on the Natura 2000 interest. Firstly, it must be established whether dredging will have a likely significant effect (alone or in combination with other plans or projects) and if is judged likely to have such an effect it must be subject to appropriate assessment against the site's conservation objectives, thus satisfying Articles 6(3) and 6(4) of the Habitats Directive. Dredging activities, sometimes as a consequence of capital dredging, in the sense of excavation, transport and relocation, are subject of Articles 6(3) and 6(4) of the Habitats Directive.

Water Framework Directive (WFD)

In contrast with the Habitats Directive which doesn't differentiate between natural and semi-natural habitats (art.1), the WFD provides the opportunity for sites to be designated as 'Heavily Modified Water Bodies' (HMWB). This is also the case for protected areas e.g. Natura 2000 sites. These are defined as water bodies resulted from physical alterations from human activity, which substantially changed its hydromorphological character. Member States may designate a body of surface water as heavily modified when the changes to the hydromorphological characteristics of that body, which would be necessary for achieving Good Ecological Status, would have significant adverse effects on navigation, including port facilities or recreation and other (if no alternative is available). This means that for the WFD transitional and coastal water bodies where port are located may be designated as

[20] Up to 50 (Natural England)?

HMWB (this seems to be a frequent case[21]). In implementing the WFD, environmental managers are required to assess the status of HMWB in terms of achieving at least 'good ecological potential' (GEP). A water body shows a Good Ecological Potential when there are slight changes in the values of the biological quality elements as compared to the values found at Maximum Ecological Potential (MEP).The MEP is considered as the reference conditions for HMWB and is intended to describe the best approximation to a natural aquatic ecosystem that could be achieved given the hydromorphological characteristics that cannot be changed without significant adverse effects on the specified use or wider environment.

Although the same solution is not clearly provided through the Habitats Directive, article 3 leaves a certain margin. The principal objective of the Habitats Directive for habitats and species concerned is to maintain them or, where appropriate, to restore them at a favourable conservation status (FCS) in their natural range (Art. 3). There are no common criteria established across the EU to define the status at site level but the deterioration is forbidden. With a proactive approach, restoration is one objective of the Directive although the expression 'where appropriate' does give some leeway for interpretation of this concept.

Hydro-morphological pressures, such as dredging, were studied in the framework of a WFD-CIS Policy Paper (EC, 2007) and it states: "*The development of infrastructures or other interventions in rivers and estuaries, such as dredging and disposal, may influence the conditions of sediment transport and storage processes at the river basin scale. Modification of these conditions may result in important changes for aquatic habitats (e.g. siltation of river beds, erosion of beds and banks, receding deltas, infilling of estuaries), as well as changes for the maintenance of some infrastructures (e.g. infilling of reservoirs, deposition in navigation channels, erosion of bridge supports). In this respect, sediment transport is a key consideration for certain water uses and in determining hydro-morphological status or physical alterations at the river basin scale.*

Sediment transport is not directly addressed by EU specific legislation. Some international conventions do regulate certain marine related activities, such as the disposal of dredged sediment in estuarine and coastal areas[22]. Given the impacts of sediment on water uses and/or aquatic habitats (as described earlier), supplementary measures dealing with sediment transport management could be part of the (sub) basin river management plans to support the achievement of the WFD objectives."

International Conventions regulating Dredging Activities

For many years dredged material management in the marine environment has been regulated by international conventions. The geographical limits of these conventions very often deeply extend into estuaries. World wide applicable are the "*Specific Guidelines for Assessment of Dredged Material*" of the London Convention 2000. Comparable guidelines exist of OSPAR, HELCOM, and others. Exemplary the London Convention Dredged Material Assessment Framework (DMAF) comprises following steps:

1. Dredged Material Characterization;
2. Waste Prevention Audit and Evaluation of Disposal Options;
3. Is Material Acceptable;
4. Identify and Characterize Disposal-Site;
5. Determine Potential Impacts and Prepare Impact Hypothesis(es);
6. Issue Permit;
7. Implement Project and Monitor Compliance; and
8. Field Monitoring and Assessment.

The assessment of potential effects should lead to a concise statement of the expected consequences of the disposal options, i.e., the "Impact Hypothesis". It provides a basis for deciding whether to approve or reject the proposed disposal option and for defining environmental monitoring requirements. Management options should be considered to reduce or control impacts to a level that

[21] However figures are currently lacking

[22] For example the London Convention, OSPAR (Oslo Paris Convention), HELCOM (Helsinki Commission), Barcelona Convention, Black Sea Convention.

will not constitute an unacceptable risk to human health, or harm living resources, damage amenities or interfere with legitimate uses of the sea.

Problem 1: Maintenance dredging has become part of the natural system

Dredging activities have been taking place in estuarine ports for many years (e.g. Humber estuary since 1778 and Port of Antwerp since 1885) and many of the users of the estuary argue that the practice is part of the current functioning of the estuary. For example where regular channel maintenance and disposal has occurred for a considerable time in a similar pattern (e.g. the Humber Estuary) it has been argued that dredging is part of the system. Therefore, changing such a practice because of the difficulties faced during the licensing procedures or because of the obligation to fulfil specific conservation objectives adopted by local authorities under the Habitats Directive as well as natural changes could alter the more or less humanised ecosystem that holds species and habitats also protected under the same Directive. An alternative view is that just because an activity has been ongoing, it does not mean that the current state is acceptable (this will depend upon national and local conservation objectives), and in fact systems with this sort of perturbation may well be gradually edging away from favourable condition. Furthermore, even without any dredging natural changes (e.g. sea level rise) within such dynamic systems as tidal estuaries can lead to a decline of the favourable status.

Problem 2: Different interpretation of EU Nature Directives between Member States-Different permit procedures

Port authorities or waterway and shipping authorities and associated dredging contractors have argued that interpretation of the Habitats & Birds Directives are applied inconsistently across the EU. These differences arise because member states have interpreted the legislation and relevant activities in a different way from one-another. MIF (2005) argue that this has led to distortion of competition between ports because infrastructure development is more strictly regulated in some countries (MIF, 2005). The conclusion of an inquiry undertaken on this subject by EUDA is that national practices differ strongly: some ports do not need any permit for maintenance dredging, other get a permit for 5 years and one country suggests an annual review of the situation and renewal of consent.

A typical example of this is the licensing procedures for maintenance dredging. For example, in France the licenses for dredging and relocation are given separately for periods of five years (Delft University of Technology, 2007b). In the UK permits are given for one year with a maximum of three years for maintenance works. In Germany, the permit for capital dredging includes also the required measures for maintenance dredging if the approved conditions do not change. In Belgium no license is required for maintenance dredging. Allowed depths and widths are defined by treaty (1995) i.e. when deepening was required; relocation requires a disposal-license (valid over a certain period ~ 5 year). This indicates a potentially large difference in amount of assessment work required and potential for impact on port operations in different Member states over a period of time.

Usually, the procedure for the application of a dredging permit consists of 3 stages: (a) the licence application procedure, (b) the sediment sampling requirements and (c) the wider environmental issues deriving from the Nature Directives and the WFD. It is in this last stage that Member States may have to proceed with an appropriate assessment (depending on the fact of the dredging is significantly affecting the Natura 2000 values) that may have to be repeated every couple of years depending on national legislation. Additionally, the requirements for the appropriate assessment may also differ from a Member State to another and this is why the implementation of the Habitat Directive is considered not to result in a level playing field. Although delays are attributed to the Nature Directives by many stakeholders this is not always true. Delays arise because of the level of scrutiny required by particular national/regional legislation and also by the procedures adopted by the competent authorities, such as periodicity of the licensing.

Problem 3: Stakeholders statement

Some stakeholders, e.g. European Dredging Association (EUDA) consider that maintenance dredging should not to be considered as plan or project and should not be subjected to article 6.3 and 6.4[23]. At the same time, Roger Morris (Natural England) has argued (*in litt.*) that dredging is an

[23] A inquiry with port authorities is currently undertaken on this subject by EUDA

activity that is imposed upon a system that is designed to respond to changing energetic regimes. "*The physics are a key part of the process and the system is constantly in a flux of perturbation if maintenance dredging occurs. So, the ecology of estuaries is not adapted to dredging - it is constantly fighting the effects and we need to recognise this*". However such questions have to be solved in a certain degree through the elaboration of conservation objectives at national level (Recognition of the anthropogenic nature of the Natura 2000 sites versus rehabilitation of "natural" functioning).

In any case, EUDA agrees that a Sustainable Maintenance Dredging Scheme smoothes the local acceptance and could benefit the environment. This occurs for example in the UK, where, whilst not endorsing the interpretation of the law, "*representatives of the ports and marine leisure industries have agreed to work in co-operation with Defra, DfT and Natural England to develop an approach which allows the effect of maintenance dredging on European sites to be assessed without placing a disproportionate burden on those who commission or approve maintenance dredging operations*." (Defra 2007).

EU Guidance already existing

The documents listed below have been developed from the EC and provide in some parts detailed guidance on how to apply the EU nature legislation and the WFD.

1. European Commission, (2000), *Managing Natura 2000 sites: the provisions of Articles 6 of the habitats directive 92/43/EEC*. Luxembourg: Office for official publications of the European Communities.
   http://ec.europa.eu/environment/nature/natura2000/management/docs/art6/provision_of_art6_en.pdf
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Further guidance proposed

Further guidance related to the EC Estuaries Interpretation Note

EU guidance n° 6 in the list above provides guidance on how to proceed with maintenance dredging in the ''Estuaries'' Habitat 1130. For the ongoing maintenance dredging the EC expressed the view that there is no immediate reason to believe that existing activities associated with port maintenance, which had been carried out over a long period of time in an estuary prior to its proposal as a site of Community interest, cannot continue. The majority of such activities would be expected to continue, provided that they do not have significant negative effects in relation to the conservation objectives of the site. Sometimes, these maintenance activities could be integrated within the site Management plan. However, Court judgements have made it clear for the EC that such works (depending on the fact of the dredging is significantly affecting the Natura 2000 values) would normally be considered to be plans or projects in the terms of the Directive and an assessment of their potential impacts would therefore normally be required as a pre-condition to the permitting process. Ultimately, it is the responsibility of the member state to decide how to apply these rules within the concrete national setting.

Box I: Key example

Specific guidance to maintenance dredging was given by the EC through EU guidance n° 4 (in the list above) where an example is presented on ''*stakeholder engagement in maintenance dredging decisions-making in the UK*''.

Stakeholder conflicts arose between the Port of London Authority and environmental associations in terms of environmental implications of maintenance dredging on the tidal Thames. Problems were solved by (a) creating a 'dredging liaison group' in order to ensure the dialogue and information exchange among stakeholders, (b) setting up a web-based GIS information exchange system enabling stakeholders to better understand the location and scale of the dredging activity and participate during the decision making of dredging licence application. Besides data collection programmes, modelling and monitoring, the whole effort also included a change in the dredging techniques from conventional dredge and disposal to more sustainable sediment management and recirculation. Stakeholders subsequently had greater confidence in the identification and mitigation of ecological impacts and improved planning of dredging programmes to periods of lower ecological sensitivity.

The European Commission considers that in the case of routine operations it would be appropriate to integrate such assessment into the overall preparation of management plans. Management plans are not totally defined and according to article 6 of the Habitats Directive they are not mandatory. However for maintenance dredging and for other similar recurring activities it could be helpful. It is suggested that **Sustainable Maintenance Dredging Schemes** could be the specific management plan for maintenance dredging activity or just one part concerning maintenance dredging to be integrated into broader management plans or other plans. This however requires that there are no adverse changes in the impact on the conservation status on species and habitats. Important conditions are listed in Box K like periodicity, timing, volumes and localities of dredging and deposition of material and the methods of dredging, transport and disposal remain stable. For example, controlling the maximum water depth for dredging is not sufficient as due to other changes in the system this may mean completely different volumes of dredging material and deposits and the necessity of different periodicity which can be vital or detrimental to the species and habitats affected.

The inclusion of maintenance dredging activities in the management plan (or other schemes) will ensure that implications of recurring activities are reviewed in a structured manner in the overall context of the conservation of the sites. In respect to operational requirements this could therefore include provisions to allow permitting of these activities, subject to monitoring, for the duration of the Sustainable Dredging Scheme. This scheme may vary due to local circumstances as well with respect to duration and timing as to the design of the monitoring scheme suitable to detect the relevant influences on the conservation of the site.

Sustainable Maintenance Dredging Scheme or strategies must be specifically designed for each site and should be underpinned by a regular monitoring scheme. In cases of fundamental changes the Sustainable Maintenance Dredging Scheme should be adjusted accordingly. It is also possible that other ongoing port, or coastal and estuarine fairway channel, maintenance activities might be assessed and managed within a similar framework. Use of a sustainable dredging strategy is unlikely to obviate the need for assessment under Article 6(3) if consent is required. It should, however, provide the background information that would make it possible for the competent authority to rapidly make a judgement that there will not be an adverse affect on the integrity of Natura 2000 i.e. a greatly streamlined process. Sustainable Maintenance Dredging schemes should be underpinned by effective monitoring systems that enable, inter-alia, assessment of the impact of potentially damaging operations that may affect the conservation objectives of the site.

In this context the question arises how to handle existing, legally valid permits for maintenance dredging which were issued without explicit consideration of the habitats directive regime because it did not yet apply. All legally binding permits remain valid and a (re)examination of Article 6 (3) and (4) is not needed. However,

- Article 6.2 with the obligation to avoid deterioration of the local conservation status of habitat and species remains valid
- by a Sustainable Maintenance Dredging Scheme it is ensured that the impacts of the maintenance dredging activity on the conservation objectives is monitored such that emerging adverse impacts on the conservation status are easily detected and will be responded by adequate changes in the regime before they cause damage.

Environmental impacts of maintenance dredging

The extent to which maintenance dredging and/or relocation might affect features in an SAC or SPA is highly varying and site specific, depending upon a number of variables as illustrated in Box J. Three mains categories of impacts may be distinguished: at the dredging site, at the relocation area and for both the changes in hydrodynamics and geomorphology. However, they have to be compared considering the uniqueness of each estuary.

Box J: Factors influencing the potential effects of maintenance dredging (ABP research, 1999)

- Magnitude and frequency of dredging activity
- Method of dredging and disposal
- Channel size and depth.
- The size, density and quality of material
- Intertidal area
- Background levels of water and sediment quality, suspended sediment and turbidity
- Tidal range
- Current direction and speed
- Rate of mixing
- Seasonal variability and meteorological conditions, affecting wave conditions and freshwater discharges
- Proximity of the marine feature to the dredging or disposal activity
- Presence and sensitivity of animal and plant communities (including birds, sensitive benthic communities, fish and shell fish).

Impacts on marine life from dredging (summary from ABP research, 1999)

During all dredging operations a first impact is the removal of benthic animals, the animals living on or in the sediments. A second impact arises with all methods of dredging that release suspended sediments into the water column, during the excavation itself and during the flow of sediments from hoppers and barges. Increases in suspended sediments and turbidity levels from dredging and disposal operations may under certain conditions have adverse effects on marine animals and plants by reducing light penetration into the water column and by physical disturbance. Reduction in light penetration may affect submerged seaweeds and plants, such as eelgrass *Zostera* species, by temporarily reducing productivity and growth rates. Also the growth of algae is reduced, which can affect the total mass of food, and by that through the lifecycle can affect higher organisms. On the other hand, increased suspended sediments can effect filter feeding organisms, such as shellfish, through clogging and damaging their feeding and breathing equipment. Similarly, young fish can be damaged when suspended sediments are trapped in their gills leading to increase fatalities. It is important to note that the degree of resuspension of sediments and turbidity from maintenance dredging and disposal depends on four

main variables: the sediments being dredged (size, density and quality of the material), the method of dredging (and disposal), the hydrodynamic regime in the dredging and disposal area (current direction and speed, mixing rate, tidal state), the state of the sediment (undisturbed or not, e.g. by fisheries) and the existing water quality and characteristics (background suspended sediment and turbidity levels).

Dredged material may also be contaminated from harmful substances (heavy metals, oil, TBT, PCBs and pesticides) especially in industrialised estuaries. The dredging and disposal processes can release these contaminants into the water column, making them available to be taken up by animals and plants, with the potential to cause contamination and/or poisoning. Contaminants can accumulate in marine animals and plants and transfer up the food chain to fish and sea mammals causing morphological or reproductive disorders.

Sediment resettlement over the seabed from both dredging and disposal may also affect the animals and plants that live on and within it. This blanketing or smothering of benthic animals and plants, may cause stress, reduced rates of growth or reproduction and in the worse cases the effects may be fatal. For example, animals with delicate feeding or breeding apparatus, such as shellfish can be intolerant to increased siltation resulting in reduced growth and fatality. Additionally, smothering of eggs and larvae can result from sediment resettlements when dredging takes place near spawning or nursery areas.

On the other hand resettlement of the dredge area is possible, especially disturbed areas can be in the same state as before dredging in a defined time

<u>Impacts on hydrodynamic regime and geomorphology from dredging (mainly from ABP research, 1999)</u>

Estuaries undergo a natural infilling depending on the size of the initial basin and the amount of sediment available which is either supplied from erosion in the catchment, or from the marine environment. It is also noted that beyond a certain point, a sort of balance is reached and the estuary begins to release sediment, rather than retain it. Capital dredging reserves the trend of estuarine infilling and provides an obstacle to the natural balance it seeks to attain (Morris, 2007). This occurs because capital dredging operations in an estuary may permit a saltwedge intrusion to travel further upstream than previously, increase shoreline wave action, change tidal range, tidal currents, suspended sediment load and suspended sedimentation in areas away from the deepened part of the river. Additionally, the hydrodynamic changes and their effect on sediment erosion, deposition and transport may cause secondary geomorphological changes away from the dredge location, including the potential erosion of mudflats and saltmarshes.

Regarding maintenance dredging, its effect on the hydrodynamics and geomorphology of a site has all the complexity of a capital scheme but the impacts are in general much smaller. The impacts depend on a series of factors like the quantity and periodicity of dredging activities and the specific locality were it takes place (including relocation). What plays an important role in maintenance dredging is the location of the disposal site, determining the sediment regime. A first case scenario could be for the location of the disposal site not to be linked to the estuary or coastal zone system, leading to a regular removal of sediment from the transport system and finally affecting the erosion and sedimentation processes and ultimately the form of the estuary. This could possibly deprive downstream coastal areas of sediment required to maintain coastal stability. A second scenario could be for the sediment to be placed back within the same system. In such case, although the net change may be insignificant the locations of maximum sediment concentration may change promoting additional siltation in specific areas. Increased erosion of mud, sand flats and salt marshes may have numerous implications on the ecology of marine habitats and species. For example a reduction in the lower intertidal area may lead to reduced intertidal communities and a subsequent loss of bird feeding grounds. By contrast, careful design of disposal can result in intertidal areas being increased.

Review of existing sustainable maintenance dredging schemes or strategies

Several initiatives have been taken at European level to facilitate maintenance dredging activities in estuaries and adjacent coastal zones protected under the EU nature legislation.

Four examples of initiatives are discussed below. They provide a basic framework of the likely areas to cover, which include the physical setting, the reasons for site designation, the nature of maintenance dredging and volumes involved, and relevant mitigation/compensation measures. The most logical form for this information is a report that can be updated on suitable subsequent occasions.

Production of an underpinning report has the advantage that it should include all of the information required by competent authorities when making judgements according to Article 6 of the Habitats Directive. Regardless of the timescales for renewal of consent, this baseline information should be capable of updating and re-use in subsequent consent applications. The following paragraphs present a review of the four methods proposed for elaborating a maintenance dredging scheme.

❶ A Conservation Assessment Protocol (CAP) on maintenance dredging & the Habitats Regulations 1994 was launched from the DEFRA (Department for Environment Food and Rural Affairs in the UK) in 2007 (Box K).

Box K: Baseline document for gathering the necessary information on maintenance dredging (Defra, 2007)

- The existing need for maintenance dredging in individual areas.
- The existing volumes, frequencies and duration of dredging operations.
- The precise locations of dredging and disposal.
- Methods of dredging, transport and disposal, including requirements for relevant authorities to take into account agitation dredging and other hydrodynamic operations.
- Any restrictions imposed as licence conditions or by physical constraints (e.g. depth, tidal flow, wave or weather conditions).
- Material type and chemical status (existing and historical).
- The history of dredging and disposal at particular locations, as well as the variability in material type and volumes due to natural changes.
- Any monitoring requirements previously imposed through licences, and the outcomes of such monitoring.
- Any beneficial use and sediment cell maintenance schemes, or mitigation and compensation schemes entered into.
- Any other relevant information from past studies or previous applications that have possible direct or indirect links to the maintenance dredging.
- The interest features of the sites and their conservation objectives, which could be affected by maintenance dredging.
- The extent to which the ecological requirements of the sites have been achieved, maintained or restored since the requirements of the Birds or Habitats Directive were applied to the sites.

DEFRA recognised that maintenance dredging differs from many other types of ‘plans or projects’ because it usually consists of a cycle or series or repeated dredges. DEFRA also accepted that environmental assessment can be time consuming and expensive, whilst repeated assessment of separate dredge applications may well add disproportionately to the cost of obtaining consents. The Conservation Assessment Protocol seeks to assist harbour and port authorities in fulfilling their statutory obligations, whilst minimising delays and costs to port and marina operators when obtaining consents. The protocol seeks to secure a mechanism for assessment that is fit for purpose and makes sure that the nature conservation objectives are met.

