Ports and nature, striking a new balance

Creation and restoration of coastal and estuarine habitats

A review of practical examples and a description of sequential guidelines for habitat creation and restoration in port areas

Final report

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June 14, 2007

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Preface

This report was produced within theme 3 ‘Habitat creation and restoration of coastal and estuarine habitats’ of the NEW!Delta project. The project was financially supported by the European Union within the Interreg IIIB Community Initiative. The lead partner of the NEW!Delta project is the province of South Holland. Active participants of theme 3 are the province of South Holland (theme co-ordinator), the Antwerp Port Authority, ABP Marine Environmental Research Ltd. (ABPmer), Alterra Green World Research, the Agency for Maritime and Coastal Services, Coastal Division, Direction Régionale de l'Environment Haute Normandie (DIREN), Institute for Infrastructure (IMI), Environment and Innovation, Grontmij consulting engineers and the Port of Rotterdam.

The NEW! Delta project has investigated ways of improving the relationship between the natural environment and economic growth. It seeks to foster the protection of the Natura 2000 sites as an integral part of economic port and estuary development in the context of the EU Birds and Habitats Directives.

Theme 3 of the NEW!Delta project includes two demonstration projects in which wildlife assets in coastal and estuarine areas are recreated and restored. The working areas of the demonstration projects are nearby areas of the Port of Antwerp in Belgium and at De Zilk Dunes on the Dutch coast some 40 km north of the Port of Rotterdam.

The key elements of this report are a review of practical examples and demonstration projects for creation and restoration of coastal and estuarine habitats, and the development of sequential guidelines. This is a first version of a decision making tool to support a combined nature/port development. These issues are described in two separate parts of this report.

We want to thank Bram van Hilten (Province of South-Holland), Luc Geelen (Watercompany GWA) and Roger Morris (Natural England) for their support and contribution to this report.

Summary

Introduction
In the north-western countries of Europe intense economic activity occurs in coastal and estuarine areas. At the same time these coastal and estuarine areas support habitats and species of high nature conservation value and significant national, European or even world wide importance. Demand for increased port capacity creates ports' need for deeper water and a new infrastructure. Against these drivers a number of European directives have set safeguards to address the pressure on nature, particularly impact of new projects on the nature conservation interest of sites designated as part of the Natura 2000 network.

Experience to date has shown that the majority of project development and project planning organizations are experiencing difficulties in dealing appropriately with nature conservation issues and in particular the application of the EU Birds and Habitats Directives. These drivers are behind the establishment of the NEW! Delta project whose purpose has been to investigate ways of improving the environment in conjunction with maintaining economic growth.

The overall aim of the NEW! Delta project was to promote sustainable development in North West European coastal, estuary and port areas in that the best interests of nature conservation. The project has sought to foster the protection of the Natura 2000 sites as a coherent ecological network, while providing at the opportunities for social and economic (including maritime) benefits.

Theme 3 ''Creation and restoration of coastal and estuarine habitats'' asks the key questions:
- What and where are good examples of habitat creation and restoration within the NEW!Delta area?
- What lessons can be learned from these examples?
- How can we use this to support a combined economic/nature development in port areas?

The main questions were consequently translated into the concrete objectives and actions and the results are reported in two separate parts of this report:
- Part one: "*Current implementation of habitat creation and restoration in coastal and estuarine areas"*;
- Part two: "*First version of a decision making tool to support a combined nature/port development*".

The target audience group for this report is port planners and decision makers in port areas. Amongst these are project leaders/managers, port authorities and consultants. However other stakeholders (such as NGOs, local and regional authorities) involved in the field of nature protection and economic development in port areas may benefit from the information in this report as well.

Part one: "*Current implementation of habitat creation and restoration in coastal and estuarine areas"*
Part one of this report contains a review of practical examples on creation and restoration of coastal and estuarine habitats. The information is synthesized from 26 practical examples of projects in which coastal and estuarine habitats are being created or restored (Annex 1).

Furthermore the two demonstration projects that were implemented within theme 3 of the NEW!Delta project are described. These projects attempt to show how port activities and nature can be combined. The first demonstration project –'de Zilk'- is concerned with restoration of a dune area by increasing its natural values.

The second demonstration project –'Port of Antwerp'- shows how restoration of habitats in and around ports can be achieved by the development of an ecological infrastructure network and promoting the possible co-existence of estuarine habitats and industrial port activities.

It is clear from recent case histories that the number of projects addressing nature conservation and habitat creation in coastal and estuarine areas has increased considerably. This has led to more widely distributed experience within the member states.

From the review of the practical examples, factors affecting success and failure for habitat creation and restoration projects can be identified. A range of factors contribute to establishing a successful process for delivering habitat restoration and creation schemes. These include clear need for the restoration/creation scheme, policy support, clear objectives for the restoration/creation scheme, adequate (early) stakeholder engagement, delivery of multiple benefits, political support, financial support, clear approval process, effective project management and public acceptance. The factors responsible for process failures in the promotion of habitat creation/restoration schemes are largely the contrary of the success factors. Factors described that are related to ecological success or failure include available knowledge, scale, local physical conditions, complexity of desired habitat, management and disturbance.

From the review of practical examples it can be concluded that the main triggers for nature restoration and creation in coastal and estuarine areas are similar across all member states: compensation, nature conservation policy and flood defence. The techniques employed are also similar; for example managed realignment. This might even be described as a level playing field. The strong points of the case studies are the techniques for habitat creation and restoration and the positive preliminary results that suggest that they work.

In the site selection process of restoration schemes scientific and multi-criteria analyses are sometimes used to develop plans and evaluate spatial scenarios. Elements to consider when selecting adequate sites can be driven by ecological, physical, and economical considerations. However, it can be concluded that the definite site selection is influenced by pragmatic motives as well. Pragmatic motives are land ownership, zonal planning and the opportunities for land purchase.

Port planning, nature conservation policy and legislation differ between the UK, France, Belgium and The Netherlands and this is readily apparent. An important difference between countries is the extent to which economic development in estuarine and coastal areas is driven by public or privately owned port authorities. In the UK, for example, responsibility for port development falls to individual companies. In countries like the Netherlands, Belgium and France the role of public authorities in the process of port development is more dominant.

In the UK, France, Belgium and The Netherlands nature reserves may be included in Natura 2000 areas but this is not always the case as Natura 2000 is a multi-use sustainable development approach. Many sites have other functions such as agriculture, ground water extraction (for example demonstration project 'De Zilk'), recreation, fishery, hunting etc. In the case of the Port of Antwerp the SPA in the Schelde Estuary is very broadly designated and in fact the whole left bank of the Antwerp port area is located in the SPA. In the other countries major ports are in the vicinity but the overlap is not as obvious as in the Schelde estuary. However overlaps do occur.

The spatial coverage of designated sites also differs between countries as does the way boundaries have been defined. In the UK, for example, Natura 2000 areas typically cover a whole estuary. In the Netherlands, Belgium and France Natura 2000 areas have generally been designated to parts of an estuary.

Another example of differences in specific circumstances is the extent to which conflicts exist between the appearance of species that are protected by the Birds and Habitats Directives and economic activities in port areas. In the Port of Rotterdam this conflict is very apparent, as is also the case in the Port of Antwerp and the Port of Le Havre (Port 2000). In the UK these conflicts are less obvious and rarely because port development areas are not left unused after they have been created (the land must earn its keep and would not have been created without a specific purpose).

Recommendations
By taking into account the success and failure factors mentioned in the 26 practical examples in Annex 1 and analysed in this report, practical guidance can be gained when implementing a restoration scheme in coastal and estuarine areas. A distinction should be made between process and ecological related aspects.

It is very apparent that the differences between countries need be taken into account when developing a decision making tool to support combined nature and port development– a one size fits all approach is unlikely to work. This is because there are considerable differences between the planning process, legal frameworks and decision-making structures.

Although there is considerable potential for maintaining and enhancing pioneer species in port areas, the current European legislation does not encourage port authorities to support this asset. We recommend the EC to give consider ways of encouraging pioneer communities and species within the context of the Birds and Habitats Directives and making it practical and desirable for ports to host such species.

There are several additional recommendations on the scientific research that might be undertaken to make further progress:

- Adapting an expert model for developing ecological infrastructure for sustainable populations of HD protected species (Natterjack toad) in a port area
- Spatial relationships between coastal bird populations in ports and estuaries; adapting a meta-population model to explore the opportunities for mitigation and compensation of breeding habitat among different (port) areas around the North Sea.

Finally, it is suggested that there would be merits in developing a database in coastal and estuarine areas in North Western Europe on:

- Habitat creation and restoration techniques and their possible effects
- Spatial plans and documents in the coastal zone of different EU member states, with a possible linkage with the Erosion database
- Possible compensation areas to maintain and support the coherence of the Natura 2000 network, being a robust, resilient EU-wide ecological network.

Part two: "*First version of a decision support tool to facilitate combined nature/port developments: the Sequential Guidelines"*
A sequential guideline tool was developed in order to promote sustainable development solutions in coastal and estuarine areas using a multi-functional integrated approach. In accordance with the rationale of the NEW!Delta project port economy and ecology are central issues in these sequential guidelines, but multi-sectoral policies and functions are explicitly incorporated as well.

The sequential guidelines are meant to be used at a strategic plan level and to give guidance in the process of scenario building and analyses at this strategic plan level. Starting point for the guidelines is that the developed scenarios are fully compliant with the Birds and Habitats Directives at all times; both with the provisions concerning the designation, the objectives and the management of SAC/SPA with the provisions regarding species protection (art.12-16 HD). The outcome after using the sequential guidelines is a strategic spatial plan/vision for coastal and estuarine areas that contributes to the achievement of the Birds and Habitats Directives objectives.

The sequential guidelines seek to provide a framework within which sites can be maintained in favourable condition (and thus habitats and species can contribute to favourable conservation status) They are especially suitable for situations where there is a potential conflict between temporary nature conservation interests in port areas and future port development. By temporary nature we mean (often pioneer) species that regularly occur in the dynamic environment that ports offer and that are protected by the Birds and Habitats Directive. Furthermore the guidelines are designed to be of help in situations in which potential conflicts between Natura 2000 areas and future port development might be expected.

Applying the sequential guidelines to a larger area can contribute to the development of a strategic plan for coastal and estuarine areas in which temporary nature protected by the Birds and Habitats Directives and Natura 2000 areas occur. This strategic plan should safeguard the favourable conservation status of the Natura 2000 areas to be achieved and maintained. This can be achieved by developing scenarios that are aimed to create a robust ecosystem and ecological network with considerable ecological resilience (see Textbox 1.2) that fully supports the Natura 2000 network. These robust ecosystems and ecological networks are less vulnerable. Therefore external effects are less likely to have a significant negative impact on Natura 2000 areas and species protected by the Birds and Habitats Directives.

The idea of a robust ecosystem supported by an ecological network that is promoted by the sequential guidelines is implemented in the Port of Antwerp. In the demonstration project in the Port of Antwerp the concept of a network of ecological infrastructure has been adopted and implemented as a way of dealing with the issue of temporary nature in the port area (see Part 1, Chapter 1.3). The network of ecological infrastructure is complemented with the development of a robust ecosystem adjacent to the port in order to support Natura 2000 areas within and adjacent to the port area. Of course the ecological network consisting of permanent and temporary elements, supports the robust ecosystems as well.

Applicability of the sequential guidelines
The applicability of the sequential guidelines was tested for the demonstration projects the Zilk and the Port of Antwerp. For both demonstration projects it appeared that the sequential guidelines are useful. In fact in the planning process that led to the realization of the projects the same steps could be distinguished, although possibly in another order. For both demonstration project involvement of and cooperation with stakeholders proved to be of vital importance for the realisation of the projects. From the analyses of practical examples the same can be concluded. A recommendation for a further elaboration of the sequential guidelines therefore could be to optimize the stakeholder process within the steps of the guidelines.

In the Netherlands the sequential guidelines were evaluated based on the situation in the Port of Rotterdam. In the port of Rotterdam itself no Natura 2000 areas are designated, but species that are protected by the Birds and Habitats Directive occur frequently. By the Port of Rotterdam the guidelines are regarded as a useful tool when developing nature management plans in which the favourable status of all protected species is secured. The sequential guidelines are expected to enable a sustainable cohabitation of port activity and estuarine and coastal nature realised by a robust but also flexible ecosystem and ecological infrastructure. Therefore, the guidelines are expected to help solving the issue of temporary nature.

The sequential guidelines as it is currently described, is not wholly applicable in the UK. This is due to the nature of the ports industry in the UK, which is essentially privatized. It is not current practice for port companies to publicize future development plans as this can have implications for the competitive nature of the industry. Therefore port companies will not be inclined to develop strategic spatial visions using the sequential guidelines. In the UK however, this strategic plan level is currently addressed in for example integrated flood management plans and flood and coastal flood defence plans. At this strategic plan level however port developments are not covered.

The sequential guidelines are very close to the way French cases are currently implemented and in France it can be used both management plans/spatial plans. One particular thing in France is that rivers are usually boundaries between regions or departments and estuaries have no legal existence. This means that a broad definition of the study area as is proposed in the sequential guidelines, might lead to involve several public authorities at the same level and many stakeholders. Furthermore, long term spatial plans that can be developed with help of the sequential guidelines might help in clearing the discussions in the stakeholder debate by offering a spatial framework.

Recommendations
It is our recommendation to implement and further develop these guidelines in strategic spatial plans in port areas where nature and port activities should be combined. When implementing these guidelines special attention should be paid to the concept of robust ecosystems and ecological network within and adjacent to port areas. This approach will help to meet the requirements of the Birds and Habitats Directives while at the same time supporting economic activities in coastal and estuarine areas by offering a flexible approach specifically for natural dynamic situations that are found in coastal and estuarine areas and port areas with large areas of fallow land. By doing so, the issue of temporary nature in port areas will be addressed.

Another recommendation is to look more at coastal regions and interregional ecological relations in order to further enhance the development of an EU wide ecological network. This will lead to more ecological resilience of ecosystems thus creating a more sustainable balance between nature and economic activity in port areas.

1 General introduction

1.1 Background and rationale

European environmental legislation has encouraged port authorities and related bodies to work together in order to solve both scientific, legal and practical problems related to port developments in a vulnerable environment. In the north-western countries of Europe intense economic activity occurs in coastal and estuarine areas. At the same time these coastal and estuarine areas support habitats and species of high nature conservation value and significant national, European or even world wide importance. Demand for increased port capacity drives ports' need for deeper water and a new infrastructure. Against these drivers a number of European directives have set safeguards to address the pressure on nature, particularly impact of new projects on the nature conservation interest of sites designated as part of the Natura 2000 network.

The forecast of continuing economic development and the wish to increase port capacity, create the ports need for deeper water and a solid infrastructure. Against these drivers a number of European directives have set safeguards to reduce and restrict the pressure on nature, particularly with respect to future project development.

Experience to date has shown that the majority of project development and project planning organizations are experiencing difficulties in dealing appropriately with nature conservation issues and in particular the application of the EU Birds and Habitats Directives. These drivers are behind the establishment of the NEW! Delta project whose purpose has been to investigate ways of improving the environment in conjunction with maintaining economic growth.

NEW!Delta

The NEW! Delta project covers the North West European region of the so-called Interreg IIIB-program. This program promotes interregional cooperation between countries from North West Europe. The overall aim of the NEW! Delta project was to promote sustainable development in North West European coastal, estuary and port areas in that the best interests of nature conservation. The project has sought to foster the protection of the Natura 2000 sites as a coherent ecological network, while providing at the opportunities for social and economic (including maritime) benefits. The project will be implemented in the area from Haute-Normandie and the French coast to the neighbouring Belgian and Dutch coasts up to the Provinces of South and North Holland and right across the west North Sea and the Channel to the east and south coasts of the UK.

One of the themes of the NEW! Delta project is Theme 3 ''Creation and restoration of coastal and estuarine habitats''. Within this theme two demonstration projects of habitat creation and restoration schemes have been implemented: one in the port of Antwerp and the other in the dune area ''De Zilk'' along the Dutch coast.

1.2 Theme 3 'Creation and restoration of coastal and estuarine habitats'

Theme 3 ''Creation and restoration of coastal and estuarine habitats'' asks the key questions:

- What and where are good examples of habitat creation and restoration within the NEW!Delta area?
- What lessons can be learned from these examples?
- How can we use this to support a combined economic/nature development in port areas?

The main questions were consequently translated into the following objectives and actions:

- To provide practical examples and concrete demonstration projects on creation and restoration of coastal and estuarine habitats
- To contribute to land use planning in areas in which creation and restoration of coastal and estuarine habitats and port development take place

- To evaluate demonstration activities and practical examples on habitat creation and restoration in coastal and estuarine areas and incorporate these results in a planning and decision making tool
- To develop a transferable and generic planning and decision making tool that supports the development of an area while at the same time supporting port development

These objectives are elaborated in two separate parts of this report:

- **Part one: Current implementation of habitat creation and restoration in coastal and estuarine areas.** This part of the report contains the following elements:
  - A review of methods and practices on creation and restoration of coastal and estuarine habitats. This is reported in the Chapters 1.1, 1.4 and 1.5 1 and exemplified in the description of 26 practical examples in Annex 1;
  - The implementation of demonstration project ''De Zilk''. This is described in Chapter 1.2;
  - The implementation of a demonstration project in the port area of Antwerp. This is described in Chapter 1.3;
  - Site selection processes in the UK, France, Belgium and the Netherlands (Chapter 2)
  - Port planning and nature policy and legislation in the UK, France, Belgium and The Netherlands (Chapter 3)
  - Conclusion and recommendations (Chapter 4)

- **Part two: First version of a decision making tool to support a combined nature/port development: the sequential guidelines.** This report contains the following elements:
  - Development of a transferable and generic planning and decision making tool that support the ecological functioning of an area while at the same time supporting port development. This tool is formed by the sequential guidelines in Chapter 2;
  - Evaluation of the developed tool in the demonstration projects (Chapter 3)
  - Conclusions and recommendations (Chapter 4)

1.3 Range of the report

Bio-geographical region and habitats concerned
The NEW!Delta project –and therefore theme 3 of the NEW!Delta project is focussed at the North Sea and Channel region that is indicated in Figure 1.1. More specifically, it concerns the coastal and estuarine region in the South and South east of the UK, the North of France (north of Cherbourg), the whole Belgian coast (including the Schelde estuary) and the western part of the Dutch coast (south of Den Helder). In biogeographical terms the area belongs to the atlantic region.

Habitats concerned
Theme 3 of the NEW!Delta project is concerned with the restoration and creation of the coastal and estuarine habitats from the atlantic region from Annex I of the Habitat Directive (Directive 92/43/EEC) that are given in Table 1.1. Annex I is concerned with natural habitat types of community interest whose conservation requires the designation of special areas of conservation. The code corresponds to the NATURA 2000 code. The sign "*" indicates priority habitat types.

Figure 1.1 Project area

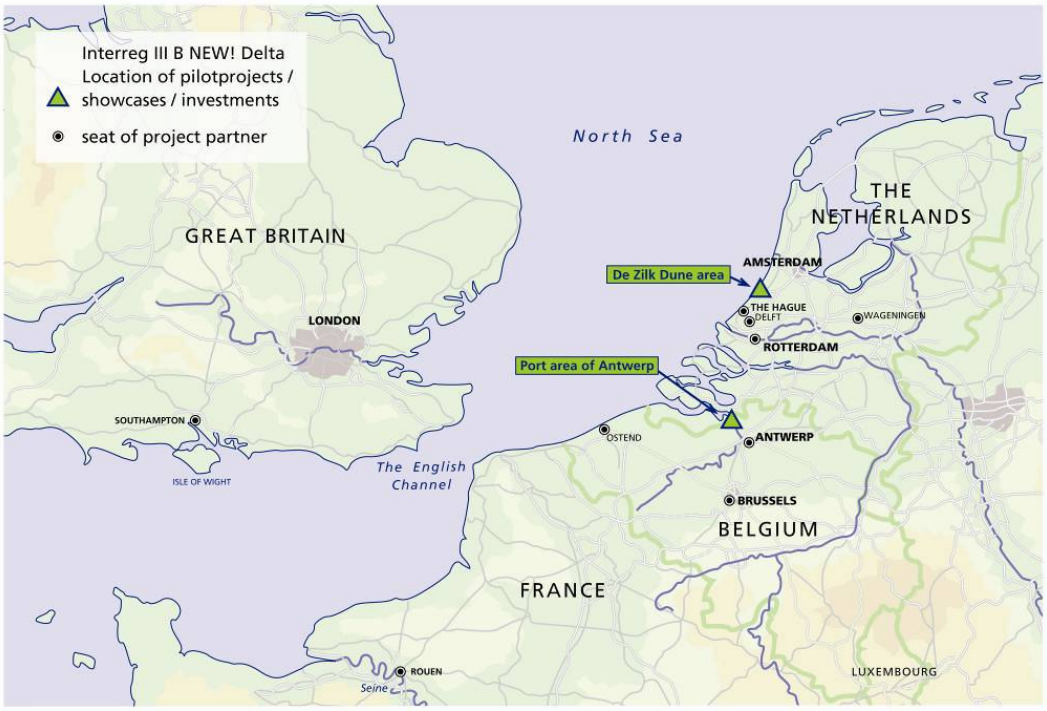

Table 1.1 Habitat types of Annex I of the Habitat directive that are regarded in theme 3

1. COASTAL AND HALOPHYTIC HABITATS
11. Open sea and tidal areas
1110 Sandbanks which are slightly covered by sea water all the time
1130 Estuaries
1140 Mudflats and sandflats not covered by seawater at low tide
1150 * Coastal lagoons
1160 Large shallow inlets and bays
1170 Reefs

13. Atlantic and continental salt marshes and salt meadows
1310 *Salicornia* and other annuals colonizing mud and sand
1320 *Spartina* swards (*Spartinion maritimae*)
1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)
1340 * Inland salt meadows

2. COASTAL SAND DUNES AND INLAND DUNES
21. Sea dunes of the Atlantic, North Sea and Baltic coasts
2110 Embryonic shifting dunes
2120 Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes")
2130 * Fixed coastal dunes with herbaceous vegetation ("grey dunes")
2140 * Decalcified fixed dunes with *Empetrum nigrum*
2150 * Atlantic decalcified fixed dunes (*Calluno-Ulicetea*)
2160 Dunes with *Hippophaë rhamnoides*
2170 Dunes with *Salix repens* ssp. *argentea* (*Salicion arenariae*)
2180 Wooded dunes of the Atlantic, Continental and Boreal region
2190 Humid dune slacks

1.4 Contributors

The following organisations contributed to this report:

- The province of South Holland. The province of South-Holland is a regional public authority involved in spatial planning, environmental issues as wel as nature conservation. The province of South Holland is the initiator of the demonstration project the Zilk, a project that aims to restore an extensive dune area along the Dutch coast. Moreover, the province of South Holland is the co-ordinator of Theme 3
- The Antwerp Port Authority. The Antwerp Port Authority port is an autonomous municipal authority. It owns the docks and the sites used by port operators and industries on the Right and Left Bank area and also some of the port's equipment. Moreover, it is responsible for the management of the port on both Banks, thus ensuring the application of uniform policies on both sides of the river. The Antwerp Port Authority is the initiator of the demonstration project for the "de Antwerpse Haven Natuurlijker" (the Port of Antwerp More Naturally), a project that aims to realize a coherent network and ecological infrastructure in the port of Antwerp
- ABP Marine Environmental Research Ltd. from the UK. ABPmer provides specialist consultancy services on coastal, estuarine and riverine developments and conservation projects. ABPmer strives to remain at the forefront of scientific understanding, technological advances and management methods through active involvement in national and international research programmes
- Alterra Green world research from the Netherlands. Alterra is the Dutch research institute for the green living environment. It offers a combination of practical and scientific research in a multitude of disciplines related to the green world around us and the sustainable use of the living environment. Alterra is part of the Wageningen University and Research Centre concern (Wageningen UR)

- The Agency for Maritime and Coastal Services, Coastal Division. The Coastal Division is involved in activities over the entire Belgian coastal zone and covers the Flemish coastal marinas. Its mission is protection of the population and national heritage against storm surges and floods; economic, social and ecologically sustainable and integrated development of the coastal zone; nature and landscape development in the coastal zone and support of coastal and sea-related recreational activities.
- Diren from France. Diren is the Direction Régionale de l'Environnement (DIREN) de Haute Normandie, a decentralised service of the French Ministry of Ecology and Sustainable Development (MED) that is involved in nature creation and restoration projects amongst other in the Seine estuary. It also has the environmental aspects of the relations with the ports of Rouen and Le Havre and the implementation of Natura 2000 at the regional level in its area of competence
- IMI from Belgium: IMI is the Institute for Infrastructure, Environment and Innovation vzw (IMI). It is an independent Brussels-based non-profit organisation. Its mission is to initiate and implement projects at European and local level. Its expertise lies in the field of EC environmental legislation and policy, in particular with respect to port development and renewable energy.
- Port of Rotterdam, the Netherlands. The Port of Rotterdam (Havenbedrijf N.V.) is responsible for the efficient and safe handling of shipping traffic in a clean and sustainable port. The (government) harbour master of Rotterdam – also head of the Rotterdam Port Authority, a division of the Port of Rotterdam – manages these activities. The Rotterdam port and industrial complex fulfils an important role as a hub for international goods flows and as a business location for industry and logistic services and is of great significance for the European, national and regional economies.
- Grontmij, the Netherlands. Grontmij is a consultancy and engineering firm that provides consultancy, management, engineering and contracting in the building, infrastructure and environment sectors (amongst others nature and water) at a local, national and international level. Grontmij supported theme 3 specifically in editing the report that lies before you.

Annex 2 contains the contact details of the contributors.

Part 1 Current implementation of habitat creation and restoration in coastal and estuarine areas

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1 Review of practical examples of habitat creation and restoration in coastal and estuarine areas

1.1 Introduction

This chapter presents examples of habitat creation and restoration schemes in coastal and estuarine areas. Factors affecting the success or failure of individual schemes are identified together with information about techniques for habitat creation.

The review is based on 26 practical examples of projects in which coastal and estuarine habitats are being created or restored (Annex 1). The review provides information on site location, target habitat/species, description of the site, methodology, monitoring, success and failure factors, policy context, stakeholder involvement and policy and decision making process. The description of the examples reflects the situation in September 2005 for the examples 1 to 24, and June 2006 for examples 25 and 26. The examples are located in The Netherlands (5 sites), Belgium (9 sites), the UK (10 sites) and France (2 sites). In addition to the description of practical examples in Annex 1, the demonstration sites 'De Zilk' and 'Port of Antwerp' are also described (see section 1.2 and 1.3).

The location of the projects is indicated in Figure 1.1. In Table 1.1 the contents of the habitat creation and restoration projects in annex 1 are summarised.

Figure 1.1 Location of chosen examples for habitat creation and restoration in coastal and estuarine areas (Annex 1). The numbers on the map correspond with the numbers of the practical examples

Table 1.1 Summarized overview of practical examples of creation and restoration of coastal and estuarine habitats (see Annex 1 for full description). The numbers correspond with the numbers in map 1.1 and annex 1

	name	country	incentive	intentional	implemented?	monitoring results available?	part of or adjacent to SPA or SAC?	habitats concerned	Additional inform...
1	Abbotts Hall	UK	coastal flood defence/nature policy	Y	Y	Y	Y	Mudflats, atlantic salt marshes and salt meadows	M
2	Chowder Ness	UK	compensation for port development	Y	N	N	Y	Mudflats, atlantic salt marshes and salt meadows	M
3	Freiston	UK	coastal flood defence	Y	Y	Y	Y	Mudflads, atlantic salt marshes and salt meadows	M
4	Orford Ness	UK	nature policy	Y	Y	Y	Y	Mudflats, atlantic salt marshes and salt meadows	M
5	Orplands	UK	sustainable coastal flood defence	Y	Y	Y	Y	Mudflats, atlantic salt marshes and salt meadows	M
6	Paull Holme Strays	UK	coastal flood defence	Y	Y	Y	Y	Mudflats, atlantic salt marshes and salt meadows	M
7	Shotley	UK	trial for use of cohesive dredging	Y	Y	Y	Y	Mudflats, atlantic salt marshes and salt meadows	M
8	Tollesbury	UK	nature policy	Y	N	N	Y	Mudflats, atlantic salt marshes and salt meadows	M
9	Welwick	UK	compensation for port development	Y	N	N	Y	Mudflats, atlantic salt marshes and salt meadows	M
10	West Chidham	UK	coastal flood defence/nature policy	Y	N	N	Y	Mudflats, atlantic salt marshes and salt meadows	M
11	Baai van Heist	BE	result of sand suppletion + pier construction	N	Y	Y	Y	Mainly coastal and inland sand dunes, atlantic salt marsh	S, S&F
12	Common tern habitat Van Cauwelaert Lock	BE	nature policy (dev. ecological infrastructure)	Y	Y	Y/N	Y	Common tern breeding habitat (no specific HD type)	M
13	De fonteintjes	BE	nature policy	Y	N	N	Y	Mainly coastal and inland sand dunes	S, S&F
14	De slufters in de Panne	BE	nature policy	Y	Y	Y	Y	Mainly coastal and inland sand dunes, atlantic salt marsh	S, S&F
15	Gull Breeding site Deurganck dock	BE	nature policy (dev. ecological infrastructure)	Y	Y	Y	Y	Gull breeding habitat (no specific HD type)	M, S&F
16	Gull Breeding site Intersection A12/R2	BE	nature policy (dev. ecological infrastructure)	Y	N	N	Y	Gull breeding habitat (no specific HD type)	M
17	Mud flat/salt marsh Paardenschor	BE	compensation for port developement	Y	Y	Y	Y	Mudflats, atlantic salt marshes and salt meadows	M, S&F
18	Spawning pond Thijsmans Tunnel (POA)	BE	nature policy (dev. ecological infrastructure)	Y	N	N	Y	Fish spawning habitat (no specific HD type)	M
19	Zwijndrecht (Port of Antwerp)	BE	compensation for port developement	Y	Y	Y	Y	Colony breeding habitat (no specific HD type)	M, S&F
20	De Kerf	NL	nature policy	Y	Y	Y	Y	Open seas and tidal areas, atlantic salt marsh	M, S, S&F
21	Dixhoorndriehoek	NL	result of land reclamation (sand suppletion)	N	Y/N	N	N	Coastal and inland sand dunes	M, S, S&F
22	Dunes The Hague-Hoek van Holland	NL	coastal flood defence	Y	N	N	Y	Coastal and inland sand dunes	
23	Kennemerstrand	NL	result of spontaneous beach developement	N	Y/N	Y	Y	Coastal and inland sand dunes	S, S&F
24	Maasvlakte 2	NL	compensation for port related activities	Y	N	N	Y	Coastal and inland sand dunes/open sea and tidal areas	S, S&F
25	Artificial mudflats, Seine estuary	FR	compensation for port development	Y	Y	Y	Y	Estuary, tidal flat in sea with tide	M, S, S&F
26	Dune Sanctuary for bird, Seine estuary	FR	compensation for port development	Y	Y	Y	Y	Estuary, tidal flat in sea with tide, embryonic shifting dune	M, S, S&F

Additional information: M= Technical Measure, S= stakeholder process, S&F= information on success and failure

Geographic distribution
There are various practical examples concerning creation and restoration of coastal and estuarine habitats from the UK, Belgium, The Netherlands and the Seine Estuary in France.

Habitats concerned
The examples concern the habitats Mudflats, Atlantic salt marshes and salt meadows (mainly UK examples and Belgian examples), Coastal and inland sand dunes (Dutch examples and Belgian examples) and Open sea and tidal areas (Dutch examples). The classification is in accordance with the EU classification of Annex I of the Habitats Directive. The habitats concerned are not specified in all examples.

All but one example are located in or adjacent to Natura 2000 areas (SPA's or SAC's). The proximity to Natura 200 areas means that the specific provisions of the Habitats and Birds directives apply to plans or projects likely to significantly affect these areas.

Stage of implementation
The projects reflect the situation in September 2005 for the examples 1 to 24 and June 2006 for the examples 25 and 26. They differ in stages of implementation: some restoration schemes have already been carried out, others have not. Monitoring results are already available for more than half of the examples, but are not always described in the text. Where possible, the source of the monitoring results has been identified.

Policy context/incentive
The policy context/incentive under which projects are initiated differ. Roughly the following categories can be distinguished:

- Compensation projects. Examples of these are the Maasvlakte-2 site, Plain of Zwijndrecht, Mudflat/Salt Marsh Paardenschor, the Seine estuary, Welwick and Chowder Ness. These are mainly examples of compensation for habitat lost for port development;
- Coastal flood defence: the Dutch example of the Hoek van Holland-The Hague dunes and various UK examples deal with projects in which coastal flood defence and nature restoration are combined;
- Implementation of (national) nature policy. An example of this is the realisation of the ecological infrastructure in the Port of Antwerp (various examples), Orford Ness and Tollesbury in the UK, 'de Fonteintjes and 'de Slufters in the Panne' along the Belgian coast and 'de Kerf' along the Dutch coast;
- In the examples 'Baai van Heist' in Belgium and 'De Dixhoorndriehoek' and 'Kennemerstrand' in The Netherlands valuable habitats have developed spontaneously and unintentionally as a result of activities such as sand recharge and harbour related construction projects. Other examples of the spontaneous development of nature conservation interest as a result of port activities are shown in Figure 1.2;
- The Shotley example was an exception that involved placement of cohesive dredge materials onto an eroded foreshore.

Figure 1.2 ***Examples of spontaneous development of nature conservation interest as a result of port activities: dunes at the Maasvlakte 2 (The Netherlands), Anagalis tenella at Oostvoornse Meer (The Netherlands), Echium vulgare below electricity pilon and Liparis loeselii at Oostvoornse Meer. Photos: P.A. Slim, Alterra***

Additional information

The practical examples differ in the level of information available. The UK examples and examples from the Port of Antwerp give rather general information on technical measures that have been or will be carried out to create or restore nature conservation features. The examples from the Seine Estuary give detailed information on technical measures.

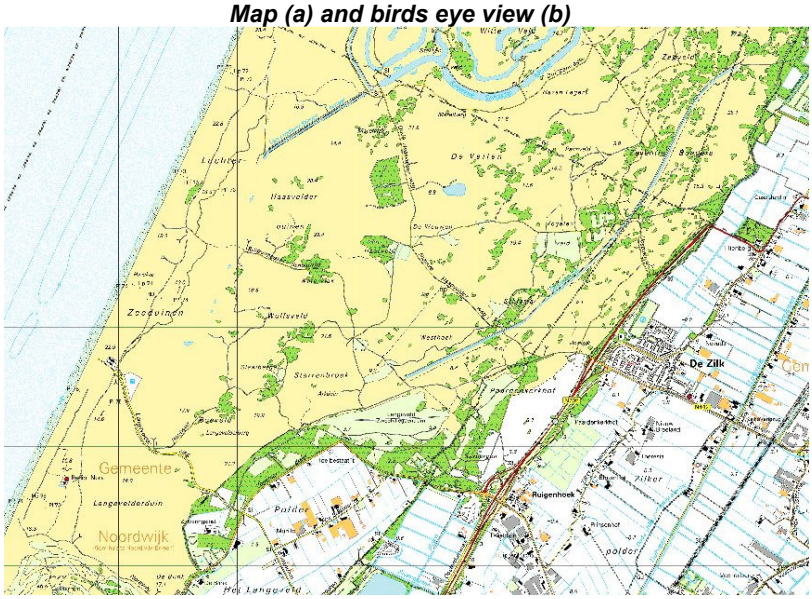
Information on success and failure is given in a greater number of cases. The information however differs between the various examples. In the Port of Antwerp and the Seine cases for example, the focus is on physical conditions and the ecological responses that have occurred. The examples along the Belgian coast are an evaluation of possible factors for success and failure focussed mainly on planning and stakeholder processes and less on the development of favourable physical conditions or natural values. In the Dutch cases information is given on both the stakeholder process and favourable physical condition or nature conservation value.

1.2 Description of demonstration site ‘De Zilk’

1.2.1 Policy context

The ‘De Zilk’ dune area, part of the Amsterdam Water Supply Area (Figure 1.3) has been identified as an area with high potential for the restoration of wet dune slacks. The area has been designated as a nature reserve in the Province of South Holland’s Spatial Policy Plan and it is proposed to implement a new strategy for groundwater abstraction to create a dune area with a natural groundwater system.

Figure 1.3a and b ***The Amsterdam Water Supply area, where the demonstration site 'De Zilk' is located. Map (a) and birds eye view (b)***



1.2.2 History of the site and project

The area has been used for the abstraction of drinking water since the mid 19th century. Saline water from the Rhine Estuary has infiltrated since the 1950s as a result of the lowering of the natural water. This river water is different in chemical composition, with higher nutrient concentrations than the natural precipitation. The influx of nutrients has resulted in the loss of typical dune plants and animals. In the southern part (situated in the province of South-Holland) two deep-lying channels are present for the interception of natural groundwater. In this part no river water has infiltrated.

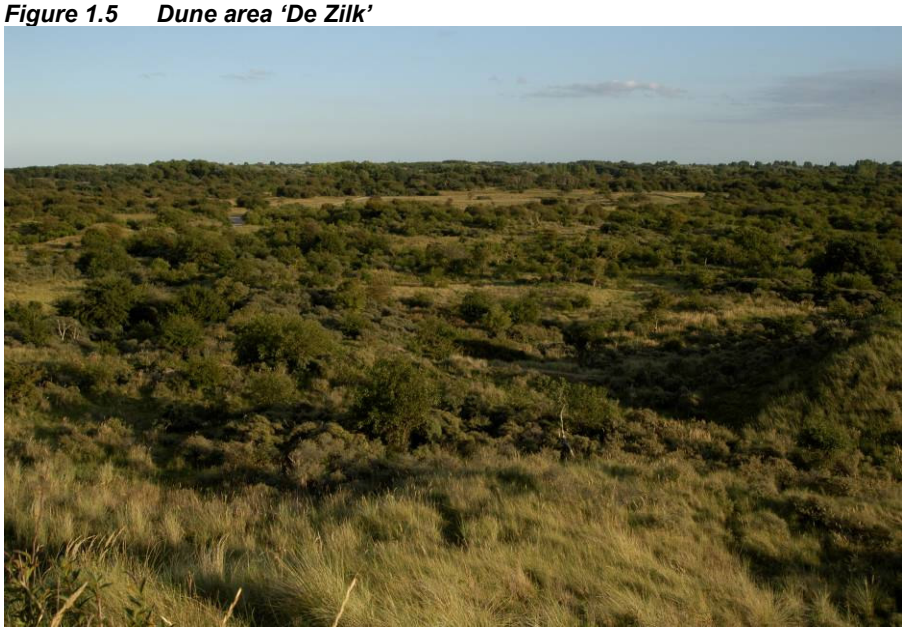
Various studies have been conducted which have resulted in proposals for a restoration project. The first step was taken in 1996 when one of the deep-lying channels, the Van Limburg Stirum channel, was taken out of use with the channel being filled up with sand. However, restoration of wet dune slacks will only advance significantly when the Oosterchannel is taken out of use as well. This is an important objective of the 'De Zilk' project. By taking the Oosterchannel out of use some 200 ha of wet dune slacks will be created. On a national scale the restoration project will be highly significant.

Figure 1.4 Parnasia palustris: a characteristic species of wet dune slacks that is threatened by the influx of nutrients. Parnasia palustris is a target species for the dune restoration project 'de Zilk'

1.2.3 Ecology of the site

The Amsterdam Water Supply Area is an important dune area, rich in Red-List species. For example, 60 animals of the Red List are found, comprising butterflies (6 species), grasshoppers (2 species), dragonflies (5 species), freshwater molluscs (5 species), reptiles (1 species), fishes (1 species), birds (34 species), bats (4 species) and other mammals (2 species). Moreover, many plants and fungi of the Red List have been found: 264 species of fungi, 16 species of mosses, 8 species of lichens and 76 vascular plant-species. One species of mollusc, protected under the Habitats Directive occurs in the area, Vertigo angustior (H1014) and one plant species, Lipartis loeselii (H1903).

Figure 1.5 Dune area 'De Zilk'



1.2.4 Designated Natura 2000 area

The Amsterdam Water Supply Area has been designated under the Habitats Directive. The following habitat types should be protected and restored: 1310 *Salicornia* and other annuals colonizing mud and sand, 1330 Atlantic salt meadows (Glauco-Puccinellietalia maritimae**),** 2110 Embryonic shifting dunes, 2120 Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes"), 2130 * Fixed coastal dunes with herbaceous vegetation ("grey dunes"), 2150 * Atlantic decalcified fixed dunes (Calluno-Ulicetea), 2160 Dunes with *Hippophaë rhamnoides,* 2180 Wooded dunes of the Atlantic, Continental and Boreal region and 2190 Humid dune slacks. The designating species are *Vertigo angustior* (H1014) and one plant species, *Lipartis loeselii* (H1903).

1.3 Description of demonstration site 'Port of Antwerp'

1.3.1 Relevant policy on ecological infrastructure in Flemish sea port areas

Spatial planning policy

Ecological infrastructure is a construct of the Spatial Structure Plan of Flanders (RSV), the Flemish policy document for spatial planning within Flanders. The Spatial Structure Plan of Flanders states that ecological infrastructure in port areas has to be located in a way that it does not obstruct (related) activities. The selection of sites for the network of ecological infrastructure has to take into account present and future infrastructure and the economic value of the areas. The amount of ecological infrastructure should reach a maximum of 5% for the port areas overall (comprising all Flemish ports: Ostend, Zeebrugge, Ghent and Antwerp), thus percentages within individual ports may vary.

The only other available document concerning ecological infrastructure is the *Administrative order for ecological infrastructure in ports* (order LIN 2002/11) which contains a description of ecological infrastructure in (sea) port area. However, an order is not a legal binding document. It also states that ecological infrastructure can either have a permanent or temporary character.

Thus the available policy documents on ecological infrastructure in sea ports are limited and merely states that ecological infrastructure includes temporary or permanent nature in port areas subordinated to the economic function of ports.

Nature policy

Ecological infrastructure is a construct of spatial planning policy, not of nature policy. The concept of ecological infrastructure is not intended for the Flemish ecological network (VEN[1]: Vlaams Ecologisch Netwerk) or Integral Connecting and Supporting Network (IVON: Integraal Verwevings- en Ondersteunend Netwerk) (corridors and stepping stones for VEN), two existing Flemish nature networks in the framework of nature policy. Nor is it applicable to the Natura 2000 network.

Temporary ecological infrastructure can occur in areas which are reserved for future port development. This can be in the form of pounds, fallow land or shrubs or trees. For such ecology a framework needs to be developed within the strategic planning process of ports.

[1] VEN or Flemish Ecological Network and IVON or Integral Connecting and Supporting Network are 'tools' of Nature Policy which is also included in spatial planning policy. The Flemish Ecological Network concerns in particular large areas in which nature is the main function; other functions like agriculture, forestry and recreation remain however possible. IVON or Integral Connecting and Supporting Network includes areas for the support, reinforcement and buffering of the Flemish Ecological Network. Nature conservation has a lower priority in these areas.

1.3.2 History of the site and project

Port of Antwerp

The Port of Antwerp occupies an area of 13,300 ha, 7,500 ha of which are in use on the Right Bank of the Schelde and a further 5,800 ha are in the course of phased development on the Left Bank. Of the total area occupied by the port on both banks of the Schelde, about 2,100 ha is surface water (approximately). When both dockside and river berths are included the overall useful berth length is roughly 130 km.

The port is run by the Antwerp Port Authority. The Port Authority owns the docks and the sites used by port operators and industrial companies on the Right Bank of the Schelde. It is moreover the owner of part of the port equipment. The Port Authority likewise manages the Left Bank port, which ensures the application of uniform policies on both sides of the river.

However, land use and industrial development policy on the Left Bank is in the hands of a separate public sector the Corporation for Land Use and Industrialisation. Close co-operation between the private sector, the port authorities and local government is encouraged by an ongoing dialogue between all the parties involved in the activities of the port. The Port Authority owns and manages docks, berths, locks, etc. It is responsible for planning, expanding, modernising and maintaining the infrastructure of the port, and also operates its own equipment, including warehouses, floating cranes, shore cranes, tugs and dredgers. The Port Authority also leases sites and land and is responsible for the distribution of electricity in the port.

The port authority is a local public authority. Since 1997 it has been autonomous from the city of Antwerp, but there remains a political control by the board.

The network of ecological Infrastructure in the port of Antwerp[2]

The project '*de Antwerpse Haven natuurlijker*' ("the port of Antwerp More Naturally") started in 2001 and is an agreement between the Antwerp Port Authority and Natuurpunt vzw - the largest Nature NGO in Flanders. The goal of this agreement is to realise +/- 5% ecological infrastructure in the Antwerp harbour on the left- and right banks of the river Schelde. The most important role of the network consists in ***supporting*** the wider network of large nature areas that surround and will surround the port area in the immediate future (Natura 2000 sites, VEN & IVON, Nature reserves, etc.).This means that the ecological infrastructure ***connects*** these large nature areas as much as possible. This goal comes straight from the definition of ecological infrastructure in the Spatial Structure Plan for Flanders.
In addition, the network may also function as an independent network/habitat for certain given (protected) species that are dependent on the port area for their long term survival (for instance because the availability of dynamic areas outside port areas is very low, habitat for instance for the Natterjack Toad and coastal colony breeders like the Common Tern.

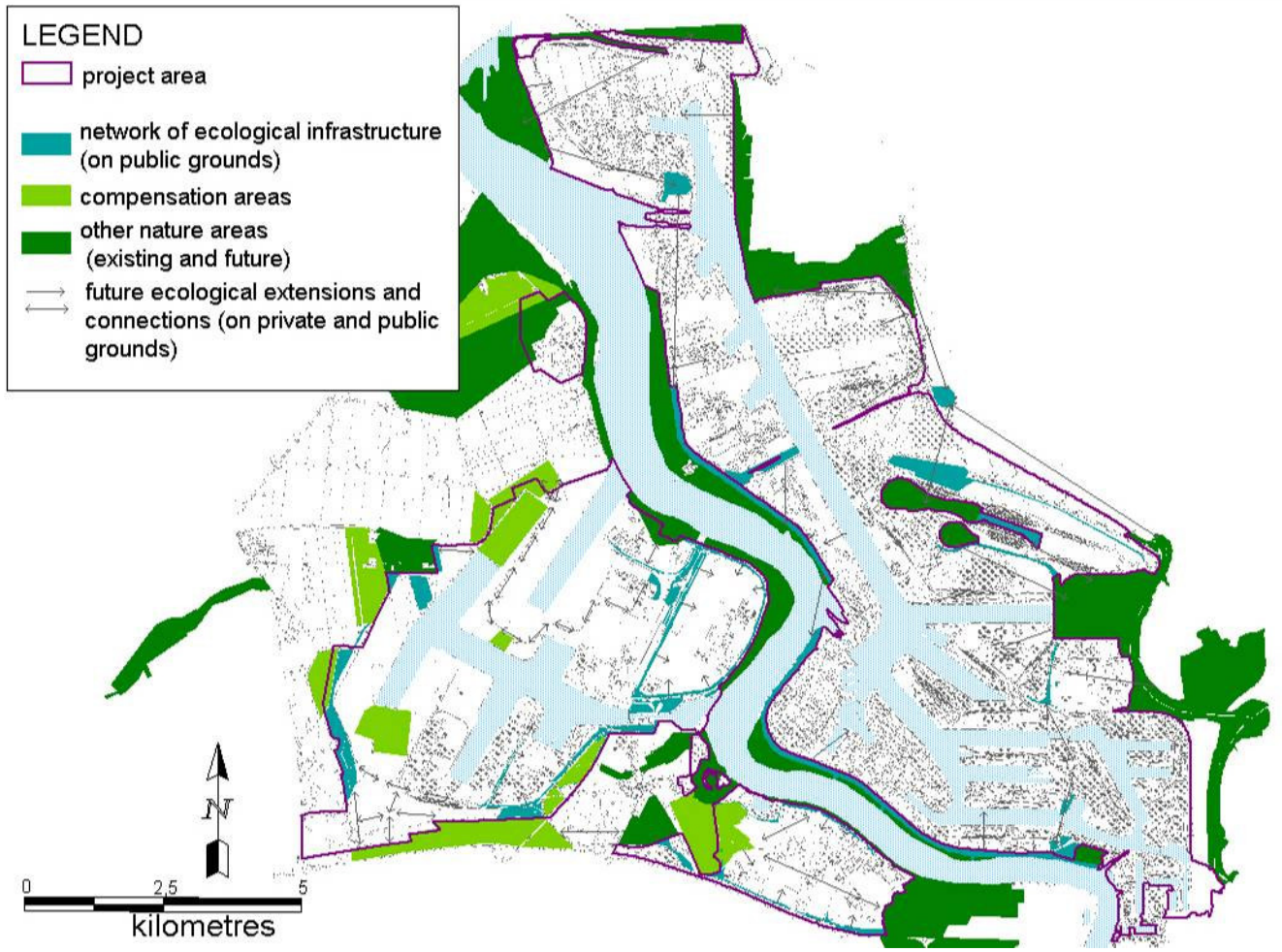
Parallel to the development of the network of ecological infrastructure the agreement foresees the start of pilot-projects on specific species. These projects are intended to show that co-existence between a mainport and wildlife is possible. Some examples are the Sand Martin plan, the Narrow-Leaved Helleborine plan and the coastal breeders plan. Thus, from the outset the potential of ecological infrastructure to play a role in the forthcoming Flemish species protection policy has been identified and applied.

[2] The original Dutch name of this project *"de Antwerpse haven natuurlijker"* (see also *http://www.antwerpennoord.be/overons/projecten/havennatuurlijker.html*).

Figure 1.6 ***Natterjack toad, a species protected under the Habitats Directive and one of the target species of the POA ecological infrastructure. Photo: Fabrice Ottburg, Alterra***

A map has been developed that indicates all those parts of the harbour where it is possible to create ecological infrastructure (bare soils, road verges, etc.). The present and potential nature conservation values, the location of existing natural structures in and around the port area and ecological priorities have been incorporated into this map. A delimitation proposal for a network of ecological infrastructure has been made based on the map (Figure 1.7). The arrows on the map indicate areas where corridors and/or stepping stones could be used to increase the connection between parts of the network.

Figure 1.7 Proposal for an ecological infrastructure in the port of Antwerp



Textbox 1.1 Key elements of the ecological infrastructure

Cores are the areas with the highest nature value and elements with a high nature-value. They are mainly places and elements which already have these values. However, it is possible that the future possibilities are also taken into account.

Besides the intrinsic nature value, the value of a core area also depends on its size and the location.

Step stones are mostly smaller areas or elements which cannot be transformed into core-areas. They involve rest places and refugee areas where species move from one core to another. Besides their magnitude and the intrinsic value the location and the connections are important to support ecological functioning.

Corridors are connecting elements used by species to move from one core (or stepping stone) to another. Such sharing creates a more stable and diverse unity of animal and plant communities. The value of a corridor depends on the intrinsic value and the width.

1.3.3 Ecology of the site

Nature in the surroundings of the Antwerp harbour

The port of Antwerp is located in the Schelde estuary. The Schelde estuary covers the entire gradient from fresh to salt water tidal areas. The resulting ecological richness (“nursery room”, important winter bird area, largest unbroken salt marsh in Western Europe, etc.) is protected by various nature conservation legislation (Natura 2000, Ramsar, national designations). This is further described in the Theme 6 report.

Due to human interventions the deep water areas are expanding at the expense of intertidal mudflats. The latter, however, are very important ecotypes for a more natural functioning of the estuary (www.proses.nl).

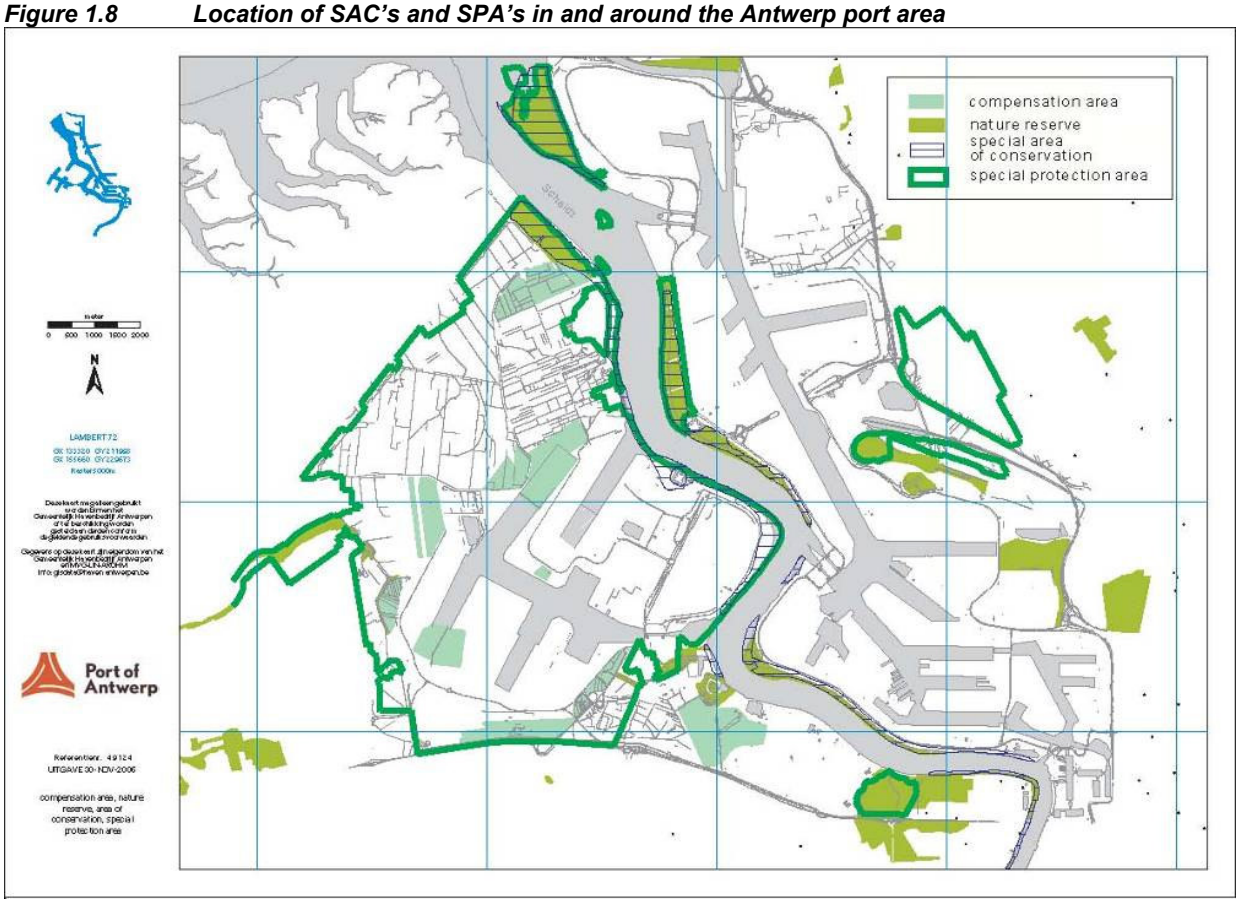
Nature in the Antwerp harbour

In the framework of the collaboration between the Port Authority and Natuurpunt (de Antwerpse haven Natuurlijker), Natuurpunt prepared an inventory of the present nature conservation value in the port area. It mainly consists of sand with pioneer vegetation. The harbour consists of docks and large basins of water with steep banks. Around the docks the land is higher because of hydraulic fill with sand. So the non-built parts of the port have sandy grounds with shells. Recent developments and the dynamic character of the port area mean that these parts mainly support pioneer habitats and species. When the dynamic character disappears, these pioneer situations evolve to grasslands and later to shrubs or woodland. Under wet conditions they develop to ponds and swamps. In the built parts of the port birds like the Common Swift and Peregrine falcon find a suitable habitat.

1.3.4 Designated SPA's and SAC's

The intertidal zones of the Schelde are designated as SAC (see Figure 1.8). Parts of it are also SPA. On the Left bank there is a large SPA which contains most of the port. On the right bank there's a smaller SPA on the location of the railway station.

Figure 1.8 Location of SAC's and SPA's in and around the Antwerp port area



1.3.5 The NEW!Delta investments

The demonstration project "Port of Antwerp" consists of several projects that have been set up inside or in close vicinity to the port area (Figure 1.9). Through these investments – Antwerp Port Authority demonstrates possible ways of co-existence between port development and nature development, focusing mainly, but not exclusively, on the requirements of the Birds & Habitats Directives and the species protection regimes in particular.

The highly dynamic character of the port area – with rapid changes in the use of land as a consequence forces the port authority to invent and experiment with new concepts such as “temporary nature” and with new methodological issues such as the question: “on what level is protection or enhancement of habitats for protected species most effectively and efficiently organised.”

Several projects are related to the creation of a network of ecological infrastructure inside the port area; a network consisting of small core areas, linked through corridors and stepping stones (see Textbox 1.1). The network of ecological infrastructure has two functions. On the one hand, it will support the large nature areas that surround or will surround the port area in the immediate future. So, in order to preserve the long term integrity of the special protection areas overlapping with the port area, a nature development scheme has been set up to enforce and expand to a significant extent the existing nature areas. On the other hand – and this was the main focus of the “Demonstration project “Port of Antwerp” – the network will create the physical backbone for the maintenance or the creation of a sustainable populations for several “port specific’’ species of plants and animals, protected by European and/or Flemish legislation. The concept of the network of ecological infrastructure is adapted in the stepwise guidelines (Part 2, Section 2).

The most important part of that network is situated at the border of the area or adjacent to it, but also in the vicinity of public infrastructures that have a relatively permanent character. The creation of the network is particularly important for the maintenance of a viable population of the Natterjack toad, an Annex IV species of the Habitats Directive (see Figure 1.6). The most important conclusion from these projects is that an effective protection of those species in a highly dynamic environment such as the port area is only possible if the protection is dealt with on a pro-active basis and on the level of the area itself, instead of on the level of particular occurrences that vary from year to year. The creation and maintenance of a network can thus be seen as a management plan for the protection of these species on the level of the port area. This plan involves the creation of new habitat in anticipation of the loss of existing areas that are expected to be lost to port development.

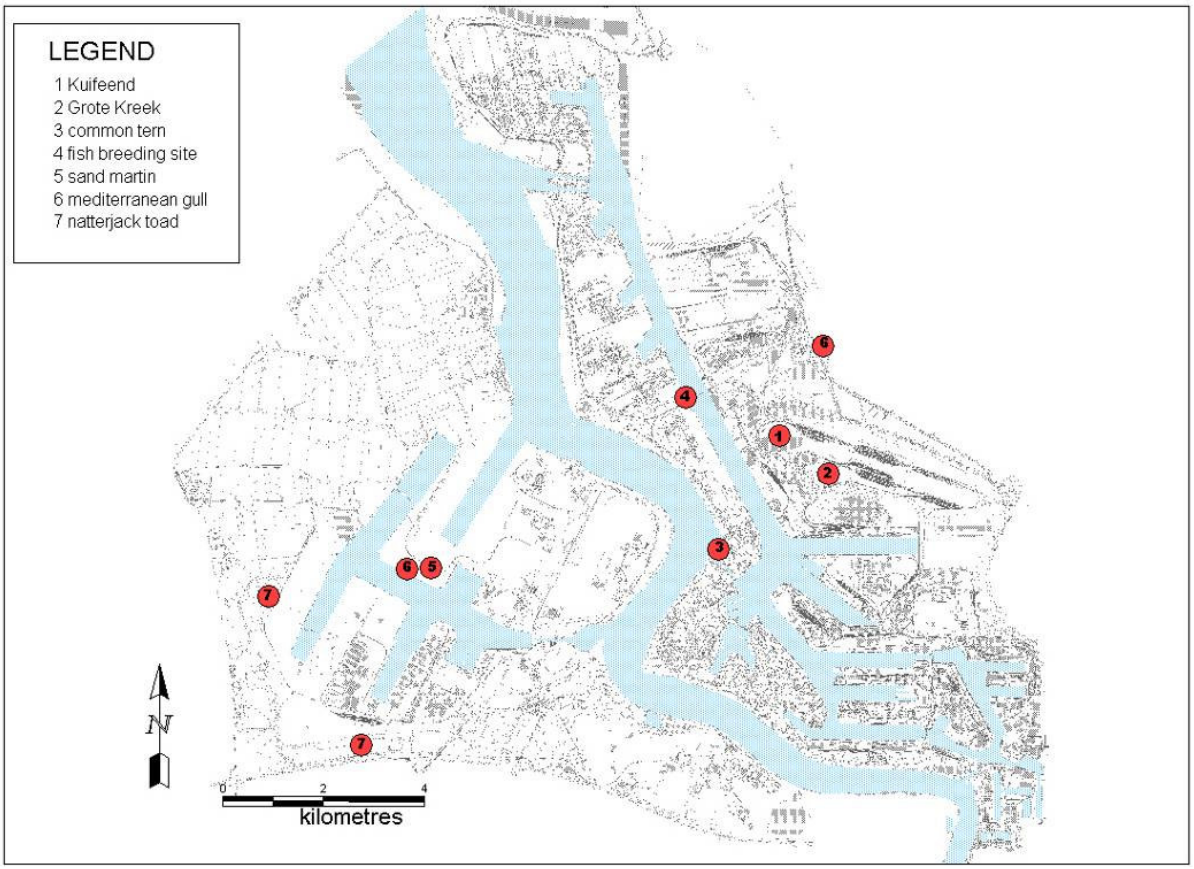
Besides species that are directly protected through the Habitats Directive, the network of ecological infrastructure is a useful instrument for the protection of birds under article 5 – 9 of the Birds Directive. Special attention is given to birds that have colonised the port area, and the replacement of their original habitats that have disappeared. Several investments have taken place during the past few years, some of which have been financed through the NEW! Delta initiative. The creation of “artificial habitat areas” inside the port for Swifts and Peregrine Falcons (on buildings), Sand Martins (during construction works), Mediterranean Gulls and Common Terns are examples of this.

Most investments are focused on the creation of suitable habitat on a permanent basis, in places inside the port that do not conflict with port development plans. However, although the creation of “temporary nature” is not a long-term solution it can make an important contribution to maintaining the conservation value of the port area. Therefore, protection plans with target values (in terms of numbers of breeding pairs and suitable habitat requirements in the port area) have been developed and serve as a framework for evaluating the situation on a global level.

In many cases, the relevant species are opportunistic in their choice of breeding sites, so that maintaining a viable population is practical reality. In other cases such as the “Marsh Helleborine” site, the situation had to be examined more carefully. In the context of NEW! Delta and with the participation of Alterra Green World Research and stakeholders, an experimental project has been set up to evaluate the possibility of displacement of the population to a place nearby the original site.

While the above projects exemplify the ambition to create and maintain (small) habitat areas inside the port area, others are intended to illustrate the need for an adequate management of border areas between areas of intense logistic activity and adjacent nature core areas. The “Kuifeend” and “Grote Kreek” investments therefore combine nature restoration with an effective buffering of these sites.

Figure 1.9 Overview of investment projects for the creation of ecological infrastructure in the Antwerp Port area



1.4 Analysis of the factors for success and failure

In Annex 1, factors for success and failure are described for various practical examples of habitat creation and restoration in coastal and estuarine areas. In this chapter we analyse the factors that determine success and failure, based on the information in Annex 1. A distinction has been made between factors of success and failure that are connected to the process and those that relate to ecological aspects of a restoration scheme. The analysis is based on the practical examples in Annex 1 and is therefore not necessarily comprehensive for all restoration schemes in general.