❷ In accordance to the constitutional law in Germany extension and maintenance of the navigable waterways in the coastal areas and estuaries are task of the Federal Waterways and Shipping Administration (WSV) whereas this task concerning port areas is assigned to the Länder.

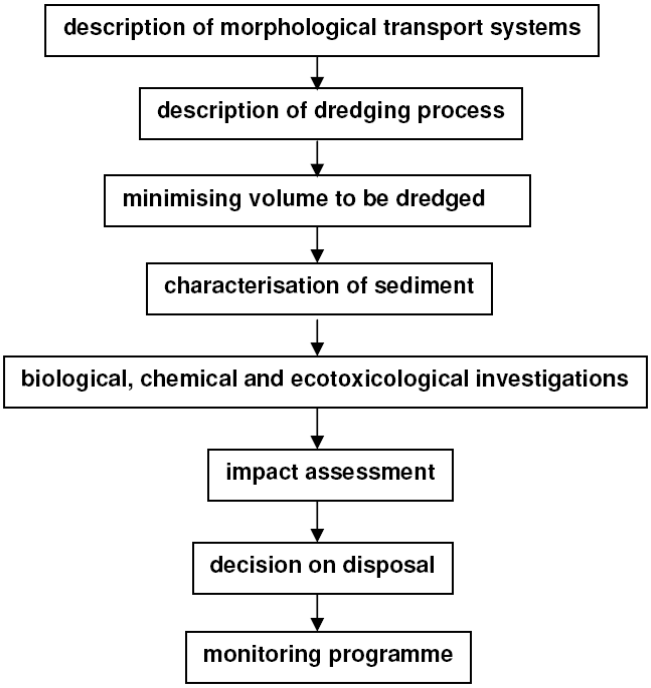
All present dimensions of German coastal and estuarine fairway channels are based on legal plan approval procedures. This formal approval in principle is necessary before starting any capital dredging and includes the consideration and balancing of all the interests of the public, of private individuals and of the environment with special respect to the EU Nature Directives. Within the concluding approval document the requirements of every single permit and license necessary in the plan are concentrated.

During the approval procedure particularly it has to be assessed that as well as capital dredging and allocation, but also maintenance dredging and relocation will not have any adverse significant effect on the features of the designated areas and the integrity of the sites. As far as necessary the concluding approval document will define suitable regulations for mitigation and/or compensation of undesired impacts and also describes requirements for monitoring including ongoing maintenance dredging activities.

In addition to this, federal maintenance work is done according to international regulations, such as London Convention and OSPAR requirements. All those regulations have been transformed into a national guideline for dredging and relocation – the "*Handlungsanweisung für den Umgang mit Baggergut im Küstenbereich - HABAK-WSV*" (Instruction on dredged material handling in coastal areas).

According to HABAK a monitoring is required to assess whether there are any effects from dredging and relocation on marine fauna, flora or habitat. Every five years a concluding analysis report is made by the WSV. Based on this report any necessary specifications on further maintenance activities are defined with consideration to objections of the federal state administrations on water quality and nature protection.

Box L: Procedural steps for maintenance dredging in Federal Waterways according to the HABAK-WSV scheme



❸ A framework for a sustainable dredging strategy was also developed from the Delft University of Technology in 2007 within the NEW!Delta project in which management and dredging operations were considered as part of an integrated estuary management that strikes a balance between environmental, economic, social and technical aspects while respecting the legal requirements (Box M).

Box M: Elements for a decision support framework for a sustainable dredging strategy (after Delft University of Technology, 2007a)

- Characterisation of the geomorphology of the estuary and development of a conceptual understanding of the physical processes and morphological dynamics of the system including natural variability and ongoing trends.
- Determination of the extent, distribution and evolution of the designated habitats and species within the system including the variability of extent, numbers and species.
- Determination of the magnitude of influence of other non dredging uses and users of the estuary system.
- Superimposition of the data sets and the derivation of natural pathways of change, including those caused by dredging, disposal or use activities.
- Evaluation of dredging (capital and maintenance) with respect to the above understanding taking into account the magnitude, frequency and duration of the dredging activity at any location within the system and the characterisation of the material type.
- Selection of the correct site for the deposit of the material and the equipment to be used.
- Determination of the correct disposal strategy, set to achieve specific goals and the minimisation of impact.
- Setting of thresholds for management control based on concerns and actual effect, not perceived affects.
- Monitoring and assessment to determine achievement of the monitoring hypotheses and or environmental goals.
- A routine management review with selected stakeholders.

❹ A similar approach was made from GEODE (Groupe d'Etudes et d'Observations sur les Dragages et l'Environnement - Observation and Study Group on the environment and dredging located in France) in 2008. Their work presented a set of recommendations for determining estuary management objectives for maintenance dredging and relocation of the dredge material (Box N). GEODE noted that maintenance dredging operations could no longer be regarded as isolated operations for which regulatory management is covered by application for a licence, extended by possible renewal, even though this is in compliance with French regulations. A more global approach to maintenance dredging was introduced relating to the estuary management plan.

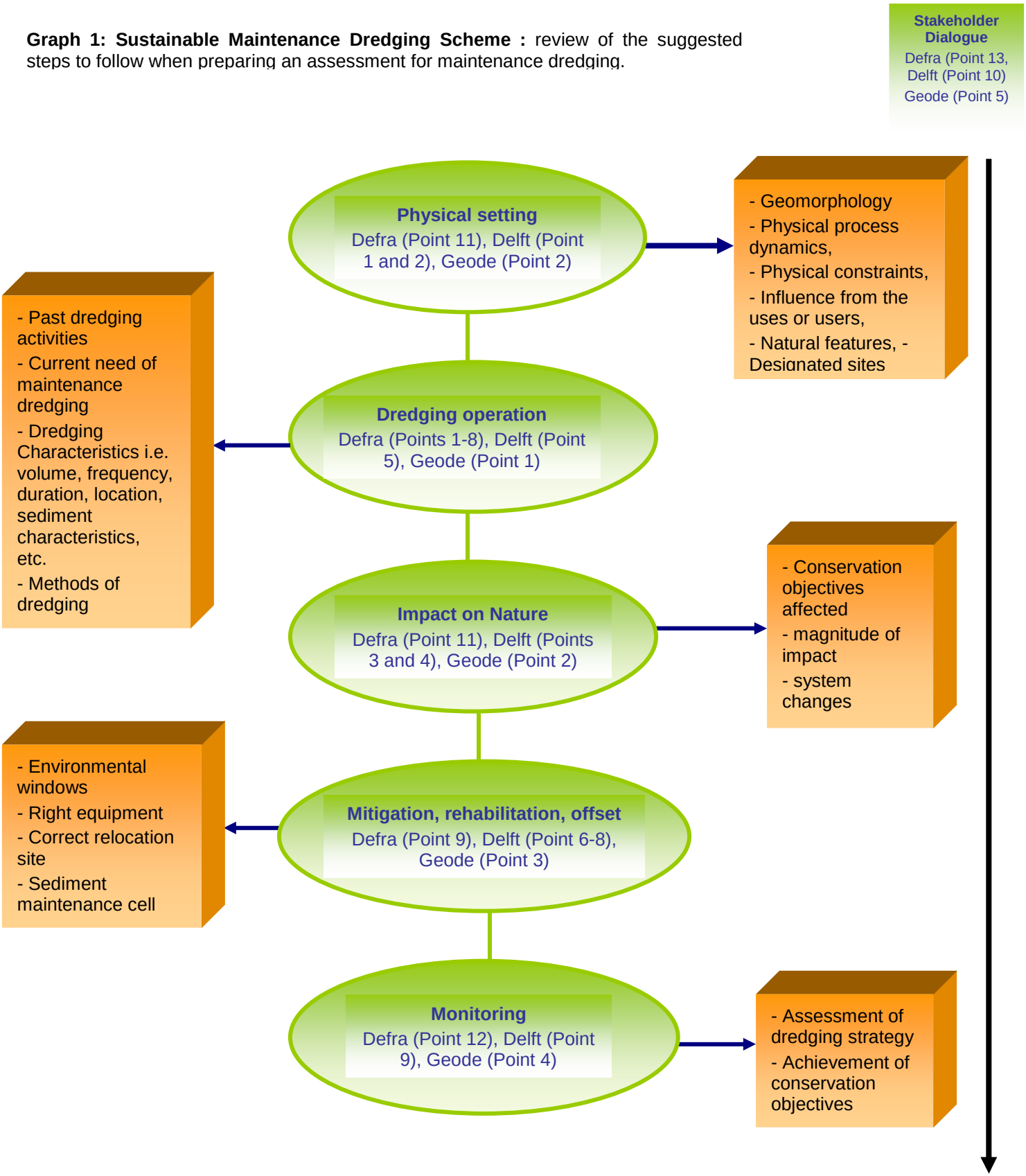
Box N: summary of the approach developed by GEODE (2008)		
Phase	**Objective**	**Advantages**
1. Development of dredging management plan	The management plan determines the volumes of material to be dredged and the frequency of dredging, the characteristics of the sediments to be extracted and the medium- and long-term dredging programme.	The dredging management plan is a translation of the forward-looking view in terms of economics (developments in shipping traffic) and of development (port master plan).
2. Defining, qualifying and ranking of environmental concerns	Definition of environmental concerns in accordance with the estuary's environmental characteristics.	Defining concerns provides the basis for analysis of the conservation status of the site required in the assessing Natura 2000 impacts document. Elements relating to conservation status will be extracted from existing studies and additional measurements in the field.
3.Selection of dredging techniques and in-water relocation sites compatible with the Natura 2000 site management objectives	Taking account of environmental parameters in each decision to help the dredging programme develop towards the most neutral operation for the environment and for conservation of the Natura 2000 site.	This iterative phase allows debate of elements for comparison, to determine the solution striking the best balance between the technical, environmental and economic parameters.
4. Assessment of effects of dredging programme selected	▪ Assessment of the direct and indirect, temporary and permanent effects for conservation of habitats and species that are of Community interest on the Natura 2000 site in question. NB: Effects must be assessed in absolute terms, but also in relative and cumulative manner in relation to the possible effects of other factors, whether natural or of human origin. ▪ Implementation of mitigating and possibly compensatory measures. These first two points are covered by the framework of applications for dredging and relocation licences. ▪ Monitoring of effects post operation (ex post monitoring/report).	▪ Monitoring of the environmental quality of the dredging programme by verifying that the residual impacts are in line with the integrated management objectives for the estuary in question and more particularly for the Natura 2000 area. ▪ Drawing of lessons for dredging of same type to be undertaken in the future, with a view to further reducing impacts.
5. Involving local stakeholders in choice of dredging management plan		Establishing dialogue with all of the stakeholders very early in the process gives the port authority the opportunity to explain the relevance of the programme it supports and to demonstrate its capacity to take account of proposals the stakeholders may make.

The DEFRA and GEODE methods were developed to facilitate maintenance dredging operations, whereas the sustainable dredging framework presented from the Delft University and WSW refers to both capital and maintenance dredging. There are six common areas in these methodologies (refer to Graph 1):

(a) understanding of the physical setting of the area concerned.
(b) collecting the necessary relevant information on the dredging operation in order to assess the environmental impact in detail,.
(c) proceeding with the assessment of the impacts of the dredging operation to the natural environment.
(d) If necessary, describing all possible solutions for mitigation and examine compensation measures that could be undertaken for the specific site (through consent process in UK).
(e) implementing a monitoring programme determining the achievement of environmental goals/ associated to the site conservation objectives.
(f) Ensuring stakeholder participation all along the process in order to avoid complaints and delaying of the procedure.

The more holistic approach is considered to be that of the Delft University of Technology where particular emphasis is placed on the system understanding (physical processes, geomorphology, morphological dynamics, etc) followed by the rest of the subsequent steps. The GEODE and Defra approaches are more streamlined aiming to integrate maintenance dredging operations in the management of the area in a pragmatic manner. They focus mostly on the detailed description of the dredging activity which will later on allow a better assessment of the dredging methods and their impact on the environment. Impact assessment, mitigation, compensation (related to consent in UK) and monitoring are equally covered from all four methodologies. Stakeholder participation is the final and very important step supported from Defra, WSV and Delft. Graph 1 could itself represent a Sustainable Maintenance Dredging Scheme combining all aforementioned methods.

Graph 1: Sustainable Maintenance Dredging Scheme : review of the suggested steps to follow when preparing an assessment for maintenance dredging.



Sustainable maintenance dredging schemes and EU legislation

The proposed scheme is a non-mandatory approach which may assist in the management of Natura 2000 sites as well as streamlining consents processes. Locally such a scheme may be subject to a national/regional authorization and in this case an appropriate assessment linked to a plan or a project will be mandatory. Even in the case where such a scheme is not subject to national/regional authorization, it is advisable to undertake an appropriate assessment to make sure that the scheme is compliant with the Habitats Directive and to gain the support of environmental stakeholders.

Maintenance dredging is generally linked to societal choices made one or two centuries ago (historic decision) for maritime transport, protection against natural forces and/or agricultural development. These choices, with some others along the coastline or in the river basins, have modified the natural system (or engine), sometime by accelerating natural evolution. Maintenance dredging could continue to modify the natural system (or engine) of the estuary and furthermore it has become a societal/ economic need to adapt to climate change or to the evolving economy (i.e. greater number of vessels, greater frequency of use of associated navigation channel, greater maintenance needs). As mentioned earlier the ecology of the associated habitats has itself adapted and changed with maintenance dredging being integrated as a semi-natural process. Some parts of the ecology is potentially under permanent decline because of dredging – where sediment loss is causing saltmarshes and mudflats to erode or where sediment movements and or dikes are causing saltmarshes and mudflats to transform into terrestrial wetlands.

Any new management schemes may have consequences to both the ecosystem and local societies/economies and should be treated with great attention.

Where maintenance dredging has been taking place for a long-time the estuary, or coastline is heavily modified and coastal communities are reliant upon these modifications, the possibility of reversing these changes is highly unlikely and could even have sometimes adversary effects on the conservation objectives of the sites.

Maintenance dredging is a recurring activity and the Sustainable Dredging Scheme has to:

- maintain the existence of socio-economical features of the area and especially navigation;
- help reach conservation objectives for the Natura 2000 site and favourable Conservation Status of physical and biotic features of protected habitats and species; and to
- help reach Good Ecological Status/Potential for physico-chemical and biological features of the water bodies of the Natura 2000 sites.

If the activity is significantly affecting the Natura 2000 values, maintenance dredging needs an appropriate assessment in relation to article 6 of the Habitat directive (and may be an SEA) and to any other local needs e.g. related to the WFD. However, the periodicity of this assessment has to be defined and the potential impacts have to be monitored, especially if effects are uncertain, during the chosen period to give the ability to modify the global assessment and find new solutions if needed. The time frame is very difficult to determine as:

- the idea is not to make a scheme every year, i.e. in this case we come back only to the regular authorisation process;
- Member States have to report every six year on the conservation status (but not at site level) and on the evaluation of the impact of the measures implemented;
- our prospective capabilities are not exceeding 20-30 years (AESN 2004); and
- the need for maintenance dredging is considered as permanent and the potential impact on geomorphology may be permanent but the threshold before impossible resilience is difficult to determine.

It is essential that a monitoring system is established to make it possible to ensure that the site's conservation objectives are met. This suggests the reporting periods should be relatively short to enable any necessary adjustments to be made before adverse effects airse/ This will enable compliance with the obligation to take appropriate steps to avoid deterioration under Article 6(2).

Cases studies:
1. Maintenance Dredging Decision Making Framework (Thames, UK - after Port of London Authority, 2008)
2. Mitigation of the impacts (after Geode 2008)
3. Mitigation of the impacts (after PIANC 2009)

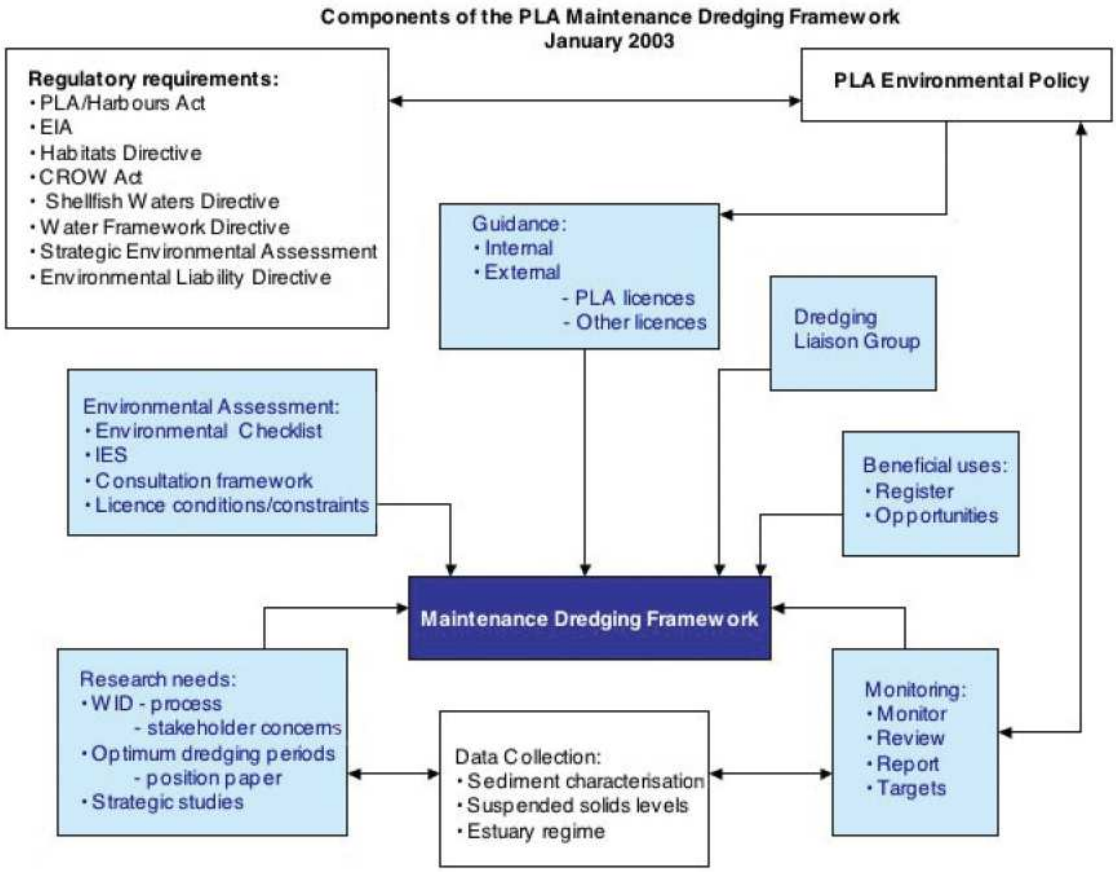
1. **Maintenance Dredging Decision Making Framework (Thames, UK - after Port of London Authority, 2008)-**
   http://www.pla.co.uk/display_fixedpage.cfm/id/761/site/environment

Maintenance dredging is necessary to maintain safe operational water depths for navigation, and to facilitate continued access to many of the 70 plus berths, docks wharves and jetties in tidal Thames. There are currently some 20 locations (see map below) where operators undertake maintenance dredging on a regular basis, from several times each year to once every 18 months or so. The quantity removed is dependent upon the sedimentation characteristics at each location and can vary from <2,000m3 to >45,000m3 of silt and/or sand per dredging campaign.

The Port of London Authority (PLA), in common with other UK ports, has historically acted under its own Act of Parliament and has not generally needed to liaise with other stakeholders. Over the past 10-15 years, however, the ability of the UK ports sector to 'operate in isolation' has changed for a variety of reasons: a general increase in environmental awareness; an appreciation of the need for environmental activities to be conducted transparently; and increased environmental legislation. In making decisions on maintenance dredging, the PLA needs to ensure a balance between meeting expectations, discharging its responsibilities under environmental regulations, and being able to operate the Port of London in an efficient and cost-effective manner.

The PLA has sought to respond to the above pressures in a constructive and innovative manner, undertaking various initiatives including the development of a strategic framework to guide decisions on maintenance dredging and ensure sustainability (Graph 2).

An important consideration in developing this framework is the need to understand the estuary at a strategic (i.e. 'whole estuary') level, and to make decisions in full awareness of strategic as well as site-specific issues. In combination, the components of the framework will help to ensure that the PLA is aware of such issues and is able to take them into account. As part of the development and implementation of this framework, the PLA intends to encourage improved forward planning along with an explanation and justification for maintenance dredging campaigns wherever this is practical. This is particularly relevant in the case of berths that are dredged regularly (sometimes several times each year). The decision making framework should enable many of the potential environmental issues associated with maintenance dredging to be identified and resolved well in advance of dredging taking place. It must, however, also be recognised that either storm events (e.g. moving sediments into the navigation channel) or certain operational requirements (e.g. the need to dredge a berth which is only used infrequently) will continue to lead to situations in which dredging needs to be undertaken more quickly. The framework needs to be able to cope with such situations equally well.



Graph 2: Port of London Authority Maintenance Dredging Framework

2. Mitigation of the impacts (Geode 2008)

Geode (2008) suggested several measures to reduce the effects of maintenance dredging. These are listed below:

Best available technologies and processes not entailing excessive costs for society

- The overflow dredging technique is virtually no longer used[24]. This technique consists in filling the dredge hopper and then continuing to dredge while continuously discharging the sediments extracted back into the immediate environment. This type of dredging is known to cause extensive re-suspension of sediments that can have severe adverse effects for the environment. Increasing the dredge hopper capacity favours direct transport to in-water relocation sites after filling.
- Extraction of dredged materials. Technical adaptations of dredging plant allow attenuation of effects on the environment, especially by reducing the amounts of fine material re-suspended during extraction (Table 4).