1.4.1 Process related aspects

Factors supporting a successful process

The case studies indicate that a range of factors contribute to establishing a successful process for delivering habitat restoration and creation schemes. These include:

- Clear need for the restoration/creation scheme – a considerable number of the schemes were required to deliver compensation for the negative effects of proposed plans or projects which were being taken forward for imperative reasons of over-riding public interest (IROPI). This creates a strong need for compensatory measures and creates an impetus in the planning system to deliver the requirements. It is also important to recognise that where projects are being delivered as compensation under the Habitats and Birds Directives the justification for the need stems entirely from an agreed assessment of the likely damage to Natura 2000 features and that the sequential tests laid down in the Habitats Directive concerning alternatives and IROPI have been addressed in a transparent manner.
- Policy support – the case studies provide examples of projects that were strongly supported in existing policy documents (e.g. ‘de Zilk’) and for which there was therefore a policy presumption that the projects would be taken forward.

- Clear objectives for the restoration/creation scheme- for many of the schemes described, there was a clear statement of the objectives of the project. This helps to identify suitable locations and to justify the preferred location against competing alternatives. It also helps to provide a focus for stakeholder support.
- Stakeholder engagement – a number of the case studies clearly demonstrate the benefits of engaging stakeholders early in the planning process, to enable them to contribute to the development of the proposal and to address potential concerns. Both of these aspects are important in engendering stakeholder support for proposals.
- Delivery of Multiple Benefits – schemes which deliver multiple benefits (e.g. nature conservation and recreation) can often attract broader support than single benefit schemes. While it can sometimes be difficult to reconcile such objectives on a project basis, it is often possible to deliver win-win solutions at a broader scale through the planning system. The case studies illustrate a number of examples of zoning to avoid potential conflicts
- Political support – some case studies identify conflicts between economic and nature conservation objectives. In such circumstances, political support for restoration proposals can be helpful in finding acceptable ways forward.
- Financial support – the majority of case studies had clearly defined funding arrangements and sufficient resources to ensure successful delivery. Where funding is in place, stakeholders are more likely to engage in the process because it is more certain that a project will proceed.
- Clear approval process – habitat creation and restoration projects are subject to a wide range of legal requirements under planning and environmental laws. A clear approvals process can facilitate meeting all the legal requirements, although none of the examples particularly demonstrate this.
- Effective Project Management – habitat creation and restoration schemes are complex projects and need to be managed as such. Success can be supported by clear project planning and management and effective communications with stakeholders.
- Public acceptance is important as well for the realization of restoration projects. This might be enhanced by informing the public (for example by information stands near restoration sites), nature education, accessibility and recreational use of areas.

Factors for failure

The factors responsible for process failures in the promotion of habitat creation/restoration schemes are largely the corollary of the success factors. For example, where the need for a project is uncertain, financial resources are not in place and the proposal conflicts with other objectives, the chances of a successful process are diminished. Table 1.2 provides a comparison of process-related factors affecting success and failure.

A widely recognised problem connected to compensation is the lack of compensation areas that are owned by the developer. As land purchase happens on a voluntary basis and landowners are not always willing to sell their land, this often frustrates the process. This can eventually lead to financial compensation by the developer where as physical compensation is the preferred option. Securing land at a realistic price that is not inflated because of a specific need (e.g. port compensation requiring a particular location) can be a serious impediment to progression of habitat creation projects solely for biodiversity reasons.

Table 1.2 Summary of process related factors for success and failure mentioned in the practical examples in Annex 1

Aspects	Factors for success	Factors for failure
Need for the project	• Need is clear and agreed • Political support	• Need is unclear
Policy Context	• Project is consistent with policy context	• Project deviates from policy context
Objectives	• Clear and agreed objectives	• Unclear/conflicting objectives
Stakeholder engagement	• Early engagement • Openness/responsiveness • Involving stakeholders as co-deliverers • Information/education	• Lack of engagement/openness
Spatial planning	• Delivery of multiple benefits and win-win solutions	• Property issues • Lack of compensation areas (linked with property issue)
Funding	• Funding available	• Lack of clear funding arrangements
Approval process	• Clear approval process	• Complex, unclear and fragmented approval process
Project Management	• Clear project plan • Effective project management • Effective stakeholder communication	
Public acceptance	• Enhanced by informing the public, nature education and accessibility	

1.4.2 Ecological related aspects

Factors for ecological success

From the examples examined it appears that a multi-species approach might be preferable when making a restoration plan, especially in areas where the faunal and floral diversity is considerable (for example in dune areas). A single species approach however can be often more successful because there are narrower parameters for success. The selection of appropriate indicator species that should be used in this approach is preferably based on scientific research. Involvement of nature specialists when making a restoration plan is wise to foresee development of nature values, and agreements concerning use of the new area with nature conservancy organisations (state and NGO's) must be made as early as possible in the planning process.

The short-term prospects of successful habitat creation in terms of biological functionality can be higher if it involves restoration of naturally dynamic and pioneer habitats. Furthermore, it can be concluded that larger areas for restoration schemes should be preferred. For example: joining larger dune areas offers better chances for the optimal functioning of natural biotopes and biota, as well as for the maintenance of typical natural and dynamic processes. Local factors might have an important influence on the ecological success of nature restoration schemes as well: for example, an isolated location will provide a breeding place free of predators. Another example is the spontaneous sand accretion that might locally occur, thus creating new coastal habitats. Therefore, when making a restoration scheme, these advantages in the local situation should be analysed and optimally used. In general a restoration project in the vicinity of existing habitat is preferable. However, there may be local circumstances where this cannot apply.

The importance of monitoring is also stressed as a factor of success, especially as a way of learning for future restoration plans and adaptive management. Monitoring will provide useful information for evaluating the success of a scheme. This information can be used in future restoration projects and will help these future projects to be carried out with a greater degree of success. Furthermore this information might be used for adaptive management of the sites that are already restored. Monitoring preferably consists of hydrology, the physical evolution and biodiversity.

Factors for ecological failure
In Annex 1 recreation is mentioned often as a factor of ecological failure. As an example it is mentioned that ground breeding birds and embryonic dunes are disturbed by people and dogs. More extreme is the conflict between leisure activities such as hunting and 4x4 driving and the need for minimal disturbance by breeding and foraging birds. Although information about wildlife disturbance and erosion of vegetation is available, the impacts of recreational developments are not always easy to assess. This might cause difficulties in the planning process when decisions have to be made about securing or opening certain areas. Zoning of recreational activities and the spatial configuration of habitats might help in solving the conflict of interests between nature and recreation. The use of natural barriers (for example channels) can facilitate some forms of zoning. Temporary restrictions on access to certain areas in the breeding season are a widely used technique to address such issues.

Scale is mentioned as a factor of failure as well: for example fragmentation of dune areas has an important negative impact along the coast. Another aspect related to the scale of a restoration scheme is the fact that restoration of large scale dynamic processes might no longer be possible because of limited space available.

Local conditions might hamper the development of a desired ecosystem as well. In Annex 1 factors such as water level and a location close to infrastructure are mentioned, but of course this list is unlimited. Furthermore, management is an important element for the sustainable development of certain habitat types. It is however not unusual that projects are being carried out while a clear plan for the management still has to be developed. Another factor for failure that is mentioned in an example in Annex 1 is the failure of the (artificial) infrastructure that was built to create habitats.

Table 1.3 Summary of ecology related factors for success and failure mentioned in the practical examples in Annex 1

	Factors for success	**Factors for failure**
Knowledge	• Nature specialist • Research • Monitoring	• Lack of recreational impact assessment • Unpredictability of natural dynamics
Scale	• Larger areas/Robustness	• Fragmentation of areas • Limited space
Effectiveness	• Choice of habitats/ multi-species approach • Dynamic natural situation • Presence of key conditions • A location in the vicinity of existing ecosystems	• Local limitations • Failure of infrastructure • No clear vision on management after construction
Disturbance	• Zoning of recreation activities	• Recreation

1.5 Techniques for habitat creation and restoration

In Table 1.4 techniques for habitat creation and restoration in coastal and estuarine areas that are used in the practical examples in Annex 1, are summarised. More information on habitat creation measures can be found for example in:

- ABP Research & Consultancy Ltd, 1998. Review of coastal habitat creation, restoration and recharge schemes. Report No- R. 909
- ABP Research & Consultancy Ltd, 1997. Design Scheme for habitat creation. Report No- R. 584(a)
- Defra & Environment Agency (2004a)
- Legget et al (2004)

From Table 1.4 it can be identified that a common technique for salt marsh and mudflat restoration is managed realignment. Elements of these techniques can include the breaching of existing sea defences, setting back of dikes and the re-profiling of a site. As a result of these measures the tidal and sea or river water influence is reintroduced and dynamic geomorphologic processes such as sedimentation and erosion are restored. Managed realignment is not merely a technique that is designed for nature restoration but is often part of coastal flood defence schemes, especially in the UK. There are relatively few examples of enhancement of existing muddy intertidal areas through sediment placement or recharge.

This is partly because such activities are only likely to provide temporary mitigation where such areas are naturally eroding as a result of climate change. However, such techniques potentially have a role as part of overall sediment management strategies within estuaries in seeking to maintain nature conservation value.

The construction of groynes can be an effective way of trapping sediment and creating new habitats in the vicinity of these structures. Such structures have created new habitats both in the Seine Estuary and the 'Baai van Heist' case study. However, such techniques can have potentially longer-term consequences for coastal processes as it involves disruption of sediment transport pathways and may cause erosion elsewhere in the coastal/estuary system depending on factors such as sediment supply and the geomorphology of the adjacent coastline.

Creation of new dune habitats might be realised by broadening the existing dune areas or by reclaiming land. In both cases sand is accreted. These kinds of techniques might be part of coastal flood defence projects or land reclamation projects for example for industrial activities. The benefits of creating these new habitats would need to be weighed against the loss of existing semi-natural habitats in near-shore areas.

Development of coastal habitats occurs unintentionally as well as a result of human activities in the coastal areas. This is the case in the practical examples of the 'Baai van Heist' (example 21), 'Van Dixhoorndriehoek' (example 23) and 'Kennemerstrand' (example 24). Creating a dynamic shoreline by creating tidal inlets in the first line of dunes is another way of creating specific dune habitats which has already been practiced in The Netherlands and Belgium. Nature protection is the most important trigger for these types of projects.

Figure 1.4. Technical measures for habitat creation and restoration. Left: sluices at the Seine estuary after construction (France); Right: artificial foreshore creation at Shotley (UK)

Techniques might be aimed at specific groups of species as well. Table 1.4 includes examples which are aimed at the creation of breeding habitat for coastal and colonial breeding bird species and fish spawning habitat. However, spontaneous settlement of species depending on pioneer habitat (such as Natterjack toad, Mediterranean gull) regularly occurs in the ruderal habitats that port areas can offer as well.

Techniques may vary in the extent to which site conditions are manipulated. In the case of the Seine estuary a sluice was constructed to permanently impose a water level fluctuation for nature conservation purposes specifically (see Figure 1.4). In nature restoration projects it is often a point of debate to what extent manipulation of the environment for nature conservation is acceptable.

A common element of most of the techniques in Table 1.4 is that the time between the action and response of the ecosystems is short. The explanation for this lies in the dynamic character of the ecosystems concerned.

The techniques that are eventually chosen in depend on a number of factors amongst others the primary (and secondary) project background, target habitat or species, the local circumstances, the extent to which site condition manipulation is accepted, the (cost) effectiveness of certain measures, financial resources etc.

Technique/habitat creation scheme	Measure	Target habitats	Primary project backgrounds	Practical example from annex 1
Dune creation by broadening the existing dune area	sand recharge	Wet dune slacks	Coastal flood defence	1
Land reclamation and successive dune creation	sand recharge	Grey dunes, white dunes, wet dune slacks, embryonic shifting dunes, shifting dunes	Compensation for industrial land reclamation projects	2, 23
Managed realignment	sea bank breach, inundation of agricultural land, set back of sea bank	Salt marsh, tidal mudflat, creek, brackish lagoon, (transitional) grassland, grazing marsh,	Coastal flood defence, nature protection and development	3, 4, 5, 7, 8, 9, 10, 11, 12
Foreshore creation	pumping of dredging material behind a artificial retaining bund of coarse gravel	Salt marsh/mudflat	Coastal flood defence (stop erosion of current sea wall)	6
Managed realignment including topsoil removal	Set back of banks, removal of the original topsoil, reintroducing tidal regimes and successive sedimentation	Salt marsh and mudflat	Compensation	13
Creation of breeding habitat for coastal and/or colonial breeders	removal of original vegetation, removal of topsoil or churn op the topsoil, adding shell rich sand (optional), creation of safe zones for ground breeders (by fences, ditches etc), mowing of the vegetation	Open sand or sand with pioneer vegetation, breeding habitat for species such as Mediterranean Gull, Common Tern and other coastal and colonial breeders	Nature protection and development	14, 15, 16, 17, 19
Creation of fish spawning areas in harbour areas	Removal of vegetation of river bank, digging of pond, connecting the pond to canal by pipes	Fish spawning pond for Common Bream, Roach, Redfin Perch, Rudd, Ide	Nature protection and development	18
Dynamic shoreline creation by creating tidal sea inlets in dune areas	Locally removal of first line of dunes and dune foot, creating depressions by removal of sand, reinforcing second line of dunes	Embryonic shifting dunes, white dunes, open sand	Nature protection and development, coastal zone management	20, 22
Construction of groins to enhance sedimentation processes	Construction of groins in estuary	Estuary, tidal flat	Nature protection and conservation	25
Digging of a environmental channel (including inlet and outlet)	Dredging	Estuary, tidal flat	Nature protection and conservation	25
Artificial water level management in estuarine environment	Digging a ditch network and a connecting channel and creating a sluice to impose water level variations	Estuary, tidal flat, embryonic shifting dunes	Nature protection and conservation	26

Table 1.4 Techniques and habitat creation schemes for nature restoration and creation in coastal and estuarine areas that are used in the practical example of annex 1

2 Considerations on site selection for habitat creation and restoration schemes

2.1 UK perspective

The number of habitat creation schemes in coastal and estuarine areas in the UK being planned and implemented has increased markedly over the last decade (Defra & Environment Agency, 2004a). These schemes are being undertaken for a number of reasons including:

- Compensation and mitigation for loss of habitat;
- Beneficial use of dredged material;
- Flood and coastal defence;
- Habitat development for nature conservation;
- Fishery and shellfishery production;
- Water quality improvement;
- Ground water recharge;
- Archaeological conservation;
- Tourism and recreation;
- Provision of educational and research opportunities; and
- Enhancement of urban landscapes.

The site selection process is largely determined by the underlying objectives/ targets of the scheme under consideration. Sites, for example, may be selected on an individual basis or as part of a strategic framework for an area. In the UK the main strategic estuarine and coastal plans, which incorporate managed realignment in decision-making are Shoreline Management Plans (SMPs) and Coastal Defence/Flood Management Strategies (FMS). Estuary Management Plans, Coastal Habitat Management Plans (CHaMPs) and Biodiversity Action Plans (BAPs) are additional tools that serve to inform the actions proposed in Shoreline Management Plans and Coastal Defence/Flood Management Strategies. Site selection for creation of compensatory habitat involves detailed evaluation to define the required parameters and to identify sites that will meet those requirements.

A review of site selection procedures was undertaken for the UK in 2004 (Defra & Environment Agency, 2004b). Between and within various agencies there are many initiatives concerned with identifying and selecting potential sites for habitat creation. These may be driven by different policies or strategies but generally the approaches and criteria used have much in common. Typically they include:

- A generic screening and filtering phase which is first applied to the full range of potential sites within a coastal or estuarine system. This generates a shortlist of candidate sites which can be investigated in greater detail. The filtering methodology ranges from Geographical Information System (GIS) tools to questionnaire based approaches.
- The use of criteria covering all aspects of site selection including environmental, economic, social and political factors.

A number of the approaches that have been employed involve the use of matrices and/ or multi-criteria analysis to rank potential sites against a set of generic criteria (e.g. ABPmer, 2002; Coutts and Roberts, 2003; Halcrow/EA, 2003). While the criteria used for each approach have been relatively consistent the methods used to provide an overall ranking are typically different. This is true not only in the way the scores for each parameter are combined but also in the methodology used to derive each of the individual scores. Typically the majority of parameters that have been considered are included in a qualitative rather than quantitative format (e.g. Binnie Black and Veatch, 2000). The weighting applied to each of the parameters varies according to the main driver for site selection. Conservation agencies, for example, may weight the environmental criteria for habitat creation more highly than stakeholders who are looking for sites for flood and coastal defence. The 2004 review indicated that the main controls on site selection for conservation management in relation to flood and coastal defence projects was largely pragmatic and overriding factors such as land purchase and other socio-economic factors tended to take priority over more environmental objectives.

2.2 French perspective: experiences from the Seine Estuary

Administration in France is based on regional structures and habitat creation and restoration are implemented at a regional scale.

The most important experience of habitat creation and restoration in the Seine Estuary is linked to compensation and mitigation for the port of Le Havre extension called “Port 2000”. Other objectives such as habitat development for nature conservation, water quality improvement, and beneficial use of dredging material have been considered more recently.

The Seine estuary is highly urbanised and industrialised; ports, industry, towns and villages are widely spread and continue to expand. Issues associated with competition for space are resolved on a pragmatic basis rather than using a complex multi-factorial approach. Possible sites for creation and restoration of habitats are limited and have to be found in:

- port areas that are designated as having a natural purpose and where no more port development is allowed
- agricultural land
- the national reserve of the Seine estuary

The site selection is determined by the targets for the project under consideration. For example, if saltmarsh is required, solutions will be sought in the marine or brackish part of the estuary. If the purpose is to create new mudflats, these will need to be created in the vicinity of existing ones. For compensation measures, European guidance indicates that the sites selected should be as close as possible to the location that will be damaged. Furthermore the habitat creation schemes should avoid impacts to protected species, taking account of scientific advice. Advice from scientists working for the scientific counsels (one fro the national reserve and one for the whole estuary) have been important in identifying potentially suitable locations for habitat creation.

The last issue is the ownership of land. The State is the owner of most of the national reserve and of some port areas. Ports are landowners too. If the project can be carried out on a public property or- in case of compensation- on port property, it will be a benefit in terms of time and costs. If it is not possible, the site selection will be finally strongly determined by the possibilities of land purchase.

2.3 Demonstration site ‘’De Zilk’’ (The Netherlands)

The main issues for restoration projects in the Province of South-Holland are loss of natural conservation interest as a result of ground water abstraction for drinking water purposes, flood and coastal defence and compensation measures. Site selection for habitat creation projects is strongly determined by the requirement that compensation has to be found in the vicinity of the affected area and/or in a more or less similar area. The Province of South-Holland province is a densely urbanised and industrialised area that is bordered by an extensive, protected dune area. As a result the majority of the nature restoration and creation projects are located in the dune areas. The following examples are an illustration of the latter.

The demonstration site ‘’De Zilk’’ is a project that aims to restore wet dune slacks by stopping or changing the location of the groundwater extraction. The project was initiated by the drinking water company and the Province of South-Holland. Like most of the coastal dunes in The Netherlands, De Zilk is part of a Natura 2000 area. The goals mentioned in the designation publications of this area focus on the restoration of wet dune slacks as well. Previously, an agreement was made between the Province of South-Holland and the drinking water company for restoration of the dune areas Meijendel and Berkheide (between The Hague and Katwijk). A number of restoration measures have already been undertaken here, and the implementation of the final restoration measures is due to start in 2007.

New models for flood and coastal defence showed that there were some coastal stretches where safety was not guaranteed for the next 50 years. One of those areas is situated between The Hague and Hoek of Holland. Measures planned to improve its coastal defence function lead to obligatory compensation as well.

However, in the coastal defence project compensation for other projects is incorporated as well. For example, the compensation of a wet dune slack as a result of the Project Mainport Rotterdam, is included in the flood and coastal defence plans.

2.4 Demonstration site Port of Antwerp

In the Port of Antwerp area there are three main reasons for nature restoration or creation. They are illustrated in Textbox 2.1. Depending on the policy context it is important to take different criteria into consideration when selecting a site for nature restoration or creation.

For compensation plans, for instance, there are important legal constraints to respect: it is for example important to compensate the same habitat type that is deteriorated or will disappear and the compensation site may not be too far away from the original site. Those constraints strongly influence the location of the site where compensation can be implemented. For instance, for the Deurganck dock project, compensation for the disappearance of a fresh water habitat was required (example 18, Annex 1). This strongly reduced the number of suitable locations.

For the ecological infrastructure in the Port of Antwerp, which might be temporary (for example in the case of breeding habitat for pioneer species such as some colony breeders), economic development has to be taken into account. This again strongly influences the choices for site location. Nevertheless it is the challenge to try to find the sites where the chance of disappearance of the investment in the ecological infrastructure because of population or other dynamics is as low as possible.

For nature creation/restoration in the framework of a nature management plan for a Natura 2000 site the ecological requirements are greater to achieve long term conservation objectives. This requires a clear focus on identifying the appropriate physical and biotic factors necessary to successfully create/restore habitats.

A spatial analysis of relevant population structures/distributions may assist the site selection process where compensation requirements primarily relate to species. In the demonstration project ‘Port of Antwerp’ the ecological population model *LARCH* was used for this spatial analysis. The outcome of the model is an indication of sites suited for a sustainable conservation of a species (taking into account the risk of extinction due to population dynamics).

From the experiences in the demonstration project ‘Port of Antwerp’’, consideration of the following questions has proven to be helpful:

- From an ecological point of view:
  - What is the abiotic situation of a site and its surrounding environment? (for example groundwater level, soil characteristics)
  - What is the biotic situation of a site and its surrounding environment? (stocktaking of the species present)
  - What are the ecological possibilities? Are there populations of target species in the vicinity (migration, colonisation)? Determined through expert judgement
  - Does it fit in/enhances the aims of a coherent nature network/connected nature (on an European, Flemish and/or more local scale)
- From a practical point of view, (because time and money are always limiting factors):
  - What land use is defined in the zoning plan?
  - Who owns the land?
  - Can a building permit be obtained for the project?
- Typical for harbours (is also relevant for other industries/areas human activities are dominant):
  - It should not inhibit or obstruct economic activity.
  - Which are the planned port infrastructures in and around the site
  - Are there pipelines? Are there other infrastructures (e.g. weather station)?

The list of questions is preferably supplemented with wider research experience in identifying suitability criteria.

It is important to emphasise that in a seaport area like the Antwerp port area the main function remains maritime-port activities. The Flemish government has recognised, on several occasions, the strategic importance of ports, and the Port of Antwerp in particular. However, national and international nature policy should be complied with as well and the Antwerp Port Authority has a strong commitment to investigate the possibilities of combining port development with nature creation, restoration and enhancement.

Textbox 2.1 Main policy contexts for habitat creation and restoration in and around the Antwerp Port area

Management plans/management schemes
Article 6.1 of the Habitats Directive states that Member States shall establish for special areas of conservation the necessary conservation measures involving, if need be, appropriate management plans specifically designed for the sites or integrated into other development plans, and appropriate statutory, administrative or contractual measures which correspond to the ecological requirements of the natural habitat types in Annex I and the species in Annex II present on the sites.
Habitat restoration or creation can be part of such a management plan in order to meet the conservation objectives set out for a special area of conservation and thus bring the site to a good state of conservation.
An example in the NEW!Delta project is 'De Zilk', described in this report.
Another example is situated in the port of Antwerp where the special areas of conservation and the special protection areas designated under the Habitats and Birds Directive in or in the vicinity of the port are the object of a large nature management plan (*Achtergrondnota Natuur)* with the aim to bring all those sites in a good conservation status so that port expansion projects can take place without deteriorating the coherence of the sites. In the framework of this nature management plan habitat restoration and creation takes place.

Compensation plans
When a plan or project has a significant negative effect on a Natura 2000 site, in view of the site's conservation objectives, one of the constraints to go further with the plan or project are compensation measures that will ensure that the overall coherence of the Natura 2000 network is ensured (Article 6.4 of the Habitats Directive). Port projects might have negative effects on Natura 2000 sites: compensatory measures have thus to be taken in the vicinity of these ports. A good example is the compensation plan that was developed for the port expansion project *Deurganckdock* in the Port of Antwerp (see case study for theme 1 on the NEW!Delta website). Other examples of compensation projects for port projects can be found in Annex 1.

Ecological infrastructure in ports
In harbours nature can be found on fallow land, unused bits of land (for instance when enclosed by road infrastructures), pipeline zones, etc. These locations often have important nature conservation value because they include dynamic and pioneer habitats that are becoming hard to find outside port areas and because they are often not accessible to public and thus quite undisturbed. Specific ecological values of port areas are, for example, temporary nature such as Natterjack Toad ponds, breeding places for coastal breeders such as the Common Tern and the Mediterranean Gull on pioneer habitat, ecologically managed verges, etc. Some of those habitats and species are protected under the Birds and Habitats Directives.
The Flemish policy document for spatial planning, *the Structure Plan for Flanders*, sets the objective to keep 5% of the Flemish seaport areas as "ecological infrastructure", these are small nature elements that are compatible with the economic function of the port area and do not hinder the ports economic function.
This ecological infrastructure has two functions: on the one hand it has a supportive role for the larger nature entities located outside the port, on the other hand there are some species of which the main habitat is situated in the port area and thus ecological infrastructure serves to contribute to the protection and conservation of those species.
The collaboration project 'the port of Antwerp in a more Natural way' between the port of Antwerp Authority and *Natuurpunt*, the largest Nature NGO in Flanders, described in chapter 1.3, aims to create and restore nature for realising a network of ecological infrastructure in the port of Antwerp. The investment project in the Port of Antwerp in the framework of NEW! Delta project as described in section 1.3 fits within this policy context.

2.5 Conclusions on site selection

The site selection process is largely determined by the underlying objective of the nature restoration and creation scheme. Roughly it can be said that projects are initiated on an individual basis or as a part of a strategic framework. Compensation projects for example can be regarded as individual projects: this is true for France, the UK, The Netherlands and Belgium.

The strategic framework for restoration and creation projects might differ from country to country. Strategic frameworks are for example offered by Shoreline Management Plans, Coastal Defence/Flood Management Strategies, Estuary Management Plans, Coastal Habitat Management Plans, Biodiversity Action Plans, Integrated Coastal Management plans, European, national or regional Ecological Networks (e.g.. Natura 2000, VEN in Flanders, EHS in The Netherlands). In estuarine and coastal areas, nature conservation and flood and coastal defence management are key issues in these kind of strategic frameworks.

Ideally, for site selection a generic screening or filtering should be applied to the full range of potential sites within a coastal or estuarine ecosystem using criteria for all relevant aspects. Relevant aspects are (not exhaustive) environment, policy, economy and social factors and a multi-criteria analysis is a suitable tool to carry out such a screening. This screening should fit within the relevant strategic framework. In practice however, pragmatic motives are decisive in the site selection process. A key pragmatic motive for example is the opportunity for land purchase. This motive is connected to limited resources in terms of time and money and the high pressure on the scarce space in heavily urbanised and industrialised areas. The possibility of obtaining land often overrules the outcomes of multi-criteria based site selection processes especially because compulsory land purchase is time consuming and expensive. This is one of the reasons that habitat restoration and creation projects are often located in existing protected areas and/or land that is owned by authorities or –in the case of development in port areas- by ports themselves. This might not coincide with the location that is optimal from nature conservation point of view. Public acceptance of projects is of major importance in the definite site selection as well.

3 Port planning and nature policy and legislation in the United Kingdom, France, Belgium and the Netherlands

3.1 Introduction

In the previous chapters we have described current practices when implementing habitat restoration and restoration schemes in coastal and estuarine areas. The information is based on information from the practical examples in Annex 1 and the demonstration projects 'De Zilk' and 'Port of Antwerp'. In this section the main focus is on the way port planning, nature policy and legislation is dealt with in the NEW!Delta partner countries UK, France, Belgium and The Netherlands. The implementation of the Birds and Habitats Directives and the relation between the implementation of these Directives and port planning is given special attention. In Table 3.1 differences between countries are summarised.

3.2 United Kingdom

In the UK the designation of Natura 2000 areas is largely complete as far as the nearshore environment but has yet to be undertaken offshore. Various SAC arising from the last moderation tranche have yet to be submitted (at the time of writing). SPA boundaries are continuously updated to reflect increased knowledge or changes in bird usage. Maps of the SPA's and SAC's are available. The consultation on, and subsequent notification of landowners concerning the designation of the Natura 2000 areas was undertaken by the Country Agencies on behalf of Defra (Department for the Environment Food and Rural Affairs) who are ultimately responsible for submission to Europe and for reporting on the status of sites.

SPA's and SAC's have to be underpinned by the status Site of Special Scientific Interest i.e. the national designation of nature conservation interest. The process of selecting and designating SSSI follows a rigorous process that involves extensive public consultation. The level of opposition by landowners and other stakeholders is variable but in the case of some SPA's and SAC's can be considerable: there is one site where opposition has been ongoing for 10 years and has not abated.

Conservation objectives for Natura 2000 in the coastal and marine environments have been provided under Regulation 33 of the Habitats Regulations. Natura sites on the coast that require management all have management schemes under Regulation 34 of the Habitats Regulations. Management of the sites is according to the site management objectives. In many areas work is ongoing to restore or create coastal and estuarine areas. Managed realignment is the most frequently used restoration technique.

Ports and nature

Ports in the UK are required to assess the potential impacts of new developments upon the site integrity of Special Protection Areas (SPA), under the EC Birds Directive (79/409/EEC), and Special Areas of Conservation (SAC), under the Habitats Directive (92/43/EEC). The same provisions also apply as a matter of policy to Ramsar Sites. The requirements of the Habitats Directive have been transposed into UK legislation through the Conservation (Natural Habitats &c.) Regulations 1994 and the Conservation (Natural Habitats &c.)(Northern Ireland) 1995 Regulations, known as the Habitats Regulations. The Regulations place a general duty on all statutory authorities (i.e. bodies with particular legal responsibilities) to perform their responsibilities in accordance with the Habitats Directive. A European Marine Site is described in the Habitats Regulations as a European site (either SPA or SAC) so far as it consists of marine areas.

In the UK port developments and activities frequently occur in or adjacent to European Marine Sites. In 1999 good practice guidelines for ports and harbours operating within or near UK European marine sites were produced (ABP Research & Consultancy, 1999). This listed the number of ports and harbours located in or adjacent to possible and candidate marine SAC's and/ or SPA's with an intertidal element, at over 110. Many estuaries, inlets and bays also contain smaller ports, harbours and piers, which were not included in this total. Therefore the total number of ports and harbours actually within or near European marine sites will be considerably higher. The numbers will also have increased since the date the report was initially published. There is therefore a considerable overlap between nature conservation interests and port activity in the UK as 1/3 or more of the UK coast is

designated as SAC's and they include major economic zones on for example the Mersey, Humber, Thames and Severn. Conflicts between the occurrence of species protected by the Birds and Habitats Directives and port activities are rarely, if ever, an important issue. However, there have been significant conflicts between port development and nature conservation. For example, land reclaimed for port development in the 1970's at Dibden Bay Southampton Water has subsequently been designated as a Site of Special Scientific Interest (SSSI) and Special Protection Area. This contributed to the refusal of the Dibden Bay Port development. On the Mersey Estuary, land reclaimed at Seaforth for future port activities has also been designated as a SSSI and Special Protection Area, effectively sterilising it for future port use.

Where a proposed port development has the potential to impact upon a designated site (SPA, SAC or Ramsar site) competent authorities, before deciding to grant permission, must undertake inappropriate assessment. In some circumstances, the port authority may also be a competent authority and have to produce an appropriate assessment. Through consultation with the Country Agencies three options may arise:

- No adverse affect (i.e. article 6.3 and 6.4 are effectively satisfied);
- Cannot determine no adverse affect i.e. the levels of confidence of no affect are not sufficient and a precautionary approach is required (i.e. compensatory measures); and
- There is an adverse affect and compensatory measures will be required.

Where agreement about compensation is reached and approval for a compensation scheme is granted, compensatory habitat is usually located outside of the boundary of the port estate. The required amount of land is therefore purchased, or rented, from local landowners at the time of consent and on a scheme by scheme basis. The identification of suitable compensatory habitat is therefore governed by a number of complex factors and may be influenced by additional factors that include:

- Proximity to the area of loss;
- Type of habitat that is required;
- Estuary wide strategies; and
- Site specific parameters.