Table 4: Technical modifications that can be made to hydraulic dredges (Geode, 2008)

Factors influencing amount of sediments re-suspended	***Technical modifications possible***
➢ Pump suction pressure ➢ Speed of lateral movement ➢ Filter angle ➢ Design of cutter (if the dredge is fitted with a cutter) ➢ Speed of rotation of the cutter in relation to suction power	➢ Increase in pump suction power ➢ Addition of booster pumps to main pump to increase suction capacity ➢ Use of a conical cutter ➢ Installation of cutter directly under suction pipe ➢ Installation of degassing system ➢ Installation of pressure and density gauges to mnitor water-sediment mixture
➢ Pump discharge flow	➢ Flow limiter during passive dredging phases
➢ Loss of material from pipe during transport	➢ Sealing of pipe joints

- Transport of dredged materials. Some measures often applied on dredging sites, during the transport of materials phase (Table 5).

[24] Within low-sediment waters because it seems still to be a common practice in sediment rich waters due to the fact that turbidity is high and the technique cost-effective as well.

Table 5: Recommendations for minimising effects of transport of dredged materials (Geode, 2008)

Factors influencing amount of sediments re-suspended	*Technical modifications possible*
Reduction in losses of material during transport of dredged material between site of extraction and place of relocation	➢ Selection of equipment and mode of transport compatible with the nature and quality of dredged materials ➢ In case of transport by barge, lighter or self-propelled dredger, avoid any spillage, especially if the dredged materials are polluted ➢ In case of discharge via a pipe, ensure that the different section joints are correctly sealed
Reduction of noise, visual pollution and risk of accident	➢ Use low-noise handling and transport equipment ➢ Ensure that machinery is adequately maintained (noise reduction, prevention of material leaks) ➢ Plan for rapid retrieval of any accidental spillage of sediments during transfer or transport activities ➢ Adopt working hours that minimise disturbance (human presence) and noise (airborne and underwater)

Optimisation of time and volumes

- Optimisation of volume of sediment to be dredged from the channel. Instrumentation to assist dredging, used by some ports, leads to the extraction of precisely the volume required for channel maintenance. With instrumentation exceeding of the required dredging gauges for the different fairways can be avoided or the gauges can be attained without the need for new intervention. Optimisation of dredging is obtained using onboard equipment (navigation system coupled to a radiolocation system, tide height receiver and monitoring indicators for depth and dredging gauge). Modernisation of hydrographic techniques with, in particular, the automation of onboard data recording, automatic depth contour recording and volume calculation also allows accurate monitoring of dredging operations.
- Optimised management of creek scouring (Loire). To maintain the network of marsh creeks without blocking them, appropriate scouring operations to rejuvenate the environment could be envisaged, after approval by the committee responsible for dredging. Removal of the scoured material would be after the flowering period and before the heavy rains, that is to say around October. This form of management would make it possible to preserve all of the habitat's potential, especially its role as an important habitat for the otter.
- Environmental windows. Dredging operations can, to varying degrees, be limited to certain periods, in order to prevent or mitigate direct effects on natural habitats and species. These periods are known as ‘environmental windows’. They mean, for example, not programming dredging during the migration period of one or several species of fish that are of Community interest or during a whole or part of the breeding period of one or several species of birds of Community interest.

Relocation area

- In-water relocation. The places where dredged material is disposed at sea must be chosen so as to prevent or mitigate, as far as possible, the harmful effects on the physical environment, on habitats and on species of Community interest. Suggestions include: (a) avoid relocation in areas that are feeding grounds for fish of Community interest (such as the European sturgeon), (b) avoid deposition of sediments on river banks so as not to destroy

habitats or bury protected plants (e.g. *Angelica*) or cause regression of habitats of species (wet grasslands, habitat of the corn crake).

- Modelling of conditions of in-water relocation to optimise relocation practices. Mathematical models can be used to improve practices for the relocation of dredged materials at sea, and especially to determine the dispersion of sediments, providing the theoretical limits of relocation sites within which all of the materials deposited will be contained. However, these models have certain limitations and must be used with caution: they require definition of limit conditions and need to be calibrated using *in situ* measurements in order to be validated.
- Relocation under favourable current conditions. Some in-water relocation may be subject to strict conditions, for example relative to currents (direction, speed).
- Management of relocation by rotation. Management of in-water relocation by rotation is also possible. This technique allows partial re-colonisation of the site by the benthos on the in-water relocation sites.
- On-land relocation. Deposition on land does not appear always to be a satisfactory solution in terms of both the quantities and geotechnical quality of dredged materials from estuaries and of the environmental aspects of estuarine areas, often covered by environmental protection measures. On-land relocation of dredged material requires, in most cases, the building of 'relocation chambers' on the edge of the estuary or river. During the work, these act as settling tanks allowing discharge to the outside environment of only residual water that is sufficiently clear to not alter the quality of the environmental receptors.

3. Mitigation of the impacts (PIANC 2009)

In January 2009 PIANC will publish its report nr. 100 "Dredging Management Practices for the Environment - A Structured Selection Approach" including the following considerations given by SEDNET.

Dredging and placement of dredged material have potential impacts on the environment, ranging from disturbance of benthic invertebrates to disruption of their habitats and direct mortality. The scale of these impacts depends on several factors, including the magnitude, duration, frequency and methodology of the dredging activity and the sensitivity of the affected environment. The table (see below) is central element of the report and summarises the ways in which dredging, transport and placement of material have the potential to affect the environment above and below the water surface.

The report provides a comprehensive overview of Management Practices applicable to dredging and the transport and placement of dredged material and an approach on how to select the Best Management Practice in a given environmental situation. Definitions are:

- Management Practice (MP): A practice intended to improve the environmental performance of a dredging project, inclusive of excavation, transport, and placement of dredged material.
- Best Management Practice (BMP): A management practice, or combination of management practices, that is determined after impact assessment, examination of alternative practices, and appropriate stakeholder participation to be the most effective, practical, and sustainable means (including technological, economic, social, and institutional considerations) of achieving an environmental performance objective.

Physical Change	Potential Environmental Effect	Examples of Impact
The presence of dredging equipment	User conflicts	Obstacles to navigation and fishing activities, lights at night
	Noise and vibration under water	Disruption of fish migration, disturbance to marine mammals
	Noise and vibration above water	Nuisance to local community, disturbance to birds
	Impacts on water quality	Oil and fuel spillage
	Altered air quality	Exhaust emissions
	Ballast water	Invasive species
Sediment removal	Altered benthic habitat	Net loss of habitat
	Mechanical removal of biota	Loss of valued organisms (e.g., prey resources)
	Hydraulic entrainment	Loss of individuals (e.g., sea turtles)
	Disturbed cultural resources	Archaeological remains
	Safety	Ordnance, pipelines, sulphide release
Altered topography/ bathymetry	Altered hydrodynamics and sedimentation	Erosion of intertidal flats
	Altered hydrology and salinity regime	Changes to species distribution, e.g., wetland loss, movement of spawning grounds
Re-suspension of sediment matrix into water column	Release of particulate matter	Behavioural / physiological responses to increased suspended solids (e.g., physical abrasion, visual effect of plume), effect on water intakes
	Reduced light penetration	Behavioural / physiological responses to increased turbidity (e.g., loss of growth for eelgrass beds, reduction in primary productivity for phytoplankton)
	Release of nutrients	Behavioural / physiological responses to enrichment (e.g., algal bloom)
	Release of toxic chemicals	Behavioural / physiological responses to contaminants (e.g., bioaccumulation of metals in fish)
	Release of organic matter	Behavioural / physiological responses to dissolved oxygen depletion
	User conflicts	Aesthetics, diving, fishing
Sedimentation induced by dredged material placement	Smothering of biota, altered benthic habitat	Impact on fish spawning grounds, shellfish beds, submerged aquatic vegetation
	Morphological change	Change to geometry of system
Rock blasting	Shock waves	Physiological response

2.9 TSD n° 9: Appropriate assessment of land use plans, sectoral plans or integrated plans in estuaries and coastal areas and relations with strategic environmental assessments (SEA)

Explanation of the question and its pertinence

Estuaries and coastal zones are where terrestrial and marine plans overlap. Furthermore, there are multiple plans (economic development, port plans, flood risk management, marine spatial planning, etc) and multiple plan makers (business, spatial planning authorities, flood risk management bodies, Natura 2000 management bodies etc.). Sustainable development demands proper integration of these plans, one of the aim for environmental purpose being to ensure that areas needed for flood alleviation or for compensation schemes aren't developed.

In this sense, Habitats Directive Article 6 process is not only a legal requirement but also a valuable tool in strategic planning – looking at plans alone and in-combination. It requires that decisions be made and sets a clear decision making framework: it can help avoid the project level conflicts that the ports industry and nature conservation bodies have found so frustrating, time-consuming and unnecessary. It can secure greater certainty and win-win solutions rather than risk lowest-common denominator compromises.

At least one European Court of Justice (ECJ) ruling case will have to be taken into consideration when envisaging long term planning: the Case C-6/04, Commission v. United Kingdom (EC 2006a). It stipulates that an appropriate assessment is compulsory for all plans and project that are likely to have significant effects on Natura 2000 sites. In October 2005 the European Court of Justice ruled that all land use plans, where they influence subsequent decisions, should be assessed for the effects they may have on the Natura 2000 sites. National legislation does not always clearly require land use plans to be subject to appropriate assessment of their implications for Natura 2000 sites in accordance with Article 6(3) and (4) of the Habitats Directive. Although land use plans do not as such authorise development and planning permission must be obtained for development projects in the normal manner, they have great influence on development decisions. Therefore land use plans must also be subject to appropriate assessment of their implications for the site concerned. This has now to be studied in relation with Strategic Environmental Assessment (directive 2001/42 on the assessment of the effects of certain plans and programmes on the environment).

Scope of the guidance concept form: definition of plan

Article 6.3 of the Habitats directive relates to "plan and projects". However, this Technical Supporting Document focuses only on plans. It does not concern projects as they are defined by article 1 of the EIA Directive (85/337/EEC and its revisions):

- The execution of construction works or of other installations or schemes,
- Other interventions in the natural surroundings and landscape including those involving the extraction of mineral resources;

It has already been highlighted that the project concept has a very broad definition, which is not limited to physical construction (EC, 2000). Project development will be addressed in the chapter 5 of the main guidance document and its related Guidance Concept Forms.

Plans were not defined in article 1 of the Habitats Directive. However, guidance was given by the EC for the definition of this term (EC, 2000): it includes land-use plans, spatial plans, sectoral plans, etc. When that guidance document was finalised, the Directive 2001/42/EC on the assessment of the effects of certain plans and programmes on the environment (SEA Directive) had not yet been published. In Article 2 of the SEA directive, plans and programmes, including those co-financed by the European Community, as well as any modifications to them, are defined as planning instruments:

- which are subject to preparation and/or adoption by an authority at national, regional or local level;
- which are prepared by an authority for adoption, through a legislative procedure by Parliament or Government,
- which are required by legislative, regulatory or administrative provisions.

The word “plan” from the Habitats Directive is equivalent to both plan and programmes as defined in the SEA Directive.

It has to be highlighted that boundaries between plans, programmes and projects are not always very clear. In a report on the relationship between the EIA and SEA Directives prepared for the EC in 2005 (Sheate & al. 2005), it was demonstrated that some overlap between the EIA and SEA directives (and so between plans and projects) exist in some Member States (e.g., in Germany for Local Plans, in Sweden for Detailed Developments Plans, which are also required for ports, in the UK for Urban Developments Plans…). Sometimes, the last step of authorisation, generally the project authorisation, is related to several preliminary authorisations. For example in the case of France, as regards transport infrastructures, after launching preliminary studies (plan) a first authorisation is given for the definition of a strip of one kilometre (plan), a second one for the definition of a strip of 300 meters (plan or project) and a final one for the precise location (project).

EU Guidance already existing

The documents listed below have been developed by the EC. They provide detailed guidance on how to apply the EU nature legislation.

1. European Commission, (2003), Implementation of Directive 2001/42 on the assessment of the effects of certain plans and programmes on the environment

http://ec.europa.eu/environment/archives/eia/pdf/030923_sea_guidance.pdf

2. European Commission, (2000), *Managing Natura 2000 sites: the provisions of Articles 6 of the habitats directive 92/43/EEC*. Luxembourg: Office for official publications of the European Communities.

http://ec.europa.eu/environment/nature/natura2000/management/docs/art6/provision_of_art6_en.pdf

3. European Commission, (2002), Assessment of plans and projects significantly affecting Natura 2000 sites. Methodological guidance on the provisions of articles 6(3) and (4) of the Habitats Directive 92/43/EEC. Luxembourg: Office for official publications of the European Communities.

http://ec.europa.eu/environment/nature/natura2000/management/docs/art6/natura_2000_assess_en.pdf

4. European Commission (2007), Guidance document on article 6(4) of the ‘Habitats Directive’92/43/EEC. Clarification of the concepts of: alternative solutions, imperative reasons of overriding public interest, compensatory measures, overall coherence, opinion of the Commission.

http://ec.europa.eu/environment/nature/natura2000/management/docs/art6/guidance_art6_4_en.pdf

Complementary guidance proposed

Benefits of strategic planning for a win-win strategy

Of obvious relevance are land-use plans and sectoral plans, including flood risk management plans and River Basin management plans. Some have direct legal effects for the use of land, others only indirect effects. For instance, regional or geographically extensive spatial plans are often not applied directly but form the basis for more detailed plans or serve as a framework for development consents, which then have direct legal effects.

These plans have to be submitted to the article 6.3 scheme and especially the appropriate assessment. Appropriate assessment critically evaluates the potential impacts of the plan on Natura 2000 sites and identifies amendments to policies or proposals so that adverse effects on Natura 2000 sites are avoided. One of the key benefits of the appropriate assessment of plans is that it requires decisions to be made on the content of the plan, based on the assessment’s findings on the impacts on Natura 2000 sites. At the same time, it can help remove the uncertainty and conflict associated with project level. Clear and justified decisions are required that avoid adverse effects on

Natura 2000 or, if that is not possible, set out precise reasons why the damage is justified (alternatives and IROPI) and secure compensatory measures.

The European Sea Port Organization recommends that port authorities become more involved in all relevant planning exercises (ESPO, 2007) as strategic planning will help to secure synchronized investments, to solve cross border issues, to anticipate on alternatives and overriding public interest (IROPI) and to promote positive externalities. As highlighted by ESPO, a port authority could then also more easily include sustainable development objectives and spatial issues in its corporate policy objectives.

Integrated management is a way to look for synergies, complementary and win-win situations as well as an exercise to promote anticipation, social responsibility and sustainable development. It should help to avoid paradoxes, conflicts, later competition for the scarcity of space … Ideally, shipping development should have equal opportunities and in a management plan this could be realised by means of an integral vision for the development of the entire estuary (Harbassins WP2, 2008).

Benefits of integrated planning for estuaries and coastal zones should not only be considered for economical purposes. The conservation of estuaries and the challenge of climate change are key issues also for local stakeholders and it is recommended for all Member states to make appropriate integrated plans for estuaries and to provide to stakeholders the necessary background knowledge on the overall management of estuaries taking into consideration these issues. At EU level, DG Mare is also promoting an initiative on maritime spatial planning.

Strategic integrated planning was promoted at EU level with the EU Recommendation 2002/413/EC on Integrated Coastal Zone Management (ICZM). The results of several pilot case studies, including on estuaries, were used to build this recommendation. The ICZM Recommendation proposes some principles including the "*use of a combination of instruments designed to facilitate coherence between sectoral policy objectives and coherence between planning and management*". Completed by the ICZM-stocktaking, this principle can help to combine water management (WFD), species and habitat protection (Habitats Directive) and economical development.

Integrated project concept will be further developed in TSD n° 9 and there are overlapping areas between strategic planning, integrated management plan and integrated projects. Integrated planning is fully in line with the environmental principle to correct environmental problems at their sources. However, care will need to be taken that any such project meets the requirements of Article 6.

Appropriate assessment of land use plans and port development plans

Land use plans, including for estuaries, and some port related activities or port development plans, are subject to art. 6.3 and, where necessary, art. 6.4 of the Habitats Directive. Article 6.3 requires appropriate assessment for all plans or projects likely to have significant effects on a Natura 2000 area. This may require a pre-assessment. In the case of plans, screening for an appropriate assessment will need to consider possible impacts on Natura 2000 sites outside the geographic boundary of the plan. In cases where likely negative impacts of planned activities are anticipated, an appropriate assessment in accordance with article 6.3 of the Habitats Directive is required to provide a finer description of the expected impacts the development would have on the site. The appropriate assessment should also identify adequate mitigation measures where such measures are possible. The search for alternative solutions becomes necessary when it appears from the appropriate assessment that a significant adverse effect of a plan or project cannot be avoided, even when mitigating measures are being undertaken. Alternative solutions should always be considered beforehand and can be incorporated within the land use plan. The iterative nature of the plan-making process and the integration of cumulative effects encourages the consideration of less damaging alternative solutions at each plan-making stage. This is one of its strengths of applying appropriate assessment at the plan-making level as it helps find solutions that avoid adverse effects on Natura 2000 sites. This is a matter of anticipation and will limit risks and delays. Appropriate assessment on plan level can provide certainty by make clear choices between different or conflicting interests.

The appropriate assessment must consider the impact on the integrity of the Natura 2000 site(s) of the plan proposals, both alone and/or in combination with other plans, with respect to the conservation objectives of the Habitats and Birds Directives. In practice, the assessment may be an iterative process, allowing for modifications to the plan. Plan appropriate assessments should help reduce the number of project appropriate assessments by avoiding significant adverse effects of projects already from the earliest planning stage. Devolving decisions to the lower level, i.e. by

allowing development in plans under the condition that appropriate assessments are being carried out at project-level, is not a sustainable solution and will create unnecessary uncertainty as to whether the projects will be able to meet the requirements of art 6.3 and 6.4.

The appropriate assessment must be recorded and carried out with a view to informing the decisions in the plan. This should be discussed with competent authorities and lead to a kind of agreement. So the project developer will know the limits of the research activities. The comprehensiveness of the assessment work undertaken should be proportionate to the geographical scope of the plan and the nature and extent of any effects identified. The assessment should be confined to the effects on the habitats and species for which a site has been designated. An appropriate assessment does not need to be carried out in any more detail, or using more resources, than is useful for its purpose. Even if sufficient information must be obtained to allow the appropriate assessment to be carried out, it would be inappropriate and impracticable to assess the effects in the degree of detail that would normally be required for the environmental assessment of a project (DCLG 2006). The assessment has, however, to be appropriate to the best level of decision/knowledge induced by the plan. and this may require some additional survey and impact analysis compared to an SEA

Knowing an appropriate assessment of a plan is generally site-focused, the process may include the following tasks[25]:

- Site Analysis
    - Identify all the Natura 2000 site(s) in the area of the plan and those outside the plan that could be affected by the plan
    - Determine the reasons for designation of each site (the habitats and species that are qualifying features) and identify the sites' conservation objectives on the basis of relevant information provided by National and regional authorities or collected by the planning authority (including Natura 2000 sites management plans as well as WFD prescriptions)
    - Identify the key environmental features and the ecological factors that support site integrity (it requires up-to-date knowledge of the status and condition of Natura 2000 sites and their interest features)
    - Analyse sites' vulnerability to all potential impacts of the plan

- Analysis of other Plans and Projects
    - Identify all National/Regional/local Strategies and Plans which may impact on some or all Natura 2000 sites which may be affected by the plan
    - Identify possible additional in-combination impacts through interaction with other plans and projects

- Plan Analysis

  Determine whether the plan is likely to have an adverse effect (with cumulative effects of other plans or projects) on the integrity and conservation objectives of Natura 2000 sites, taking into account the following issues:

  a. The status and condition of the sites;

  b. Factors affecting the integrity of the sites' qualifying features in the light of the conservation objectives of the site(s) and the management strategies chosen to meet these objectives (including precise figures and location within the SPA/SAC);

  c. Influence of the Plan on these factors;

  d. Determine likely effect on site integrity and its conservation objectives;

  e. Relationship of other plans/programmes on sites integrity and conservation objectives (including cumulative effects);

  f. Possible mitigation measures to alleviate and, where possible, avoid impact on Natura 2000 sites.

[25] Based on Appropriate Assessment for the King's Lynn & West Norfolk Core Strategy Development Plan Document. 2006.

Potential risks of significant impacts on Natura 2000 sites should be identified using the worst case scenario. This fulfils the need for a precautionary approach. However, this approach can be problematic due to lack of knowledge about potential risk. The appropriate assessment considers the impact of the plan '*in combination with other plans and projects*' on the integrity of the Natura 2000 sites and their conservation objectives.

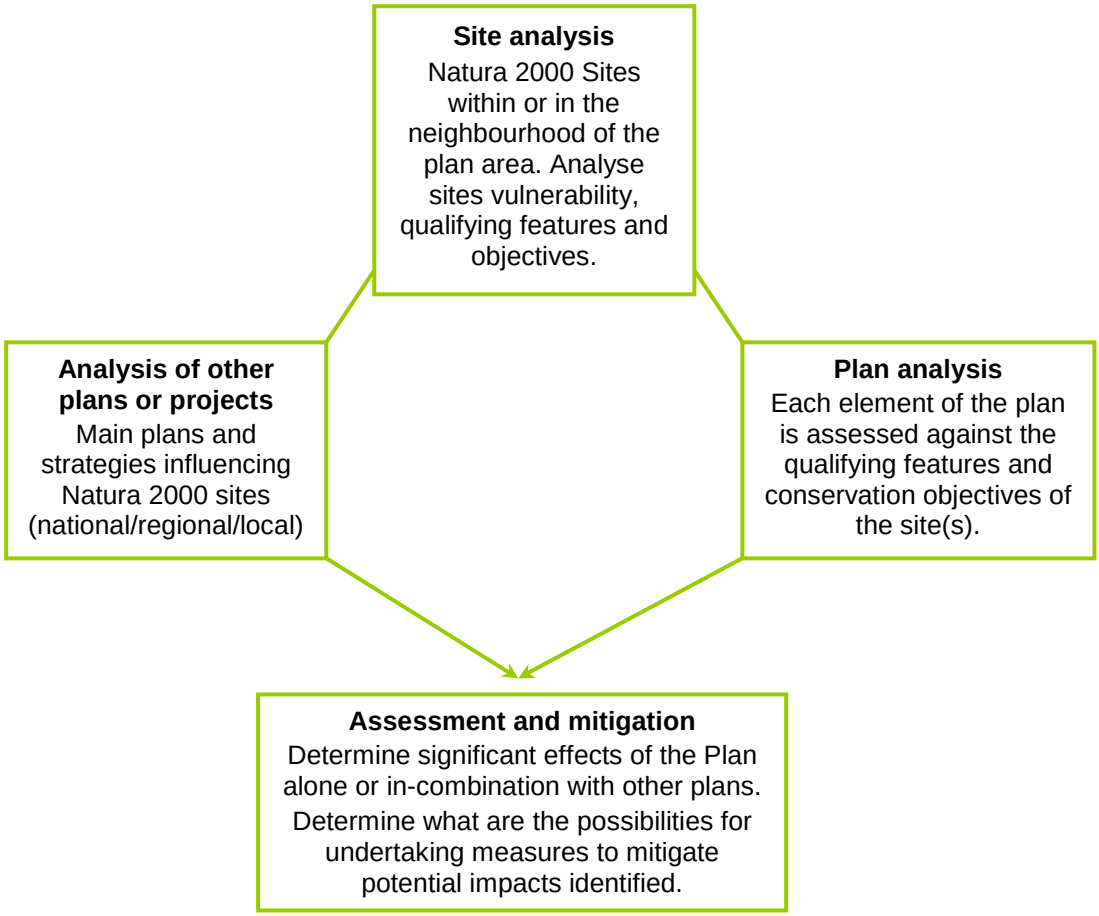
Where adverse impacts are being identified, mitigation for those impacts should be proposed. The proposal of such measures can be included in the assessment. The plan-making authority must be confident that the mitigation will work, and can be secured and enforced, in order to be able to conclude that, when it is taken into account, there will be no adverse effect on the integrity of the site. The main options to avoid adverse effect will be:

- To delete or modify parts of the plan;
- Relocate or re-design the proposal
- Establish a mitigation strategy at plan level.

Where one or more specific projects are covered by a plan in a general way but not in terms of project details, the assessment made at plan level does not exempt the specific projects from the assessment requirements of Article 6(3) in relation to details not covered by the plan assessment. However, appropriate assessment at plan level can help narrow the areas requiring assessment at project level.

Consultation with the appropriate nature conservation authority about whether the plan is likely to have a significant effect is advisable. As a minimum, consultation with the appropriate nature conservation authority about whether the plan is likely to adversely affect the integrity of any Natura 2000 site or its conservation objectives is essential. Planning authorities should start consultation with competent authorities and non-governmental organisations (NGOs) early in the plan-making process.

Figure 7: Article 6(3) assessment of plans



Application of Article 6.4 to plans

Where the conclusions of the appropriate assessment do not allow the competent national authorities to ascertain that the plan will not adversely affect the integrity of a Natura 2000 site, three conclusions arise:

- The plan in its current form may be rejected and a revised plan brought forward that avoids adverse effects on the integrity of a Natura 2000 site
- The plan may only be adopted according to the provisions of Article 6.4 (absence of alternative solutions, imperative reasons of overriding public interest, compensatory measures and, if priority species are affected, delivery of a European Commission opinion);
- The plan may be approved with a reservation. Its final realisation will depend upon the appropriate assessments of the individual projects covered by the plan which may affect the integrity of the site. However, this is likely to create uncertainty as to whether the individual projects will go ahead. Therefore it should be seen as a last resort and full justification given as to why this option has been chosen.

The integrity of the site relates to the site's conservation objectives and the decision as to whether it is adversely affected should focus on and be limited to the site's conservation objectives (EC,2000).

Sometimes the information is insufficient at the level of a plan to fully apply the provisions of article 6.4 of the Habitats Directive because the detailed level of impacts (value) or the possible alternative solutions, or the detailed location of individual projects cannot be determined at the stage of the proposed plan (which are sometimes indeed more related to policies rather than projects). This is the case when the plan only sets the general framework for future project development. However some stakeholders as RSPB considers that the need to take article 6 compliant decisions means plan makers should stop "fudging" decisions and that the plans in question need to be made more spatially specific in order to avoid the adverse effect predicted or set out the no alternatives and overriding public interest case at the strategic level that justifies the predicted adverse effect. In any case, in such a situation, an EIA and an appropriate assessment according to Article 6 will be needed for each project individually. Detailed preliminary studies and detailed information on project design is needed to apply the full Article 6.4 process (including notably the design of appropriate compensatory measures to protect the coherence of the Natura 2000 network).

However, even in these cases, some parts of the conditions foreseen by article 6.4 will be mandatory:

- Explaining which alternative solutions were envisaged, including the zero-option (no plan) and justifying why such solutions are not feasible;
- Explaining the existence of imperative reasons of overriding public interest (IROPI)

It is worth noting that if IROPI can be justified at the level of the plan, it will probably be easier to justify their existence also at the level of the project.

With regard to environmental damage, the Habitats Directive promotes a hierarchy between avoidance, mitigation, and compensation. Compensation is a last resort when all efforts to avoid adverse effects have failed. It can only be used in particular and strict circumstances that are defined in Article 6.4 of the Directive. Compensatory measures must be provided in order to protect the coherence of the Natura 2000 network. They can only be designed correctly if the precise ecological functions of the negatively affected protected features for the coherence of Natura 2000 are known. Compensatory measures should then be

Box O: Key question from Hamburg Port Authority

The issue of compensation scheme/policy could be illustrated with a proposal made by some members of the environmental team of the Hamburg Port Authority. It is considered that since large parts of the estuary are designated it becomes more and more difficult to find adequate areas for compensation measures. So therefore a long-term solution could be to rededicate other protected sites to establish sites, which are more valuable for the estuarine system. In order to create additional areas with tidal influence in front of the dikes, dikes could be realigned to establish typical estuarine areas, which contribute to the whole system. But this often means to give up, or at least alter, other protected areas behind the dikes which may result in a conflict of nature conservation objectives even though. The areas once belonged to the tidal system and could be now reconnected to their initial function. This proposal is a good example of the need of integration between land use plans, protected areas management plans and port development plans.

proposed and secured in order to replace the ecological functions that are being deteriorated so that the coherence of the Natura 2000 network will be maintained. This usually involves habitats restoration or recreation and requires that new habitats be in place in time to fully replace the ecological functions before the predicted damage occurs.

At a high strategic level (e.g. national/regional plans), this may mean that only broad parameters for compensatory measures can be set out. The measures will then need to be worked out in more detail at a more local level, where it should be possible to set out the detailed ecological, spatial, temporal, legal and financial parameters that need to be met by any further planning application implementing the plan at the project level. The proposed compensatory measures should be validated by relevant bodies such as Nature Conservation authorities to make sure that they are both appropriate and capable of being secured and implemented (Dodd et al. 2007).

The key spatial element that plan-making authorities will need to consider is the most suitable location for habitat compensation. This clearly relates to the type of habitat affected and the availability of suitable sites that will enable to reproduce habitats of appropriate quality and functions.

Box P - Key proposal for port-industrial complexes: Natural Asset Creation (from Rotterdam Port Authority

There should be a clear distinction between the approach regarding direct habitat loss as result of a new plan or project and indirect loss of habitat due to the development of existing port-industrial complexes. Direct loss of habitat in terms of hectares can be relatively easy connected to article 6.4 procedures. This is different for the indirect loss of habitat which is more difficult to monitor and to assess. Especially when there is a need to asses the cumulative effects of different plans and projects within an industrial region.
In this case a complicating factor can be that the sum of plans and projects, causing individually a negligible negative effect, can cause altogether a possible significant effect. Examples are the cumulative effects of atmospheric deposition, underwater-noise, vibrations and light emission around ports industrial complexes….
There is a need to find a strategic approach to deal with the uncertainties that comes with the nature protection permitting procedures. The solution could be the concept of “Natural Asset Creation", in relation to a buffer required around port industrial complexes. This solution can be used within a SEA or Natura 2000 management plan

Links between Appropriate Assessment and Strategic Environmental Assessment

The appropriate assessment is required by Article 6.3 of the Habitats Directive in order to study the implications of all plans or projects which may have a likely significant effect on one or more Natura 2000 sites i.e. undermine the site’s conservation objectives. The SEA Directive has introduced several preambles and articles on the links between the appropriate assessment and the Strategic Environmental Assessment:

- Preamble n° 10: …”*all plans and programmes which have been determined to require assessment pursuant to Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild flora and fauna, are likely to have significant effects on the environment, and* ***should as a rule be made subject to systematic environmental assessment***”. However, “*when they determine the use of small areas at local level or are minor modifications to the above plans or programmes, they should be assessed only where Member States determine that they are likely to have significant effects on the environment*”.
- Preamble n°19 and article 11.2: Where the obligat ion to carry out assessments of the effects on the environment arises simultaneously from the SEA Directive and other Community legislation, such as Council Directive 79/409/EEC, Directive 92/43/EEC, or Directive 2000/60/EC (WFD): in order to avoid duplication of the assessment, Member States may provide for coordinated or joint procedures fulfilling the requirements of the relevant Community legislation in order, inter alia, to avoid duplication of assessment.
- Furthermore, Article 3 of the SEA Directive stipulates that the obligations of this directive apply for all plans and programmes:

- Which are prepared for agriculture, forestry, fisheries, energy, industry, transport, waste management, water management, telecommunications, tourism, town and country planning or land use and which set the framework for future development consent of projects listed in Annexes I and II to the EIA Directive (85/337/EEC),
- Which, in view of the likely effect on sites, have been determined to require an assessment pursuant to Article 6 or 7 of Directive 92/43/EEC.

Any plan subject to an appropriate assessment under the Habitat Directive has to be submitted to an SEA with a public consultation (article 6) with the exception of "*small areas at local level or minor modifications to the plan, if not likely to have significant effects on the environment*". This process will reinforce environmental protection of Natura 2000 sites. However both processes can be gathered in one step as long as fulfilments of both directives are respected. This means that:

- Full implementation of article 6.3 has to be assured including if needed an appropriate assessment, ascertaining that there is no significant adverse effect on the integrity of a Natura 2000 site…
- An environmental report has to be produced with all the items included in annex 1 of the SEA Directive including a description of:
  - any existing environmental problems which are relevant to the plan or programme including, in particular, those relating to any areas of a particular environmental importance, such as areas designated pursuant to Directives 79/409/EEC and 92/43/EEC (➔ could be part of HD article 6.3 process);
  - the environmental protection objectives, established at international, Community or Member State level, which are relevant to the plan or programme and the way those objectives and any environmental considerations have been taken into account during its preparation (➔ including conservation objectives related to nature directives and any other environmental objectives as those related to WFD);
  - the likely significant effects (including secondary, cumulative, synergistic, short, medium and long-term permanent and temporary, positive and negative effects) on the environment, including on issues such as biodiversity, population, human health, fauna, flora, soil, water, air, climatic factors, material assets, cultural heritage including architectural and archaeological heritage, landscape and the interrelationship between the above factors (➔ biodiversity, fauna and flora could be part of HD article 6.3 process but other consideration as local conservation issues have to be considered);

When the Plan will have a significant effect on the conservation objectives of a Natura 2000 site the Plan will have to be subject to:

- A process of derogation to the general rule of the article 6.3 HD through the application of Article 6.4 HD (absence of alternative solution, IROPI, compensatory measures…)
- Complementary demands of the SEA Directive as:
  - A description of the measures envisaged to prevent, reduce and as fully as possible offset any significant adverse effects on the environment;
  - An outline of the reasons for selecting the alternatives dealt with, and a description of how the assessment was undertaken including any difficulties (such as technical deficiencies or lack of know-how) encountered in compiling the required information;
  - A monitoring scheme for the significant environmental effects (article 10)

When, the information is insufficient at the level of a Plan to ascertain the absence of adverse effects, the SEA Directive stipulates (article 5.2) that the environmental report shall include the "*information that may reasonably be required taking into account current knowledge and methods of assessment, the contents and level of detail in the plan or programme, its stage in the decision-making process and the extent to which certain matters are more appropriately assessed at different levels in that process in order to avoid duplication of the assessmen*t". There is not such an article in the Habitats Directive.

Conclusion

- A common process for the appropriate assessment (article 6.3 HD) and the SEA is possible for plans and programmes. It always includes a public consultation. However, contrary to SEA scheme, the appropriate assessment required by article 6.3 should permit a decision on the content of the plan to be based on its findings.
- The result of this process can lead to three different cases:
    - The plan or programme is detailed enough to trigger the need for an appropriate assessment and, if needed (exception), a derogation related to the article 6.4 of the Habitats Directive. Where a plan or programme requires an appropriate assessment it will trigger the need for an SEA
    - The plan or programme falls within the scope of both the SEA and the EIA[26] (possible parallel procedures as proposed by Sheate et al. 2005) and in this case it is mandatory to apply the appropriate assessment and, if needed, the derogation regime under Article 6.4 of the Habitats Directive.
    - The plan or programme does not contain enough details to undertake a full appropriate assessment but the environmental report prepared for the SEA will pave the way or even set conditions to make, at project level, a correct appropriate assessment and, if needed, a derogation procedure following Article 6.4 of the Habitats Directive. In this case the SEA will identify projects that could have a significant effect to study during the project authorisation process. It means that the risk to see a project refused is already anticipated.

As stipulated in the guidance document (EC, 2000), the zero-option will always have to be considered in examining alternative solutions (article 6.4). This option has also to be considered in the SEA.

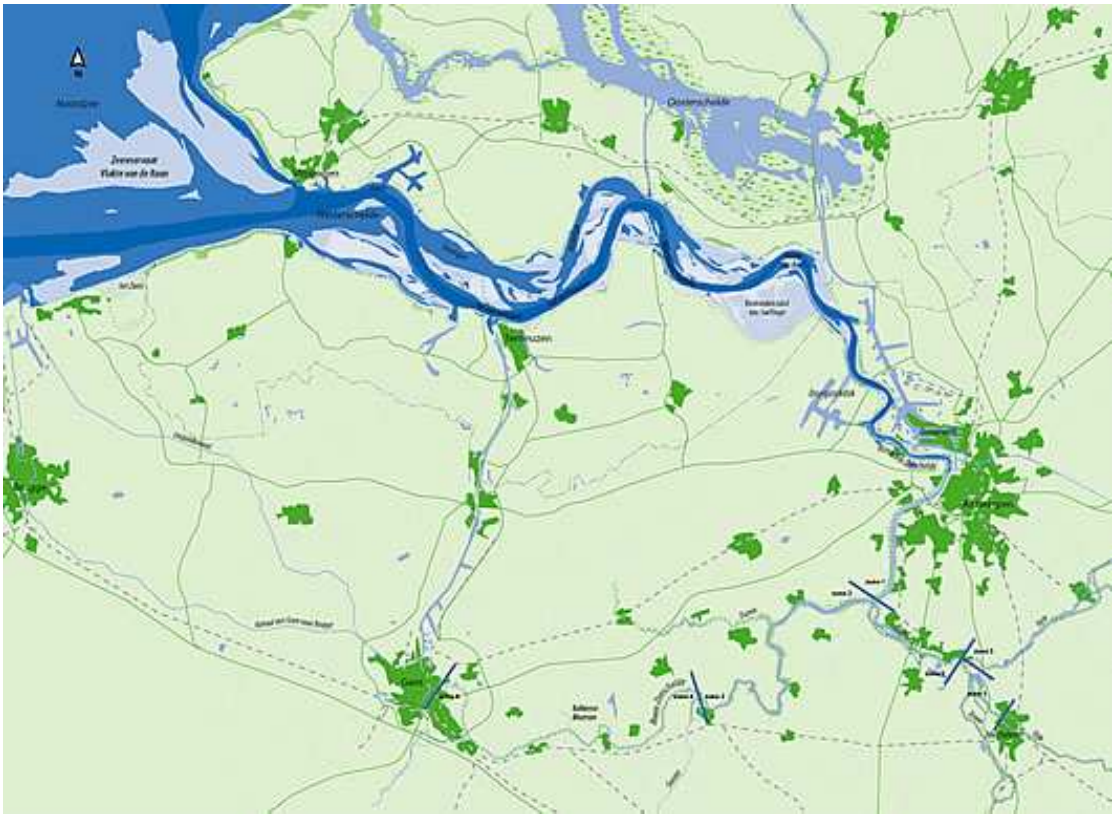
Cases studies:

1. The Schelde Estuary
2. The Seine Estuary
3. Estuaries Initiative in UK
4. Rotterdam: from plan to project

1. The Schelde Estuary

The estuary of the Schelde River (see map 1) is located partly in the Flanders region of Belgium and partly in the Netherlands. It is the navigation route to the harbour of Antwerp, situated 80 km upstream, especially important for container traffic and vital for Flander's economic welfare. With its very densely populated catchment basin, the estuary faces problems such as decreased retention capacity, a fragmented ecological infrastructure, peak discharges and increased sedimentation rates, turbidity, current velocities and tidal amplitude (Van de Bergh et al., 2005). These issues result from the combined effects of land reclamation, land use and water management in the catchment, discharge manipulations, canalisation, channel deepening and the general rise in sea level. Additionally, significant dredging has taken place in the estuary, since 1970, to enlarge the navigation channel (De Groote, undated). The morphological system has become less and less diverse and the channelled areas have expanded at the expense of shallow water and intertidal flat areas. This also affected safety against flooding as the enlargement of the channel has led to quicker and greater tide penetration inland, increasing the risk of floods mainly upstream the Belgium-Dutch border (De Groote, undated). Sectoral management of these aspects threatened the sustainable use of the estuary and an integrated approach was considered more effective.

[26] This means that the plan can be considered as a project



Map 1: Schelde Estuary

The Long-Term Vision, a Dutch-Flemish managerial plan for the Scheldt estuary (LTVS) was determined as "*the development of a healthy and multifunctional estuarine water system that can be utilised sustainably for human needs*". The LTVS sets quality targets for the estuary in the year 2030 and the management measures to achieve them. Goals and management measures were integrated from three central perspectives: accessibility, flood management and ecology. Both governments in 2001 adopted the LTVS quality targets. It focuses on five objectives: preservation of the geomorphology, safety against floods, optimal accessibility of the ports, a healthy dynamic ecosystem and transboundary cooperation. However, the target of 2001 does not set out specific projects to meet the five objectives. To define more specific objectives, the ProSes Plan (Schelde Estuary Project Management Development Plan) was established in March 2005, which contains dozens of resolutions regarding how the two governments intend to improve the safety, accessibility and natural environment of the estuary. A brief summary of those resolutions for all three pillars are presented below:

<u>Flood management (abstract from ProSes leaflet)</u>

- Increasing dyke heights and establishing flooding areas along the Zeeschelde

The regional and national authorities have decided to increase safety along the Zeeschelde by establishing controlled flooding areas no later than 2030. Where space for flooding areas is lacking, such as in urban areas and industrial areas, the heights of the dykes will be increased. Flanders aims to establish 280 hectares of controlled flooding areas by 2010. Of this, more than 200 hectares will be configured as estuarine environment areas.

- Common approach to safety

Flanders and the Netherlands calculate the required level of safety in different manners. In the process of selecting the safety level, Flanders considers the amount of damage that could be caused by a flood. Locations where a large amount of damage could occur are given increased protection. The approach taken by the Netherlands is based on an equal chance of flooding along the entire Westerschelde. Both governments wish now to better align the safety approaches used on both sides of the border.

Studies have shown that a flood barrier would be much more expensive than a combination of raising dyke levels and establishing controlled flooding areas, which is the option that has been selected. In addition, a flood barrier would not provide any new environmental values and would require dykes in Flanders and the Netherlands to be raised even further.

Accessibility (abstract from ProSes leaflet)

- Deepening and widening the shipping channel

Flanders and the Netherlands have decided that ships with a draught of 13.1 metres must be able to sail as far as the harbour of Antwerp regardless of the tide. For this purpose, the authorities will lower the level of the sills in the channel by 1.4 metres. In the vicinity of the Deurganck Dock, the Zeeschelde will be widened from 250 metres to 370 metres over a length of 5 kilometres.

- Flexible dredge material relocation sites

To achieve optimum conditions in the Scheldt estuary, it is important to maintain the vitality of the estuary and its network of multiple channels. Changing the way the shipping channel is maintained can help achieve this objective. Regular dredging is constantly necessary to maintain the sills at the desired depth.