Port industry in the UK is essentially privatised or privately funded. As a result it is not current practice for port companies to publicise future development plans as there are obvious issues involving competition between ports for customers. There is also a risk that where proposals are publicised the value of land suitable for compensation will rise to an uneconomic level and may limit options.

3.3 France

In France the designation of the SAC's and SPA's was finalised in March 2007. For every Natura 2000 area the boundaries are now fixed and a map of each designated area is available. On a national level the Ministry of Ecology and Sustainable Development has been responsible for the designation of the areas. Although French regulation says that only towns and towns' groups should be consulted in the designation process, the actual consultation was much larger. The main attitude of stakeholders towards the designations of the Natura 2000 areas was not positive.

The Birds and Habitats Directives are transposed into French regulation through the Code of Environment. For each site (SPA or SAC), a document called "objectives document" (DOCOB) has to define objectives for management and conservation of the area. It is negotiated with stakeholders and does not forbid human activities as long as they have no significant effects on species or habitats. Information included in this document will be regularly updated. The Seine estuary is the only one that has a ''document d'objectif''. Management plans are not available yet for Natura 2000 areas in coastal and estuarine areas.

In coastal and estuarine areas nature reserves are usually included in Natura 2000 areas, but this is not always the case. The criterion for the designation of SPA's in coastal and estuarine areas was the occurrence of protected wetland bird species of annex I of the Birds Directive. The SAC's contain estuarine habitats of great ecological importance. The French 'cahiers d'habitats' (habitat books) focus upon benthos communities in coastal and estuarine areas.. In France SPA's are usually much larger than SAC's because birds need diversity in their life areas.

SAC's are strictly limited to areas where the protected species occur. In the Seine delta for example there is one large SPA and several smaller SAC's. The main size of SPA's is around 2000 ha and the main size of SAC's is around 1000 ha divided into smaller pieces.

Not all Natura 2000 areas in estuaries have achieved favourable conservation status yet. The Gironde for example is in favourable conservation status, the Loire is medium and the Seine is in a bad status of conservation. In the case of the Seine Estuary this means it is beneficial to promote restoration plans. Restoration can be effective if the conditions in the Natura 2000 haven't changed irreversibly and if projects are realistic with fair financial and social costs. Sometimes proper management of a site might be more effective then ecological engineering measures.

Ports and nature

Ports are located outside SPA's and SAC's but frequently in the vicinity. Other (economic) activities in or in the vicinity of SPA's and SAC's are towns, recreation, industry, agriculture, hunting and reed cutting. The vicinity of ports in SPA's and SAC's means that there are overlaps and possible conflicts between ports development and protection of the designated sites. The conflicts are based on differences in interest, incompatible use and covetousness about land especially in the scarce space like the Seine Estuary. In other French estuaries there is more space.

In the Seine Estuary the conflict was solved by sharing the land between economic development and nature areas. The size of the nature areas is quite limited and for a good ecological functioning the nature areas depend on areas that in future will be used for economic development and therefore will disappear as natural lands. This can endanger the natural values of the estuarine ecosystem.

Conflicts between economic activity and the occurrence of species protected by the Birds and Habitats Directive have been reported in France as well. An example of this is the delay in port developing works of Port 2000 in the Seine Estuary because of the presence of breeding protected species. The fact that nature areas and development areas are spatially woven in the Seine Estuary might well cause more conflicts in the future: after all, protection of the nature areas will probably improve the conditions for wildlife to live and breed, and as a result protected species will probably migrate further to development areas.

In France, ports are largely autonomous and have mainly an economic vision, even if they have a public status and are under control of a Civil Service central authority. Their strategies are not completely public as they are in competition with other ports.

When a port project has a potential negative impact on the environment, it is required to produce an Environmental Impact Assessment for the permit delivery procedure. Furthermore, if the development has a potential impact on a Natura 2000 site, an Appropriate Assessment will be produced. In practice, the two kinds of assessments are gathered in only one document. If mitigation does not prevent the negative impacts of the project, Imperative Reasons of Overriding Public Interest can be put forward. It is then decided by the central authorities at the State level after getting the advice of the European Commission.

Spatial planning processes need to be well prepared in coastal and estuarine areas where nature conservation and economic development interact. This is necessary to prevent difficulties on issues such as political will about what is expected in the considered area, insufficient space left to nature that does not allow it to maintain itself, lack of knowledge due to insufficient monitoring, uncertainties about the results of ecological engineering because of lack of experience and conflicts with stakeholders about the use of the land.

In the case of the Seine Estuary, the purpose of the long term vision that is currently in implementation (see Theme 4, NEW!Delta) is precisely made to prevent some of those difficulties. One particular thing in France is that rivers are usually boundaries between regions or departments and these boundaries do not reflect estuarine ecosystem functioning. This means that when making a plan for a certain estuary it is necessary to involve several public authorities at the same level and many stakeholders.

Scarce space is one of the main problems nature conservation in the Seine Estuary is facing. The limits of the development and nature areas are now fixed by the Local Planning Directive and, because of pressure of ports, industry and towns it is no use to make investments for nature out of its own area. This means that to implement an ecological project, it is necessary to destroy another kind of nature. In these conditions, it can be difficult to establish the desired habitats unless the existing physical conditions at the site can be modified. The share of the land coming from the Local Planning Directives can be one way to provide some kind of certainty for ports development as it delimitates an area where infrastructural projects can be located, out of the Natura 2000 sites. Then, the aspects to discuss with stakeholders, are the assessment of the effects of the project on existing natural values in the development area and the external effects on the protected natural sites.

In the previous economic development projects in the Seine Estuary, especially Port 2000, the discussions with some stakeholders like farmers and hunters were especially difficult because they felt that they were being pushed out of the area by every kind of project, both for development or environment. Long term visions or special agreements are possible ways to make discussions easier.

3.4 Belgium

Belgium contains one major estuary, the Schelde Estuary which is designated both as an SPA and SAC. Although the boundaries of the SPA's and SAC's are fixed and reported in maps (see www.gisvlaanderen.nl), the designations of the SAC's are not final yet. Management plans are not available yet for the Natura 2000 areas in coastal and estuarine areas. The competent authority for the designation is the Flemish region.

The Natura 2000 areas in the Schelde Estuary contain amongst others nature reserves, docks, industrial areas and agricultural areas (see Figure 1.8). The SPA is especially broadly designated. A key criterion for the designation of the SPA in the Schelde Estuary was the recording of the presence of protected species from annex 1 of the Birds Directive. The boundaries of the SPA were based on spatial planning units and not ecological functionality.

In the Schelde Estuary the development of robust nature in nature cores is promoted (see Textbox 2.1). The location of nature creation and restoration sites in this approach is not restricted to areas designated under the Birds and Habitats Directives. It is regarded more important that the nature creation and restoration areas function in an ecological network.

Ports and nature

Most of the Port of Antwerp on the Left Schelde Bank is located in a SPA. The SAC does not overlap with the port, although the SAC contains pipelines and other smaller infrastructural elements that are connected to port activity.

All four Belgian seaports are located in Flanders: Ostend, Zeebrugge, Gent and the Port of Antwerp. Following recent state reformations the Flemish region is the competent authority for amongst others ports, nature conservation and spatial planning policy. The Flemish ports are regulated through a port decree (1999). All ports are local public authorities and autonomous municipal port authorities.

According to the port decree, the port authority is the manager of the seaport area. It is competent for all related matters. The Flemish administrations remain however still competent within the port area (for instance for roads of Flemish importance, nature, etc.). The locks are managed and paid for by the Flemish government as is the dredging in maritime access.

The Port Authority owns the docks and the sites used by port operators and industrial companies. It is, moreover, the owner of part of the port equipment. The Port Authority owns and manages docks, berths, locks, etc. It is responsible for planning, expanding, modernising and maintaining the infrastructure of the port, and also operates its own equipment, including warehouses, floating cranes, shore cranes, tugs and dredgers. The Port Authority also leases sites and land and is responsible for the distribution of electricity in the port.

In 1999, the Flemish Government decided that every Flemish port should have a strategic plan leading amongst other things to a new spatial implementation plan setting the limits of the seaport area. In this strategic plan an evaluation of the demands for good coexistence between ports and nature conservation is often included.

The Nature Policy Decree is an overall decree including the transposition of the European Birds and Habitats Directives. Management plans for Article 6 of the Habitats Directive are called *natuurrichtplan* in Dutch and are regulated through a separated decision of the Flemish government. At present, there are no *natuurrichtplan* but several pilot projects are being established.

An element of Flemish nature conservation policy is, complementary to the Natura 2000 network and to the network of ecological infrastructure (see below), the Flemish ecological network (Vlaams Ecologisch Network (VEN)) and the Integral Connecting and Supporting Network (Integraal Verwevings en ondersteunend network (IVON)). This is composed of nature reserves in the classical sense and connecting areas where multifunctional land use is promoted where possible.

Ecological infrastructure is a concept of the spatial planning policy, not of nature policy. It is a terminology used in the Spatial Structure Plan of Flanders (RSV), the Flemish policy document for spatial planning at the level of Flanders. The Spatial Structure Plan of Flanders states that ecological infrastructure in port areas has to be located in a way that it does not obstruct (related) activities. The selection of sites for the network of ecological infrastructure has to take into account the infrastructural and economical value of the area, now and in the future. The amount of ecological infrastructure should reach a maximum of 5% for the port areas overall (comprising all Flemish ports: Ostend, Zeebrugge, Ghent and Antwerp), percentages within individual ports may vary.

The protection of species from the Birds and Habitats Directives has only recently being given more attention in Belgium. In the Port of Antwerp this –amongst others- has led to the development of a network of ecological infrastructure inside the port area; a network consisting of small core areas, linked through corridors and stepping stones (see Section 1.3). The network of ecological infrastructure has two functions. On the one hand, it will support the large nature areas that surround or will surround the port area in the immediate future. So, in order to preserve the long term integrity of the special protection areas (SPA's) overlapping with the port area, a nature development scheme has been set up to enforce and expand to a significant extent the already existing nature areas. On the other hand the network will create the physical backbone for the maintenance or the creation of a sustainable populations for several "port specific'' species of plants and animals, protected by European and/or Flemish legislation.

3.5 The Netherlands

In the Netherlands the designation of Natura 2000 areas has not been finalised. The location of the proposed designated areas is clear, however, and maps of these areas are available. In general it can be said that on land SAC's largely overlap with current nature reserves (for example the coastal dune areas). For SPA's this is not the case: these areas might be located in nature reserves but they are often located in agricultural areas as well. In the coastal zone and the estuarine areas, SPA's and SAC's are often located in open water as well. The Dutch Ministry of Agriculture, Nature and Food Quality is responsible for the designation process. An extensive consultation of stakeholders was organised in the process of the (pre)designation.

For the (pre)designation of SAC's the occurrence of habitats protected by the Habitats Directive was an important criterion for selection, for the (pre)designation of SPA's the presence of breeding or wintering bird species protected by annex 1 of the Birds directive was often decisive. The size of the Natura 2000 areas is highly variable.

Management plans for the Natura 2000 areas are not yet available. These plans have to be delivered within three years after the final designation. A considerable part of the Dutch coastal dune area is (pre)designated as a Natura 2000 area. However, these areas are faced with current uses that do not always benefit the natural values in these areas. One example is the ground water abstraction for drinking water purposes in these dune areas (see the demonstration project ''De Zilk'', Section 1.2).

It is not always possible to stop these ground water abstractions because of the public importance of this activity. In these cases nature restoration within these areas is an adequate way of helping to achieve the favourable conditions of these sites.

Ports and nature: the Port of Rotterdam perspective
Ports in the Netherlands are mostly public (municipalities), but large ports like the Port of Rotterdam are partially privatised. Ports might be located in the vicinity of Natura 2000 areas. In Rotterdam the present port area is not located in a Natura 2000 area. However the Port of Rotterdam does deal with the external influence of port development activities on the Natura 2000 areas and with species protection under the Birds and Habitats Directive. The port expansion project Maasvlakte 2 (practical example 24, Annex 1) is located in a Natura 2000 area. This project is not included in the rest of this chapter because it is a separate project organisation and the problems that have to be dealt with in this project are very specific.

In The Netherlands conflicts occur between the port development and Natura 2000 area: examples of these conflicts include expansion plans for the port of Vlissingen and the expansion project Maasvlakte 2. Furthermore the occurrence of species protected by the Birds and Habitats Directive on fallow land in port areas that still has to be developed, might delay economic activities. The species are mainly pioneer species of dynamic environments and the occurrence of these species is often referred to as temporary nature.

Ports are required to assess the potential impacts of new developments upon the site integrity of Special Protection Areas (SPA), under the EC Birds Directive (79/409/EEC), and Special Areas of Conservation (SAC), under the Habitats Directive (92/43/EEC). The requirements of the Habitats Directive have been transposed into Dutch legislation through the Flora and Fauna Act (species protection), 2002 and the Nature Conservation Act (area protection), 2005.

Flora and Fauna Act, 2002 (Flora and Faunawet)
This Act regulates protection of wild plant and animal species. It includes those aspects of the Habitats Directive and Wild Birds Directive dealing with species protection, and the Convention on International Trade in Endangered Species of Wild Fauna and Flora. Activities that may be damaging to protected species are essentially prohibited. It includes a duty of care, applying to all animals and plants. Finally, the Act also allows landscape elements to be designated protected habitat.

In February 2005 an amended regulation to the Flora and Fauna Act was accepted that regulates that dispensation is not always required in order to perform activities. In this way the time-consuming dispensation procedures can be avoided. An exemption now applies for recurrent activities and spatial development. In brief the regulations amount to the following:

Table 1 - Common species: general exemption or dispensation/cursory assessment.
These common species are subject to the lowest form of protection. If these species are found on the site an exemption from the prohibitions in the Flora and Fauna Act applies.

Table 2 - Other species: exemption with code of behaviour or dispensation/cursory assessment.
These species receive more extensive protection. An exemption only applies in the case of recurrent activities and spatial development, if you act in accordance with a code of behaviour approved by the Minister of Agriculture, Nature and Food Quality. In the case of activities other than those described, you must apply for a dispensation.

Table 3 – Species referred to in Annex IV of the Habitats Directive and in Annex 1 of the Order in Council: exemption with code of behaviour or dispensation/extensive test.
These species enjoy the most extensive protection. Even in the case of recurrent activities, it still depends on the precise nature of the activities whether an exemption with a code of behaviour applies or whether a dispensation subject to an extensive test is required. In the case of spatial development and changes in land use you must always apply for these kinds of dispensation; there is provision for exemption with a code of behaviour.

Bird species are not included in the tables. All birds in The Netherlands are equally protected. Activities or the use of space whereby birds are killed or startled, or their nests or roosting places disturbed are prohibited. Activities referred to as recurrent activities and spatial development both qualify for an exemption if the activity is undertaken in accordance with an approved code of behaviour. In respect of all other activities it is necessary to apply for a dispensation. The application will then be subjected to the extensive test. In the case of birds the risk of disruption, killing or the disturbance of nests or roosting places or abodes will be greatest in the breeding season. If the activities take place outside the season a dispensation will not generally be required.

The Port of Rotterdam Authority has formulated an area specific policy to deal with the issues of species protection in a comprehensive manner, so as to avoid the delays in the projects and extra costs, which a case-by-case reaction would entail. The approach, the so-called nature management plan, contains the following activities:

1. Collection of monitoring data of all protected species and nature values in the area of the Port of Rotterdam, every year;
2. Making a plan for the protected species (table 2 and 3) in the port area, to maintain “favourable conservation status”. This might require mitigation or compensation. Sometimes larger study areas are surveyed, in order to check that the species are connected with populations outside the port area;
3. Translating the specific nature obligations in the protection plans into spatial pre-requisites or design compensation areas and monitoring plans;
4. Establishing a code of behaviour for sustainable maintenance of the present infrastructure (pipe line corridors, road, quay walls and railway), matching the nature obligations and port activities;
5. Applying a “dispensation” in advance on the Flora and Fauna Act for a limited number of species for the remaining `waste` commercial sites in the port area. This means that the measures described in the protection plans to maintain “favourable conservation status” are taken before the dispensation comes into force.

Nature Conservation Act (Natuurbeschermingswet)
On 1 October 2005 the amended Nature Conservation Act 1998 came into force. Nature areas designated under the Birds and Habitats Directives are secured under this specific Dutch law. The Netherlands will apply a permit system, with permits issued by the provincial governments or the Ministry of Agriculture, Nature and Food Quality. This will ensure that future projects that may affect Natura 2000 areas, will be evaluated most carefully. The reasons for designation and conservation objectives are included in the designation decision and will be formalised under Dutch Law.
In the coming years a management plan has to be drawn up for these areas. This period is essential for the Port of Rotterdam because the management plan gives direction how to maintain/expand the different kind of habitat types, how to protect the species in the Natura 2000 areas and how to deal with external influence of the surrounding areas. The Port of Rotterdam will lobby for taking into account all the external influence of existing activities and future developments of the surrounding (port) areas.

Table 3.1 Differences between France, Netherlands, UK and Belgium for aspects concerning port planning and nature policy and legislation

	France	Netherlands	UK	Belgium (Flanders)
Nature protection laws (Transposition of Bird and Habitats Directive).	Regulation: Code of Environment.	Flora and Fauna act (species protection) & Nature conservation act (area protection).	Conservation (Natural Habitats &c.) Regulations.	(flemish) Nature Conservation Decree (mainly area protection).
Status of ports (private / public).	Public (under control of the Civil Service central authority) but large ports are highly autonomous.	Mostly public (municipality), but large ports such as Rotterdam are (partially) private.	Privatisation since 1983 – Trust Ports are a form of public ownership but heavily focussed on independence from political interference.	Public (municipality) but autonomous.
Overlap/conflicts between designates sites under the BD & HD and ports	Potential conflict and overlap, e.g. port Le Havre and Rouen. Most of the ports are adjacent to possible SAC's and/or SPA's. Every expansion project has an impact on protected areas.	Potential conflict and overlap, e.g. port Rotterdam	Considerable overlap between nature conservation interests and port activity (ABPmer review of 1999: over 110 ports and harbours located in or adjacent to possible and candidate marine SAC's and/or SPA's with an intertidal element)	Potential conflict and overlap, e.g. port Antwerp.
Involved levels of authorities / statutory institutions with port (expansion) project in/close to designated area under the BD & HD.	IROPI is decided by the State (central authority). Permits are delivered by the regional authority (Prefect).	Ministry of Agriculture, Nature and Food quality, Provincial Government.	Department for Environment, Food and Rural Affairs, Department for Transport, English Nature, Environment Agency. Can be others depending on issues associated with a particular scheme	IROPI is decided by Regional Authority (Flanders), building permits delivered by regional authority.
Environmental Impact Assessment.	Prepared by the ports in the permit delivery procedure.	Mandatory. strategic EIA (plan-MER) on highest level for global impact of project - more detailed project EIA (project-MER) for each subproject after acceptance of plan-MER.	Mandatory – typically prepared by consultants for the ports as part of the planning process.	Strategic Environmental Assessment (SEA, plan-MER in Dutch) on highest level for global impact of project - more detailed Environmental Impact Assessment (project-MER in Dutch) for each subproject after acceptance of plan-MER.
Public participation (active / passive, early / late, institutionalised / voluntary).	Public consultation is institutionalised through public inquireries. The contracting authority can make the choice to organise a public consultation earlier, from the beginning of the project preparation.	Active, early, institutionalised.	Public consultation; mitigation and compensation measures are agreed through consultation with statutory and non-statutory bodies (on a voluntary basis).	Mostly passive through public consultation of building permit demands and EIA's, some active at the planning level.
Management Plan for designated areas under the BD & HD.	Objectives Documents (DOCOB).	Nature objective plans are available, management plans in preparation.	Regulation 33 Advice, Management schemes under Regulation 34.	Nature objective plans + management plans for official nature reserves.

	France	Netherlands	UK	Belgium (Flanders)
Other relevant strategic plans.	• Local Planning Directive (DTA). • towns planning documents.	• Development Scheme for the Schelde. • Strategic (long term) plan for ports.	• Shoreline Management Plans and Flood Management Strategies. • Local Development Frameworks. • Regional Spatial Strategies. • Coastal Habitat Management Plans.	• Development Scheme for the Schelde Estuary • Strategic (long term) plan for the Antwerp Port Area
Long Term (port / estuary) plan /vision.	• Long term port strategy is not public. • Refection begins on long term estuaries vision (for example the Seine estuary).	Yes, ports have long term visions. For example Port of Rotterdam has an integrated vision of its port area. For nature visions on estuary level are available a well.	Each port company will hold its own plans for port development within a particular location.	For all Belgian (Flemish) seaports there is a strategic planning process. Fort the port of Antwerp, there isn't a final Strategic Plan yet. Preparations are ongoing.

4 Conclusions and recommendations

4.1 Conclusions on the review of practical examples of habitat creation and restoration in coastal and estuarine areas

Many different examples of habitat creation and restoration in coastal and estuarine areas are available in all countries. The examples are in different stages of implementation: some of the examples have already been completed; others have still to be carried out. Furthermore the examples differ in the objectives of the restoration scheme and techniques and measures that are used for habitat creation and restoration. The latter is of course connected to the different objectives of restoration schemes and differences in local circumstances. The reason or cause for the development of projects differs as well. Triggers for restoration schemes are for example compensation, to improve flood and coastal defences and nature policy implementation. In some cases nature has developed spontaneously as a (unintended) result of infrastructural works in coastal and estuarine areas.

From the review of the practical examples, factors affecting success and failure for habitat creation and restoration projects can be identified. A range of factors contribute to establishing a successful process for delivering habitat restoration and creation schemes. These include clear need for the restoration/creation scheme, policy support, clear objectives for the restoration/creation scheme, adequate (early) stakeholder engagement, delivery of multiple benefits, political support, financial support, clear approval process, effective project management and public acceptance. The factors responsible for process failures in the promotion of habitat creation/restoration schemes are largely the contrary of the success factors. Factors described in Annex 1 that are related to ecological success or failure include available knowledge, scale, local physical conditions, complexity of desired habitat, management and disturbance.

Several practical examples describe how species and habitats evolve spontaneously, as an unintentional effect of economic activity in port areas. These areas can have an important added value for nature in coastal and estuarine areas.

4.2 Conclusion on the site selection process

In the site selection process tools such as constraint mapping and multi-criteria analyses are sometimes used to develop and evaluate spatial options. The selection of appropriate sites is generally driven by a combination of ecological, economic, and practical considerations. A key practical issue often relates to land ownership, zone planning and the opportunities for land purchase.

Different types of projects have different main drivers for site selection. For compensation projects specific legal constraints are connected to site selection. These are described in the EC report ‘Managing Natura 2000 sites’ (EC, 2000) and the ‘Guidance document on article 6(4) of the Habitats Directive’ (EC, 2007). For example: compensation should be sought in the same area where ecological losses are to be expected where feasible. For nature creation/restoration in the framework of a nature management plan for a Natura 2000 site, the ecological requirements usually weigh heavy because of the importance of achieving a sustainable, long term conservation status. Thus, the potential biotic and abiotic characteristics of a site will dominate in the site selection process because these are decisive for the ecological success of a habitat creation/restoration scheme.

4.3 Conclusions on port planning and nature policy and legislation in the UK, France, Belgium and the Netherlands

In all countries ports are located in the vicinity of Natura 2000 areas and this has the potential to cause conflict. Port expansion projects, for example, might lead to loss of natural habitats and external effects that negatively influence the conservation status of a certain site.

Nature reserves might be included in Natura 2000 areas but this is not always the case. Often the sites currently have other functions such as agriculture, ground water abstraction (e.g. the demonstration project ‘‘De Zilk), recreation, fishery, hunting etc. In the case of the Port of Antwerp the SPA in the Schelde Estuary is very broadly designated and in fact the whole left bank of the Antwerp port area is located in the SPA.

By means of creating a network of ecological infrastructure the Port of Antwerp aims to preserve the long term integrity of the SPA overlapping with the port area. In the other countries major ports are in the vicinity but the overlap is not as obvious as in the Schelde Estuary. However overlaps do occur. An example of this is the expansion project “Maasvlakte 2’’ in the Netherlands (expansion for the Port of Rotterdam).

The spatial coverage of designated sites (SPA’s or SAC’s) between countries also differs. In the UK, for example, SPA’s and SAC’s typically cover a whole estuary, as is prescribed by the European Commission. In the Netherlands, Belgium and France SPA’s or SAC’s have only been designated to parts of their estuaries. There are differences between the countries in the way boundaries of Natura 2000 areas have been set. In the UK the approach adopted seeks to reflect ecosystem functioning using judgements based on science. In France the estuary of the Seine has been divided between natural areas and areas where future economic activities can take place. In the case of the SPA in the Schelde Estuary the boundaries are not only determined by ecosystem functioning but also by spatial planning.

Another example of differences in specific circumstances is the extent to which conflicts exist between the appearance of species that are protected by the Birds and Habitats Directives and economic activities in port areas. In the Port of Rotterdam this conflict is very obvious because of the fact that there are large areas of fallow land waiting for development where protected pioneer species become established. In Port 2000 (Le Havre) conflicts have occurred as well and in Belgium the protection of species from the Birds and Habitats Directive have only recently been given more attention. However in the Port of Antwerp a network of ecological infrastructure aims to support the development of sustainable populations of these port species. In the UK conflicts have arisen over areas previously reclaimed for port development but which have developed significant nature conservation value prior to development opportunities being pursued.

An important difference between countries is the extent to which economic development in estuarine and coastal areas is predominantly centrally determined by public authorities on one hand or privatised on the other hand. In the UK, for example, ports are largely privatised or privately funded and the initiative for port development processes is in the hands of competing private companies. As a result private companies will publicise their plans for individual port expansion or modification within a strategic timescale. In countries like the Netherlands, Belgium and France the role of authorities in the process of port development is more dominant and as a result future development plans and visions are typically within the public domain.

4.4 Conclusions and results in the framework of the four strategic objectives of the NEW!Delta project

Objective 1: Level Playing Field

- Review of methods and practices for creation and restoration of coastal and estuarine habitats
  Information and good practices have been exchanged;.

Objective 2: Co-operative Network for Natura 2000

- Developed network for co-operation by working together, and exchanging
  Information and experiences in (Theme 3) of NEW! Delta Organising joint meetings, preparing reports, excursions to demonstration sites.

Objective 3: Better information Access

- Review of methods and practices for creation and restoration of coastal and estuarine habitats
  Information about 26 existing projects concerning habitat creation and restoration in coastal and estuarine areas in The Netherlands (5 sites), Belgium (9 sites), the UK (10 sites) and France (2 sites) has been made available. These projects demonstrate the possibilities for creation and restoration in dynamic habitats.

Objective 4: Guidance on Natura 2000 Legislation

- Review of methods and practices for creation and restoration of coastal and estuarine habitats.
  The case studies provide information about factors affecting the success and failure when implementing a restoration scheme and techniques for habitat creation. Approaches to site selection amongst the partner countries have also been reviewed

- Method for dealing with protected plant species on local scale (in port areas)
  Within the context of the general ecological infrastructure of core areas, stepping stones and corridors a simple and practical Decision Support Model was developed for a sustainable population of a Red List protected orchid species (*Epipactis palustris*) on a local scale, within the extremely urbanised habitat of the harbour of Antwerp. The method is recommended for plant species to be used also in comparable (harbour) situations elsewhere.

- Information on migrating by HD protected animals on local scale (in port areas): tool for connecting ecological zones for sustainable conservation status
  Report, poster and article in peer reviewed journal published about an EU Habitats Directive protected animal species as the Natterjack Toad (*Bufo calamita*) found in and around ports. For the sustainable conservation of this animal within the harbour of Antwerp the LARCH expert system was used. The results led to a proposal for the measures needed and for alternative spatial configurations to ensure the preservation of this protected species. The method is recommended to be used also for animal species in comparable (harbour) situations elsewhere.
  Report about cooperation among NEW!Delta ports and estuaries regarding biotope management in a constructive way to deal with EU nature conservation regulations and coastal (B&HD protected) birds, giving possibilities for interpreting these regulations in an ecological sound way.

- Investment 1
  Environmental Impact Assessment.
  Application of spatial hydrological, terrain and ecological models for developing a robust ecosystem (part of an ecological network).

- Investment 2
  Preparatory research and plans in order to develop an ecological infrastructure network in a port area.
  Breeding place for colony of Common Tern.

4.5 Recommendations

By taking into account the success and failure factors mentioned in the 26 practical examples in Annex 1 and analysed in this report, practical guidance can be gained when implementing a restoration scheme in coastal and estuarine areas. A distinction should be made between process and ecological related aspects. Relevant process related aspects to take into account are need for the restoration/creation scheme, policy support, the objectives for the restoration scheme, stakeholder engagement, delivery of multiple benefits, political and financial support, the approval process, project management and public acceptance. Relevant ecological related aspects include available knowledge, scale, local physical conditions, the target habitat, management and disturbance.

It is very apparent that the differences between countries need be taken into account when developing a decision making tool to support combined nature and port development– a one size fits all approach is unlikely to work. This is because there are considerable differences between the planning process, legal frameworks and decision-making structures.

Although there is considerable potential for maintaining and enhancing pioneer species in port areas, the current European legislation does not encourage port authorities to support this asset. We recommend the EC to give consider ways of encouraging pioneer communities and species within the context of the Birds and Habitats Directives and making it practical and desirable for ports to host such species.

There are several additional recommendations on the scientific research that might be undertaken to make further progress:

- Adapting an expert model for developing ecological infrastructure for sustainable populations of HD protected species (Natterjack Toad) in a port area
- Spatial relationships between coastal bird populations in ports and estuaries; adapting a meta-population model to explore the opportunities for mitigation and compensation of breeding habitat among different (port) areas around the North Sea.

Finally, it is suggested that there would be merits in developing a database in coastal and estuarine areas in North Western Europe on:

- Habitat creation and restoration techniques and their possible effects
- Spatial plans and documents in the coastal zone of different EU member states, with a possible linkage with the Erosion database
- Possible compensation areas to maintain and support the coherence of the Natura 2000 network, being a robust, resilient EU-wide ecological network.

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Part 2 First version of a decision support tool to facilitate combined nature/port developments: the Sequential Guidelines

Table of contents

1 Introduction

1.1 Integrated framework of the guidelines

Coastal and estuarine areas all over the world are very important for socio-economic and environmental reasons. In recent decades socio-economic pressures have increased as have natural pressures. The socio-economic pressure is mainly caused by population growth, urbanization and growth of the global economy. The ports industry is linked to the global maritime traffic linked at their time to global economy. Therefore global growth causes an increase in the necessary port capacity. Natural pressures involve climate change and declines in natural resources, natural habitats and related species. Declines in natural habitats and related species were the major drivers behind the introduction of the European Birds and Habitats Directives.

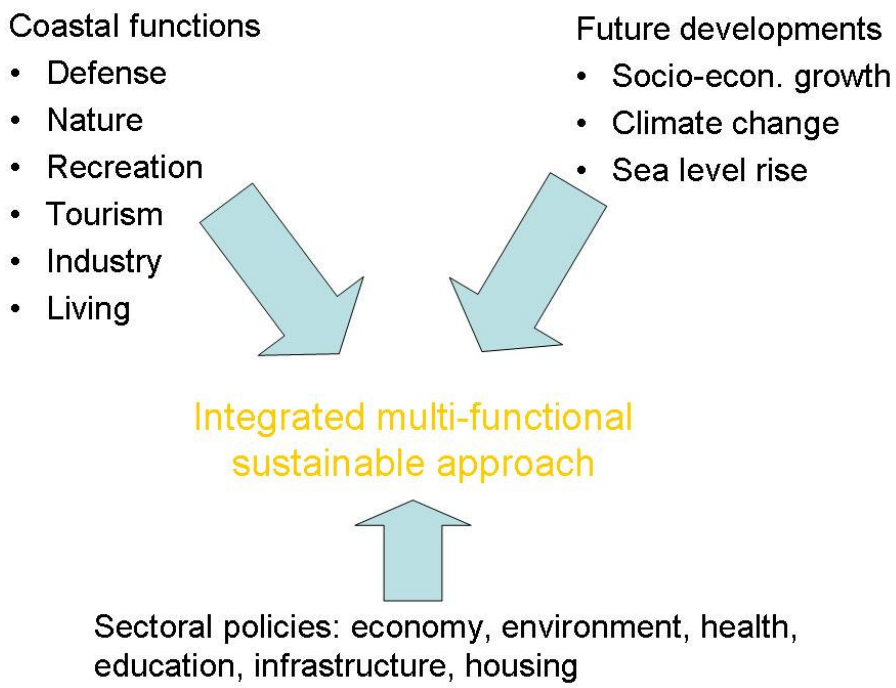
In the past few years, ports in the European member states have encountered similar difficulties in progressing port expansion projects in or around protected sites protected under the Birds and Habitats Directives. Well known examples include: Deurganckdok in Antwerp (Belgium), Port2000 in Le Havre (France), Maasvlakte 2 in Rotterdam (Netherlands) and the Dibden Terminal (United Kingdom). As a result, projects have been delayed, altered or even rejected by the competent authorities. This creates uncertainty that makes it difficult for the industry to respond to market forces and is not beneficial for the port and transport economies. These issues can also undermine support amongst politicians for the Birds and Habitats Directives and their biodiversity objectives.

The NEW!Delta partners have examined ways of resolving and avoiding the conflicts between the need for new port infrastructure and new nature conservation laws. The combination of high socio-economic and environmental pressures mean that there are many problems to resolve in circumstances where there is limited space to meet these demands.

Figure 1.1 Functions in the coastal zone

Figure 1.1 illustrates how multiple activities combine within a limited area and impose a wide range of pressures. Relevant functions can be roughly classified into environmental, economical and social categories; all of which have specific demands on the use of the area. The current multifunctional use of the area and the future developments that are related to socio-economic growth, climate change and sea level rise make it necessary to find new integrated solutions. This involves combining objectives of separate sectoral policies and multi-functional use of the limited space with appropriate spatial planning or zoning (Figure 1.2). The multi-functional integrated approach will help to achieve integrated coastal zone management (ICZM) and sustainable development in the long-term.

Figure 1.2 The integrated multi-functional sustainable approach



In addition to integrated coastal zone management, there has recently been increased attention given to the use of marine spatial planning as a way to address multiple, cumulative and potentially conflicting uses of the sea. On a European level, the Green Paper on future EU Maritime Policy, constitutes a first step towards the establishment of an all-embracing EU Maritime Policy (Textbox 1.1). The EU Maritime Policy should provide for better integration of maritime transport policies and nature conservation policies.

Textbox 1.1 Green Paper on Maritime Policy

Green Paper on Maritime Policy
Based on a Communication of 2 March 2005, it was decided that a Green Paper on a future EU Maritime Policy, to be adopted by the Commission in the first half of 2006, should constitute a first step towards the establishment of an all-embracing EU Maritime Policy.

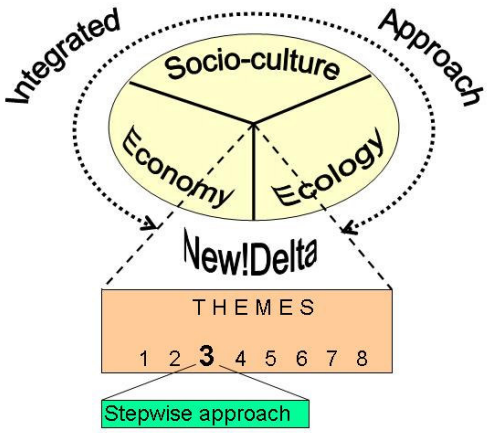
So far, our policies on maritime transport, industry, coastal regions, offshore energy, fisheries, marine environment, socio-economic cohesion and other relevant areas have developed separately as no one was examining how these policies could be combined to reinforce each other. The time is therefore ripe to bring all these elements together and forge a new vision of how to manage our relations with the oceans. The Green Paper seeks to promote a debate on a future Maritime Policy for the EU that treats the oceans and seas in a holistic way. The maritime policy should be anchored within the Lisbon strategy, whilst reflecting the principles of and ecosystem-based management.

In this context a major issue is the reconciliation of the development of maritime transport and environmental conservation, against the background of the constraints imposed by EU regulations under Natura 2000 and the Birds and Habitats Directives at the same time as accommodating the need to extend ports for further developing intermodal transport services. This subject is related to the question of whether port activities should take place in a few, very efficient ports connected to Transport European Networks (TEN-T), or be distributed among a larger number, avoiding an excessive concentration of activity, with its attendant problems of congestion and pressure on the environment and the hinterland infrastructure.

The NEW!Delta project has developed a decision support tool to help to refine sustainable development solutions in coastal and estuarine areas where ports and nature co-exist using a multi-functional integrated approach. This tool comprises a set of sequential guidelines that are presented in Chapter 1.2. In accordance with the rationale of the NEW!Delta project port economics and ecology are central issues in these sequential guidelines, but multi-sectoral policies and functions are explicitly incorporated as well (see Figure 1.3).

The sequential guidelines are intended to contribute to managing conflicts between European port expansion projects and the legal constraints and biodiversity objectives of the designated Natura 2000 sites in a given coastal and/or estuarine area. They are intended to help development proposals to achieve a greater degree of success while at the same time achieving the biodiversity objectives of the surrounding protected sites. Win-win situations rather than conflicts between ports and nature are the main objective. The emphasis within the sequential guidelines is placed upon habitat creation and restoration. The aim is also to improve management of estuaries and coastal areas to facilitate co-existence between ports and other activities.

Figure 1.3 Integrated approach enhanced by the NEW!Delta project in general and theme 3 in particular



1.2 Scope of the sequential guidelines

The sequential guidelines are meant to be used at a strategic plan level and to give guidance in the process of scenario building and analyses at this strategic plan level. Purpose of the guidelines is that the developed scenarios are fully compliant with the Birds and Habitats Directives at all times. In the sequential guidelines this is warranted in various sequential steps (steps 3 to 6, see Chapter 2). The outcome after using the sequential guidelines is a strategic spatial plan/vision for coastal and estuarine areas that fully meets the requirements of the Birds and Habitats Directives. Depending on the status of the strategic plan, a Strategic Environmental Assessment (SEA) might be mandatory. In this case the sequential guidelines can be used as a scenario building tool within the SEA procedure. If however, a port expansion project is being carried out within the strategic plan area all mandatory procedures (such as Environmental Impact Assessments and Appropriate Assessment) should be applied for this individual project and if necessary mitigation and compensation should be carried out.

On a national scale there are considerable differences between countries (see Chapter 3, Part 1) that lead to differences in the way the sequential guidelines will be used within the spatial planning process. The most important difference between countries is the extent to which economic development in estuarine and coastal areas is predominantly centrally determined by public authorities on one hand or privatized on the other hand.
In countries like the Netherlands, Belgium and France the role of regional and port authorities in the processes of port development is more dominant and as a result future development plans and strategic spatial plans are typically within the public domain. In the UK however, ports are privatized and the initiative for port development processes is in the hands of competing private companies. As a result private companies will publicise their plans for individual port expansion or modification within a strategic timescale and they will not be inclined to publicise a strategic spatial plan. Nevertheless the strategic plan level for coastal and estuarine areas is being addressed in the UK as well, for example in integrated flood management plans and flood and coastal flood defence plans. At this strategic plan level however port developments are not covered because of the privatized nature of port development in the UK.

The sequential guidelines seek to provide a framework within which sites can be maintained in favorable condition (and thus habitats and species can contribute to favourable conservation status) They are especially suitable for situations where there is a potential conflict between temporary nature conservation interests in port areas and future port development. By temporary nature we mean (often pioneer) species that regularly occur in the dynamic environment that ports offer and that are protected by the Birds and Habitats Directive. Furthermore the guidelines are designed to be of help in situations in which potential conflicts between Natura 2000 areas and future port development might be expected.

The habitats that these sequential guidelines are concerned with are coastal and estuarine habitats (see Table 1.2 in the general part of the report). These include dynamic and pioneer habitats as well as more complex habitats arising as a result of ecological succession that can be (re)created through human intervention. The NEW!Delta project is specifically directed to coastal and estuarine areas in North Western Europe (see Figure 1.1 in the general part of the report for the project area). The sequential guidelines are intended to provide a more generic approach that can be used in European coastal and estuarine areas beyond the boundaries of the project area, especially those areas bordering the Atlantic coast.

Public acceptance and stakeholder dialogue are important issues when looking for ways to enhance sustainable co-existence of nature and economic development in port areas. This is underpinned by various practical examples in Annex 1 and described in Part 1 of this report. Early involvement of relevant stakeholders is helpful in developing sustainable port development solutions and provides opportunities for stakeholders to influence development proposals. It is recommended that stakeholders are involved at all steps of the sequential approach. The sequential guidelines don't, however, provide actual guidance on this issue.

The added value of the guidelines in the EU member states that are represented in the NEW!Delta project is summarised in Table 1.1.

Table 1.1 Added value of the sequential guidelines in the member states that are represented in the NEW!Delta project

	UK	Belgium	Netherlands	France
Use as a spatial planning tool for strategic visions concerned with port development in/near to designated areas		X	X	X
Manage and reduce uncertainties in the planning process for economic activity in port areas	X	X	X	X
Generate more spatial flexibility		X	X	X
Support the development of a ecological robust ecosystem and ecological infrastructure	X	X	X	X
Use as a checklist in restoration schemes and port development project	X	X	X	X

Delimitation of the study area

The delimitation of the study area is a vital step when implementing an integrated multi-functional sustainable approach for development in coastal and estuarine areas. In general it can be said that the larger an area is, the more opportunities there are to implement a complete integrated approach. After all, only if areas are large enough scenarios can be developed in which different functions can be weighed in balance. Considering the importance, 'delimitation of the study area' is a separate step in the sequential guidelines (Section 2.2).

1.3 Creating a robust ecosystem and ecological network with ecological resilience

Applying the sequential guidelines to a larger area can contribute to the development of a strategic plan for coastal and estuarine areas in which temporary nature protected by the Birds and Habitats Directives and Natura 2000 areas occur. This strategic plan should safeguard the favourable conservation status of the Natura 2000 areas to be achieved and maintained. This can be achieved by developing scenarios that are aimed to create a robust ecosystem and ecological network with considerable ecological resilience (see Textbox 1.2) that fully supports the Natura 2000 network. These robust ecosystems and ecological networks are less vulnerable. Therefore external effects are less likely to have a significant negative impact on Natura 2000 areas and species protected by the Birds and Habitats Directives.

In certain cases, the strategic plan may also facilitate mitigation and compensation solutions for development projects having significant adverse effects on Natura 2000 sites. For example, the strategic plans may assist in identifying suitable areas for compensatory habitat for damaging developments, subject to these developments meeting the criteria for Imperative Reasons of Over-riding Public Interest (IROPI). In order to achieve a robust ecosystem and ecosystem with ecological resilience a safety margin needs to be built-in by creating more habitat than is strictly needed, given the maintenance objectives and by taking into account possible longer term projections of economic activity. As such, the strategic plan should look further than just the current nature conservation objectives under the assumption of the actual socio-economic situation and future pressure.

By doing so, a pro-active approach is taken towards spatial planning in areas with designated Natura 2000 areas as well as areas where only species protection regimes apply but where similar obligations in terms of maintaining a favourable conservation status, compensation and mitigation measures exist.

The idea of a robust ecosystem supported by an ecological network that is promoted by the sequential guidelines is implemented in the Port of Antwerp. In the demonstration project in the Port of Antwerp the concept of a network of ecological infrastructure has been adopted and implemented as a way of dealing with the issue of temporary nature in the port area (see Part 1, Chapter 1.3). The network of

ecological infrastructure is complemented with the development of a robust ecosystem adjacent to the port in order to support Natura 2000 areas within and adjacent to the port area. Of course the ecological network consisting of permanent and temporary elements supports the robust ecosystems as well.

Textbox 1.2 Principle of a robust ecological network and ecological infrastructure

The result of implementing the sequential guidelines on a plan level is a network of cohesive nature entities (robust ecosystems) combined with a network of ecological infrastructure inside port areas.

The importance of robust ecosystems:

- Robustness guarantees long-term conservation;
- The main part of protected nature is located in large (robust) nature entities;
- An example of this can be found in the dune area the Zilk (demonstration project of NEW!Delta, theme 3).

Ecological Infrastructure:

- fulfils a network function: connectivity between larger nature entities improves the robustness & ecological resilience of the nature;
- is of importance for vital populations of specific port species (= species of highly dynamic areas) such as for example Natterjack Toad, Sand Martin, some orchids. Those species already inhabit the North West European Port areas;
- contains smaller parts of protected nature, this mainly concerns dynamic and flexible natural values;
- An example of Ecological infrastructure network can be found in the Port of Antwerp (demonstration project of NEW!Delta, theme 3).

2. The sequential guidelines

2.1 Step 1: Initial decision for strategic plan

The decision for a spatial port-nature plan, including a port-nature development scheme can come from:

- Port planners or port authorities
- Nature policy-makers
- Other decision makers involved in nature and port development

When the intention to start a planning process is approved by the relevant authority (at this stage in a conceptual phase), the preparation phase can be initiated (step 2-7). Step 1 and 2-7 interact and can be reversed and duplicated if necessary (first preparation, then approval, then further preparation).

2.2 Step 2: Defining the study area

Key elements for a good study area are listed below.

A good study area must:

- Reflect ecosystem functioning (could include SPA'S, SAC's and nature reserves)
- Not be limited to the port area
- Be large enough to make site replacement within the area possible
- Not be limited only to sites of current/actual value (for nature, port or other), but also include sites with potential nature or other value
- Be kept manageable by taking into account the administrative boundaries

The advantage of defining a study area on ecosystem functioning level is that when a spatial plan is concerned, replacement of a site (for nature or human activity) within the study area is more likely to be possible. This avoids replacement of the 'problem' to another area (with other stakeholders).

2.3 Step 3: Stocktaking

Port planners need to ensure proposals are designed to be compliant with international and national legislation and policy. Typically the feasibility of the port plan has already been investigated by this stage (as part of step 1).

Stocktaking should not be limited to the ecological aspects (which plants and animals are present in the study area), but should include legal information (which protection is upon those habitats/species) and an analyses of policy documents at an international, national and local scale as well. All these documents are the framework for developments in the study area. This step is about acquiring the necessary information of environmental legislation protecting sites, species and habitats as well as a description of the ecology itself. The inventory should, at least, include the following:

- All legal and policy documents applicable on the study area for separate sectoral policies and relevant functions. These will be setting the 'limits' for any plan or project in the study area and is vital in implementing an integrated multi-sectoral approach;
- Monitoring data of all nature values in the study area (habitats, species);
- Description of current nature values and their possible/probable evolution;
- The species/habitats for which the protected nature sites were designated;
- A summary of all nature obligations lying on the study area (conservation objectives, etc). A GIS based database could be a useful support for port planners at this phase;

A preliminary assessment of environmental impacts of spatial scenarios could be part of this step as well.

2.4 Step 4: Defining what must be protected

The information collected in the previous step needs to be translated into concrete, pragmatic, workable and quantified nature obligations for the study area. It involves identification of what environmental law specifically means in terms of nature obligations for the study area as delimited, where step 3 enumerates and describes the environmental and nature law and objectives in several policy documents. For this, a thorough analysis of all nature obligations is needed.
The translation of (sometimes abstract) laws and policy into concrete obligations isn't easy and demands expert judgement and a thorough analysis. It is linked with establishing the reference situation and the favourable conservation status. If a management plan for designated areas is available this could be used instead.

The result may be a summarizing table in which all nature obligations are quantified for the study area. It will also result in the definition of the favourable conservation status of the study area. Being at least equal to legal necessities, the favourable conservation status may exceed the requirements of the birds and habitats directive depending on the local/national policy issues/goals.

The favourable conservation status of Natura 2000 areas is currently being expressed in terms of species and habitats to be conserved within their biogeographically range. However, in order to fully take into account the dynamic nature of the marine and estuarine environment that causes a succession in the appearing habitats and species, the hydromorphological and geomorphological processes that are essential for the development of the target ecosystems should be described and quantified. Succession in time and possibilities for adaptive management in case of succession should be regarded here as well. In terms of ruderal habitat favoured by Terns, Plovers and Natterjack Toad, the state of succession must be arrested to maintain the favourable conservation status.

2.5 Step 5: Spatial translation

Another key step for implementation of the scheme is the spatial translation of the nature obligations defined in step 4. This is an essential pre-requisite for achieving "favourable conservation status". Spatial translation means translating nature obligations (e.g. 10 breeding pairs of the Spoonbill is favoured) into habitat requirements (e.g. achieved through 3 ha of breeding habitat). The actual potential complexity of this process is illustrated by Textbox 1.3.

What's been done in this step is translating nature obligations into spatial prerequisites. This step requires expert judgement and calculation as far as appropriate ecological models are available. To make this step feasible, the habitat types are kept general and lumped. However, the abstraction level on which habitat types are distinguished should address ecosystem functioning. In practice, habitats will only be lumped if they are found under similar environmental conditions (same habitat requirements).

Textbox 1.3. Ecological consideration on the favourable conservation status of habitats

European habitat types demonstrate a great variety (1), whereby each type has its own characteristics, i.c. ecological conditions. Therefore, they cannot be combined if for example ecological assessments have to be carried out. 'Atlantic salt meadows' and 'mud flats' differ from each other and from 'coastal dunes', but even the latter consists of different habitats: amongst others 'embryonic shifting dunes', 'shifting dunes along the shoreline with *Ammophila arenaria*' and 'fixed dunes with herbaceous vegetation'. Their ecosystems are functioning in a different way, and they have different carrying capacities for the use by man.

Organisms are tied to one single habitat type or to a special combination of types, either neighbouring or not. Habitats are species specific and this is most relevant for the conservation of rare and protected species. As animals move, they may need a combination of habitat types that are separated spatially. Also the quality and the size of a habitat type play a role. Animals need a minimum surface area for their home range activities and this may be quite large if the quality is not optimal: the lower the quality, the larger the size of the habitat.

If the favourable conservation status of habitats and organisms is under discussion, the quality and the size of the habitat must be such that its permanent existence is guaranteed and the populations of the

organisms concerned can survive sustainable, over a period of at least one hundred years. It is the population level that matters, individuals play a role of minor importance.

Many ecological features are still insufficiently understood and research is needed for clarifying such relationships, e.g., dispersal, home range, meta population structure and habitat quality. This is often seen as a problem in projects where areas have to be developed or landscapes be designed and where economic interests determine tight time constraints.

Decisions can only be made after thorough research, supplemented with best professional judgements, but always keeping in mind that we have to live with uncertainties in the field of ecology (2).

(1) Romão, C. (1996): The Interpretation Manual of European Union Habitats - Version EUR15. European Commission, Directorate General XI, Brussels. 148 pp.
(2) Cappelle, H.M.P. & A.H.P. Stumpel (2003): Ecologie op de weegschaal. Verkenning van de raak- en snijvlakken tussen juridisch-bestuurlijke en ecologische principes en uitgangspunten. Alterra, Wageningen. 53 pp.

2.6 Step 6: Spatial allocation within the study area

The next step consists of spatial allocation within the study area. In this step it is important to keep in mind that starting point when applying the sequential guidelines is the aim to develop scenarios that are fully compliant with the Birds and Habitats Directives at all times. Another important issue is the aim to develop a network of well connected and sufficiently large nature entities to achieve robust nature with high ecological resilience (see Chapter 1.3). This is of particular importance for nature in the vicinity of areas with intensive human activities such as ports. Knowing what the nature obligations for your study area are (step 4) and knowing what habitats you need to achieve them (step 5), this step consist in finding adequate locations for your habitat creation/restoration of conservation schemes.

Relevant criteria include:

- Initial nature value
- Potential nature value
- Looking at environmental features: soil, water quality/quantity, the presence of features such as rivers
- Size and amount of potential/actual disturbance; preference for robust nature with high ecologic resilience
- Good connectivity/migration possibilities between nature entities (enhances the ecological resilience)
- Possibilities for exposure to people

Those criteria are purely environmental as the key concern is to have a spatial plan that complies with the nature obligations of the area. In order to come to integrated multi-functional and sustainable scenarios, at the same time an inventory should be made of future (spatial) plans, developments and spatial claims from other relevant sectors. Plans, opportunities and constraints from the marine environment should be incorporated as well. Additional considerations on wishes and long term development in relevant sectors might be added by consulting representatives from relevant stakeholders. In this stage the stakeholders are sector representatives: for example a regional farmer organisation and no individual farmers. Opportunities for win-win situations for nature and other functions are explored together with stakeholders and spatial scenarios are being developed. In this way stakeholders get an opportunity for positive feedback at an early stage.

Once several scenarios have been developed it is important to check once again if every scenario truly complies with the nature obligations and will succeed in achieving legal certainty towards the Birds and Habitats Directives. This is important in order to adapt a pro-active approach towards nature conservation. Once this has been done, the resulting scenario's are all "environmentally equal".

2.7 Step 7: Scenario evaluation

In this step one most preferable scenario will be chosen from the scenarios that were developed in step 6. In this process stakeholder involvement is of vital importance. Key element here is public acceptance as the selection of the nature restoration/creation scheme should be acceptable for all, as this will increase the chances for a successful implementation. The result is a societal choice made through consultation of all involved stakeholders.

In the evaluation process, multiple factors and functions will influence this evaluation process. In fact, this will be the most time consuming and hardest step in the planning process in which stakeholder involvement is crucial. Several practical examples in Annex 1 and the analysis of factors of success and failure in Part 1 (Chapter 1.4) illustrate how stakeholder related processes can eventually influence the outcome of this step and therefore the success of implementing a restoration scheme.
By involving all relevant functions in the evaluation –connected to the functions and use of the land and marine environment-, the outcome of this last step will be a long term, sustainable and multi-functional integrated solution to meet the nature obligations in an area containing Natura 2000 areas and/or species protected by the Birds and Habitats Directive.

2.8 Realisation: Creation or restoration of nature

This last step consists of the implementation of a nature restoration or conservation scheme that is consistent with the spatial scenario that was chosen in step 7. Now the restoration scheme from the chosen scenario can be realised and the existing nature values can be managed in line with the plan. In practise, waiting for a consensus decision may take a long time. However, some plans are recognised as essential by all stakeholders and can be realised during the decision making process.

3 Evaluation of the applicability in the demonstration sites

3.1 Applicability of the sequential guidelines in the demonstration site ''De Zilk''

Although the sequential guidelines are meant to be used at a strategic plan level, in this section it is evaluated if the sequential guidelines could be of help when implementing a nature restoration scheme, such as 'De Zilk'. This example is more about identifying opportunities to create the desired habitat at a local site level rather than at a strategic level. The demonstration project ''De Zilk'' is described in further detail in Part 1, Section 1.2.

Step 1: Initial decision for project

The "De Zilk" project fits into national and provincial policy plans and this is of particular importance. It is implemented in a long term vision at a larger spatial and temporal scale for the whole Amsterdam Water supply dune area. The national government has announced plans for this in its National Nature Policy Plan (1990), the province of South-Holland in *het spatial plan Zuid-Holland West* (2003). On a local scale this vision for nature conservation in the area is called "Struinen in the duinen"(Walking through the dunes) has more objectives at various levels of certainty. The intention to start the project, in a conceptual phase, was approved by the provinces of South and North Holland and the municipality of Amsterdam being the most relevant authorities. Working at a larger scale has helped in overcoming the local interests. A very imported step in bringing project The Zilk further was the decision to follow the procedure of an Environmental Impact Assessment (E.I.A.) witch structures the steps to be taken and also involves an independent EAI commission to advise on the project.

Step 2: Defining the study area

The study area was larger than the area directly involved. This was done by clearly defining the potential influences in the hydrological system in the dune and neighbouring polder region. This was done for the following reason: first of all it reflects the hydrological functioning of the dune ecosystem and second the zero hydrological influence of the project was communicated to stakeholders in the region (bulb-growing, residence). Furthermore, the study area was split up for different aspects. For hydrological influences a large area was chosen. For the actual restoration the focus was on current and potential dune slacks.

Step 3: Stocktaking

This step is about acquiring the necessary information of environmental legislation, protected sites, species, habitats as well as a description of the ecology itself. Technical feasibility of the project was also investigated, especially the installation of a hydrological buffer zone and water catchment wells were worked out. Interaction between technical aspects of the project and nature aspects could occur. Because nature regulations aspects are the main emphasis of this report the nature aspects are indicated here. The inventory included all legal and policy documents applicable on the study area, a summary of the nature conservation objectives of the project site, description of current nature values (habitats, species) and their possible/probable evolution, with special attention to the species/habitats for which the site is designated. These where brought together in one of the E.I.A reports.

Step 4: Defining what must be protected

This step is linked to establishing the reference situation and the good conservation status. Because habitat restoration of dune slacks was the main goal of the project a pragmatic approach was chosen in defining the nature obligations for this habitat type. In this approach especially the groundwater level in comparison with the surface water level was one of the essential environmental conditions that had to be fulfilled. Database analysis and expert judgement were combined in GIS decision model building. Furthermore, input for a management plan for the designated area was developed in the "The Zilk Project".

Step 5/6: Spatial translation and allocation within the project area
In the Zilk project spatial hydrological, terrain and ecological models were used. These models were used to translate nature obligations into spatial prerequisites. A very important step in this stage is the development of different possible scenario's that could comply with the nature goals and obligations of the area. Calculations were done with the ecological model PROBE.
In this way spatial allocation within the project area was achieved and the sites could be found that were favourable for dune-slack development. Furthermore, it's assumed that this habitat can be achieved through appropriate management when physical conditions are realised. So these steps led up to finding adequate locations for our habitat creation/restoration and delivered input for the conservation scheme. In the Zilk Project Step 5/6 were combined in a scenario-building step.

Step 7: Scenario evaluation
Multiple factors and functions influenced the evaluation process, which made this step a very time consuming and difficult step. To come to a sustainable decision, aspects of people-planet-profit had to be combined and considered. In this process stakeholder involvement was of vital importance. Key element here was the public acceptance of the nature restoration scenario to be chosen. To increase the chances for a successful implementation a preference scenario was developed which fulfilled the ecological goals and which had a high regard for the wishes of the stakeholders (i.e. no hydrological changes outside the dune area). So the stakeholder processes eventually influenced the outcome of the total project. But this also brought the implementation of the restoration scheme a lot closer to realisation.

Step 8: Realisation: Creation or restoration of nature
Once a decision is taken, the chosen scenario has to be elaborated. The last step consists of the implementation of the nature restoration or conservation scheme. An important aspect to consider is the development of a monitoring scheme.

Conclusion
The "Zilk project" showed that cooperation and participation is an important success factor for this project. Another important success factor was the existing planning policies that supported delivery of the project. However, the cooperation between the different government levels and participation of the relevant stakeholders should be carefully and well organized. Clear communication with the inhabitants and users of the area was essential. Furthermore, the use of existing procedures in the environmental impact assessment showed to be very useful. Also very important was the use of spatial models and instruments in the decision making process. A sequential approach in this process is a useful tool in a complex social and natural environment.

3.2 Applicability of sequential guidelines in the demonstration project at the Port of Antwerp

In this section the applicability of the sequential guidelines is considered for every step of the Antwerp demonstration project. The demonstration project ''Building a Network for Ecological Infrastructure in the Port of Antwerp'' is described in Section 1.3 of Part 1 of this report in further detail. The case demonstrates the spatial planning approach within the port strategic area. Although the development of a network of ecological infrastructure can play a minor role in supporting the development of a robust ecosystem in adjacent or overlapping Natura 2000 sites, its main purpose is to show how to use spatial planning concepts in dealing with the obligations laid down in the B&H directive specifically related to species protection.

Step 1: Initial decision for project
The Flemish Spatial Structure Plan decided in 1997 that 5% of seaport areas had to be kept free of economic activity for ecological infrastructure. In 1999 the Flemish government decided all Flemish ports had to make up a long term strategic plan which would lead to a new spatial implementation plan setting the spatial limits of the seaport area. On the 10th of July 1997 the directing committee of the Antwerp Port Authority decided the port would strive to realise 5% of ecological infrastructure within its own territory, independent of what the other three Flemish port would do (RSV set the objective for all 4 port areas together). In 2001 the Antwerp Port Authority decided to collaborate with *Natuurpunt* under the banner of *The Antwerp port More Naturally* setting the start of the implementation of the project. In 2003 the NEW!Delta project started.

Step 2: Defining the study area
In 2001 Natuurpunt took a pragmatic overview of the study area, similar comparable to that of the study area used in the strategic planning process for the port. The actual boundaries however, will only be formalized when the new spatial implementation plan for the port area will be ready, probably in 2008.

Step 3: Stocktaking
Natuurpunt prepared an inventory of all not yet economically (or not yet hardened) surfaces looking at actual and *potential* nature values.

Step 4: Defining what must be protected
In September 2006 joint agreement was signed with the University of Antwerp in order to give the University of Antwerp the job of developing objectives and quantitative conservation objectives for the network of ecological infrastructure in the port of Antwerp taking into account the legal obligations and the potential for nature in the port area. These objectives should reflect the sustainable contribution that the port area can make to conservation of those species that use the port area as habitat.

Step 5: Spatial translation allocation within the project area
This collaboration with the University of Antwerp comprises four phases of which one concerns the explicit elaboration of quantitative (thus expressed in hectare) habitat requirements. These requirements will be compared to the inventory prepared by Natuurpunt in 2005.

Step 6: allocation within the project area
Extensive discussions with stakeholders were held at the end of 2004-2005 leading to a preferred solution shown in Figure 1.7 of Part 1. The University of Antwerp will review this map once the objectives have been determined to check if it is still accurate.

Step 7: Scenario evaluation
A map was chosen. This map has to be reviewed as well.

Step 8: Realisation: Creation or restoration of nature
Demonstration projects were realised from step 1 on (starting in 2001), parallel to the whole process because it was felt necessary to show that nature could indeed coexist with port activity. The pilot-projects in the field thus provided valuable learning opportunities for the rest of the programme.

It became clear that gaining acceptance from port user and actors for nature creation and restoration takes a lot of time and a specific approach. In order to gain acceptance a brochure was produced and sent to all companies in the port. Furthermore a seminar was organised on the network of ecological infrastructure in the Port of Antwerp to which all port users and relevant Flemish administrations were invited.

Conclusion
The sequential guidelines are applicable to the project planning for a network of ecological infrastructure in the port of Antwerp. If fact all steps were applied in the planning process. The steps were not always followed in the order that is described in Section 2. However, this isn't strictly necessary to be of value in a planning process.

4 Conclusions and recommendations

4.1 Conclusions on the applicability of the sequential guidelines

The main reason for developing the sequential guidelines was that throughout the European member states similar problems are encountered regarding the execution of port development projects in or around protected Natura 2000 areas and sites where species occur that are protected by the Birds and Habitats Directives. The sequential guidelines aim to support the initiators and all relevant stakeholders in the planning process in order to enhance a multi-functional integrated approach for sustainable development of coastal and estuarine areas that may contribute to managing conflicts between port expansion projects and the legal constraints and biodiversity objectives of designated Natura 2000 areas. By providing a generic (spatial planning) tool a more efficient and effective approach for sustainable development in these areas is stimulated EU wide.

The sequential guidelines have been designed to comply with integrated coastal zone management (ICZM). This is a strategic and comprehensive framework in which all relevant functions and sectoral policies from the coastal zone are involved and interconnected for both land and sea. Experiences and conclusions from the practical examples and demonstration projects in Part 1 of this report were used for developing the guidelines.

The sequential guidelines are meant to be used at a strategic plan level and to give guidance in the process of scenario building and analyses at this strategic plan level. Starting point for the guidelines is that the developed scenarios are fully compliant with the Birds and Habitats Directives at all times; both with the provisions concerning the designation, the objectives and the management of SAC/SPA with the provisions regarding species protection (art.12-16 HD). The outcome after using the sequential guidelines is a strategic spatial plan/vision for coastal and estuarine areas that contributes to the achievement of the Birds and Habitats Directives objectives.