Ecology (Coosen & Verheyen, 2006)

- More room for estuarine environments

Flanders and the Netherlands will create more space for estuarine environments. In total, at least 1000 hectares of new estuarine environment will be added to the Schelde. At minimum, they will execute the following projects in the period up to 2010:

- Cross-border:
    - Designation of the Vlakte van de Raan as a 'marine reserve'
    - Enlarging the Zwin by at least 120 hectares, and possibly 240 hectares
    - Developing a 440-hectare intertidal area in the Hertogin Hedwigepolder and the northern part of the Prosperpolder
- In Flanders:
    - Restoring the conditions necessary to allow fish migration in the Zeeschelde
    - Reconfiguring the Durme and its valley
    - Developing 125 hectares of estuarine environment in existing controlled flooding areas
    - Establishing 600 hectares of wetland in the Kalkense Meersen
    - Developing 210 hectares of estuarine environment in locations still to be chosen, in combination with establishing flooding areas
- In the Netherlands:
    - Developing approximately another 300 hectares of estuarine environment in locations still to be chosen

In combination with activities for improved safety, accessibility and the natural environment, the governments will also take measures to restore natural vitality where possible. Some examples of such measures are using alternative dredging and relocation strategies, constructing or removing breakwaters, excavating old salt marshes, and increasing or decreasing the depths of channels. Specific plans for such activities will be made during the implementation phase.

Silting-up of side channels and erosion of salt marshes and mud flats can be avoided by a careful selection of relocation sites. The authorities will make the selection of relocation sites more flexible in order to allow relocation of dredge material to take place where it is most favourable for the vitality of the estuary. All maintenance dredging will be dumped back into the estuary. To protect the side channels, a larger proportion of the dredging will be dumped in the main channel in the future. In addition, more dredging will be dumped in the eastern part of the Westerschelde and fewer in the mouth region.

Flanders and the Netherlands wish to make the new natural environment areas usable for other purposes where possible. They foresee possibilities for combining natural environments with other objectives such as safety, agriculture, marine aquaculture, recreation, and residential/employment initiatives.

SEA in transboundary context and appropriate assessment (abstract from De Groote, undated)

The approach to drawing up the Development Plan 2010 (ProSes 2010) comprises both research and advisory consultation in order to:

- Compare the desired situation with the situation without extra measures;
- Propose projects and measures to solve the bottlenecks emerging from that comparison;
- Describe the effects of these projects and measures in a strategic environmental assessment (SEA) and a social cost-benefit analysis;
- Prepare a nature development plan
- Evaluate the projects and measures against the European Bird and Habitat directive to protect valuable natural life.

When ProSes was getting started, the authorities had no experience on SEA and there were no procedures for public participations. Furthermore, the difference on legislation between the countries when working in transboundary context made it is difficult to find an acceptable procedure for both countries. However good communication to the inhabitants of the Schelde estuary and the interested parties was necessary during the project. Consultation means involving interest groups in the area of the SEA, the social cost-benefit analysis (SCBA) and the nature development plan. ProSes organises hearings to inform the public about the evolution and the results of the studies. An Internet newsletter (www.proses.nl and www.proses.be) is published every two weeks.

The SEA was undertaken for the approval of the development plan (including the appropriate assessment required under art. 6.3) and many EIA are already being set.

When working in transboundary context, new legislation has to be made, which is a mix of the requirements of both countries. You have to make a risk-analysis of both legislations. One can conclude that you are in fact not following any of the procedures of the countries and that carries a risk with it. Ideally there is a need for a uniform legislation for all the countries, but on the policy level that is not yet possible because each country has the freedom to implement a directive from the EU in its own way.

2. The Seine Estuary

The Seine estuary is about 160 km long and includes two major ports (Le Havre and Rouen). The elements shaping the Seine valley, estuary, the associated maritime area, as well as the tributary river (Risle) and adjacent (Touques) play an important role at international level. It is an important migratory route for avifauna: 272 species of birds visit the lower parts of the Seine. Additionally, the Seine estuary and broader coastal areas are of high ecological importance as they are appropriate for the reproduction and population increase of numerous marine species.

However the estuary is heavily degraded e.g. with a strong reduction of intertidal areas (from 150 km² in 1850 to 30 km² today – Hocte 2005) Biological diversity has decreased during the last decades not only through urbanisation and intense industrialisation of the valleys but also from agricultural intensification that led to the drainage of a great number of wetlands and the regression of salt marshes. Canalisation has also been an important factor for this regression and other activities related to ports development have degraded an important part of the estuarine environment. The natural phenomenon of infilling of the estuary from sediment has been altered from port-related activities.

The ports located in the Seine estuary are of strategic importance for the national economy. Another important economic activity in the port besides agriculture and fishing, is the petrochemical industry which is responsible for one third of the national production.

During the last 150 years the two ports have not given much thought to nature issues. But this attitude is changing gradually, Natura 2000 being one the forces for this change. During the 1990s,

the development of a new maritime port in Le Havre (Port 2000) was the catalyst to develop integrated management and to take care of environmental matters.

In 1995 an interdisciplinary scientific programme was established with the involvement of a group of 160 scientists. Its task was to reach a better understanding of the estuary ecosystem and to facilitate the work of the decision-makers and developers in the estuary (Hocte 2005). In 2003, a new body (GIP Seine-Aval) was set up to intermediate between scientist and other local stakeholders (local and national authorities and port related activities stakeholders). A partnership was built to participate in the cooperation and decision-making of the global management plan with an Estuary Monitoring Committee (120 representatives of all stakeholders), a Scientific Committee and an Estuary Council with decision makers and economical stakeholders. Their first task was to undertake a prospective study to formulate a common long-term vision for the estuary (AESN-DIREN 2004). Four different scenarios were formulated (Hocte 2005):

- *We continue…:* a scenario based on the risks of the « laisser-faire » that results clearly in an unfavourable situation for everybody – a so called lose-lose situation. This was particularly surprising for the ports and made them realise the need for action.
- *Strong obligation due to consequences:* a scenario based on the voluntary restoration, with a results obligation. The conclusion was that an ambitious action programme for rehabilitation of the environmental functions of the estuary is possible only in a favourable economic context.
- *Catastrophe:* a scenario of a major economic crisis
- *We try locally to do the best…:* a scenario based on local initiatives and the fact that the estuary ecosystem is now hyper-anthropologised and has become completely dependent on human management (e.g. dredging).

However this interesting exercise was not a global management plan even if it leaded to a wish of global management plan with a long term vision of 20 years. Furthermore another land planning exercise occurred at the same period with the elaboration of the DTA: a territorial plan directive[27]. The DTA is a French legal and administrative tool allowing to define obligations for a certain territory within a particular framework as regards the environment or the territorial management. On one hand, a DTA aims at establishing fundamental governmental principles in the field of management and a new balance between the development perspectives, the environmental protection and other territorial values. On the other hand, a DTA proposes national objectives in terms of localisation of big infrastructures and preservation of the natural environment. Up to now less than ten DTAs have been validated in France, including two DTAs for estuaries and port related activities: one for the Seine estuary published on the 10/07/2006 and one for the Loire estuary published on 19/09/2006.

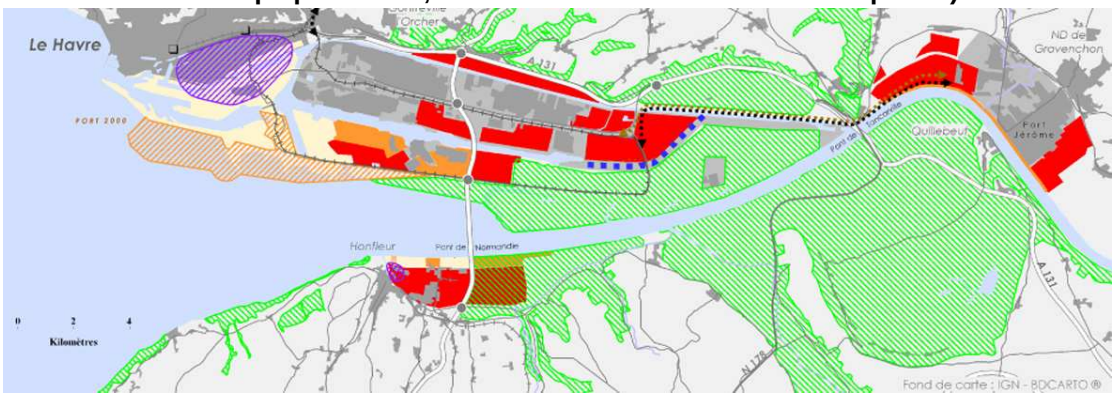
The territory of the Seine estuary DTA comprises 942 communes of three departments (Calvados, Eure and Seine-Maritime). The Seine estuary territory was under the pressure of several risks : industrial and transportation projects, maritime traffic, port operations, natural and health risks…. In order to integrate all these activities, the DTA has proposed the following objectives:

- **Objective 1:** Integrate all port related areas of Normandy within a common framework based on the respect and the protection of the Seine estuary ecological inheritance (by monitoring the development policy of the ports, promoting synergies between ports, improvement of port services by increasing logistics and related activities in the floodplain of the Seine).
- **Objective 2**: Preserve and highlight the values of the natural environment and the whole landscape and take into consideration the risks (by preserving the natural processes and fisheries of the Seine Estuary, by promoting the ecological values of the natural and landscape features of Normandy, by preventing natural and technological risks and by development of wind energy).
- **Objective 3** : Reinforce the dynamic development of different parts of the territory (by reinforcing the metropolitan functions of the three big regional departments, by organising development through coastal spatial planning, by promoting urban reconstruction development and by improving the exchange and displacement of people).

Map 2 bellow illustrates the future developments and protections in the Seine Estuary

[27] Directive territoriale d'aménagement

Map 2: the future of Seine Estuary in the DTA (red: future industrial areas, green; nature and landscape protection, dotted lines: infrastructure development)



In the area of the Seine estuary it is proposed around 2000 ha earmarked for industrial activities, a new channel, new train lines and new pipelines. On the other hand some large areas are earmarked as natural areas (including farming areas) and a policy to protect coastal zones was proposed. However this will to balance economical development and nature protection was not based on European tools and policies. SEA was not mandatory at the stage of the publication of the DTA and conservation objectives proposed for the Natura 2000 sites (including one on 10.931 ha called the Seine Estuary) were not published. Natura 2000 is quite not considered in the text of the DTA and this lack of anticipation, may create bottleneck at the end because compatibility between the scheme and the conservation objectives of the Natura 2000 site will have to be debated or studied later on.

3. Estuary Management Plans in the UK

Estuary Management Plans and Estuary partnerships were established at more than 40 English estuaries as a result of English Nature's Initiative, which commenced in 1992. The 8,000 km of English coastline includes more than 80 estuaries rich in wildlife and out of which 56 have been designated partially or wholly for their natural interest (Morris, 2008). Land reclamation, port development and climate change are the three main causes of environmental degradation of estuaries as described below:

- "*Estuarine land had been lost to land-claim at a rate of between 0.2% and 0.7% per year and on just 18 estuaries the cumulative total was 89,000 ha.*
- *In 1989 there were 135 development proposals affecting 55 estuaries, and barrage schemes alone were projected to lead to loss of 8% of remaining inter-tidal resource*
- *Climate change and sea level rise were a growing issue, especially as much of the coastline had been 'fixed' by sea defence structures*."

Thames Estuary Management Guidance (after the Thames Estuary Partnership, 1999)

http://www.thamesweb.com/dev/documents/guidance/strategy.pdf

- Sustainable Agriculture
- Improving Air Quality
- Maintaining and Enhancing Biodiversity
- Sustainable Commercial Use
- Promoting Education and Awareness
- Managing Our Fisheries
- Effective Flood Defence
- Conserving and Promoting
- Historical and Cultural Resources
- Maintaining Landscape Character
- Maintaining and Enhancing Recreation
- Managing Waste
- Effective Water Management

Estuary Management Plans were the first attempt for the integration of all issues facing English estuaries in a single document. Estuary Management Plans, prepared by a partnership of statutory stakeholders and local users were proposed and a five-year funding programme was established to

promote the development of Estuary Partnerships. English Nature's "Estuaries Initiative" set objectives for the delivery of 40 Estuary Management Plans covering 80% of English estuaries by area by the year 2000. It ran for five years and largely met its objectives, although around 50% of the partnerships that developed have since dissolved or fallen into quiescence (partly for financial reasons). Three examples of UK management plans are provided below with a list of the thematic sections included as an indicator or the variety of issues integrated in one document.

The programme for delivery of these Estuary Management Plans was well advanced by the time the Habitats Directive came into force through the introduction of the *1994 Habitats Regulations*. The Regulations transposed the Habitats Directive into UK law and gave the legal framework for management of sites in the marine environment.

The majority of the current European marine sites (Natura 2000 sites) include estuaries, and many therefore benefit from the foundations established by Estuary Management Plans prepared during English Nature's "Estuaries Initiative". Such plans were not strictly nature conservation plans but sought to integrate the broader spectrum of interests (effectively a plan for sustainable development). However , there was a tendency amongst Local Authority to view Estuary Management Plans as nature conservation plans (Morris 2008), and some therefore offered representation by their ecologists rather than planners and economic developers.

Wash Estuary Management Plan (1996)

http://www.washestuary.org.uk/uploaded/files/Wash%2096.pdf

- Flood Defence and Coast Protection
- Planning and Development
- Landscape
- Ports and Navigation
- Marine Conservation and Fisheries
- Water Quality
- Agriculture
- Military Use
- Saltmarsh Conservation
- Waterfowl Conservation
- Recreation
- Implementation
- Monitoring, Survey and Research

The initiative led to the establishment of a series of management groups within partnerships comprising statutory bodies, NGOs and relevant user groups. This meant that in many key sites, there was already a structure in place that allowed the development of a management plan in partnership with local interests, and in many cases there was a project officer available to help manage the process. Experience has shown that where there was an Estuary Partnership, with a project officer, progress with the EMS management scheme has largely progressed more smoothly and more quickly.

River Hamble Estuary Management Plan (2003-2008)

http://www.hants.gov.uk/rh/hamble/hamble-full.pdf

- Harbour Management
- Coastal Defence
- Environmental Quality
- Nature Conservation
- Access to the Countryside and

As concluded by Morris (2008), whilst estuary Partnerships experienced a multitude of problems, they often provided the first forum that allowed adjacent Local Authorities and key stakeholders to talk to one-another, and to this extent they must be regarded as having been successful, especially in cross border areas. However the author considers that experience has shown that there are a variety of activities within estuaries and on the coast that are better resolved through legislative means and the establishment or management of consents processes.

4. Rotterdam: from plan to project

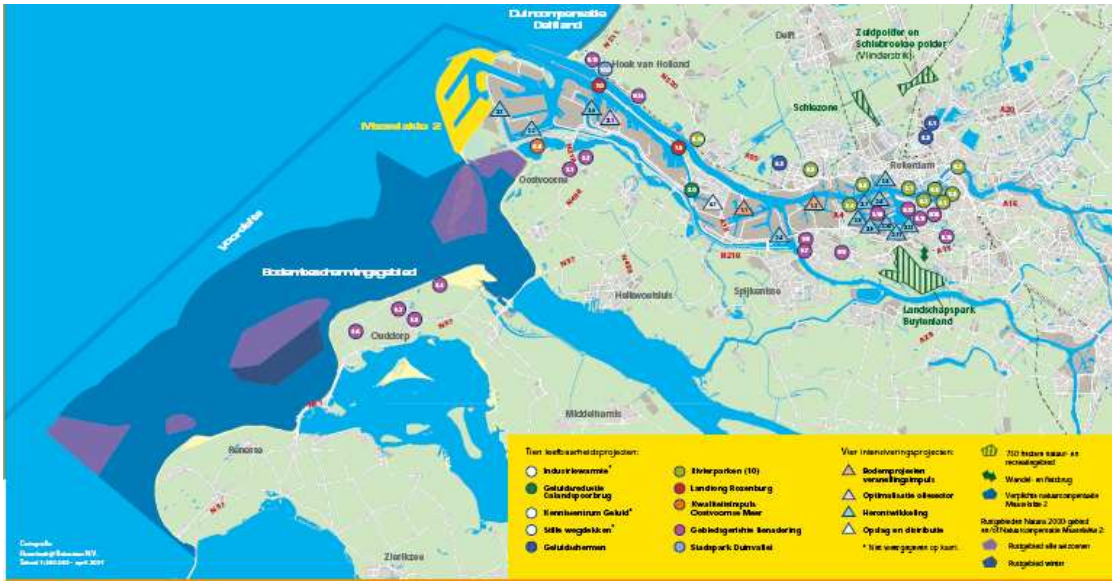
Project Main Port Development Rotterdam is a collaboration of the Ministry of Transport, Public Works and Water Management, the Ministry of Economic Affairs, the Ministry of Finance, the Ministry of Housing, Spatial Planning and the Environment, the Ministry of Agriculture, Nature and Food Quality, the municipality of Rotterdam, the city region of Rotterdam, the Port of Rotterdam, the province of South Holland, and the province of Zeeland.

This project follows the decisions made within a planning procedure called Key Planning Decisions or PKB. On 26 January 2005, the Administrative Jurisdiction Division of the Council of State ruled that a number of objections to the concrete policy decisions in the PKB were well-founded. Due to the interrelationship between these and other decisions, the Council of State declared all the concrete policy decisions of the PKB invalid. The Council of State found the following objections to be well-founded:

- the consequences of the land reclamation for the transport of silt and fish larvae to the Wadden Sea were not assessed according to the European Habitat Guidelines as they should have been;
- the consequences of the establishment of new green areas for companies currently located in the area has been insufficiently investigated;
- the location from which sand will be extracted for the land reclamation is partially located outside of the Netherlands' territorial waters and is therefore not legally founded;
- establishment of a sea reservation in the Voordelta, to compensate the elimination of natural area due to land reclamation, is insufficiently legally safeguarded.

With the exception of the issues listed above, the content of the PKB received no criticism. The Council found, for example, that sufficient investigation was conducted into alternatives to a harbor expansion. The decision also indicated that the legal obligations concerning the avoidance of damage to protected nature and compensation for unavoidable damage were complied with satisfactorily.

Map 3: Project Mainport development Rotterdam



In response to the decision of the Council of State, a rectification procedure for the PKB started. On 2 October and 20 November 2006, the Lower and Upper House definitively ratified the implementation of the Project Main Port Development Rotterdam (PMR) on the basis of the rectified PKB. Upon ratification, the Administrative Agreement and the implementation agreements for the three PMR sub-projects (land reclamation, 750 hectares of nature and recreation area, and the quality of life and intensification project in the existing Rotterdam area) were also immediately confirmed.

The Port of Rotterdam is responsible for the construction of the new harbour area and the national government is responsible for the associated mandatory nature compensation. Construction of Maasvlakte 2 started officially in September 2008 since compensatory measures where incorporated within the Natura 2000 management plan Voordelta. The province of South Holland has responsibility for the 750 hectares of nature and recreation area, and the municipality of Rotterdam is responsible for the sub-project Existing Rotterdam Area (BRG).

More useful summaries on Project Mainport development Rotterdam are available on the following sites:

- http://www.verkeerenwaterstaat.nl/english/topics/freight_transportation/project_main_port_development_rotterdam_%28pmr%29/090_decision-making/
- http://www.maasvlakte2.com/en/Environmental_Impact_Assessment/index.jsp

2.10 TSD n° 10: Estuaries and specific key words of article 6.3 (appropriate assessment, significant impact

Explanation of the question and its pertinence

The EC has published guidance documents in order to assist Member States and operators to understand and apply article 6 of the Habitats Directive. This Technical Supporting Document provides a review of the main points of these guidance documents concerning article 6.3 of the Habitats Directive and more specifically the interpretation of terms not well understood from the stakeholder's i.e. significant effect, in combination effects with other plans or projects, appropriate assessment.

Some recommendations are formulated to summarize key elements of existing texts to make clear some specifications but there are no new concepts conflicting with the existing ones.

EU Guidance already existing

The documents listed below have been developed by the EC. They provide detailed guidance on how to apply the EU nature legislation.

1. European Commission, (2000), *Managing Natura 2000 sites: the provisions of Articles 6 of the habitats directive 92/43/EEC*. Luxembourg: Office for official publications of the European Communities.
   http://ec.europa.eu/environment/nature/natura2000/management/docs/art6/provision_of_art6_en.pdf
2. European Commission, (2002), Assessment of plans and projects significantly affecting Natura 2000 sites. Methodological guidance on the provisions of articles 6(3) and (4) of the Habitats Directive 92/43/EEC. Luxembourg: Office for official publications of the European Communities.
   http://ec.europa.eu/environment/nature/natura2000/management/docs/art6/natura_2000_assess_en.pdf
3. European Commission (2007), Guidance document on article 6(4) of the 'Habitats Directive'92/43/EEC. Clarification of the concepts of: alternative solutions, imperative reasons of overriding public interest, compensatory measures, overall coherence, opinion of the Commission.
   http://ec.europa.eu/environment/nature/natura2000/management/docs/art6/guidance_art6_4_en.pdf

Key concepts of these documents are summarized below.

Significant effect

ESPO has raised several times the question on the meaning of the term significant effect or in combination effect mentioned in article 6.3 of the Habitats Directive. More precisely, it was mentioned in the ESPO code of Practice (2007) that such terms leave the plan or project developer with the very difficult task of gathering information on all possible effects (cause-and-effect relationships). A first attempt of guidance was given from the EC in 2000 (text in purple) and then a more detailed technical analysis was published in 2002 (text in brown). Interpretation of the 2007 guidance just reminded some principles with no new information.

The notion of what is a 'significant' effect cannot be treated in an arbitrary way and the directive uses the term in an objective context, i.e. it does not qualify it with discretionary formulae (EC 2000).

A consistency of approach to what is 'significant' is necessary to ensure that Natura 2000 functions as a coherent network (EC, 2000). To this effect, the Court has already held, in case C-127/02 *Waddenvereniging and Vogelbeschermingsvereniging* and confirmed in C-6/04 *Commission v United Kingdom of Great Britain and Northern Ireland*, that Article 6(3) of the Habitats Directive makes the requirement for an appropriate assessment of the implications of a plan or project conditional upon there being **a probability, or a risk**, that it will have a significant effect on the site concerned. In the light, in particular, of the precautionary principle, such a risk is considered to exist if it cannot be excluded, on the basis of objective information, that the plan or project will have a significant effect on the site concerned (EC, 2007).

The trigger for an assessment under Directive 85/337/EEC is comparable to the trigger for an assessment under Directive 92/43/EEC, being essentially related to the likelihood of significant effects. The European Court of Justice has emphasised that, in relation to the transposition of Directive 85/337/EEC (and by implication its application), it is necessary to take into account sensitivity of location (EC, 2000).

While there is a need for objectivity in interpreting the scope of the term 'significant', clearly such objectivity cannot be divorced from the specific features and environmental conditions of the protected site concerned by the plan or project (EC 2000). It is clear that what may be significant in relation to one site may not be in relation to another (EC, 2007). In this regard, the conservation objectives of a site as well as prior or baseline information about it can be very important in more precisely identifying conservation sensitivities. Some of this information will be present in the data that accompanies the site selection process under Article 4 of Directive 92/43/EEC. Member States may also have available detailed site conservation objectives or management plans which describe variations in sensitivity within a site (EC, 2000).

The significance test may require little more than consultation with the relevant nature conservation agency. In other cases, particularly where there is a difference of opinion between stakeholders, it may be necessary to carry out further investigations to establish whether the effects on a project or plan are likely to be significant. A common means of determining the significance of effects is through the use of key indicators (EC, 2002).

Where it has been decided to carry out further investigation, it will be important to make use of verifiable assessment techniques. In order that the test of significance of effects can be carried out in a systematic and objective manner, further checklists and matrices may be used. Once the screening matrix has been completed, the decision could be in the form of one of two statements (EC, 2002):

1. It can be objectively concluded that there are not likely to be significant effects on the Natura 2000 site; or

2. The information provided either suggests that significant effects are likely or that sufficient uncertainty remains to indicate that an appropriate assessment should be carried out.

Cumulative impact

A series of individually modest impacts may in combination produce a significant impact. Article 6(3) tries to address this by taking into account the combination of effects from other plans or projects: "…either individually or in combination with other plans or projects…"

It remains to be determined what other plans and projects are covered. In this regard, Article 6(3) does not explicitly define which other plans and projects are within the scope of the combination provision. It is important to note that the underlying intention of this combination provision is to take account of cumulative impacts, and these will often only occur over time. In that context, one can consider plans or projects which are **completed, approved but uncompleted**, or **known about but not yet approved** (EC, 2000).

In addition to the effects of those plans or projects which are the main subject of the assessment, it may be appropriate to consider the effects of already completed plans and projects in this 'second level' of assessment. Although already completed plans and projects are excluded from the assessment requirements of Article 6(3), it is important that some account is still taken of such plans and projects in the assessment, if they have continuing effects on the site and point to a pattern of progressive loss of site integrity (EC, 2000).

Such already completed plans and projects may also raise issues under Article 6(1) and (2) of Directive 92/43/EEC if their continued effects give rise to a need for remedial or countervailing conservation measures or measures to avoid habitat deterioration or species disturbance (EC, 2000).

Plans and projects which have been approved in the past and which have not been implemented or completed should be included in the combination provision. On grounds of legal certainty, it would seem appropriate to restrict the combination provision to other plans or projects which have been **actually proposed**. At the same time, it must be evident that, in considering a proposed plan or project, Member States do not create a presumption in favour of other as yet unproposed plans or projects in the future (EC, 2000).

Appropriate assessment

Additional concerns were frequently expressed from port-related stakeholders and ESPO on the meaning of the term "appropriate assessment". ESPO published in 2007 that *"in the experience of port authorities, the term "appropriate assessment" itself can lead to various problems and interpretations. The allegation (for example by an interested party) that an assessment is not "appropriate" can jeopardise the plan or project as the assessment may then need to be scrutinised by a court with various possible consequences. The uncertainty about the exact meaning of an "appropriate assessment" leading to legal procedures has caused delays and significant extra costs for several plans and projects."* The EC has provided guidance on how to conduct an appropriate assessment in 2000, 2002 and in brief in 2007. This guidance is summarised in the following chapter.

For a project likely to have a significant effect on a site, it will often be appropriate to undertake an assessment that fulfils the requirements of Directive 85/337/EEC. Where an appropriate assessment (art. 6-3) takes the form of an assessment under Directive 85/337/EEC, this will provide obvious assurances in terms of records and transparency (EC, 2000). The ecological impacts of the plan or project may not be properly assessed in many cases without an assessment of the other environmental components (i.e. soil, water, landscape, etc) set out in Article 3 of Directive 85/337/EEC. Furthermore, even allowing for an exclusively conservation focus, the assessment in its methodology can usefully draw on the methodology envisaged by Directive 85/337/EEC. In particular, Directive 85/337/EEC envisages that an assessment may contain information on several points, including a description of the project, a description of the aspects of the environment likely to be affected by the project and a description of the project's likely significant effects (EC, 2000).

Regardless of whether the provisions of Article 6(3) are delivered following existing environmental impact assessment procedures or other specific methods, it must be ensured that (EC, 2007):

- Article 6(3) assessment results allow full traceability of the decisions eventually made, including the selection of alternatives and any imperative reasons of overriding public interest.
- The assessment should include all elements contributing to the site's integrity and to the overall coherence of the network as defined in the site's conservation objectives and Standard Data Form, and be based on best available scientific knowledge in the field.
- The information required should be updated and could include the following issues:
    - Structure and function, and the respective role of the site's ecological assets
    - Area, representativity and conservation status of the priority and non-priority habitats in the site
    - Population size, degree of isolation, ecotype, genetic pool, age class structure, and conservation status of species under Annex II of the Habitats Directive or Annex I of the Birds Directive present in the site
    - Role of the site within the biographical region and in the coherence of the Natura 2000 network
    - Any other ecological assets and functions identified in the site
- The assessment under Article 6(3) applies the best available techniques and methods, to estimate the extent of the effects of the plan or project on the biological integrity of the site(s) likely to be damaged.

- The assessment provides for the incorporation of the most effective mitigation measures into the plan or project concerned, in order to avoid, reduce or even cancel the negative impacts on the site.
- The characterisation of the biological integrity and the impact assessment should be based on the best possible indicators specific to the Natura 2000 assets which must also be useful to monitor the plan or project implementation.

An assessment should be **recorded**. A corollary of the argument that the assessment should be recorded is the argument that it should be **reasoned**. Article 6(3) and (4) requires decision-makers to take decisions in the light of particular information relating to the environment. If the record of the assessment does not disclose the reasoned basis for the subsequent decision (i.e. if the record is a simple unreasoned positive or negative view of a plan or project), the assessment does not fulfil its purpose and cannot be considered 'appropriate' (EC, 2000).

In order to ensure that adequate information is available to complete the appropriate assessment, it is suggested that the checklist in Table 1 be completed (EC, 2002). Where information is not known or not available, further investigations will be necessary. The first step in this assessment is to identify the conservation objectives of the site and to identify those aspects of the project or plan (alone or in combination with other projects or plans) that will affect those objectives. These objectives can normally be obtained from the Natura 2000 standard data forms for the site or, where available, from the site's management plan.

Table 6 : Information checklist on the appropriate assessment (EC, 2002)

Are these known or available?	**Yes/No**
Information about the project or plan	
Full characteristics of the project or plan which may affect the site	
The total range or area the plan will cover	
Size and other specifications of the project	
The characteristics of existing, proposed or other approved projects or plans which may cause interactive or cumulative impacts with the project being assessed and which may affect the site	
Planned or contemplated nature conservation initiatives likely to affect the status of the site in the future	
The relationship (e.g. key distances etc.) between the project or plan and the Natura 2000 site	
The information requirements (e.g. EIA/SEA) of the authorisation body or agency	
Information about the site	
The reasons for the designation of the Natura 2000 site	
The conservation objectives of the site and the factors that contribute to the conservation value of the site	
The conservation status of the site (favourable or otherwise)	
The existing baseline condition of the site	
The key attributes of any Annex I habitats or Annex II species on the site	
The physical and chemical composition of the site	
The dynamics of the habitats, species and their ecology	
Those aspects of the site that are sensitive to change	
The key structural and functional relationships that create and maintain the site's integrity	
The seasonal influences on the key Annex I habitats or Annex II species on the site	
Other conservation issues relevant to the site, including likely future natural changes taking place	

Once the effects of the project or plan have been identified and predicted, it will be necessary to assess whether there will be adverse effects on the integrity of the site as defined by the conservation objectives and status of the site. From the information gathered and the predictions made about the changes that are likely to result from the construction, operation or decommissioning stages of the project or plan, it should now be possible to complete the integrity of site checklist in Table 7. From this checklist , it should be possible to determine whether or not the project or plan, either alone or in combination with other projects or plans, will have an adverse effect on the integrity of the site. If at this stage information or evidence is lacking, then adverse effects should be assumed (EC, 2002).

Table 7: Integrity of site checklist (EC, 2002)

Conservation objectives *Does the project or plan have the potential to:*	**Yes/No**
o cause delays in progress towards achieving the conservation objectives of the site? o interrupt progress towards achieving the conservation objectives of the site? o disrupt those factors that help to maintain the favourable conditions of the site? o interfere with the balance, distribution and density of key species that are the indicators of the favourable condition of the site?	
Other indicators *Does the project or plan have the potential to:*	**Yes/No**
o cause changes to the vital defining aspects (e.g. nutrient balance) that determine how the site functions as a habitat or ecosystem? o change the dynamics of the relationships (between, for example, soil and water or plants and animals) that define the structure and/or function of the site? o interfere with predicted or expected natural changes to the site (such as water dynamics or chemical composition)? o reduce the area of key habitats? o reduce the population of key species? o change the balance between key species? o reduce diversity of the site? o result in disturbance that could affect population size or density or the balance between key species? o result in fragmentation? o result in loss or reduction of key features (e.g. tree cover, tidal exposure, annual flooding, etc.)?	

In carrying out the necessary assessments, it is important to apply the precautionary principle and the focus of the assessment should be on objectively demonstrating, with supporting evidence, that there will be no adverse effects on the integrity of the Natura 2000 site. Where this is not the case, adverse effects must be assumed. Where it cannot be demonstrated that there will be no adverse effects on the site, it is necessary to devise mitigation measures to avoid, where possible, any adverse effects (EC, 2002).

Complementary guidance proposed

Ecology and biodiversity are not based on standardized functioning they depend on a multidimensional model based on local conditions (variability and complexity of abiotic and biotic factors), and spatial and time scales. The words “appropriate” or “significant” are not normative concepts and studies have to be adapted to these local conditions (case-by-case basis).

Significant effect

- Significance of the effects of a plan or a project can only be assessed objectively. It is strongly dependant of site’s features and of the conservation objectives of a site when they are known (Standard Data Form, Management plan…). Significance of an effect should be related to the specific features and environmental conditions of the site.
- It should be kept in mind that a consistency of approach to what is “significant” is necessary to ensure that the Natura 2000 functions as a coherent network. In the light, in particular, of the precautionary principle, a probability or a simple risk of significance are enough to trigger for an appropriate assessment
- The absence of adverse effects is sometime related to a significance threshold that has to be justified. In case of mitigation measures, an appropriate assessment will offer the possibility to explain this justification
- Significance should be assessed objectively whilst considering factors as indicated in directive 97/11/EEC with particular attention to the extent of the potential impact, the magnitude and complexity of the impact, the probability, the duration frequency and reversibility of the impact. This exercise has to be done in consultation with the environment agency

Cumulative impact

- Cumulative impacts can be considered from plans or projects which are completed or approved but also uncompleted or not yet proposed.
- Cumulative impacts should also be assessed during the elaboration or land use or sectoral plans since they also require an appropriate assessment. This seems even to be the best time to study possible cumulative impacts.

Appropriate assessment

An appropriate assessment should contain the right information for the plan or project, the protected site and whether the plan or project affects the integrity of the site.

- Information on the plan or project should include: full characteristics of the project or plan which may affect the site, the total range or area the plan will cover, size and other specifications of the project, the characteristics of existing, proposed or other approved projects or plans which may cause interactive or cumulative impacts with the project, planned or contemplated nature conservation initiatives likely to affect the status of the site in the future, the relationship (e.g. key distances etc.) between the project or plan and the Natura 2000 site, the information requirements (e.g. EIA/SEA) of the authorisation body or agency.
- Information on the protected site should include: the reasons for the designation of the Natura 2000 site, the conservation objectives of the site and the factors that contribute to the conservation value of the site, the conservation status of the site, the existing baseline condition of the site, the key attributes of any Annex I habitats or Annex II species on the site, the physical and chemical composition of the site, the dynamics of the habitats, species and their ecology, those aspects of the site that are sensitive to change, the key structural and functional relationships that create and maintain the site’s integrity, the seasonal influences on the key Annex I habitats or Annex II species on the site, other conservation issues relevant to the site, including likely future natural changes taking place.
- In carrying out the necessary assessments, it is important to apply the precautionary principle and the focus of the assessment should be on objectively demonstrating, with supporting evidence, that there will be no adverse effects on the integrity of the Natura 2000 site. In other words, the plan or project should not cause delays in progress towards

achieving the conservation objectives of the site, should not interrupt progress towards achieving the conservation objectives of the site, should not disrupt those factors that help to maintain the favourable conditions of the site, should not interfere with the balance, distribution and density of key species that are the indicators of the favourable condition of the site in order.

2.11 TSD n°11: How to handle alternatives (article 6.4)?

Explanation of the question and its pertinence

The question of alternatives is related to the exception rules foreseen by the article 6.4. It means that article 6.3 scheme has been correctly applied and that, in spite of the negative effects, there is a will to seek after the project.

According to article 6.4 of the Habitats Directive "if, in spite of a negative assessment of the implications for the site and in the absence of alternative solutions, a plan or project must nevertheless be carried out ….". Further guidance on how to examine alternative solutions was requested from the EC. The current Technical supporting document intends to present the guidance provided from the EC on how to "objectively" examine all potential alternative solutions for a project.

The EC has published guidance documents in order to assist Member States and operators to understand and apply article 6 of the Habitats Directive. This Technical Supporting Document provides a review of the main points of these guidance documents concerning "alternatives". Some recommendations are formulated to summarize key elements of existing texts but there are no new concepts conflicting with the existing ones.

EU Guidance already existing

The documents listed below have been developed by the EC. They provide detailed guidance on how to apply the EU nature legislation.

1. European Commission, (2000), *Managing Natura 2000 sites: the provisions of Articles 6 of the habitats directive 92/43/EEC*. Luxembourg: Office for official publications of the European Communities.
   http://ec.europa.eu/environment/nature/natura2000/management/docs/art6/provision_of_art6_en.pdf
2. European Commission, (2002), Assessment of plans and projects significantly affecting Natura 2000 sites. Methodological guidance on the provisions of articles 6(3) and (4) of the Habitats Directive 92/43/EEC. Luxembourg: Office for official publications of the European Communities.
   http://ec.europa.eu/environment/nature/natura2000/management/docs/art6/natura_2000_assess_en.pdf
3. European Commission (2007), Guidance document on article 6(4) of the 'Habitats Directive'92/43/EEC. Clarification of the concepts of: alternative solutions, imperative reasons of overriding public interest, compensatory measures, overall coherence, opinion of the Commission.
   http://ec.europa.eu/environment/nature/natura2000/management/docs/art6/guidance_art6_4_en.pdf

Key concepts of these documents are summarized above.

The first step of the competent authorities is to examine the possibility of resorting to alternative solutions which better respect the integrity of the site in question. Such solutions should normally already have been identified within the framework of the initial assessment carried out under Article 6(3). They could involve alternative locations, different scales or designs of development, or alternative processes (EC, 2000). Possible alternative solutions may include variants of (EC, 2002):

1. locations or routes;
2. scale or size;
3. means of meeting objectives (e.g. demand management);
4. methods of construction (e.g. 'silent piling');
5. operational methods;

6. decommissioning methods at the end of a project's life;
7. scheduling and timescale proposals (e.g. seasonal working)

In line with the need to prevent undesired impairment to the Natura 2000 network, the thorough revision and/or withdrawal of a proposed plan or project should be considered when significant negative effects on the integrity of a site have been identified. This should be observed especially in the case of effects on priority habitats and/or species protected under the Habitats Directive or globally endangered bird species listed in Annex I of the Birds Directive. The competent authorities have to analyse and demonstrate first the need of the plan or project concerned. Thus, the zero option should be considered at this stage (EC, 2007)

According to stakeholders involved with port development it is difficult to prove that no alternative solutions exist for a specific project and to be judged objectively from a competent authority. However, in its Opinion for the case C-239/04, the Advocate General (paragraph 44) considers that "*among the alternatives short-listed the choice does not inevitably have to be determined by which alternative least adversely affects the site concerned. Instead, the choice requires a balance to be struck between the adverse effect on the integrity of the SPA and the relevant reasons of overriding public interest*." (EC, 2007). In conformity with the principle of subsidiarity, it rests with the competent national authorities to make the necessary comparisons between these alternative solutions (EC, 2000).

The examination of alternative solutions requires, therefore, that the conservation objectives and status of the Natura 2000 site will outweigh any consideration of costs, delays or other aspects of an alternative solution. The competent authority should not, therefore, limit its consideration of alternative solutions to those suggested by the project or plan proponents. It is the Member State's responsibility to consider alternative solutions, which could be located even in different regions/countries (EC, 2002). While it is the responsibility of the competent authority to consider whether alternative solutions exist, its determination will inevitably rely, to some extent, on information provided by the project or plan proponent.

Once all potential alternatives have been identified, they need to be assessed against their relative impact upon Natura 2000 sites. For each alternative, there must be a description and an indication of how it was assessed (EC, 2002).

Complementary guidance proposed

The following mains recommendations could be concluded from the existing guidance:

- The competent authority should not limit its consideration of alternative solutions to those suggested by the project or plan proponents. It is the Member State's responsibility to consider alternative solutions, which could be located even in different regions/countries, including the zero option.
- A range of alternative ways of achieving the objectives of the project or plan should be identified and these alternatives can then be assessed against their likely impact upon the conservation objectives of the Natura 2000 site.
- Alternatives should be assessed keeping in mind the following recommendations: consultation with relevant agencies and other bodies on the alternatives, have a clear view on the key objectives of the project or plan, identify alternative means of meeting those objectives, gather as much information as possible and provide sources of this information, assess impact of alternative to the conservation objectives of the protected site, apply the precautionary principle to the assessment of all alternatives.
- Among the short-listed alternatives, the choice does not inevitably have to be determined by which alternative adversely affects the least the site concerned. Instead, the choice requires a balance to be struck between the adverse effect on the integrity of the site and the relevant reasons of overriding public interest.

Alternative solutions: "Project Mainport Rotterdam" (PMR)

The Dutch Government has decided to launch a planning exercise regarding the future of the harbour of Rotterdam. It has justified this measure by reference to predictions that in the case of continuing economic growth trends, a shortage of space for petrochemical industry, container handling and the distribution sector would develop in the Rotterdam harbour and its surrounding industrial areas.

Project Mainport Rotterdam (PMR – further "the plan") is an extension plan for the port of Rotterdam consisting of a combination of better use of space still available in the existing harbour area, the "Maasvlakte 2" land reclamation from the sea covering 2500 ha (further "the land reclamation project") and 750 ha new nature and recreation areas on shore.

The alternative solutions presented were as follows:

8. better use of existing space in the actual Rotterdam port area
9. increased use of existing port sites in the SW Netherlands
10. expansion of the existing Maasvlakte artificial peninsula by the land reclamation project

The SW Netherlands option was abandoned because of large investments in hinterland connections and lack of space for the kind of developments to be expected in Rotterdam, while the landside expansion of the existing Rotterdam port areas was not considered because of a too large potential for conflict with environmental, social and safety requirements.

One reference land reclamation design would make use of the existing harbour entrance, the other proposes a new entry channel farther out to sea. This second option appears to be more suitable to future extension of the land reclamation and is expected to offer better nautical security. But as it makes use of fixed structures that go farther from the coastline, it may have a larger effect on sediment transportation towards the North.

Alternative solutions: New port of Granadilla (Tenerife)

Construction of a new port in Granadilla, Tenerife, Canary Islands. It is argued that the existing port facilities in Santa Cruz are inadequate and that new facilities with increased capacity should be developed to respond to projected increased in maritime traffic.

The definitive Granadilla project foresees the construction of a 650m container terminal covering 26ha, a 200m dock for general goods with an annexed 5,7ha area and a 19,5ha trading harbour area for raw materials traffic. The port works are made up of a main breakwater of 2.557m length going down to -55mts seabed depth and a total land filling of 786.000m2 by using 12mio m3 of quarry material.

The new harbour will dispose of a contiguous terrestrial area with 12,4ha for the development of logistic activities and an area with 15ha for the installation of a natural gas plant.

The alternative solutions presented were as follows:

In order to mitigate the expected impacts of the interruption of sand movements in the coastal waters, the Spanish authorities have proposed a "North South sand bypass in the Granadilla harbour". This proposal provides for pumping machinery and associated pipe work to take all the sand deposited on the north-side of the new port and to pump it to the southern end of the port. Windmills built in the project area would produce the necessary electricity for powering the system. The Commission considers the commitment by the Spanish authorities regarding a properly dimensioned North-South sand by-pass as an essential part of the port project.