The delimitation of the study area is a crucial step when pursuing the integrated multi-functional approach that is stimulated by the sequential guidelines. In general it can be said that the larger an area is, the more opportunities there are to implement a complete integrated approach on plan level. After all, only if areas are large enough can scenarios be developed in which different functions can be weighed in balance. If the delimited area is large enough to incorporate various (current and future) functions and areas are large enough for robust ecosystems and ecological networks to evolve, this will create more spatial flexibility. This will enhance the development of resilient or robust nature. Therefore external effects are less likely to have a significant negative impact on Natura 2000 areas and species protected by the Birds and Habitats Directives. In this way the strategic plan helps in preventing individual projects (as a result of economic activity) within or adjacent to a Natura 2000 area or an area with temporary nature from having a significant negative effect.

The added value of the sequential guidelines depends on the specific national situation in the different Member States. Important differences are:

- The extent to which economic activity in coastal and estuarine areas is predominantly centrally determined by the public authority or privatized
- Differences in legislation and the way EU directives are implemented in national law
- The spatial coverage of Natura 2000 sites. A crucial difference between the member states is that in some member states Natura 2000 sites cover whole estuaries where as in other member states only part of estuaries have been designated

The applicability of the sequential guidelines was evaluated in the demonstration projects “de Zilk’’. In “De Zilk” project cooperation with and participation of stakeholders has proven to be an important success factor as well as planning policy that supported the project. Cooperation between different governmental levels and participation of many stakeholders however was very time consuming. Furthermore, the use of existing procedures in the environmental impact assessment showed to be very useful in the planning and decision making process as well as the use of spatial models and instruments. The guidelines would have been a useful tool in the planning and decision making process of “de Zilk”.

In the Netherlands the sequential guidelines were evaluated based on the situation in the Port of Rotterdam as well. In the port of Rotterdam itself no Natura 2000 areas are designated, but species that are protected by the Birds and Habitats Directive occur frequently. By the Port of Rotterdam the guidelines are regarded as a useful tool when developing nature management plans in which the favourable status of all protected species is secured. The sequential guidelines are expected to enable a sustainable cohabitation of port activity and estuarine and coastal nature realised by a robust but also flexible ecosystem and ecological infrastructure. Therefore, the guidelines are expected to help solving the issue of temporary nature (textbox 4.1). The Port of Rotterdam stresses that there is a need for future coordination for all plans that have an impact on nature obligations. Therefore the need for a database, which contains information and spatial coverage of all important initiatives, is stressed by the Port of Rotterdam. A deficiency in the Dutch transposition of the Birds and Habitats Directives is that for species, Table 3 outside Natura 2000 areas, authorities have no management plans. Because of this it is very difficult to `prove` that the “favourable conservation status” is achieved. However, the sequential guidelines are suitable to develop a management plan in which the favourable status of all protected species within the Port area is secured.

For the Port of Antwerp it is concluded that the sequential guidelines have been a useful tool in the planning process and in fact all steps were (implicitly) applied in the planning process that forms the general framework for realisation of the demonstration project. Therefore this demonstration project can be regarded as a pilot to illustrate the application of the sequential guidelines. However, it is stressed that steps might be elaborated in a different order. Stakeholder acceptance and communication was a crucial element in the planning process in the demonstration project that was more time consuming then initially assumed. In addition, for Belgium it is being stressed that the sequential guidelines are a potentially effective tool in integrated and multifunctional spatial planning processes.

The sequential guidelines as it is currently described, is not wholly applicable in the UK. This is due to the nature of the ports industry in the UK, which is essentially privatized. It is not current practice for port companies to publicize future development plans as this can have implications for the competitive nature of the industry. Therefore port companies will not be inclined to develop strategic spatial visions using the sequential guidelines. In the UK however, this strategic plan level is currently addressed in for example integrated flood management plans and flood and coastal flood defence plans. At this strategic plan level however port developments are not covered.
The sequential guidelines described in chapter 2 are very close to the way French cases are currently implemented and in France it can be used both management plans/spatial plans. One particular thing in France is that rivers are usually boundaries between regions or departments and estuaries have no legal existence. This means that a broad definition of the study area (step 1 of the guidelines) might lead to involve several public authorities at the same level and many stakeholders. Furthermore, in previous port development projects in France, especially Port 2000, very difficult discussion occurred with stakeholders like farmers and hunters because they felt like being pushed out of the area by both nature conservation and port development. Long term spatial plans that can be developed with help of the sequential guidelines might help in clearing these discussions by offering a spatial framework.

Textbox 4.1 Temporary nature and dynamic habitats: a large potential

Temporary nature and dynamic habitats: a large potential

Port areas of the larger European port like the Port of Rotterdam and the Port of Antwerp often contain large areas that are fallow ,awaiting industrial activity. Because these areas are located in the coastal zone, these areas are very attractive for example, for coastal birds. Plant species that are specific for dune areas colonize the area easily as well as pioneer species like Natterjack Toad. Therefore these areas have a large potential for nature and more specifically for pioneers, species that are specific for the early stages of ecological succession, migrating birds and wintering birds (Reker, 2006). The ecological value of these areas –although they accommodate species for only a limited time-lies in the fact that the dynamic habitat that's been offered is very scarce and this new dynamic habitat offers the species concerned a temporary stepping stone and living area from which new areas can be colonized. Pioneer species are dependant on the existence of such dynamic areas.

However, the occurrence of temporary nature might lead to a conflict of interest for port authorities at the moment the areas are developed for industrial activity because the species connected to temporary nature are often rare and protected by the Birds and Habitats Directive. This is exemplified in the previous report. Port authorities are therefore sometimes inclined to prevent the establishment of temporary nature communities, for example, by applying certain types of land management (for example sawing grass or maize) in order to prevent time and cost consuming procedures and a negative image in the public opinion.

The sequential guidelines that are elaborated in this report enable a sustainable cohabitation of port activity and temporary nature in port areas that is realised by a robust ecosystem supported by a flexible ecological infrastructure. The idea behind the guidelines is to approach the existing nature obligations, especially those falling under the rules laid down in the Birds and Habitats directive from a holistic point of view, thereby covering and anticipating individual losses on the project level and the specimen level. The sequential guidelines might encourage port authorities to let the ecological potential of temporary nature in port areas develop to the full extent.

4.2 Conclusions and results in the framework of the 4 strategic objectives of the NEW!Delta project

Objective 1: Level Playing Field

- Development of a transferable and generic planning and decision making tool that supports the ecological functioning of an area while at the same time supporting port development.
  The sequential guidelines intend to prevent or solve conflicts between European port expansion projects and the designated areas under the European Birds and Habitats Directives. Even more so, the guidelines are designed to facilitate the implementation of proposed developments with a greater degree of success while at the same time achieving the biodiversity objectives of the protected sites. It's a generic approach on cohabitation between ports and nature in the framework of a sustainable multi-sectoral vision for European coastal and estuarine areas.

Objective 2: Co-operative Network for Natura 2000

- Development of a transferable and generic planning and decision making tool that supports the ecological functioning of an area while at the same time having the potential to contribute to managing the negative impacts of port developments.
  The sequential guidelines intend to facilitate the maintenance or achievement of favourable condition for features within Natura 2000 sites. They may also contribute to the identification of mitigation and or compensatory measures for port development projects. The applicability of the sequential approach is evaluated for the specific national situations in the Netherlands, Belgium and UK. Moreover the approach is also evaluated for the 2 investment projects of NEW!Delta.

4.3 Recommendations

Within part 2 of this report a first version of a decision making tool is elaborated to support a combined nature and port development: the sequential guidelines. It is our recommendation to implement and further develop these guidelines in strategic spatial plans in port areas where nature and port activities should be combined. When implementing these guidelines special attention should be paid to the concept of robust ecosystems and ecological network within and adjacent to port areas. This approach will help to meet the requirements of the Birds and Habitats Directives while at the same time supporting economic activities in coastal and estuarine areas by offering a flexible approach specifically for natural dynamic situations that are found in coastal and estuarine areas and port areas with large areas of fallow land. By doing so, the issue of temporary nature in port areas will be addressed.

Another recommendation is to look more at coastal regions and interregional ecological relations in order to further enhance the development of an EU wide ecological network. This will lead to more ecological resilience of ecosystems thus creating a more sustainable balance between nature and economic activity in port areas.

5 References

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Annex 1

Examples of habitat creation and restoration in coastal and estuarine areas

Reflects the situation of examples 1 to 24 at September 2005, and of example 25 and 26 at June 2006

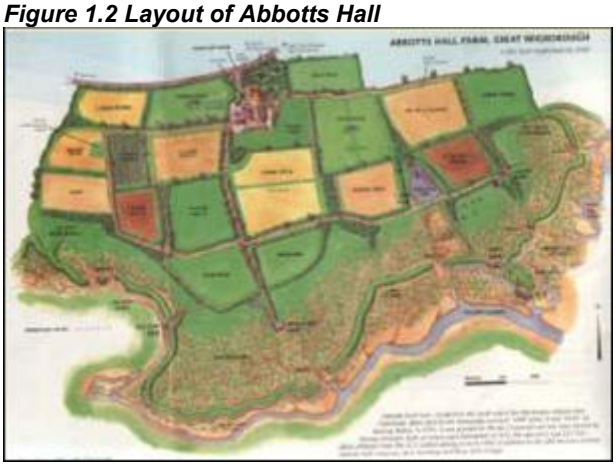
1 Abbotts Hall, UK

1.1 Identification of the site

Abbotts Hall Farm forms the centre piece in a conservation project that links together over 3,000 acres (around 1200 ha) of wildlife-rich land along a 25km length of the Essex coast. The site is situated on the Blackwater Estuary, an internationally important area for wildlife, protected as a Site of Special Scientific Interest (SSSI),
a Special Protection Area for Birds (SPA), and a marine Special Area of Conservation (SAC).

Figure 1.1 Location of Abbotts Hall

Figure 1.2 Layout of Abbotts Hall



1.2 Habitat type

Abbotts Hall is part of the Blackwater Estuary SPA, Blackwater Estuary Ramsar Site and Essex Estuaries SAC.

1.3 Description of the site

Site objectives

The objective of the Abbotts Hall scheme was to create approximately 85 ha of intertidal habitat including mudflat, saltmarsh, transitional grassland, grazing marsh and new freshwater habitat. The scheme is also designed to provide a sustainable management mechanism for the flood defences of this region.

Description of the site
The Abbotts Hall scheme has been undertaken at the seaward margin of a 700 acre (300ha) coastal farm. The realignment site itself was previously agricultural land. Post inundation, the site has created a mixture of intertidal habitat.

Figure 1.3 Abbotts Hall site

Figure 1.4 Breach at Abbotts Hall (Mark Dixon, 2004)

1.4 Methodology
The seawall was breached in October 2002 allowing salt water back onto land originally reclaimed by the construction of the seawall over three hundred years ago. The 3.5 km seawall along the farms boundary was breached in 4 places. Two counter walls have been constructed at either end of the site to protect neighbouring land but elsewhere the land rises gently away from the seawall naturally checking the incoming tide without building new sea defences.

1.5 Monitoring

Prior to breaching continuous monitoring was undertaken throughout the estuary to understand how the system works. The information was used to design breaches that would minimise the changes in current speed and sediment load within the estuary. The monitoring will continue for 5 years after the breaching to test the predictions that have been made. Parameters that have been monitored at the site include:

- Hydrodynamics;
- Topographic surveys;
- Habitats;
- Invertebrates;
- Protected species including reptiles, amphibians and mammals;
- Birds; and
- Fish.

Results to date

The scheme design appears to have been effective in safeguarding the local natural environment of the Channel and the West Mersea Oyster Fishery downstream of the realignment site. The site now has extensive mudflats and saltmarsh was first recorded on the site in the Spring 2003. Up to 18 different species of wader have now been recorded on the site. The site has been demonstrated as being beneficial for both commercial and recreational fisheries in the Blackwater estuary.

1.6 Policy context

The 700-acre coastal farm, purchased in 2001 by Essex Wildlife Trust with support from a legacy from the late Joan Elliot, Trust members, WWF, English Nature, the Environment Agency, and the Heritage Lottery Fund, aims to show how the recreation of saltmarsh can act as a more cost-effective, sustainable sea defence whilst supporting a rich variety of wildlife. This coastal realignment will be a major contribution to the nation's Biodiversity target for restoring coastal marshes and will bring real benefits for the estuary and its wildlife.

1.7 References

Environment Agency (2004). Sustainable Flood defences- Monitoring of the Managed Realignment Scheme at Abbotts Hall, Essex, UK

2 Chowder Ness

2.1 Identification of the site

The realignment site at Chowder Ness is located on the south bank of the Inner Humber Estuary upstream from the Humber Bridge behind the current sea defences (UK). It is a twin project of the Welwick project (see case study 9).

Figure 2.1 Location of the site

2.2 Habitat type

The intertidal and subtidal areas of the estuary fronting the Chowder Ness managed realignment site form part of the the Humber Estuary pSPA, Humber Estuary pRamsar Site and the Humber Estuary pSAC.

2.3 Description of the site

Site Objectives

Associated British Ports (ABP) is proposing to construct a Roll-on/Roll-off (Ro/Ro) terminal at Immingham and Lift-on/Lift-off (Lo/Lo) berths at Hull, known as “Quay 2005”. In consultation with regulatory bodies and local nature conservation interest groups, a potentially acceptable compensation/mitigation package for the two port developments has been identified which includes two managed realignment schemes. Chowder Ness forms one of these projects and it is the objective of this scheme to create 10.5 ha of mud and 0.8 ha of saltmarsh to support a variety of invertebrate and bird species.

Description of the site The re-alignment site at Chowder Ness is currently under construction. Prior to construction the area landward of the sea defences (12.2 ha), was largely set-aside agricultural land and in front of the sea defences was composed of narrow mudflat and a small amount of saltmarsh and reedbed covering approximately 0.1 ha. Once the site has been completed it will create mudflat, saltmarsh and grassland habitat.

Figure 2.2 Land behind the sea defences- prior to inundation

Figure 2.3 Mudflat in front of the sea defences- prior to inundation

2.4 Methodology

It is proposed to remove the existing sea defences and to construct new defences to the landward boundary of the proposed site. Minor levelling of the site will be undertaken to fill-in existing drainage ditches and reprofile the raised peninsular area of the site which runs from south to north across the centre of the site. This will create conditions more appropriate to the establishment of 10.5 ha of good quality intertidal mud. It is envisaged that the works would be undertaken over a period of 2 years, in a number of stages, with the intention of starting in the spring of 2005 and completion in the autumn of 2006.

2.5 Monitoring

An extensive programme of environmental monitoring will be carried out, before, during and following completion of the scheme. A programme of general verification monitoring will be undertaken to seek to assess the longer-term impacts of the realignment scheme on the adjacent intertidal areas. A number of monitoring objectives have also been established for the scheme to seek to achieve the maximum ecological potential for the site. These monitoring objectives have been established as a guide to what the site should be capable of delivering. An initial review is planned after five years to ensure that the habitat creation is on track, followed by a formal review of compliance after ten years. The monitoring requirements at the site include:

- Topographic surveys (1 per year);
- Sediment parameters (1 per year);
- Habitat surveys (1 per year);
- Invertebrate surveys (1 per year); and
- Birds (throughout each winter).

The results of the monitoring will inform whether the project has met its compensation objectives.

Results to date
The scheme is currently under construction.

2.6 Policy context
The scheme is being implemented by Associated British Ports in compensation for port development on the Humber Estuary.

2.7 Factors for failure or succes
Extensive consultation was undertaken with both statutory and non-statutory bodies during all phases of this scheme. In this respect Chowder Ness was considered a success because all of the required permissions were obtained and the scheme was able to proceed.

2.8 References
ABPmer (2004). Environmental Statement for a Managed Realignment Scheme at Chowder Ness. Report No. R.979.

3 Freiston, UK

3.1 Identification of the site

In total the Wash Banks flood defence scheme covers 8km of the coast of the Wash in Lincolnshire from Hobhole Sluice in the Witham Haven to Butterwick. Freiston managed realignment scheme formed part of this project.

Figure 3.1 Map of the site

3.2 Habitat type

Freiston is a SPA, Ramsar site and SAC.

3.3 Description of the site

The managed realignment scheme at Freiston was designed to improve the flood defences of this part of the coastline, objectives include:

- To create a sustainable flood defence scheme through the establishment of saltmarsh;
- To establish a saltmarsh community of botanical value, and as suitable habitat for invertebrates and birds;
- To establish new brackish/freshwater habitat through the excavation of a borrow pit landward of the setback bank;
- To avoid adverse impacts to existing habitat and adjacent saltmarsh and mudflat.

The scheme created a new nature reserve by returning 78 ha of agricultural land to mudflat and salt marsh habitat and creating a 12 ha brackish lagoon. The resulting habitats, provide an additional element to the sea defences of this region, as well as helping to re-create habitat lost over the centuries to enclosure.

Figure 3.2 Freiston managed realignment site at high water

3.3 Methodology (Schemes and tools, objectives, success factors)

Three 50 m breaches were cut into the outer sea bank at Freiston shore to the east of Boston, allowing salt water from the Wash to encroach on 78 ha of farmland. Improved sea defences were put in place at the rear of the site prior to it being breached in August 2002.

3.4 Monitoring

The monitoring adopted at Freiston covers a wide range of parameters including:

- Topographic surveys (2 per year);
- Sediment parameters (1 per year);
- Hydrodynamics (including, waves, tides and currents - continuous for 2-4 years);
- Habitat surveys (1 per year);
- Invertebrate surveys (1 per year);
- Fish surveys (1 per year);
- Birds (throughout each winter).

Results to date

The Wash Banks flood defence scheme has provided a sustainable 1:200 year standard of flood defence to the town of Boston and the surrounding area. The scheme also provides access for birdwatching and a focus for education and the provision of recreational facilities. The scheme has created extensive mudflats, and saltmarsh has started to develop at the site. Monitoring of the site has shown that it has attracted nationally significant numbers of birds. The more detailed monitoring reports for this site are not yet available.

3.5 Policy context

The managed realignment scheme at Freiston formed part of the Wash Banks flood defence scheme. The scheme was funded by a number of sources including Defra, the Environment Agency and the Lincolnshire Flood Defence Committee and the European Agricultural Guidance and Guarantee Fund.

3.6 References

Defra & Environment Agency (2004). Habitat Quality Measures And Monitoring Protocols- DEFRA/Environment Agency Flood and Coastal Defence

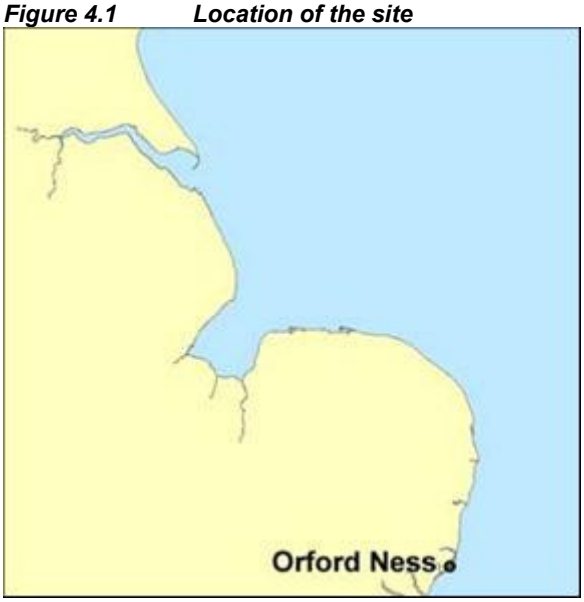
R&D Programme, 2003- Technical Report: FD1918. Symonds, A. (2004). Hydrodynamic conditions over an intertidal flat, with reference to managed realignment at Freiston Shore. - National Oceanography Centre.

4 Orford Ness, UK

4.1 Identification of the site

Orford Ness is located on the Lantern Marshes at Orford Ness, Suffolk, UK. The area of land is owned by The National Trust (National Trust, 2000 to 2002).

Figure 4.1 Location of the site



4.2 Habitat type

Orford Ness is part of the Alde Ore Estuary SPA, Alde Ore Estuary Ramsar Site, Orfordness and Shingle Street SAC and Alde Ore and Butley Estuaries SAC.

4.3 Description of the site

Site objectives

The scheme was solely aimed at enhancing the ecological value of the area.

Description of the site

Prior to the breach the area was a meadow of glyphotic vegetation. Since the initial breach there have been increasing amounts of saltwater inundating the area and consequently the vegetation of the site has changed. As would be expected there has been a general decline in the original vegetation types and the meadow plants that previously existed have largely been killed. There has also been an overall increase in the cover of exposed mud at the site, due to both the accretion of sediments and the dying of the original plants as originally predicted. Opportunistic ephemeral algal species such as *Enteromorpha* and *Ulva* cover large areas of this mud and saltmarsh communities have developed at the site.

Figure 4.2 Orford ness. Mud flat and creek development

Figure 4.3 Orford Ness. Salt marsh developement

4.4 Methodology

Orford Ness was previously an enclosed area of land until the sluice gate controlling water movements on the site failed. At this time the marsh area became partially inundated by the tide and saltmarsh vegetation began to cover the mud. After a period of consultation it was decided to deliberately breach the site in 1999. Since this date the breach has allowed a greater volume of water to pass on and off of the marsh.

4.5 Monitoring

Initially there was no structured monitoring programme for the scheme but in August 2000 a monitoring programme was established. Since this time results have been collected annually and can now be analysed and compared in a meaningful way. The parameters that are measured include:

- Topography and sedimentation rates (1 per year);
- Vegetation (1 per year).

Results to date

In the three years following the breach, the accretion on the marsh and the change in vegetation occurred to expectations. The breach naturally widened, as predicted, and the erosion of the borrow ditches behind the breach, if anything were less than expected. Visual observations suggest most sediment is settling in the middle of the marsh. The changes in vegetation types at the site are consistent with the change in the inundation period. It is concluded that the breach of Lantern Marsh has not had a significant impact on the working of the estuary and during the first three years appears to be performing to expectations.

4.6 Policy context

In 1996 the National Trust undertook a review on the best way to manage their land holding, taking into account the conservation status and the engineering costs of maintaining the riverside embankments which had been severely eroded and were in danger of being breached. The outcome of the review was a decision to breach the site at the location of the existing sluice.

4.7 References

ABP Research (1999). Lantern Marsh, Orfordness Management Options, ABP Research & Consultancy Ltd, Research Report No. R.727.

National Trust (2000 - 2002). MAFF Habitat Saltmarsh Agreement Scheme, Upper Lantern Marsh, Orford Ness, Monitoring Reports.

Defra & Environment Agency (2004). Habitat Quality Measures And Monitoring Protocols- DEFRA/Environment Agency Flood and Coastal Defense R&D Programme, 2003- Technical Report: FD1918.

5 Orplands, UK

5.1 Identification of the site

Orplands forms part of St Lawrence Bay on the south shore of the Blackwater Estuary, UK.

Figure 5.1 Location of Orplands

5.2 Habitat type

The Orplands is part of the Blackwater Estuary SPA, Blackwater Estuary Ramsar Site and Essex Estuaries SAC.

5.3 Description of the site

Site Objectives

The seawall along a 2 km frontage at Orplands had become destabilized as a result of erosion of the saltmarsh. Consequences of this erosion were that the seaward toe of the defences became undermined, with loss of the concrete revetment blocks through the increase in wave energy and overtopping causing scour of the crest and backslope. The objectives of the scheme were to restore saltmarsh yielding a natural defence.

Description of the site

The Orplands 38 ha coastal managed realignment site is an example of an experimental restoration of tidal flats and saltmarshes on tidal land. The Orplands site, prior to inundation, was essentially divided between rough grassland and agricultural land. Post inundation extensive mudflats and saltmarsh have become established at the site.

Figure 5.2 The Orpland site (Mark Dixon, 2004)

Figure 5.3 The Orplands site (Mark Dixon, 2004)

5.4 Methodology

Orplands seawall was breached in two places in 1995, enabling inundation by saline water of the coastal grassland. The breaches were made in the seawall of each compartment and were designed to accommodate tidal flows without substantial erosion. The material from the breaches was placed landward to serve as a buffer to waves entering through the breach. The old seawall was left to decay through natural erosion. The tall grass vegetation was left in place at the rear of the field to die and decompose naturally with saline water intrusion, providing an input of organic material to the soil and a sediment trap for the finer silt materials. The sediments were allowed to undergo natural colonisation by saltmarsh vegetation. The surviving tall grasses at the fringe of the saltmarsh area were left to allow a transition of vegetation communities as the saltmarsh evolves. A series of nine meandering vertically sided 'creeks' one metre deep were excavated within the site to facilitate tidal flow over the area.

5.5 Monitoring

A comprehensive monitoring programme has been carried out for the first five years of the site development (information supplied by the Environment Agency). This was done to demonstrate the effectiveness of the scheme as a flood control and habitat creation structure and includes monitoring of:

- Topography and sedimentation rates (1 a year);
- Sediment properties (1 a year);
- Habitats (1 a year);
- Invertebrates (1 a year);
- Birds (throughout each winter); and
- Fish (1 a year).

Results to date There has been an overall gain in sediment on the new marsh surface, although the extent that this has resulted from re-distribution of sediments from the wave buffer bunds is unclear. Widespread colonisation by halophytic vegetation has already started to occur naturally at all levels of the marsh. Invertebrates and crustaceans have also colonised the site and it is used extensively by birds.

5.5 Policy context

The scheme was undertaken to create a sustainable flood defence mechanism for this section of coastline.

5.6 References

ABP Research (1998). Review of coastal habitat creation, restoration and recharge schemes, Report N0.R.909.

Defra & Environment Agency (2004). Habitat Quality Measures And Monitoring Protocols- DEFRA/Environment Agency Flood and Coastal Defence R&D Programme, 2003- Technical Report: FD1918.

6 Paull Holme Strays

6.1 Identification of the site

The Paull Holme Strays site is located approximately 10 km to the south east of Hull on the north bank of the Humber Estuary, UK.

Figure 6.1 Location of Paull Holme Strays

6.2 Habitat type

The intertidal and subtidal areas fronting the Paull Holme strays forms part of the Humber Estuary pSPA, pRamsar Site and pSAC.

6.3 Description of the site

Site objectives

The scheme was designed in response to the need to implement urgent flood defence works prior to the formulation of a long term flood defence strategy for the entire estuary. The process is expected to create 80 ha of wetland and saltmarsh habitat.

Description of the site

Prior to the creation of the managed realignment site the land use behind the tidal defence was predominantly Grade 2 agricultural land. A number of scattered farms, houses and a gas distribution compound were situated in the flood risk zone with a number of gas pipelines crossing the foreshore. Seaward of the defence there was a narrow strip of saltmarsh and an extensive mudflat.. Post inundation the site has become intertidal mudflat and saltmarsh has started to colonise the site.

Figure 6.2 Paull Holme Strays. Mud flat developmen

Figure 6.3 Paull Holme Strays New sea defence

6.4 Methodology

A new sea defence was constructed to the rear of the realignment site prior to the existing defences being breached in October 2003. The site was breached in two places - a 150 m long breach and a 50 m long breach.

6.5 Monitoring

The monitoring at Paull Holme Strays is comprehensive in the types of parameters that are measured:

- Topographic surveys (2 per year);
- Sediment parameters (1 per year);
- Habitat surveys (1 per year);
- Invertebrate surveys including terrestrial species (1 per year);
- Fish surveys (1 per year);
- Birds (throughout each winter).

Results to date

Since the site was inundated in 2003 accretion has been observed across the entire site. At least 15 salt marsh and salt tolerant species have been recorded on the site where land is suitable for such colonisation, albeit at low density and very patchily. To date the invertebrate communities in the inside of Paull Holme Strays are impoverished as compared to those found on adjacent well established mudflats. Initial results appear to suggest that the highest rate of colonisation may be taking place at those sites which experience the most frequent tidal inundation.

Ornithological monitoring indicates that the site is already a valuable resource, especially for wildfowl which are less specialised in their feeding requirements. In overview it is considered that the site has developed largely as expected over the first year of tidal influence.

6.6 Policy context

Throughout the early 1990's considerable work was carried out on behalf of the National Rivers Authority (predecessor to the Environment Agency) to assess tidal defence needs in the Humber Estuary. Whilst a long term flood risk management strategy was being developed (the Humber Estuary Shoreline Management Plan) the investigations also showed that urgent flood defence improvements were required at a number of locations, including the Thorngumbald Clough to Little Humber section on the north bank of the estuary to the east of Hull. Subsequent investigations, consultations and design development led to the submission of a Planning Application in August 2000 for the Paull Holme Strays scheme.

6.7 References

Colclough S, Fonseca L and Astley T. (2004). Fish utilisation of managed realignments. Report. Environment Agency. Environment Agency (2005)

Humber Estuary, flood defence strategy, Paull Holme Strays. Environmental Monitoring Report.

7 Shotley

7.1 Identification of the site

Shotley foreshore is located in the lower Orwell Estuary, south east England, UK.

Figure 7.1 Location of Shotley

7.2 Habitat type

Shotley is part of the Stour and Orwell Estuaries SPA, Stour and Orwell Estuaries Ramsar site and Stour and Orwell Estuaries SAC.

7.3 Description of the site

Site objectives

An innovative approach to the immediate problem of estuarine foreshore protection involves the use of dredged sediment to restore eroded intertidal profiles and to thereby enhance both their effectives for flood protection and their ecological conservation. Shotley was therefore undertaken as a trial recharge scheme to assess the beneficial use of cohesive dredgings for foreshore recharge. It was aimed at improving the local flood defence mechanisms as well as creating additional intertidal habitat.

Description of the site

In the vicinity of the recharge an earth wall protects a strip of low-lying grazing land to the north of Shotley Marina. Following near complete loss of the saltmarsh over the last few decades, the seawall has suffered erosion and, despite the addition of gabions and concrete facing, is in poor condition along much of its length. The foreshore comprises low intertidal muds and gravels with isolated erosional remnants of high saltmarsh, mostly stripped of vegetation. Since the recharge was undertaken the site has become an extensive intertidal mudflat where vegetation has started to establish.

Figure 7.2 Shotley saltmarsh

Figure 7.3 Shotley foreshore

7.4 Methodology

In December 1997, a trial recharge of the eroding Shotley foreshore in the lower Orwell estuary was undertaken by Harwich Haven Authority (HHA) as a joint venture with Environment Agency. Approximately 22,000 m^3 of maintenance dredgings (d50 = 20 microns) were pumped behind a retaining bund of coarse, poorly-sorted, gravel (d50 = 7 mm). The placement extended over 450 m of foreshore with a maximum width of about 70 m (Figure 1a). The mud was pumped at a density of approximately 1.3 g cm^{-3} and achieved an initial elevation of between 1.0 and 1.3 m above Ordnance Datum (OD). In comparison, MHWN = 1.4 m and MHWS = 2.0 m OD, and the remnants of old saltmarsh typically lie between 2.0 and 2.2 m OD.

7.5 Monitoring

The main aim of the monitoring was to determine the post-placement behaviour of fine silts placed within the protective gravel bund, and to evaluate the potential, for flood defence protection and ecological enhancement, of future large scale recharges in the Orwell and elsewhere in the region. There was a pre-placement and placement baseline survey for a number of the parameters measured. The parameters that have been monitored include:

- Topography and sedimentation rates (3 monthly);
- Waves (3 monthly);
- Sediment properties (3 monthly);
- Invertebrates (3 monthly);
- Habitats (3 monthly).

Results to date
Sequential mud surface surveys indicate an initial loss in elevation (range = 0.1 to 0.4 m) over the 3 to 6 months after placement. Subsequent elevation loss has been minimal and the mud appears to have achieved a fairly stable elevation after 24 months. The medium-term flood defence value of the scheme is difficult to judge from the shorter-term monitoring carried out to date. However, it is clear that wave heights are much reduced by dissipation over the elevated foreshore. The unconsolidated nature of the mud and the low elevation is reflected in very limited colonisation by saltmarsh plants. Prior to recharge, the sediment infauna was impoverished relative to foreshores elsewhere in the estuary. Subsequently, the site has been rapidly colonised by invertebrate species, chiefly polychaete and oligochaete worms, the gastropod Hydrobia, and a few bivalves. The establishment of a diverse sediment infauna at substantially higher elevations compared to the pre-existing tidal flat has led to an increase in its use by wading birds. Although no quantitative bird monitoring has been undertaken, it is qualitatively clear that birds are able to feed on the recharge mud until much later into the tidal cycle than was previously the case.