In order to respond to important concerns regarding the effects of ships anchors on sensitive habitats, the Spanish authorities' ministerial order 3777/2005, 18 November 20053 prohibits the anchorage of vessels in the Site of Community Importance "Sebadales del sur de Tenerife" (SCI ES7020116).

2.12 TSD n° 12: How to consider integrated project design and accompanying measures?

Explanation of the question and its pertinence

This TSD would like to introduce and to promote projects that integrate mitigation, compensation and proactive conservation management as a full part of the project since the beginning.

EU Guidance already existing

The documents listed below have been developed by the EC. They provide detailed guidance on how to apply the EU nature legislation.

1. European Commission, (2003), Implementation of Directive 2001/42 on the assessment of the effects of certain plans and programmes on the environment
   http://ec.europa.eu/environment/archives/eia/pdf/030923_sea_guidance.pdf
2. European Commission, (2000), *Managing Natura 2000 sites: the provisions of Articles 6 of the habitats directive 92/43/EEC*. Luxembourg: Office for official publications of the European Communities.
   http://ec.europa.eu/environment/nature/natura2000/management/docs/art6/provision_of_art6_en.pdf
3. European Commission, (2002), Assessment of plans and projects significantly affecting Natura 2000 sites. Methodological guidance on the provisions of articles 6(3) and (4) of the Habitats Directive 92/43/EEC. Luxembourg: Office for official publications of the European Communities.
   http://ec.europa.eu/environment/nature/natura2000/management/docs/art6/natura_2000_assess_en.pdf
4. European Commission (2007), Guidance document on article 6(4) of the 'Habitats Directive'92/43/EEC. Clarification of the concepts of: alternative solutions, imperative reasons of overriding public interest, compensatory measures, overall coherence, opinion of the Commission.
   http://ec.europa.eu/environment/nature/natura2000/management/docs/art6/guidance_art6_4_en.pdf

New guidance proposed

Working with nature : a reconciliation initiative launched by PIANC

PIANC, the world association for waterborne transport infrastructure[28], launched at the end of 2008 a position paper entitled "*Working with Nature*". It calls for an important shift in thinking in our approach to navigation development projects to help deliver mutually beneficial, 'win-win' solutions. It promotes a proactive, integrated approach which:

- focuses on achieving the project objectives in an ecosystem context rather than assessing the consequences of a predefined project design;
- focuses on identifying win-win solutions rather than simply minimising ecological harm.

"*Working with Nature*" thus considers the project objectives firstly from the perspective of the natural system rather than from the perspective of technical design. However, Working with Nature does not mean that we no longer achieve our development objectives: rather it ensures that these objectives are satisfied in a way which maximises opportunities and - importantly - reduces frustrations, delays and associated extra costs.

[28] http://www.pianc.org

It is an approach which needs to be applied early in a project when flexibility is still possible. A proactive approach such as Working with Nature should also be applied to the development of strategic plans and programmes, but this initiative focuses particularly at the project level.

By adopting a determined and proactive approach from conception through to project completion, opportunities can be maximised.

Integral design (from SAND 2008)

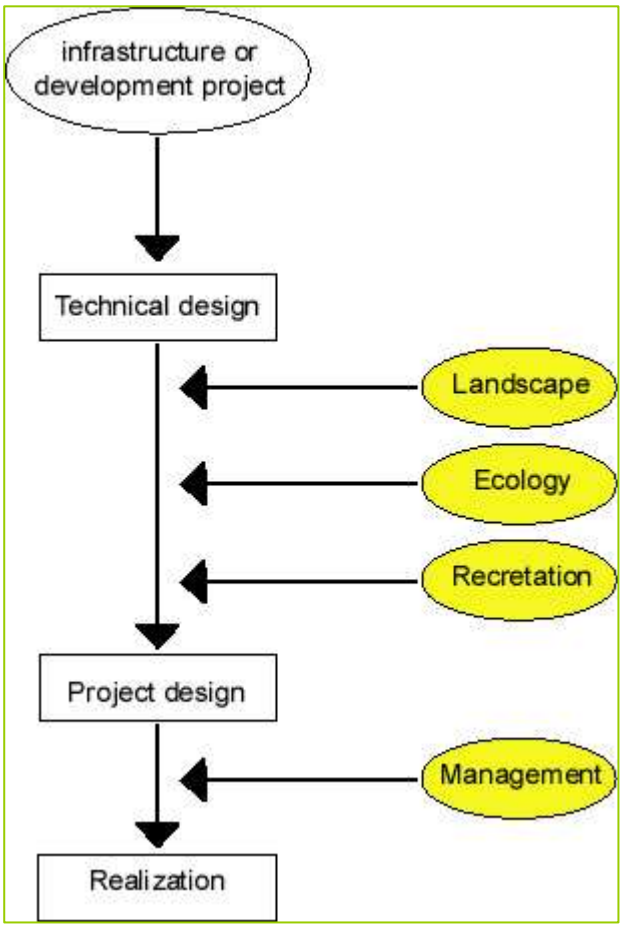
The concept on Integral Design was mainly developed in Netherlands (Van der Molen, 2007) and has been explained and/or improved within the context of the Interreg IIIb SAND project (Cornelissen et al. 23007, SAND, 2008). In it based on the facts that :

- In all projects a form of multifunctional land use is the final result of the project.
- The approach to project design is one of integrating the various aspects from the start in a simultaneous interacting way.
- Project planning is crucial as well as stakeholders involvement

There are two main possibilities of designing a project:

- Without priority and not integral (figure 8);
- With priority and integral (figure 9).

Figure 8: non integral design



It is common to have a design according to the first concept (see figure 8): no priority and not integral. A technical plan is made to answer issues as economical development or hydrological problem and after the technical plan is ready, an ecologist, a landscape architect and a specialist in recreation are asked to do something for nature, landscape or recreation within the blank spots left in the design. In most cases there is no priority given to the sub-goals nature, landscape and recreation. So it is unclear what kind and how much nature, landscape or recreation should be developed.

In some projects and countries (e.g. Netherlands), it is now more common to have a design according to the second concept (see figure 9) : with priority and integral. First of all, all the goals are quantified and given a priority. In this way it is clear to everybody which goals are more important than others. At the same time the goals for management are determined.

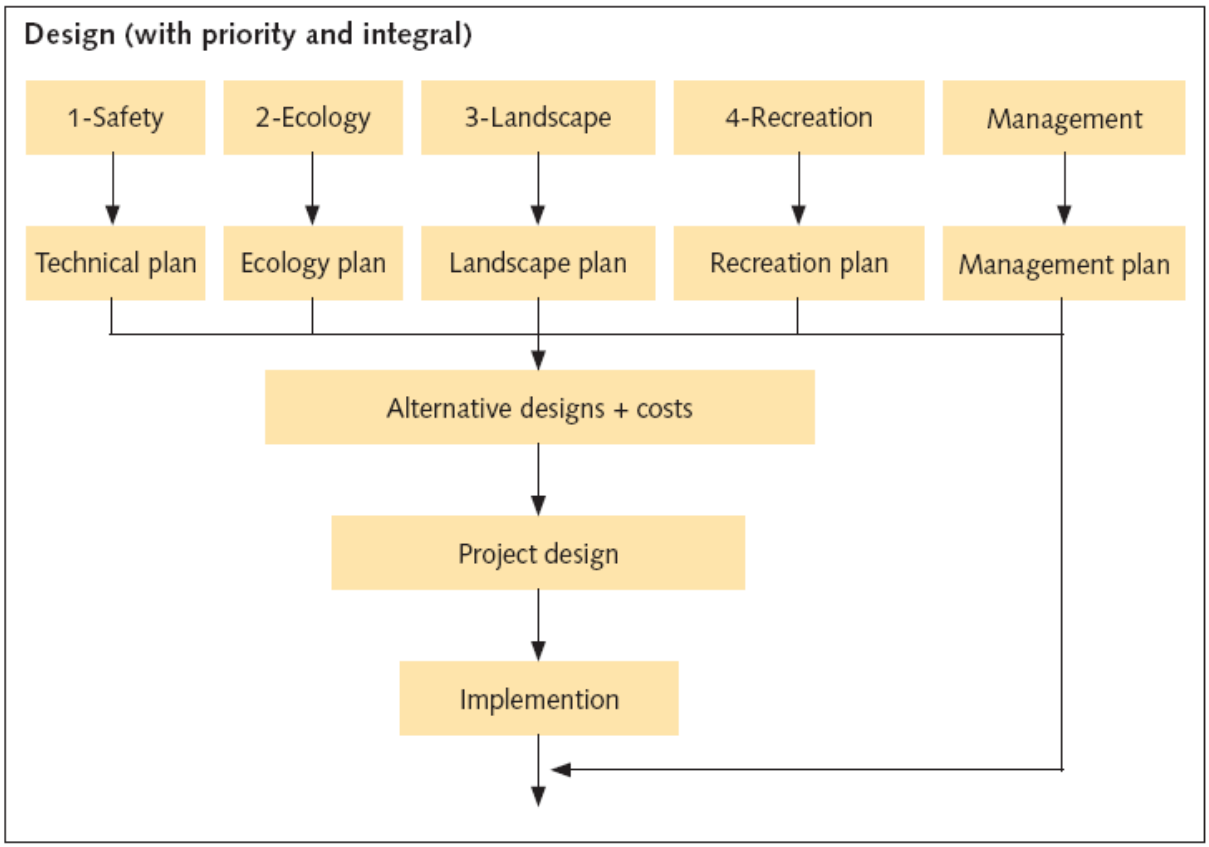


Figure 9: An integrated plan requires a structured and phased approach. The numbers in front of the goals (safety, ecology, etc.) refer to the priority given to them.

Then specialists, e.g. hydrologists, ecologists, landscape architects, etc., make separate plans for each goal. A plan shows the area of interest, requirements and conditions, which are needed to achieve the goal. A plan shows the area of interest and a first draft on a map, and gives a list of requirements, preconditions and wishes needed to achieve the specific goal and first draft. This enables each sector to look at the assignment with the same preconditions and constraints and to explore the best options available for them.

Once this is done the different plans can be integrated in a way that tries to maximize the benefits for all whilst delivering the overall objective in as cost-effective and efficient a way as possible. In practice, this means that the specialists sit down together to draft the final project design on the basis of their original individual plans. The project leader and the specialists, will then try to join all plans and look for the best options. The process needs to be chaired by an independent project manager. Some alternative scenarios in terms of design and costs are made for the authority which has commissioned the project, local inhabitants who use the area and other stakeholders to choose from. After a particular alternative is chosen, a final design is worked out. This final design will be published so all those concerned can give their comments.

The management goals are determined simultaneously. Although management takes place after the design is implemented, determine the goals for management already in this phase so account can be taken of management during design.

Before a design is implemented and spatial quality is considered satisfactory to all who were involved in the process, a few things have to be organized and carried out first. Within the project different phases can be distinguished:

1. Pre-exploration phase: a quick scan of a large area, somewhat bigger than the project area, to allow the planners to get a clearer overview of the wider area, its environment (including legislation and policies, other projects, stakeholder interests), as well as the main opportunities and constraints. Several goals and priorities can be set which take account of and are compatible with the area's overall spatial planning and land use issues.

2. Exploration phase: more detailed and restricted to the project area and its direct surroundings, detailed information (technical, legal…) is gathered and analyzed . At the end it should be clear what the solution to the problems is, how the goals can be met and what the requirements, preconditions and wishes for the different goals are.
3. Design phase: as described above, the best way of making a design is to integrate the various aspects and sectors in a simultaneous interactional way from the start (figure 9), i.e. when prioritize and quantify the goals.
4. Implementation of the design: in order to meet the goals and optimize spatial quality, the best way to implement the design is to use a constructor who has some experience with ecological and landscape construction (by the mean of specific staff dedicated if needed) .
5. Management: The need for involving management in the process right from the beginning is crucial as to maintain spatial quality as foreseen, it is important that the future managers have taken part in the process.
6. Evaluation: A few years after implementation, it is wise to evaluate the project as it is important to know if the project still meets the goals and, if not, what has caused the difference.

It is important to involve the stakeholders people in the process right from the beginning of the project. It is also important to discuss the way they are involved in the project. They are the ones who live or work in the area or are competent employees of national, regional or local authorities who are needed for permits or releases. If they become involved too late, or they are not involved in the way agreed, the whole project can be delayed or, even worse, cancelled.

This approach was applied to a large project called Keent (Van der Molen - 2007), located in the Province of North-Brabant in The Netherlands. The project aims at contributing to lowering the water level of the Meuse and realizing ca. 400 ha of nature development. The result of the integrated approach is a plan that is supported by all specialists and provides the best combination of interests and policies. The project is anchored in national and provincial policies and local development plans. It is part of the “Room for the River” policy and of the Provincial “Nature Target Types”, the building block of the National Ecological Network.

Differences between mitigation, compensation, voluntary measures

In the case of the Dibden bay (port of Southampton), where a 1,850-metres, six berth deep water quay was not accepted by the UK government after analyzing the article 6.3 & 6.4 scheme, the proposed offsetting measures were considered inadequate compensatory measures. It was even found that the applicant’s appropriate assessment was fundamentally flawed in that it confused mitigation and compensation measures (Van Hooydonk, 2006).

The suitability of “voluntary” measures as mitigation is questionable, given the requirement to establish ‘certainty’ that adverse effects will be avoided (ECJ Waddensee ruling) and that by definition voluntary measures cannot be enforced. The idea of voluntary offsets as a part of mitigation measures is generally not in line with the well-established differentiation between mitigation and compensation. It mingles Art. 6 (3) and Art. 6(4) of the Habitats Directive and thus may result in bypassing the provisions of the derogation procedure of Art. 6 (4). “Proposing compensatory measures from the beginning could not exempt from the need to respect beforehand the steps *described in Article 6, in particular the study of alternatives and the comparative assessment of the interest of the project/plan in relation to the natural value of the site.”* (EC 2000b)

2.13 TSD n° 13: How is the value of damage assessed and how is it related to compensation? What about aftercare?

Explanation of the question and its pertinence

Article 6.4 of the Habitats Directive stated that *if, in spite of a negative assessment… a plan or project must nevertheless be carried out … the Member State shall take all compensatory measures necessary to ensure that the overall coherence of Natura 2000 is protected. It shall inform the Commission of the compensatory measures adopted.* Questions arising from stakeholders to this question included:

- How is the damage caused from the project implementation assessed in economic terms?
- How is the equivalent to the damage compensation measured?
- Who is responsible for the continuity of the effectiveness of compensation measures?

The EC has published a specific guidance document providing answers to the stakeholder questions and those are presented below (EU guidance already existing). Further methods developed to assess the value of damage caused from a project are also presented below, as well as compensation examples in one European port (Bremerhaven).

EU Guidance already existing

European Commission already published in 2007 "*Guidance document on article 6(4) of the 'Habitats Directive'92/43/EEC. Clarification of the concepts of: alternative solutions, imperative reasons of overriding public interest, compensatory measures, overall coherence, opinion of the Commission*". http://ec.europa.eu/environment/nature/natura2000/management/docs/art6/guidance_art6_4_en.pdf

The key concepts of this guidance are as follows (see the publication for details):

- Compensatory measures are intended to offset the negative effects of the plan or project so that the overall ecological coherence of the Natura 2000 Network is maintained.
- The compensatory measures constitute measures specific to a project or plan, additional to the normal practices of implementation of the "Nature" Directives. They aim to offset the negative impact of a project and to provide compensation corresponding precisely to the negative effects on the species or habitat concerned. The compensatory measures constitute the "last resort". They are used only when the other safeguards provided for by the directive are ineffectual and the decision has been taken to consider, nevertheless, a project/plan having a negative effect on the Natura 2000 site.
- In order to ensure the overall coherence of Natura 2000, the compensatory measures proposed for a project should therefore: a) address, in comparable proportions, the habitats and species negatively affected; b) provide functions comparable to those which had justified the selection criteria of the original site, particularly regarding the adequate geographical distribution. Thus, it would not be enough that the compensatory measures concern the same biogeographical region in the same Member State.
- The distance between the original site and the place of the compensatory measures is not necessarily an obstacle as long as it does not affect the functionality of the site, its role in the geographical distribution and the reasons for its initial selection.
- The compensatory measures *sensu stricto* have to ensure the maintenance of the contribution of a site to the conservation at a favourable status of natural habitats types and habitats of species "within the biogeographical region concerned" that, as a general principle, a site should not be irreversibly affected by a project before the compensation is indeed in place. However, there may be situations where it will not be possible to fill this condition.
- Best efforts should be made to ensure compensation is in place beforehand and in the case this is not fully achievable, the competent authorities should consider extra compensation for the interim losses that would occur in the meantime.

- Member States should pay particular attention when the negative effects of a plan or project are produced in rare natural habitats types or in natural habitats that need a long period of time to provide the same ecological functionality. Under these circumstances, the zero option should be seriously considered.
- Compensatory measures appropriate or necessary to adverse effects on Natura 2000 site can consist of a) restoration or enhancement in existing sites (restoring the habitat to ensure the maintenance of its conservation value and compliance with the conservation objectives of the site or improving the remaining habitat in proportion to the loss due to the plan or project on a Natura 2000 site); b) habitat recreation (recreating a habitat on a new or enlarged site, to be incorporated into Natura 2000; c) in association with other works, proposing a new site under the Habitats and Birds Directive.
- The Habitats Directive also includes a) species reintroduction, b) species recovery and reinforcement, including reinforcement of prey species, c) land purchase, d) rights acquisition, e) reserve creation (including strong restrictions in land use), f) incentives for certain economic activities that sustain key ecological functions, g) reduction of (other) threats, usually upon species, either through action on a single source or though co-ordinated action on all threat factors (e.g. resulting from space crowded effects).
- Criteria for designing compensation measures include: the compensation has to be targeted and effective, technical feasibility will have to be assessed, the extent and location of the compensation needs to be described, as well as the timing of the compensation and if it will be long-term.
- The Member State is bound to compensatory measures as from the entry into force of Article 6. Their financing can fall within its competence.
- The information about compensatory measures must enable the Commission to appreciate the manner in which the conservation objectives of the site in question are pursued in the particular case. However, it is not the Commission's role to suggest compensatory measures.

Recent research work

Main results of two recent research projects are presented in order to help stakeholders to better plan compensation of their project or plan. A first concept is presented from the Business and Biodiversity Offsets Programme (BBOP) and the second from the REMEDE (Resource Equivalency Methods for Assessing Environmental Damage in the EU) project.

A) Business and Biodiversity Offsets Programme BBOP

http://www.forest-trends.org/biodiversityoffsetprogram/index.php

The BBOP is a partnership of leading conservation groups, governments, companies and financial institutions that is exploring and testing biodiversity offsets. **Biodiversity offsets are measurable conservation outcomes resulting from actions designed to compensate for significant residual adverse biodiversity impacts arising from project development and persisting after appropriate prevention and mitigation measures have been implemented.** Their goal is to achieve no net loss, or preferably a net gain, of biodiversity.

BBOP aims to develop, test and disseminate good practice on biodiversity offsets and to demonstrate, through a portfolio of pilot projects in a range of contexts and industry sectors, that biodiversity offsets can deliver improved and additional conservation and business outcomes than have often resulted in the context of development projects to date.

Biodiversity offsets should comply with all relevant national and international law, and be planned and implemented in accordance with the Convention on Biological Diversity and its ecosystem approach. The draft voluntary principles presented here are offered for use where they will complement existing policy requirements, or where no guidance exists. They offer a robust framework under which the design and implementation of biodiversity offsets will contribute not only to positive conservation outcomes, but also to increased collaboration between key stakeholders to address one of our planet's most pressing concerns: the loss of biodiversity.

- ***No net loss:*** A biodiversity offset should achieve measurable conservation outcomes that can reasonably be expected to result in no net loss of biodiversity.
- ***Adherence to the mitigation hierarchy:*** Biodiversity offsets are a commitment to compensate for significant residual adverse impacts on biodiversity identified after appropriate avoidance, minimization and rehabilitation measures have been taken according to the mitigation hierarchy. Offsets cannot provide a justification for proceeding with projects for which the residual impacts on biodiversity are unacceptable.
- ***Landscape context:*** Biodiversity offsets should be designed and implemented in a landscape context to achieve the best measurable conservation outcomes, taking into account available information on the full range of biological, social and cultural values of biodiversity and supporting an ecosystem approach.
- ***Stakeholder participation:*** In areas affected by the project and by the offset, the full and effective participation of stakeholders should be ensured in all phases of decision-making about biodiversity offsets, including their evaluation, selection, design and implementation. Special consideration should be given to the existing, recognised rights of indigenous and local communities.
- ***Equity***: Biodiversity offsets should be designed and implemented in an equitable manner, which means the sharing of the rights and responsibilities, risks and rewards associated with a project in a fair and balanced way among the stakeholders.
- ***Long-term success***: The design and implementation of biodiversity offsets should have as their objective sustained outcomes in terms of: a) the viability of key biodiversity components, b) the reliability and accountability of governance and financing, and c) social equity.
- ***Transparency***: The design and implementation of biodiversity offsets, and communication of their results to the public, should be undertaken in a transparent manner.

A draft Biodiversity Offset Design Handbook has been developed so far by BBOP offering a step-by-step process for offset planners to adapt and use in designing a biodiversity offset, from conception through to site selection and the definition of the offset activities. The step-by-step procedure is presented below:

Activity 1: Orientation/Getting Started

Step 1: Define the principal elements of the project and delimit preliminary site boundaries
Step 2: Identify relevant stakeholders and develop an initial participation plan
Step 3: Review regulatory or legal requirements for a biodiversity offset

Activity 2: Analyze Biodiversity Components and Project Impacts to Determine the Residual Biodiversity Impacts to be Offset

Step 4: Identify biodiversity components occurring at the impact site
Step 5: Determine the potential significance of the project's impacts on biodiversity and apply the mitigation hierarchy

Activity 3: Quantify the Residual Impacts to Determine the Amount of Offset Required

Step 6: Quantify losses with respect to key habitats and species at the impact site

Step 6.1: Identify a benchmark site
Step 6.2: Select and weight the benchmark attributes and record the reference level of each.
Step 6.3: Quantify the pre-project condition of the attributes at the impact site.
Step 6.4: Predict the post-project condition for each attribute.
Step 6.5: Calculate the biodiversity loss at the impact site.

Activity 4: Offset Site Selection and Evaluation

Step 7: Develop a shortlist of potential offset sites

Step 7.1: Determine whether the offset is a candidate for an out-of-kind offset.
Step 7.2: Identify potential offset sites.

Step 8: Select appropriate offset sites
Step 8.1: Screen sites on the basis of the biodiversity components they support.
Step 8.2: Screen sites on the basis of their potential to demonstrate additionality.
Step 8.3: Screen sites on the basis of their sufficiency to support key biodiversity components in the long term.
Step 8.4: Classify candidate offset sites into levels on the basis of their conservation priority.
Step 8.5: Prioritize candidate offset sites within each level on the basis of additional criteria.
Step 8.6: Assess whether biodiversity multipliers are required and calculate the area needed for the biodiversity offset.

Step 9: Define the activities for the biodiversity offset and their location

B) Resource Equivalency Methods for Assessing Environmental Damage in the EU (REMEDE)
http://www.envliability.eu/

REMEDE is the acronym of Resource Equivalency Methods for Assessing Environmental Damage in the EU (Lipton & al. 2008). It is a project that aims to develop, test and disseminate resource equivalency methods appropriate for determining the scale of complementary and compensatory remedial measures necessary to adequately offset environmental damage. In achieving this objective, the project draws from US experience and that of EU Member States to apply and develop resource equivalency methods in accordance with the requirements of the Environmental Liability Directive, and the Environmental Impact Assessment, Habitats and Wild Birds Directives, in order that a standard Toolkit can be applied to all damage cases in the EU.

In the language of REM (and hence REMEDE Toolkit), the debit refers to an expression of the loss suffered due to environmental damage. The debit is often multi-dimensional, since an environmental damage can have adverse impacts on many species, habitats, ecosystem functions, and human use and non-use values. In addition, the spatial and temporal extent of the damage and degree of the damage can vary depending on how damage is measured.

The credit in an equivalency analysis is the amount of resource or service benefit that will be gained through complementary and compensatory remediation. An off-site project (or suite of projects) is designed and implemented to enhance the resources and services that were damaged. The number, type and size of projects are scaled so that the expected amount of benefit generated approximately equals the debit, quantified in terms of the same metric used to quantify the debit.

Ensuring equivalency between the debit and credit is conceptually quite simple:

- Add up all the losses (debits) caused by the damage;
- Determine the amount of benefit expected per unit of remediation (credits); and
- Divide the debit by the per-unit credit to get the total amount of remediation needed.

However, in practice, ecosystems are complex, and understanding and quantifying the impact of an environmental damage can be difficult. In addition, quantifying the benefit that will be provided over time by a remediation project can be difficult. Therefore, quantifying the debit and credit typically requires expertise and professional judgment on the part of the equivalency analysis team.

There are five basic steps in implementing the REM which apply all approaches:

Step 1: **Initial evaluation** is performed to determine whether an equivalency analysis should be conducted and, if so, the appropriate scale and content of the analysis.

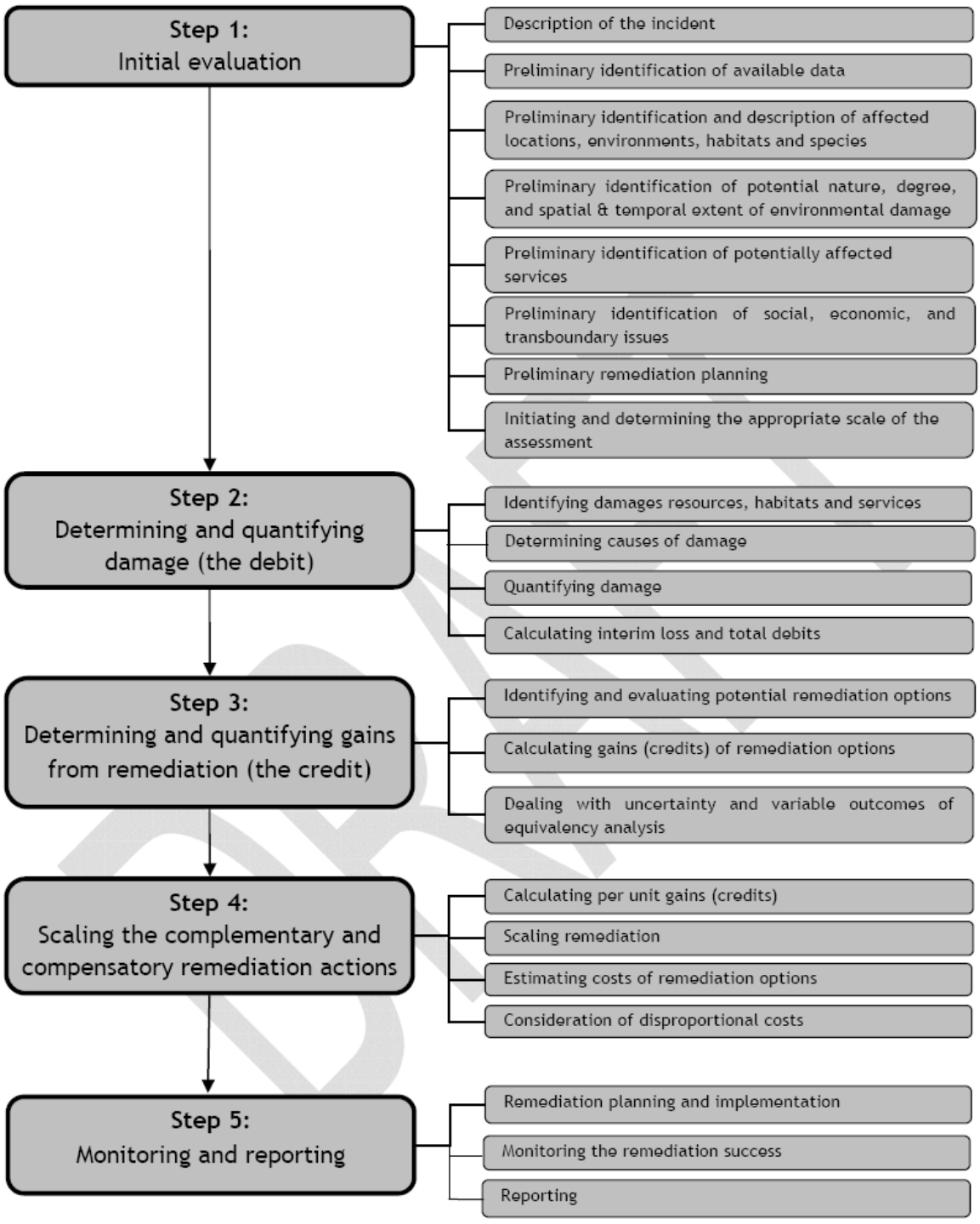
Step 2: **Determine the environmental damage** (debit). In this step, damaged resources, habitats and/or services are identified and quantified relative to baseline conditions. The causes of damage are determined. Finally, the benefits of primary remediation are determined and the total debit (net of primary remediation) is quantified.

Step 3: **Determine the environmental benefit from remediation** (credit). Credits are determined by identifying and evaluating potential remediation alternatives and by calculating the benefits that will be gained by implementing complementary and/or compensatory remediation projects.

Step 4: **Scale remediation**. The final step in the equivalency analysis per se is determining the scale or quantity of the remediation project(s) to implement. Scaling is performed so that, over time, the discounted flow of services from the remediation projects (credits) is equal to the loss (debits).

Step 5: **Monitoring and reporting**. After the equivalency analysis is performed and remediation projects are selected and scaled, a remediation plan is prepared that includes project goals, implementation details, engineering plans and designs, and biological plans and designs. The remediation plan also includes procedures and schedules for monitoring the recovery of resources and services following implementation, and evaluating the project's success.

The figure below shows the break-down of the five basic steps which also correspond to the subsections of the Toolkit.


Step 1:
Initial evaluation
Description of the incident
Preliminary identification of available data
Preliminary identification and description of affected locations, environments, habitats and species
Preliminary identification of potential nature, degree, and spatial & temporal extent of environmental damage
Preliminary identification of potentially affected services
Preliminary identification of social, economic, and transboundary issues
Preliminary remediation planning
Initiating and determining the appropriate scale of the assessment
Step 2:
Determining and quantifying damage (the debit)
Identifying damages resources, habitats and services
Determining causes of damage
Quantifying damage
Calculating interim loss and total debits
Step 3:
Determining and quantifying gains from remediation (the credit)
Identifying and evaluating potential remediation options
Calculating gains (credits) of remediation options
Dealing with uncertainty and variable outcomes of equivalency analysis
Step 4:
Scaling the complementary and compensatory remediation actions
Calculating per unit gains (credits)
Scaling remediation
Estimating costs of remediation options
Consideration of disproportional costs
Step 5:
Monitoring and reporting
Remediation planning and implementation
Monitoring the remediation success
Reporting

Case study: Bremerhaven

Mitigation and compensation for the construction of Container terminal 4 (CT 4) in Bremerhaven (Germany, information provided by the Ministry of economic affairs and ports, Environmental unit Bremen)

Project description: The project involves the extension of the existing containerterminal in Bremerhaven by four additional berths for big container ships comprising one of the currently biggest port extension projects in Europe. The authorization of the project plan took place on 15th of june 2004. The construction was foreseen to finish autumn 2008. The existing quay is extended by 1.7 km to a total length of approximately 5 km. Behind this new quay a storage area for containers is washed up of approx. 90 hectares, this means the Terminal has a width of 570 m. One canal which flowed into the river Weser at the southern border of the construction site is relocated to the northern boundary involving the construction of a new watercourse (Figure 10).

Figure 10: Aerial view on the construction site

Nature protection: The Weser estuary is covered by a variety of protected areas under the EU and national law (Fig. 11). At the northern boundary of the construction site the National Park "Niedersächsisches Wattenmeer" which is part of the Federal State of Lower Saxony begins. According to the European Nature Directives this area was designated as a SPA and SAC. At the western boundary meanwhile a SAC is situated which belongs to Bremen. The conservation goal of this area is the protection and development of the habitat type 1130 "estuary" and its function as migrating corridor for the fish species twaite shad, river lamprey and sea lamprey.

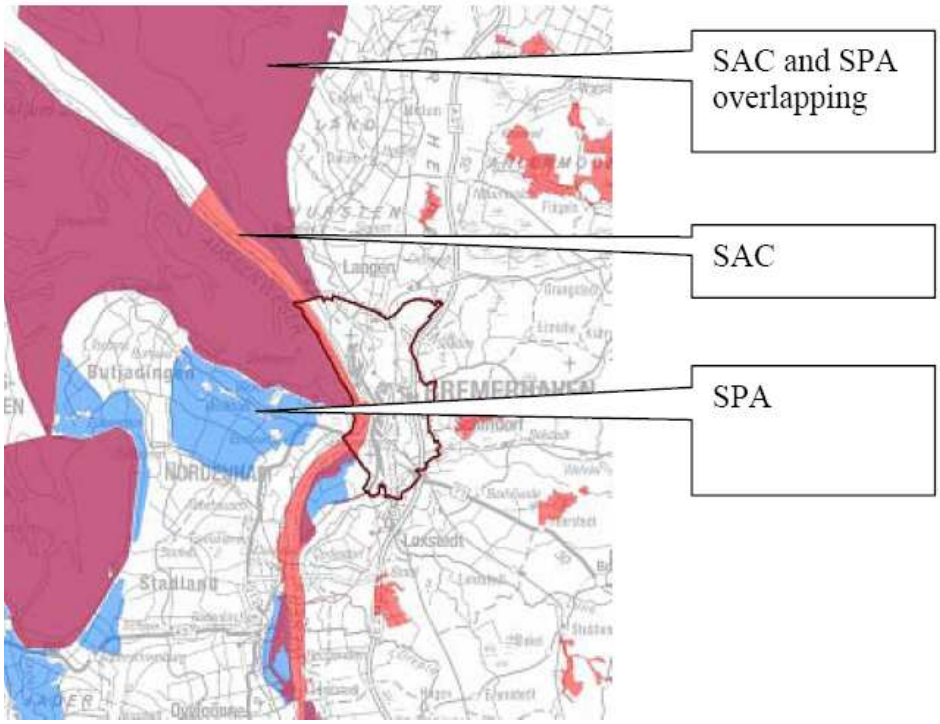


Figure 11: The Weser estuary and its designated sites

The conflict: A project of this dimension has a profound impact on nature. In total 154 hectares of valuable estuary habitats are directly degraded. The major habitats are mudflats without vegetation (70 hectares), parts of the river Weser (55 ha) and saltmarsh (8 ha). Additional detrimental light and noise emissions will affect birds and insects in the northern adjacent National Park. Finally, the project was going to lead to additional sedimentation of tidal habitats and to degradation in other areas because of changes of the current.

Mitigation: To find solutions for this problem a round table was initiated which consisted of regional fish experts, the developer and the competent authorities. The outcome was that individual fish could possibly suffer from physical injuries. However, the population itself would not suffer taking into account the high reproduction rate of this species and the following mitigation measures which were implemented during the construction phase:

- Pile driving by means of vibration wherever and as much as possible
- Low intensity piling at the beginning of the pile driving process. This enables the fish to flee without getting physical injuries
- Pile driving one pole per day during the migratory period
- Installation of a bubble curtain to lower the emissions of the pile driving
- Additional examinations to get more knowledge about the migrating period of this species.

Furthermore additional mitigation measures were carried out which focused more on the quality of habitats:

- Protected plants of reed and saltmarsh which grew on the construction site were relocated to other spots.
- Stones and cobbles of the sublitoral spots of the construction site were inserted in the river Weser to create stony habitats

Compensation: The compensation was carried out in two areas: The principal area of compensation is the so called “Grosse Luneplate”, a former island in the river Weser, approx. 12 km south of the construction site. This area forms a compensation pool because a variety of projects are compensated here (Figure 12). The principal goal for this project was the creation of

tidal influenced areas (215 ha).To achieve this the dike will be pierced and a storm barrage with a width of 30 m will be built. This enables normal tides to flow in freely. High tides above spring tides will be cut for coastal protection reasons. Here brackish habitats like mudflats, reed and tidal ponds will develop. This area will be left without human use. The eastern part so far intensely used by agriculture will consist of extensively used grassland (240 ha). Furthermore water bodies will be enhanced, moist zones will be created and a backwater will be restored. The majority of those measures go back to provisions of other projects. Out of the total compensation area approx. 175 ha go back to the requirements of this project.

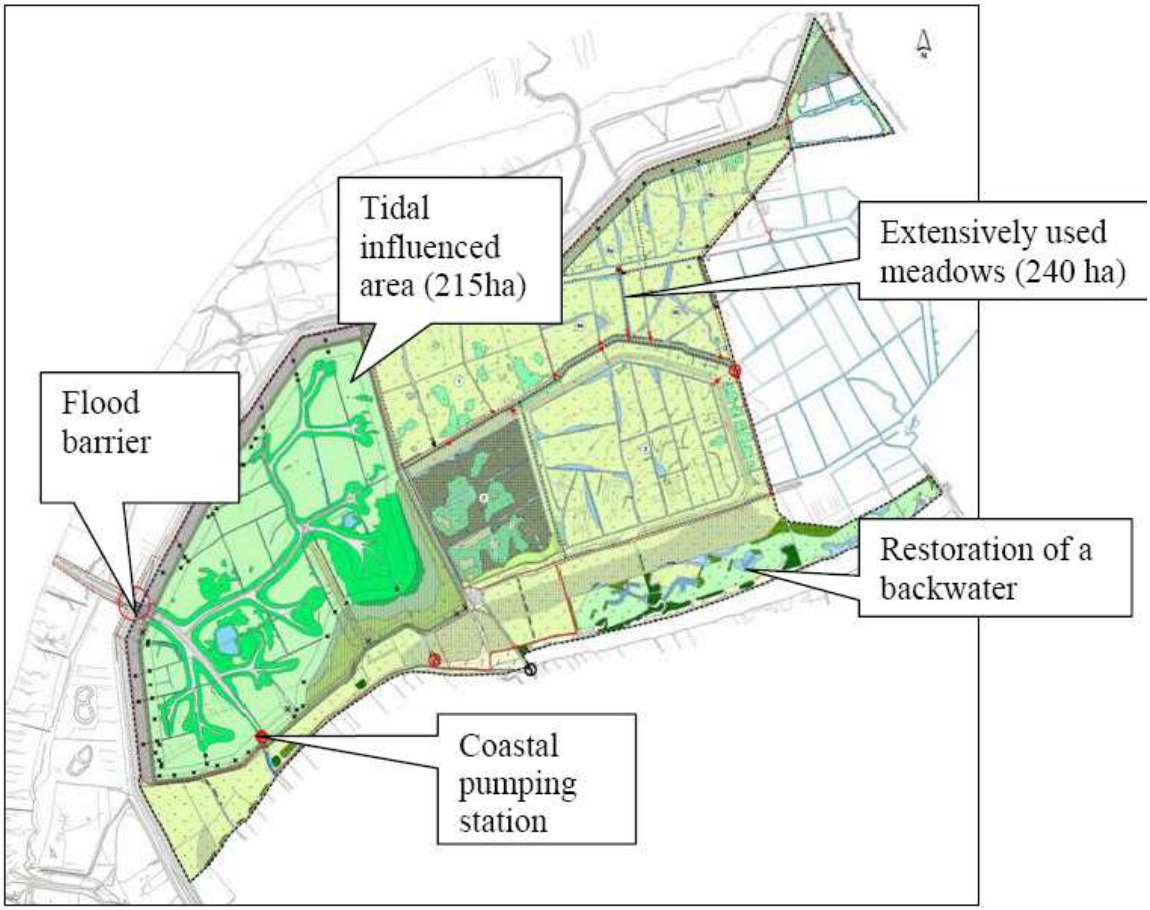


Figure 12 Compensation at Grosse Luneplate

The second compensation site is situated north in the National park “Niedersächsisches Wattenmeer”. Here two areas are ameliorated for the purpose of nature conservation (in total 145 ha). The two areas consist of grassland which is enclosed by summer dikes. This means that nowadays only high tides during winter can reach those areas. Normal tides are cut. The compensation concept involves the piercing of the dikes at 10 spots with a width of 20-50 m. So normal tides can come in and natural saltmarsh can develop.

Lessons learned: The search for suitable compensation sites in estuaries is difficult because:

- High quality compensation is needed to meet the requirements of the directive (like for like)
- There is a scarcity of space because the Weser estuary is intensely used by various uses
- Quite a few areas have already high value for nature conservation so there is not enough potential for nature developing

It has been common practice for Bremen to compensate for its development project in Lower Saxony, since Bremen as a city state has not enough space for compensation. For this project the

need for a transparent and regular procedure was expressed to come to suitable compensation sites. So a round table was initiated where various authorities from Lower Saxony and Bremen worked together to find suitable compensation sites with respect to the needs of nature conservation respective Natura 2000 and spatial planning. The process was followed in consequent phases:

1. The Weser estuary was checked for the needs of Nature conservation respective Natura 2000.
2. Five sites were then identified to be suitable as development sites from the nature conservation point of view.
3. These sites were checked against the needs of various users like agriculture, coastal protection, spatial planning etc.
4. The conservation objectives with regard to Natura 2000 were specified.
5. Three sites had to be rejected because they were either not compatible enough for the nature development goals or too important for agriculture or dedicated for commercial uses.
6. Finally two sites remained which as presented above.

If compensation is needed in existing SPAs and SACs it is necessary to proceed as follows:

- the requirements of existing Natura 2000 sites have to be met • you may not affect the goals of these sites
- it has to be proven that the already designated areas do still have enough options for nature development (compensation) and
- the measures must go beyond the normal protection and development measures of the site In this case important compensation requirements of the project as regards coherence of the network Natura 2000 were tidal influenced areas with brackish influenced habitats which was achieved on the Luneplate as described.

The Luneplate is part of one extensive SPA which stretches over wide areas of the river Weser. The goals for this site were the protection and enhancement of birds which are roosting in this area (Nordic geese) and enhancement of conditions for birds which breed in reed and grassland. This pointed out to a general conflict between conservation / development of estuary habitats as SACs on the one hand and conservation / development of adjacent SPAs in the grasslands of the floodplains or behind the dikes on the other hand. This was the conflict faced by the compensation of the now planned next deepening of the Weser.

Solution: The compensation was designed in a way which supports both goals. The established tidal influenced area (compensation / coherence) encloses reed habitats that enhance breeding birds at the same time. The roosting birds do loose these area which they have used so far but their living conditions are enhanced in total by developing the grassland to their needs. This means to introduce an extensive agricultural use, create winterly flooded areas and stop hunting.

3 Annex 1 : References

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