7.6 Policy context
Shotley was undertaken as a trial recharge scheme to assess the beneficial use of cohesive dredgings for foreshore recharge.

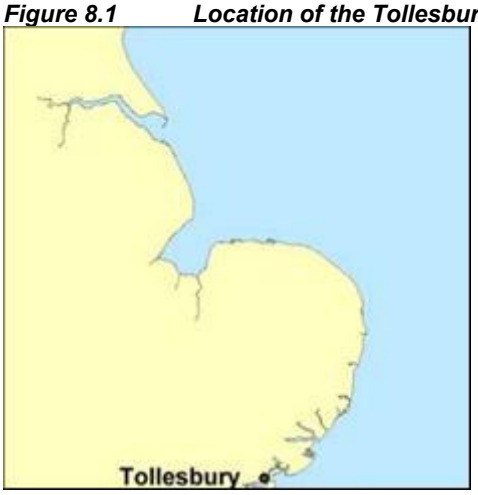
7.7 References
Defra & Environment Agency (2004). Habitat Quality Measures And Monitoring Protocols- DEFRA/Environment Agency Flood and Coastal Defense R&D Programme, 2003- Technical Report: FD1918.

8 Tollesbury

8.1 Identification of the site

Tollesbury is located on a tributary of the Blackwater Estuary in Essex (Reading *et al,* 2002; Defra Project CSA 2313).

Figure 8.1 Location of the Tollesbury site



8.2 Habitat type

Tollesbury is part of the Blackwater Estuary SPA, Blackwater Estuary Ramsar Site and Essex Estuaries SAC.

8.3 Description of the site

Site objectives The objectives of the scheme were:

- To retreat the line of coastal defence;
- To restore saltmarsh habitat for conservation purposes by breaching the existing flood embankment;
- To investigate the re-establishment of natural intertidal processes and habitat.

Description of the site

The site extends over 21 ha of agricultural land which had previously been reclaimed from salt marsh. Since the site was inundated in 1995 intertidal habitats have developed at the site including mudflat, saltmarsh and transitional marsh.

Figure 8.2 The Tollesbury site (Mark Dixon, 2004)

Figure 8.3 The Tollesbury site (Mark Dixon, 2004)

8.4 Methodology

Low embankments were constructed behind the existing sea wall, surrounding approximately 21 ha of low-lying agricultural land, adjacent to Tollesbury Creek. Following the completion of the new sea defences, the existing seawall was breached on 4 August 1995 and the enclosed area of agricultural land behind it exposed to tidal inundation for the first time in at least 150 years.

8.5 Monitoring

Intensive monitoring of the site was undertaken for 7 years post initiation of the scheme. Parameters monitored include:

- Topography and sedimentation rates (1 a year);
- Sediment properties (1 a year);
- Habitats (1 a year);
- Invertebrates (1 a year);
- Birds (throughout each winter); and
- Fish.

The site was also used to conduct scientific experiments throughout this time period.

Results to date

A number of studies were conducted at the site including a series of experimental trials. Sediment accreted throughout the site and it was found that where sediment accretion was greatest, the material became more stable. It was also observed that the soil strength within the site was still significantly stronger than on the adjacent saltmarsh. The number of intertidal invertebrate species at the site increased between 1995 and 1998. Natural colonisation of the realignment area by saltmarsh plants occurred alongside experimental introductions.

Bathymetric studies showed that during the monitoring period the whole estuary deepened. The data indicated that the increased tidal volume moving through the estuary has modified all of the channels, but that a relatively stable situation is now emerging.

8.6 Policy context

In 1994 MAFF and English Nature agreed to set up a joint project to investigate the effects of managed inundation of agricultural land by seawater. Tollesbury was acquired by English Nature and funded by the Ministry of Agriculture, Fisheries and Food (MAFF) and the Environment Agency.

8.7 References

ABP Research (1998). Review of coastal habitat creation, restoration and recharge schemes, Report N0.R.909.

Centre for Ecology and Hydrology (2002). Managed Realignment at Tollesbury and Saltram, Annual report for 2000. Defra Project CSA 2313.

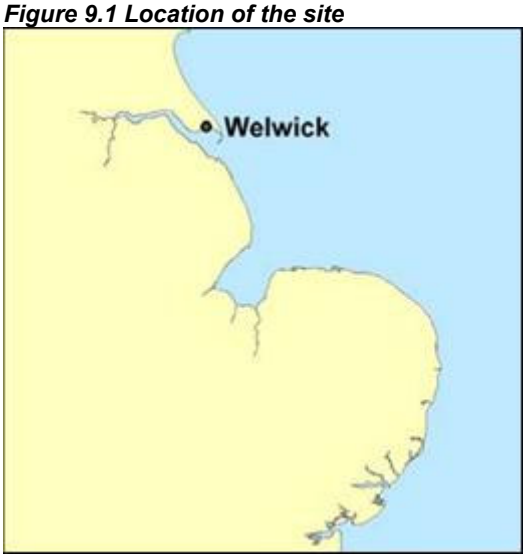
Flood and Coastal Defence, Research News (2001). Managed Realignment at Tollesbury: 1995-1999. Issue 1.

9 Welwick

9.1 Identification of the site

The realignment site at Welwick is located on the north bank in the outer Humber Estuary, UK. It is a twin project of the Chowder Ness project (see case study 2).

Figure 9.1 Location of the site



9.2 Habitat type

The foreshore and subtidal areas froting the Welwick site form part of the Humber Estuary pSPA, The Humber Estuary pRamsar Site and the Humber Estuary pSAC.

9.3 Description of the site

Site objectives

Associated British Ports (ABP) is proposing to construct a Roll-on/Roll-off (Ro/Ro) terminal at Immingham and Lift-on/Lift-off (Lo/Lo) berths at Hull, known as “Quay 2005”. In consultation with regulatory bodies and local nature conservation interest groups, a potentially acceptable compensation/mitigation package for the two port developments has been identified which includes two managed realignment schemes. Welwick forms one of these projects and it is the objective of this scheme to create between 15 and 38 ha of intertidal mudflat, between 12ha and 28ha of saltmarsh and between 4 ha and 10 ha of grassland.

Description of the site

The re-alignment site at Welwick is currently under construction. The site covers a total area of some 54 ha to the edge of the current saltmarsh in front of the seawall. Landward of the current defences the site area covers approximately 48ha, whilst the current sea defence accounts for 3 ha and saltmarsh in front of this covers 3ha. The land behind the existing seawall is currently low-lying agricultural land. Once the site has been inundated it will create mudflat, saltmarsh and grassland habitat.

Figure 9.2 Saltmarsh at Welwick prior to inundation

Figure 9.2 The Welwick site under construction

9.4 Methodology

The existing sea defences will be removed and new defences will be constructed to the north and east of the site. The saltmarsh which fronts the current defences will be left in place and two breaches will be made to link the newly created site with the wider estuary. The reprofiling of the fields within the scheme will create the correct levels for the establishment of the various habitats. It is envisaged that the works would be undertaken over a period of 2 years, in a number of stages, with the intention of starting in the spring of 2005 and completion in the autumn of 2006.

9.5 Monitoring

An extensive programme of environmental monitoring will be carried out, before, during and following completion of the scheme. A programme of general verification monitoring will be undertaken to seek to assess the longer-term impacts of the realignment scheme on the adjacent intertidal areas. A number of monitoring objectives have also been established for the scheme to seek to achieve the maximum ecological potential for the site. These monitoring objectives have been established as a guide to what the site should be capable of delivering. An initial review is planned after five years to ensure that the habitat creation is on track, followed by a formal review of compliance after ten years. The monitoring requirements at the site include:

- Topographic surveys (1 per year);
- Sediment parameters (1 per year);
- Habitat surveys (1 per year);
- Invertebrate surveys (1 per year); and
- Birds (throughout each winter).

The results of the monitoring will inform whether the project has met its compensation objectives.

Results to date
The scheme is currently under construction.

9.6 Policy context
The scheme is being implemented by Associated British Ports in compensation for port development on the Humber Estuary.

9.7 Factors for failure or succes
Extensive consultation was undertaken with both statutory and non-statutory bodies during all phases of this scheme. In this respect Welwick was considered a success because all of the required permissions were obtained and the scheme was able to proceed.

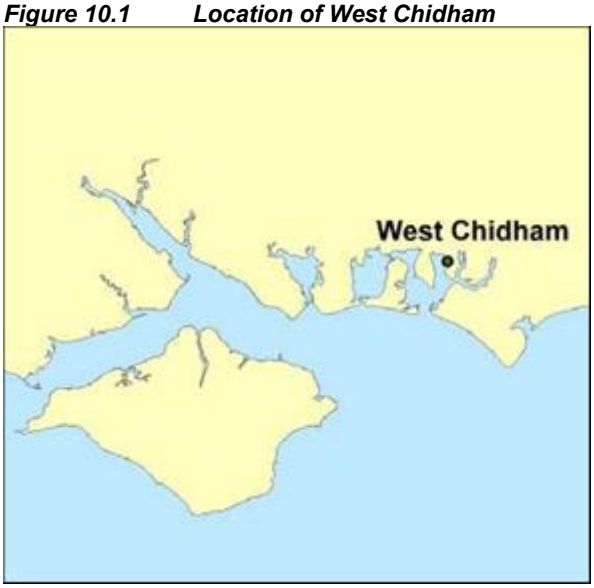
9.8 References
ABPmer (2004). Environmental Statement for a Managed Realignment Scheme at Welwick. Report No. R.980.

10 West Chidham

10.1 Identification of the site

West Chidham is located within Chichester Harbour, on the south coast of England, UK. The site extends for approximately 2km southwards from Chidham Point, and extends landward up to 250m to the east of the existing sea defences.

Figure 10.1 Location of West Chidham



10.2 Habitat type

West Chidham is part of the Chichester and Langstone Harbours SPA, Chichester and Langstone Harbours Ramsar site, Solent and Isle of Wight Lagoons SAC and Solent Maritime SAC.

10.3 Description of the site

Site objectives

The main objective for the West Chidham scheme was to upgrade the exisiting sea defences fronting Chidham Manor farm. Subject to achieving ideal conditions, approximately 9.74 ha of new inter-tidal habitat may be created by the scheme.

Description of the site

The scheme at West Chidham has received planning permission and is currently under construction. The application site comprises approximately 24 ha of cultivated agricultural land. The entire shoreline and intertidal area adjacent to the application site within Chichester Harbour is designated a Site of Special Scientific Interest (SSSI), Special Protection Area (SPA), Ramsar Site and candidate Special Area of Conservation (cSAC) (Chichester Harbour Conservancy, 2002). Existing habitats in the vicinity of the site include mudflat, saltmarsh and transitional grassland.

Figure 10.2 West Chidham prior to scheme construction

Figure 10.3 West Chidham, prior to scheme construction

10.4 Methodology

The scheme comprises the realignment of the existing sea defences along a 2.3 km section of the shoreline. An earth embankment, 1.8 km in length, will be constructed along the eastern edge of the application site. The existing embankment will be breached to allow the sea to inundate the low-lying land behind the former line of defence. Three sections of the existing embankment will be retained to create islands for roosting birds.

10.5 Monitoring

As a result of discussions with statutory organisations the following monitoring requirements were identified:

- Water quality (suspended solids and nutrient concentrations;
- Existing sediment profiles;
- Density and distribution of eelgrass beds;
- Benthic macro-invertebrate assemblage within the mudflats;
- Density and distribution of macro-algal mats;
- Distribution pattern of existing saltmarsh; and
- Information on local fish populations as species and age classes

Results to date

The scheme has yet to be implemented.

10.6 Policy context

Chichester Harbour Conservancy proposes to carry out a managed realignment scheme along the west shore of the Chidham Peninsula to upgrade the sea defences fronting Chidham Manor Farm. The proposed realignment of the sea defences along this section of shore, is a specific objective of the Chichester Harbour Management Plan (Chichester Harbour Conservancy, 1999) as it has landscape, conservation and long-term flood protection benefits.

10.7 References

Chichester Harbour Conservancy (1999). Chichester Harbour Management Plan.
Chichester Harbour Conservancy (2002). West Chidham, Managed retreat scheme-Environmental statement.

Defra & Environment Agency (2004). Habitat Quality Measures And Monitoring Protocols-DEFRA/Environment Agency Flood and Coastal Defense R&D Programme, 2003- Technical Report: FD1918.

11 De Baai van Heist, Belgium

11.1 Identification of the site

Beach reserve on the east side of the port of Zeebrugge (community of Knokke-Heist) consisting mainly of embryonic dunes and intertidal areas.

Figure 11.1 Overview of de Baai van Heist

11.2 Habitat type

Habitat directive: complete area
2110 (16.211) Embryonic shifting dunes, 2120 Shifting dunes along the shoreline with Ammophila arenaria (white dunes), 1310 Salicornia and other annuals colonising mud and sand.

This area was the first Flemish beach nature reserve (1992).

11.3 Description of the site

Between 1977 and 1985 the eastern pier of the Port of Zeebrugge was built and between 1977 and 1979 the Knokke-Heist beach was recharged for the second time. Apart from this artificial supply of sand, the eastern pier formed a buffer between the beach in Heist and the sea currents. Under the lee of the pier and the sea wall much sediment settles because of the slowed current. A broad beach originated partly through the beach recharge and partly through natural sedimentation. The considerable distance (up to 700 m) to the sea and the sand that is enriched with sediment kept the average tourist away from the area. Thanks to the less intensive use pioneer vegetation could germinate and grow and even dunes started to form.

The development of the Zeebrugge harbour created hundreds of hectares of flat, undisturbed raised ground, providing an ideal breeding ground for terns and gulls. Before 2000 all terns and most gulls were located in the western part of the harbour, where populations grew to internationally important numbers (e.g. Little tern: max. 425 pairs or 3% of biogeographical population; Sandwich tern : max. 1650 pairs; Common tern : max. ca. 2000 pairs).
Due to industrial development and in line with the requirements of the Bird Directive, compensation for loss of habitat in this western part of the harbour was created at the opposite (eastern) side in 1999. This “tern peninsula” became very successful in the following years by the growing proportion of birds settling here instead of in the western harbour. As a third stronghold for breeding terns, the “Baai van Heist” became a very important nesting ground for Little tern.

De Baai van Heist is presently the most important habitat bordering the sea, both in terms of species and vegetation: many typical species are rare and/or on the Red List and the floodmark vegetation species are quite complete. Moreover, the surface that is covered with this vegetation is considerable.

Thanks to the development of salt marsh vegetation, embryonic dunes and floodmark vegetation, including many of the most typical, rare and endangered species, this area belongs to the highest rating. The most specific botanical values of the site are situated in the floodmark and embryonic dunes. Most of the species of this habitat type present in the Flemish region can also be found here, including at least regionally rare plant species such as Parapholis strigosa, Crithmum maritimum, Catapodium maritimum, Honckenva peploides and Beta vulgaris ssp. Maritime.

On top of this, the natural development and limitation of disturbance can lead to an even higher rating. Other vegetation elements, such as rare and/or endangered species contribute to the area's diversity, even though they are sometimes only poorly developed or marginal.

11.4 Methodology
Spontaneous development of salt marsh vegetation, embryonic dunes and floodmark vegetation. No restoration or development scheme was involved.

11.5 Identification of factors for success and failure
Factors for success
- Spontaneous sand accretion under the lee of the port = positive effect of the port of Zeebrugge;
- Has been appointed Flemish Nature Reserve;
- Restoring natural dynamic situations, however small-scale they are, through simple measures leads to a direct result;
- As the faunal and floral diversity in dune areas is so considerable, a multispecies approach is the only correct approach; the selection of appropriate indicator species must be based on scientific research;
- local and infrastructural bottlenecks are fairly easy to solve. Solving more general issues often demands input from different actors at different (administrative) levels. This requires a structured approach. Developing an integrated approach sometimes requires the courage to change your way of thinking, but also offers opportunities to solve complex problems.

Factors for failure
- large-scale dynamic processes are no longer possible within the spatial conditions of the area;
- to compensate for the visual pollution, caused by the port of Zeebrugge, the higher authorities promised to build a marina in the area in spite of the fact that the area has been designated as "nature development area" in the "Groene Hoofdstructuur". The accompanying revalorisation of Heist's seawall has already been largely executed, causing many art nouveau façades to be demolished;
- The main problem of the area is its accessibility : ground breeding birds and embryonic dunes are being disturbed by people and especially dogs.

11.5 Monitoring
- morphological monitoring by ir. Stefaan Gysens;
- detail mapping of flora by the Institute of Nature Conservation (***http://www.instnat.be/content/page.asp?pid=BIO_DUI_Florakartering***)
- also by the Nature Conservation Institute : detailed vegetation survey
- study into accretion (sandbank) is presently in preparation.

11.6 Policy context
Spontaneous development as a result of the expansion of the harbour of Zeebrugge and sand recharge at the Knokke-Heist beach.

11.7 References

- Mees J., J. Seys, J. Haspeslagh & J.-L. Herrier (eds). 2002. Academische studiedag : 5 jaar strandnatuurreservaat “De Baai van Heist” – De Vlaamse stranden : steriele zandbakken of natuurpatrimonium ? Zeebrugge (B), 14 juni 2002. Ministerie van de Vlaamse Gemeenschap, AMINAL, afdeling Natuur – Vlaams Instituut voor de Zee (VLIZ). VLIZ Special Publication, 9 : Oostende, Belgium
- Provoost S., M. Hoffmann. 1996. Ecosysteemvisie voor de Vlaamse kust – Ministerie van de Vlaamse Gemeenschap, AMINAL, afdeling Natuur
- Verwaest, Toon, Peter De Wolf, Jean-Louis Herrier and Marc Leten. Windows in the dunes - the creation of sea inlets in the nature reserve de Westhoek in De Panne
- Devos, Koen, Jean-Louis Herrier, Marc Leten, Sam Provoost & Guido Rappé. 1995. De Baai van Heist : natuur in volle ontwikkeling.

12 Common tern habitat Van Cauwelaert Lock

12.1 Location of the site

Breeding place at the tip of the Van Cauwelaert lock, located on the right bank of the Scheldt. A climate station is also located on the lock, close to the breeding habitat.

12.1 Location of the common tern breeding habitat on the Van Cauwelaert lock

12.2 Habitat type/target species

Open sand or sand with pioneer vegetation/Common tern.

12.3 Description of the site

Before

Grassland with proliferating blackberry.

After

The site is composed of open sand with (in the future) some pioneer vegetation. Branches of wood were also placed to allow for outlining of breeding territories. Small pipes will also be added to create possibilities for the young to shelter from the sun. A fence is placed to protect the site. The site is approximately 0.5 ha.

Figure 12.2 Before implementation of the scheme on the Van Cauwelaert lock

Figure 12.3 After implementation of the scheme on the Van Cauwelaert lock

12.4 Methodology

The breeding habitat creation scheme was implemented in spring 2005 and involved the following components:

- Heighten the area with shell rich sand;
- Add an iron fence;
- Add wood and little tubes for shelter.

This habitat creation scheme falls under "The placement of sediments (dredged material) to create coastal and estuarial islands to provide new feeding, roosting and breeding habitat for birds (Landin, 1991)." (cf. ABP Southampton 1998, Review).

12.5 Monitoring

Monitoring is done by volunteers of *Natuurpunt* (the largest Nature NGO in Flanders). The scheme was implemented in spring 2005. Monitoring is done by volunteers of *Natuurpunt* (the largest Nature NGO in Flanders). No Common terns (*Sterna hirundo*) were observed yet at the location. One Oystercatcher (Haematopus ostralegus) was breeding on the spot during the 2005 breeding season. The breeding site was established a little too late for the 2005 breeding season.
Subsequently, an extra fence has been constructed around the site at a greater distance to minimise disturbance by fishermen during the breeding season.

12.6 Success and failure

The breeding site was established a little too late for the 2005 breeding season. Furthermore, ornithologists observed that 2005 was generally a 'bad' year for breeding Common terns. This may also have contributed to the lack of initial success

Concerning reaching the preferred environmental conditions or ecological goals

Success factors

- Pioneer habitat is easy to create and demands little management
- Rapidly colonised because it is a pioneer habitat.

Failure factors

- Disturbance is a potential failure factor. The placement of an extra fence at a larger distance of the breeding place in March 2006 should resolve this. Also an information panel will be added at the fence.

Key element in succeeding or failing to take the process from the planning phase of the nature creation project to the implementation phase of the project

Success factors

- Low cost/ High effectiveness

Failure factors

- None for the moment.

In conclusion we can state that it is an easily, relatively cheap and potentially successful habitat creation scheme

12.7 Policy context

This breeding habitat is part of the network of ecological infrastructure the Port Authority of Antwerp is developing and implementing in collaboration with *Natuurpunt*, Flanders largest nature NGO. The implementation of the network of ecological infrastructure is co-funding by the European Commission through the INTERREG IIIB project NEW!Delta. The network of ecological infrastructure in the Port of Antwerp is, on the one hand, an implementation of local spatial planning guidelines, on the other hand, it could present an opportunity for implementing species protection at the 'port area' level.

12.8 Stakeholder involvement and policy and decision making process

The Port of Antwerp initiated this project in close collaboration withNatuurpunt (nature NGO) as part of the realisation of a network of ecological infrastructure in the port area. Natuurpunt, together with POA, developed the design for the breeding site. Natuurpunt is linked with the POA though a collaboration arrangement since 2000.

An information panel will be in place in March 2006 (co-funded by the EU through the NEW!Delta project).

The project was financed by the POA and co-funded up to 50% by the European Commission through the Interreg project *NEW!* Delta. The scheme costed approximately € 27.000.

13 De Fonteintjes

13.1 Identification of the site

The Fonteintjes concerns the Dune belt between Blankenberge and Zeebrugge.

Figure 13.1 Overview of the Fonteintjes

13.2 Habitat type

Habitat directive: complete area natural habitats of the annex I of the European Habitat-directive '2110 (16.211) Embryonic shifting dunes', 2120 Shifting dunes along the shoreline with Ammophila arenaria (white dunes), 2160 Dunes with Hippophae rhamnoides, 2190 Humid dune slacks, 3140 Hard oligo-mesotrophic waters with benthic vegetation of Chara spp. Offers also breeding opportunity to at least Kentish Plover (Charadrius alexandrinus) and Great Ringed Plover (Charadrius hiaticula). Birds directive: almost complete area.

13.3 Description of the site

The dune area between Blankenberge and Zeebrugge contains a number of dune depressions with marshes and small freshwater lakes (known as "De Fonteintjes") with a high ecological value. The depressions originate from a middle age coastal defence structure, consisting of two parallel dykes. Due to sand accretion a foredune ridge was formed and the depressions gradually obtained dune slack characteristics. On the regional land use planning map the area is partly indicated as a scenic area and partly as a nature reserve. Some vulnerable dune areas are managed as a nature reserve and are not open to the public. Nevertheless, high recreational and tourist pressures caused a disruption of nature values, erosion and general degradation of the dune area which has also an important coastal defence role as dune area bordering the sea (known in Dutch as 'zeereepduinen'). However, damage to these dunes may have far-reaching consequences. These dunes form a natural seawall preventing flooding of the low-lying polder land that lies behind the dunes. The Administration of Waterways and Maritime Affairs of the Ministry of the Flemish Community manages this dune area. The administration wanted to rearrange the area as a model project. The aim is to deliver more sustainable development by zoning and directing of recreation, the protection and increase of nature conservation value in the area and keeping the dunes function as a seawall intact.

The major ecological value of De Fonteintjes is situated in the depressions. They consist of Calthion dune slack vegetations (with a.o. a large population of Dactylorhiza praetermissa), oligotrophic lakes (Chara spp. and Potamogeton coloratus) and scrub or reedland. The dune belt is rather narrow and mainly consists of semi-fixed marram dunes.

This project is an ideal test case for the Flemish region where dunes bordering the sea still have an important coastal defence role. The possible interconnection between the functions of seawall, nature reserve and recreation was examined in detail. The plan for the institution of the area will serve as an example for similar dune areas in Flanders and in other regions in Europe that are under strong pressure because of increasing tourist-recreational demands upon them.

13.4 Methodology

The area development vision starts from three basic objectives:

1. guaranteeing a stable massif of dunes offering sufficient safety for coastal defence;
2. preservation and increase of nature values;
3. spatial and intrinsic structuring of recreation and encouragement of nature conservation use.

To realize these objectives, a series of measures aiming at readjustment of recreation in the area have been executed.

General keynotes for the institution plan:

- Multiple use of principal and additional functions: first and foremost the area's function has to be outlined. The three principal functions of the area are: seawall, nature conservation and recreation. This multifunctionality needed to be maintained! Yet, it is appropriate to advance a hierarchy in the functions by distinguishing the primary and additional functions for example. In this case seawall and nature conservation constitute the primary function and recreation the additional function. In the case of recreation we are here using the term "recreational joint use". This means that the area can be used for recreational purposes but without disturbing the natural characteristics of the area;
- Interrelation of functions and prior conditions: in case of multifunctional use of an area there is the possibility of choosing between separation and intermingling of functions. The first option is advisable in case of an incompatibility between the primary functions. This is not the case in the present example. The preservation of a stable massif of dunes permits an integration of primary and additional functions on condition that certain preliminary conditions are fulfilled. For the maintenance of the seawall and for the recreational infrastructure, for example, one has to look for techniques and materials that disrupt this characteristic area as little as possible. Moreover, the recreational activities must be geared to the system's capacity

The opening up of the area for recreation use was largely selective, namely an exclusive walking and nature-oriented recreation geared to the area's capacity. This requires that:

- the number of entrances, passages and paths though the area is limited;
- the network of paths is visualized formally by means of a clear paving in order to guide the holidaymaker;
- spatial zoning is designed to lead holidaymakers (with the exception of anglers) as much as possible to the beach and a small area of the dunes range bordering the sea;
- elementary reception provisions are provided in the form of shielded information signs and information panels at the various entrances to the area;
- vulnerable vegetation sensitive to erosion is protected in a fenced-off area.

13.5 Identification of possible factors of success and failure

Possible factors for success

- Restoring natural dynamic situations, however small-scale they are, through simple measures leads to a direct result.
- Joining larger dune areas and setting up a global management vision offers better chances for the optimal functioning of natural biotopes and biota, as well as for the maintaining of typical natural and dynamic processes. Defragmentation of larger dune areas will only be meaningful if a global management vision exists about the recreational processes in the complete project area.
- Participation by actors in the process will broaden the basis of the management plan.
- Multifunctional use of spaces and the respect for the natural quality of dune areas demand a clear spatial vision.
- Measures of nature education also broaden the basis for nature conservation.
- Accessibility, use of sustainable materials fit into an integrated vision on sustainable management of coastal areas.

- As the faunal and floral diversity in dune areas is so considerable, a multi-species approach is the only correct approach; the selection of appropriate indicator species must be based on scientific research.

Possible factors for failure

- Fragmentation of dune areas remains an important factor causing negative impacts along the Flemish coast; even today dune areas are being lost because of building projects, recreation etc.
- The impact of recreation and development is hard to assess. Recreational pressure or impact cannot be measured objectively and little is known about the influence of disturbance, trampling etc. on the different dune biotopes and their specific fauna. Still, this is used as an important criterion for the closing down or opening up of certain areas.
- Judging the recreational impact on areas with high nature conservation values requires an element of subjective assessment.
- The existing legislation makes it legally and technically difficult to remove thicket as a restoration measure: the required procedure to exempt the prohibition on deforestation is lengthy. The obligation for spatial compensation is impeded by the lack of compensation areas that are owned by the initiative taking authority. Possible compensation areas that are owned by the same authority are being reserved for new forestation and not for compensation of deforestation. The pressure on the open spaces by different social sectors makes it even harder to find compensation areas. Financial compensation for deforestation is extremely expensive. An alternative for the compensation obligations might be to frame the deforestation measures within an approved management plan of an official nature reserve, as these are exempt from compensatory forestation.
- It is hard to reconcile the nature conservation objectives of a nature reserve with intensive recreation. The problem of increasing thicket can only be solved through an integrated long term approach. In the short term we have to see to areas that need priority deforestation (pan vegetation, wet pans, moss dunes) It is important meanwhile to continue to research into alternative sand fixing methods that do not need the use of exotic species or osier.
- The mass planting of exotic species for dune fixation and for the prevention of erosion has led to a management that is not oriented towards nature in an important part of the dune areas. By omitting the natural dynamic processes (such as erosion), biotic management influences (natural grazing by rabbits), small-scale human management (grazing by cattle and deforestation through tree farming) and general environmentally disturbing effects (deposition of acidification elements) the remaining nature conservation value is also threatened without additional management measures.

13.6 Monitoring

No inventories have been made for De Fonteintjes yet.

13.7 Policy context

The Coastal Division intends to have all dune areas rearranged in a similar way. This happens according to the following cycle: survey of the area, arrangement plan, investment works. Every step happens according to the principles of integrated coastal zone management: participative planning, involvement of stakeholders, to harmonise the different interests and views.

13.8 Stakeholders involvement, socio-economics, financial aspect, decision making process

The decision making process was carried out by a steering committee (governmental organisations & NGOs). An advisory commission has been involved in every step of the process.

Financial aspects: the costs of preliminary studies were 1,125,000 Bfr. (+/- € 28,000), the investment works were € 859,049.44.

14 De slufters in de Panne

14.1 Identification of the site

The Flemish Nature Reserve 'De Westhoek' is the largest area of natural coastal dunes along the Flemish coast. It is situated near the border with France. Together with the French state-domain 'La Dune du Perroquet' it forms a trans-border coastal dune reserve of 700 hectares. From high-tide mark to polders, the range of dunes has a width of approximately 2 kilometres.

Figure 14.1 Overview of the Westhoek reserve near de Panne

14.2 Habitat type

Habitat directive: complete area
2120 Shifting dunes along the shoreline with Ammophila arenaria (white dunes), 1310 Salicornia and other annuals colonizing mud and sand.
Birds directive: complete area

14.3 Description of the site

In the 1950s heavy storms beat a breach through the foredunes of 'La Dune du Perroquet'. Consequently during high tides the seawater could penetrate through the breach into the low lying areas behind the foredunes. This phenomenon is called a 'sea inlet', or a 'slufter'. A sea inlet has a limited lifespan. Eventually a sea inlet will close when natural accretion by sand that is transported from its surroundings by wind and water, blocks its mouth. A closed sea inlet can reopen again by erosion during stormy weather. A sea inlet is a feature of a dynamic sandy coastline. Sea inlets in the dunes are a rare phenomenon along the sandy coasts of the southern North Sea. They usually harbour a highly specialised bird-life and salt-tolerant flora.

At the end of the 1970s a concrete dunefoot revetment was built in front of 'De Westhoek' dunes in order to prevent further coastal erosion of these dunes. Back then the shore-line management in Belgium consisted very much of fixing the coastline wherever erosion was taking place. Meanwhile the coastal resort of De Panne was expanding. Dune areas were built up with apartment blocks and villas. These buildings further necessitated protection against erosion of the dunes.

Nowadays, a quarter of a century later, the shoreline management of the Flemish Regional Authority has changed and it is now forbidden by law to build inside the dunes. The concept of fixing the coastline has been replaced by the concept of a dynamic coastline, meaning that the natural processes of sand transport along the coastline are being re-established wherever possible. According to these new shore-line management principles a project has been developed for the artificial creation of sea inlets in the dunes of the 'Westhoek'.

The project idea is essentially to remove the first line of dunes and the dunefoot revetment at two locations, to build two bridges at those locations, and to remove sand from the slufter areas and transport it to the second line of dunes.

14.4 Methodology

The management-plan for the Nature Reserve 'De Westhoek', that was approved in 1996, suggested to create sea inlets by locally removing the concrete dunefoot revetment. The creation of sea inlets allows the development of the natural habitats of the annex I of the European Habitat-directive '1310 (15.11) Salicornia and other annuals colonising mud and sand' and '2110 (16.211) Embryonic shifting dunes', and also offers breeding opportunity to Kentish Plover (Charadrius alexandrinus) and Great Ringed Plover (Charadrius hiaticula).

The coastal defence policy aims at minimising the possible damage by the sea during storm periods. The creation of sea inlets in the foredunes had to be combined with strengthening the dunes behind the sea inlets. Thus, the risk of storm damage for the local residents as well as for the hinterland does not increase.

On top of the dunefoot revetment is a very popular path for walkers. It is part of the sign posted footpaths across the 'Westhoek' dune reserve. Breaching the foredunes and the dunefoot revetment had to be combined with the building of bridges over the mouths of the sea inlets. In that way the continuity of the walk-ways is preserved.

A groundwater resource exists underneath the 'Westhoek" dunes. Part of it is pumped up as drinking water. The creation of the sea inlets is not expected to cause major salinisation of this aquifer.

The works were executed in the spring of 2004.

The works consisted of:

- lowering the bottom of two deflation zones behind the fore-dunes and partly the fore-dunes themselves to a level that is lower than the high tide level;
- strengthening the dunes that surround those lowered deflation zones to prevent the sea-water from penetrating the dune-area further than is considered desirable; this reinforcement was carried out with the sand that was excavated from the deflation zones and the fore-dunes;
- removing the concrete dunefoot revetment at two locations over a distance of 20 metres and 15 metres respectively to allow the seawater to penetrate the deflation zones;
- building two bridges over the breaches in the dunefoot revetment to allow pedestrians to continue their walk uninterrupted.

14.5 Identification of possible factors for success and failure

Possible factors for success

- restoring natural dynamic situations, however small-scale they are, through simple measures leads to a direct result;
- multifunctional use of spaces and the respect for the natural quality of dune areas demand a clear spatial vision;
- accessibility, use of sustainable materials fit into an integrated vision on sustainable management of coastal areas;

- because the faunal and floral diversity in dune areas is so high, a multispecies approach is the only correct approach; the selection of appropriate indicator species must be based on scientific research;

- local and infrastructural bottlenecks are fairly easy to solve. Solving more general issues often demands input from different actors at different (administrative) levels. This requires a structured approach. Developing an integrated approach sometimes requires the courage to change your way of thinking, but also offers opportunities to solve complex problems.

Possible factors for failure
- large-scale dynamic processes are no longer possible within the spatial conditions of the area.

14.6 Monitoring
Measurements of the morphological changes during the first months after completion of the works reveal that especially the mouths of the sea inlets are very dynamic. Wind blown sand accumulates in the mouths but is eroded again by the sea when flooding occurs. Also a thin layer of silt and mud has already formed a deposit in the slufter areas' gullies, together with organic debris such as sea weed.

A large number of boreholes with open pipe piezometers have been installed to monitor the evolution of the groundwater salinity in the immediate surroundings of the slufter areas and also at a larger distance from the slufter areas in the direction of the drinking water wells. Conductivity measurements in the boreholes (EM 39 technique) show that on January 13th 2005 salt water has infiltrated underground no farther than ca. 10 m from the slufter areas, and no deeper than ca. 10 m beneath ground level. This can be attributed to the main groundwater flow which is directed seaward.

The aim of the project is an occasional flooding of the slufter at high spring tides. Until now the area has been flooded about 3 times and a number of annual floodmark species such as Cakile maritime have already established.

Monitoring of the different environmental, ecological and natural characteristics will be continued in the coming years. Already a number of breeding birds, such as Kentish Plover, have been spotted. No complete inventory has been made yet.

14.7 Policy context
Integrated Coastal Zone Management, Management of Westhoek Nature Reserve

14.8 Stakeholders involvement, socio-economics, financial aspect, decision making process
It has been very difficult to agree on common goals during the development of the project. Different stakeholders emphasised different view points. A lot of aspects had to be taken into consideration. The most important aspects were nature conservation and enhancement, coastal safety, recreation, landscape conservation and protection of the fresh groundwater that is being extracted for drinking water in the adjacent dune site.

Stakeholders: municipality of De Panne, water extracting company, nature organisations.

Administration, safety and recreational aspects: bridges were needed to be able to cross the border to France.

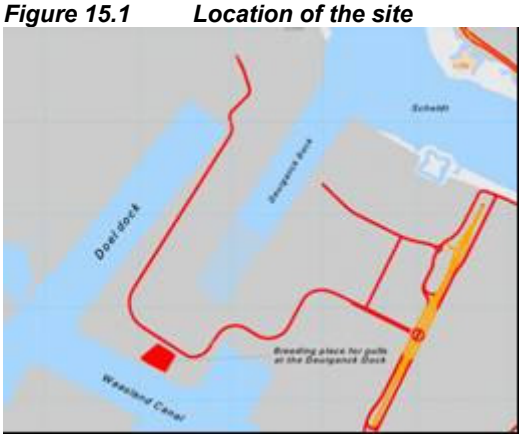
Decision making process: an advisory commission has been involved in every step of the area development vision study and the environmental impact report. At first there was resistance from the Municipality of De Panne and the water extracting company.

15 Gull Breeding site Deurganck Dock

15.1 Identification of the site

The site of 8 hectare is located southwest of the Deurganck Dock between the Deurganck Dock and the Waasland canal on the left bank of the Scheldt.

Figure 15.1 Location of the site



15.2 Habitat type/target species

Open sand or sand with pioneer vegetation/Gulls, especially the Mediterranean Gull (*Larus melanocephalus*)

15.3 Description of the site

Before

Mostly Silver birch and Goat willow. The vegetation in the more open areas was dominated by Wood small-reed.

After

Open sand and pioneer vegetation. The purpose of this scheme was to create a suitable breeding habitat for the Mediterranean Gull (Larus melanocephalus), and to a lesser extent the Black-Headed Gull (Larus ridibundus).

Figure 15.2 Gull breeding habitat at Deurganck dock after implementation of the scheme (on the left you can clearly see the dikes created around the breeding habitat)

15.4 Methodology

The breeding place creation scheme involves the following components:

- Removal and disposal of ligneous vegetation to create a more open grassland;
- Digging of a canal around the area to give breeders a safe 'island' feeling and protect them from ground predators like the fox. The material excavated from the site was used to create a dike surrounding the area.

15.5 Monitoring

The scheme was implemented in spring 2004. Already during the 2004 breeding season, 37 pairs of breeding Mediterranean Gull were spotted, as well as 1 Bluethroat (*Luscinia svecica*).

Monitoring of this site (as well as for in the entire left bank area) happens through an agreement with the Flemish Institute for Nature Conservation (Spanoghe *et al.* 2003, Gyselings *et al.* 2004). Volunteers of nature associations also contribute in collecting monitoring data.

15.6 Success/failure

Issues relevant to achieving the preferred environmental conditions or ecological goals included:

Success factors

- Easy to create because it is a pioneer habitat type
- Rapidly colonised because it is a pioneer habitat

Failure factures

- None for the moment.

Key elements in succeeding or failing to take the process from the planning phase of the nature creation project to the implementation phase of the project included:

Success factors

- Low cost/ High effectiveness

Failure factures

- None for the moment.

15.7 Policy context

This breeding habitat is part of the network of ecological infrastructure the Port Authority of Antwerp is developing and implementing is collaboration with *Natuurpunt*, Flanders largest nature NGO. The implementation of the network of ecological infrastructure is co-funding by the European Commission through the INTERREG IIIB project NEW!Delta.
Ecological infrastructure is part of the national planning policy with the ambition, in the near future, to be a link between planning and nature policy on the small scale (smaller nature units for species protection and supportive to large nature units like SACs[1] and SPAs[2]).

15.8 Stakeholder involvement and policy and decision making process

There has been consultation with Natuurpunt (Nature NGO), the Flemish Institute for Nature Conservation, the public administration for Nature and the Antwerp Port Authority. The port area is an important breeding area for birds breeding on pioneer situations like the coast. This explains the choice of a breeding place in the port area.
The Port of Antwerp initiated the project in close collaboration with Natuurpunt which elaborated the design of the site/implementation scheme and chose the site.

The project cost approximately € 14.000 and was financed by the Port of Antwerp and European co-funding through the Interreg project NEW!Delta. The land is property of the port so no land purchase had to be done.

An information panel will be established.

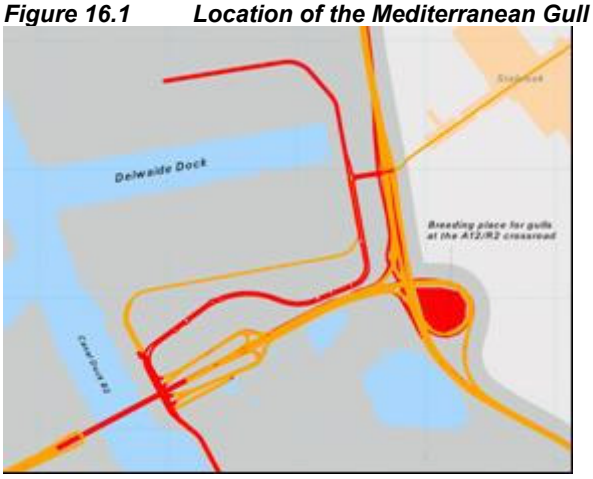
[1] Special Areas of Conservation (SACs) are designated under the EU 'Habitats Directive' (Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora).
[2] Special Protection Areas (SPAs) are designated under the EU 'Birds Directive' (Council Directive 79/409/EEC on the conservation of wild birds).

16 Gull Breeding site Intersection A12/R2

16.1 Identification of the site

The A12/R2 Mediterranean Gull breeding habitat is located within the loop of a highway intersection (A12/R2) on the right bank of the Scheldt at the border of the port area (Antwerp, Belgium).

Figure 16.1 Location of the Mediterranean Gull breeding habitat at the A12/R2 highway intersection



16.2 Habitat type

Open sand or sand with pioneer vegetation/Gulls, especially the Mediterranean Gull (*Larus melanocephalus*).

16.3 Description of the site

Before

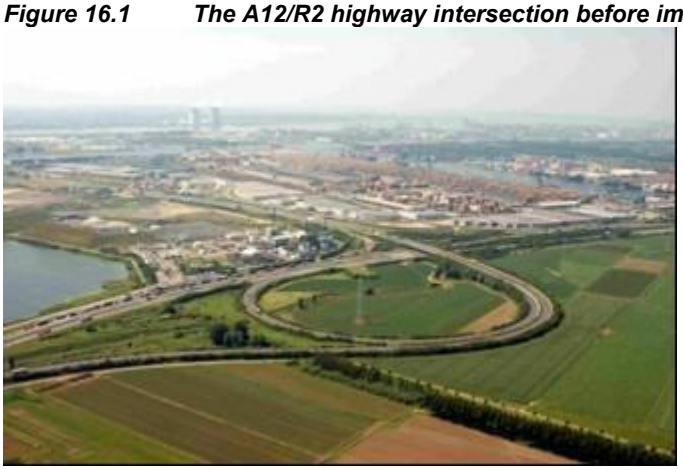
The site is currently in agricultural use and is part of a polder. A canal crosses the area from north to south. A high voltage electricity cable runs above it, as well as a gas pipeline beneath it. Its easterly border, close to the highway is composed of higher ligneous vegetation (trees and shrub).

After

This site hasn't been developed yet. The implementation of the scheme is planned for 2006.

A breeding place for Mediterranean Gulls (*Larus melanocephalus*), and to a lesser extent the Black-Headed Gull (*Larus ridibundus*) will be provided at this location. The area will then be composed of shell-rich sand with pioneer vegetation. Since the works still have to be done, additional information will be added in a later phase.

Figure 16.1 The A12/R2 highway intersection before implementation of the scheme.



16.4 Methodology

The scheme, to create a new suitable breeding habitat for Mediterranean gull, is likely to be implemented during summer 2006 and will involve the following components:

- Elevated terrain with shell rich sand, creating a habitat with variation in the topology and thus dryer and wetter areas.
- Improved control over the groundwater level (decoupling from agricultural land in the vicinity)
- Digging of a canal around the area to give the breeders a safe 'island' feeling (and thus protecting them from ground predators like the fox).
- Compartmenting the breeding habitat with canals or branches.
- Allowing for a significant buffer around the breeding habitat to shelter the nesting birds from the impacts of surrounding (human) activities.

16.5 Monitoring

No information available yet. Additional information can be added in a later phase.

16.6 Policy context

This breeding habitat is part of the network of ecological infrastructure the Port Authority of Antwerp is developing and implementing in collaboration with *Natuurpunt*, Flanders largest nature NGO. The implementation of the network of ecological infrastructure is co-funding by the European Commission through the INTERREG IIIB project NEW!Delta. The network of ecological infrastructure in the port of Antwerp is, on the one hand, an implementation of local spatial planning guidelines, on the other hand, it could present an opportunity for implementation of species protection at the 'port area' level.

16.7 Stakeholder involvement and policy and decision making process

The Port of Antwerp initiated this project in close collaboration of Natuurpunt (nature NGO) as part of the realisation of a network of ecological infrastructure in the port area. Natuurpunt, together with POA, developed the design for the breeding site. Natuurpunt is linked with the POA though a collaboration arrangement since 2000.

Because of the inaccessibility of the site, no information panel will be placed at the site. Potentially, a webcam could be installed to allow the public to observe the breeding gulls through an internet portal.

The project will be financed by the POA and co-funded up to 50% by the European Commission through the Interreg project *NEW!*Delta. The estimated cost for implementation of the scheme is approximately € 80.000.

16.8 Factors for success and failure

Issues relevant to achieving the preferred environmental conditions or ecological goals include:

Success factors	Failure factors
• Isolated location providing a breeding place free of ground predators.	• Hydrology. Water levels are potentially insufficient to create a wet habitat.

Key elements in succeeding or failing to take the process from the planning phase of the nature creation project to the implementation phase of the project include:

Success factors	Failure factors
Additional information can be added in a later phase.	Additional information can be added in a later phase.

17 Mud flat/salt marsch Paardenschor

17.1 Identification of the site

The “Paardenschor” is located on the left bank of the river Scheldt adjacent to the river, at the border of the Antwerp seaport area and close to the Belgian-Dutch border. It is located in the vicinity of a nuclear power plant.

Figure 17.1 Location of the case studies for the port of Antwerp: 1)Mud flat/salt marsh at Paardenschor, 2)Gull breeding habitat at Deurganck dock, 3) Common tern breeding habitat on the Van Cauwelaert lock, 4) Breeding habitat at the plain of Zwijndrecht, 5) Mediterranean Gull breeding habitat at the A12/R2 highway intersection, 6) Fish spawning pond at the Thijsmans tunnel

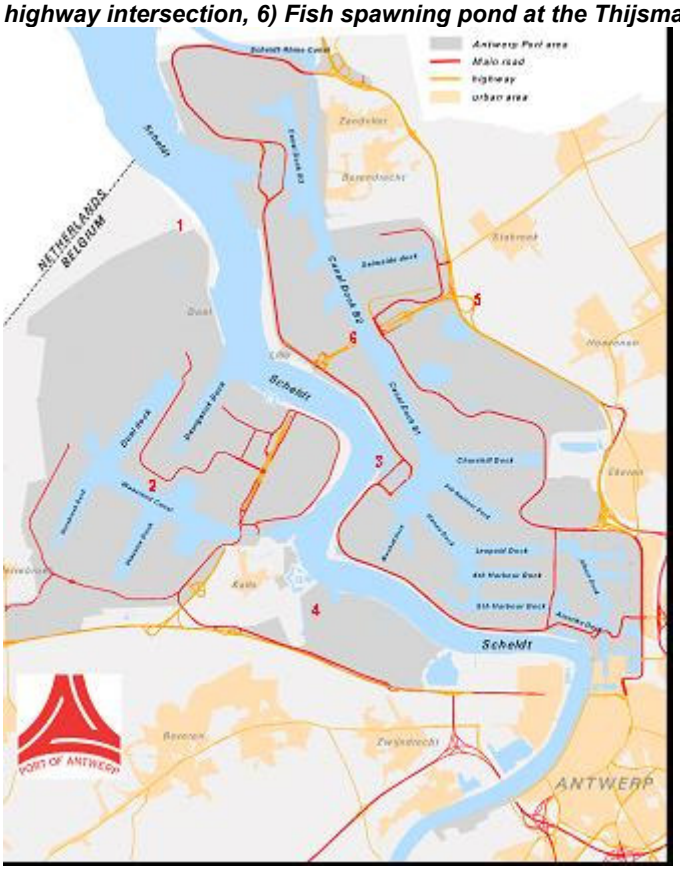
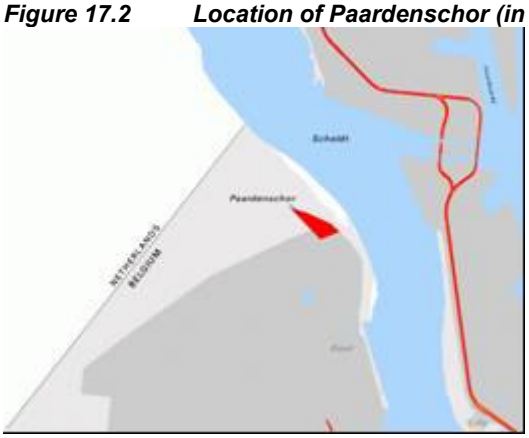


Figure 17.2 Location of Paardenschor (in red)



17.2 Habitat type

Mudflat (and salt marsh) - Habitat type 1140 (1310, 1320) of the EU Habitats directive/no specific target species

17.3 Description of the site

Before

From the 1900s through to 2003 the Paardenschor was a meadow created through poldering. It was also used for the deposition of dredged sediments resulting in its elevation by some 5 to 6 meters.

After

The Paardenschor is now a newly created mudflat of approximately 15 ha. It is predicted that through natural succession and natural processes like sedimentation, the mudflat will evolve to become a salt marsh.

Figure 17.3 Paardenschor before implementation of the scheme

Figure 17.4 Paardenschor after implementation of the scheme

17.4 Methodology

The scheme for restoring a brackish salt marsh adjacent to an estuary involves the following components:

- Building a new dike landwards of the old one,
- Dredging the sediments between the new and the old dike (~ 475.000 m³) to create an appropriate elevation for mudflat; creating a mudflat elevation instead of a saltmarsh elevation will enhance natural dynamics and serve to better link the newly created habitat to an older salt marsh located North of it ("*Schor Ouden Doel*").
- Remove the old dike

- Allow for natural processes (accumulation of mud, formation of trenches and colonisation by mud flat/salt marsh species*)*

Because of the retreat of a dike, the cost for habitat creation was high in proportion to the realised surface: approximately 6.5 million € for 15 hectares new mud flat.

This habitat creation scheme falls under "The creation and restoration of salt marsh habitat by the re-introduction of tidal regimes to previously enclosed or reclaimed land by managed retreat of the use of sluices" (cf. ABP Sothampton 1998, Review).

17.5 Monitoring

The scheme was implemented between March and September 2003. Monitoring of the winter and breeding season started from winter 2003-2004 on. The monitoring is done by the Flemish Institute for Nature Conservation in order of the Flemish Government and financed by the Flemish Government.

2000 (reference situation)	Three territories of the Shelduck (Tadorna tadorna) The Greylag Goose (Anser anser) and Curlew (Numenius arquata), no other wintering waterfowl
2003 report (winter 2002-2003 and breeding season 2002)	**Winter:** Greylag Goose and Curlew.
2004 report (winter 2003-2004 and breeding season 2003)	**Breeding season:** Little Egret, Spoonbill, Shelduck, Avocet, Lapwing, and large numbers of Greylag Goose. This species is mainly on the site when the mud flat is covered by water at high tide. During the summer, colonisation by Vaucheria sp. was already observed on large areas. **Winter:** Observed birds during winter 2004-2005 will be reported in the 2005 report.
New monitoring data will be available.	

The hydrology is also monitored (evolution mudflat to salt marsh) as the physical evolution and the benthos (main feeding source for birds). See also ***http://www.inbo.be/content/page.asp?pid=MON_waaslandhaven*** for monitoring reports (only in Dutch).

17.6 Success/failure

Concerning reaching the preferred environmental conditions or ecological goals

Success factors

- Good monitoring of the hydrology, the physical evolution and biodiversity. This will provide useful information for evaluating the success of the scheme and provide learning opportunities for future schemes.
- Being a dynamic pioneer habitat, natural dynamics will support rapid achievement of hsort-term objectives.

Failure factors

- Long term success is more difficult to guarantee because of the natural dynamics of sedimentation (erosion, too much accumulation). It is predicted that natural accumulation of sediment will transform the newly created mudflat into a salt marsh , but this is dependent on a sufficient understanding of local estuary processes and the morphological evolution of the foreshore.

Key element in succeeding or failing to take the process from the planning phase of the nature creation project to the implementation phase of the project

Success factors

- Political willingness, due to the legal constraints of the Birds Directive and the strategic importance of expansion of the port of Antwerp
- Informing the public through an information stand. This potentially increases the public acceptance of the scheme.

Failure factors

- The very high cost of the scheme could undermine public acceptance. Because of the retreat of a dike, the cost for habitat creation was high in proportion to the realised surface: approximately 6.5 million € for 15 hectares new mud flat.

In conclusion we can state that the scheme is not very cost efficient but its realisation was important from a strategic point of view. Because of its relatively high cost it has a potential low public acceptance. This could be resolved by information and communication actions.

17.7 Policy context

The *Paardenschor* is part of the *compensation plan* for the construction and exploitation of the Deurganck dock. Deurganck dock is a large new tidal container dock located inside a special protection area of the Birds directive on the left bank of the Scheldt estuary (see ***www.deurganckdok.be*** for more information (in Dutch and English).

17.8 Stakeholder involvement and policy and decision making process

The project is part of a compensation plan for the Deurganck dock project. It is an integral part of the Deurganck Dock project. The Deurganck Dock project was decided by the Flemish Government as being a project of strategic importance to the Flemish and Belgian economy. The project was initiated and carried out by the Flemish Government and the Antwerp Port Authority. Stakeholders were only involved in the site location process (decided through the Environmental Impact Assessment of the project). The involved stakeholders were: the Flemish Institute for Nature Conservation (a scientific institute of the Flemish Government) and *Natuurpunt* (the largest nature NGO of Flanders).

Acquisition of land was financed by the Flemish Government through the public administration in charge of land purchase. It was expropriated from the nuclear power plant located nearby. Implementing the habitat creation scheme was financed by the Antwerp Port Authority and costed approximately 4.5 million €.

An information panel will be installed. During the weekend of the 11th and 12th June 2005, an information stand was placed on the site to inform visitors during a special 'Scheldt weekend'.

18 Spawning pond Thijsmans Tunnel (POA)

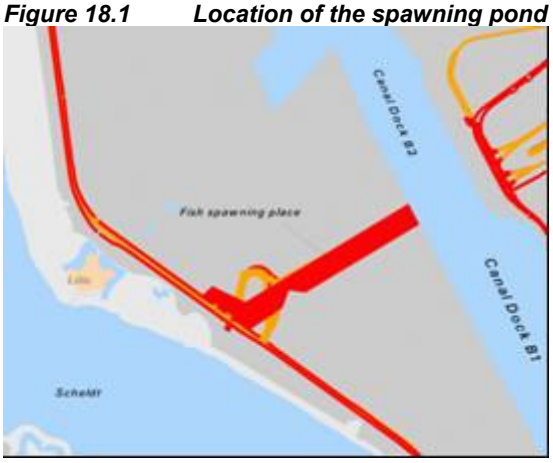
18.1 Identification of the site

The fish spawning place is located on the right bank of the Scheldt above the Thijsmans tunnel on the westerly side of the canal dock.

A fish spawning place is a calm, shallow water body with water plants. These places formerly occurred at the river banks. Because river banks (and harbour docks) are artificially steepened and straightened, good spawning places are rare. Hence the necessity for artificially created fish spawning places.

The project has been implemented in collaboration with the Provincial Fishery Commission of the Province Antwerp, providing the practical knowledge of similar projects

Figure 18.1 Location of the spawning pond



18.2 Habitat type

Fish spawning pond/ fish spawning in the Scheldt estuary, for probably the species Common bream (Abramis brama), Roach (Rutilus rutiles), Redfin perch (Perca fluviatilis) and eventually Rudd (Rutilus rythrophthalmus) or Ide (Leuciscus Idus).

18.3 Description of the site

Before

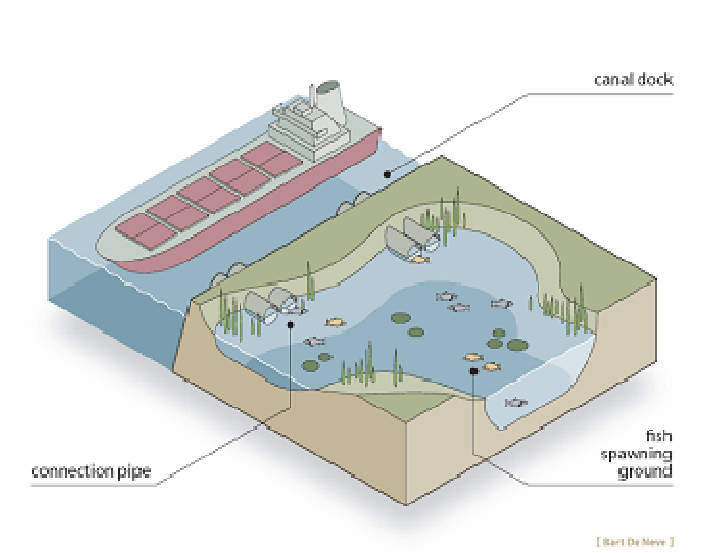
This area used to be a ‘rest zone’ with mainly grassland. It functioned as a buffer area between different (petro)chemical factories and road infrastructure.

After

A pond with a variable depth (is better for spawning habitat) with a maximum depth of 1.5 m (above the Thijsmans tunnel) is created. The pond is in communication with the canal dock through 2 times 2 pipes of 60 cm diameter and 25 m long. These pipes are at water level, partly emerged (15 cm) and partly immersed (45 cm), thus allowing fish in the canal dock to come to the calmer waters of the fish spawning pond.

Figure 18.2 The 'rest zone' above the Thijsmans tunnel before creation of the fish spawning pond

Figure 18.3 Illustration of the fish spawning pond at the Thijsmans tunnel after implementation of the scheme.



18.4 Methodology

The scheme to create a fish spawning place involves the following components:

- Cutting off and removing vegetation;
- Digging a pond with variable depth and maximal water depth of 1.5 m and removing the earth;
- Placing the 4 pipes and thus making connections with the canal dock;
- Adding water plants.

18.5 Monitoring

Additional information can be added in a later phase.

18.6 Factors for success and failure

Issues relevant to achieving the preferred environmental conditions or ecological goals include:

Success factors	Failure factors
Additional information can be added in a later phase.	Additional information can be added in a later phase.

Key element in succeeding or failing to take the process from the planning phase of the nature creation project to the implementation phase of the project.

Success factors

- 'Rest zone' that otherwise wouldn't be used.

Failure factors

- Property issues
- Being above a tunnel, limitations to the design could affect its success.

Additional information can be added in a later phase

18.7 Policy context

This fish spawning pond is part of the network of ecological infrastructure the Port Authority of Antwerp is developing and implementing in collaboration with *Natuurpunt*, Flanders largest nature NGO. The implementation of the network of ecological infrastructure is co-funding by the European Commission through the INTERREG IIIB project NEW!Delta. The network of ecological infrastructure in the port of Antwerp is, on the one hand, an implementation of local spatial planning guidelines, on the other hand, it could present an opportunity for implementing species protection at the 'port area' level.

18.8 Stakeholder involvement and policy and decision making process

The Port of Antwerp initiated this project in close collaboration withNatuurpunt (nature NGO) as part of the realisation of a network of ecological infrastructure in the port area. Natuurpunt, together with POA, developed the design for the fish spawning pond in collaboration with the provincial fishery commission and the University of Antwerp. Also, since the area is located above a tunnel, the competent authority for roads in Flanders was involved and consulted.

Estimated cost is €200.000 financed by the Antwerp Port Authority with EU co-funding through the Interreg project NEW!Delta..

An information panel will be placed.

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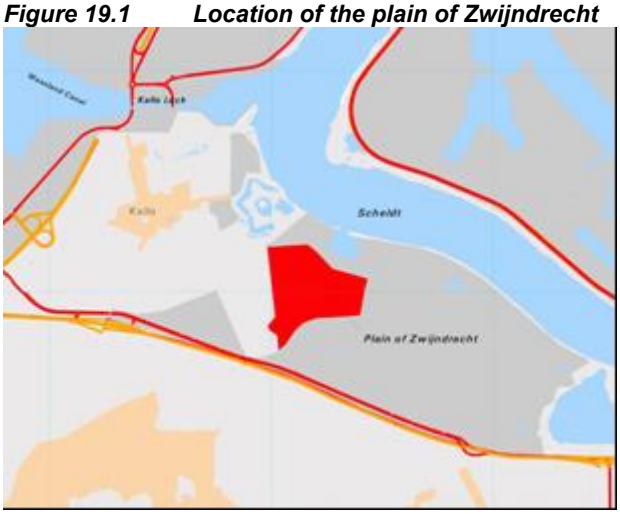
19 Zwijndrecht (Port of Antwerp)

19.1 Identification of the site

The plain of Zwijndrecht is located on the left bank of the Scheldt, port of Antwerp, Belgium. On the west side of the plain there is a large reedbed, on the east side it is bordered by an industrial (chemical) complex.

Figure 19.1 Location of the plain of Zwijndrecht



19.2 Habitat type

Open sand or sand with pioneer vegetation/Breeding place for coastal and colony breeders, also for the Sand Martin (*Riparia riparia*)

19.3 Description of the site

Before

The area comprised bare land (sand heightened by hydraulic fill and developed for some years) with pioneer and some ligneous vegetation and already had some ecological value.

Figure 19.2 Plain of Zwijndrecht before implementation of the scheme

Figure 19.3 Several habitat types at the plain of Zwijndrecht, before implementation of the Scheme

After

The implementation of the habitat restoration scheme improved the quality of the site by removing ligneous vegetation and creating more relief and a more 'open' landscape

19.4 Methodology

The breeding habitat restoration scheme involved the following components and was implemented during October 2004:

- Mechanical excavation and placement of material to create more relief. This resulted in a more diverse area and stopped the succession of vegetation for a while.
- The ligneous vegetation was mown and the cut material removed.

19.5 Monitoring

Table 19.1 Results of the monitoring until 2004

2000 (reference situation)	2 **Avocet (Recurvirostra avosetta)** and 1 Bluethroat (*Luscinia svecica*) as Annex I species. Also 30 or some other waterfowl breeding.
2003 report (winter 2002-2003 and breeding season 2002)	3 **Avocet (Recurvirostra avosetta)** and 6 Bluethroat (*Luscinia svecica*) as Annex I species breeding. Almost 80 other waterfowl breeding.
2004 report (winter 2003-2004 and breeding season 2003)	43 **Avocet (Recurvirostra avosetta)**, 12 Bluethroat (*Luscinia svecica*) and 1 Commen tern (*Sterna hirundo*) as Annex I species breeding. 85 other waterfowl breeding (f.i. 22 couples of Lapwing (*Vanellus vanellus*)).

The monitoring of this site (as well as for in the entire left bank area) happens through an agreement with the Flemish Institute for Nature Conservation (Spanoghe et al. 2003, Gyselings et al. 2004). Volunteers of nature associations also contribute in collecting monitoring data. New monitoring data will be available.

19.6 Evaluation of success and failure

Due to the dry first half of the year 2003, the results of the first breeding season after the implementation of the scheme weren't a complete success (the pools were dried out by the beginning of the breeding season)[3]. But the more 'open' character of the site was probably advantageous for the

[3] To be a successful breeding habitat for coastal and colony breeders, a site need to have an alternation between sand with pioneer vegetation and pools. This can be created by adding micro relief to a site (variations of tens of centimetres can be enough).

Avocet. Also breeding birds of the adjacent great reed area came to feed at the site (e.g. Marsh harrier (*Circus aeruginosus*)). The site at least kept its nature value that, without management, would have diminished and disappeared. Monitoring will continue so new data will be available to further assess the success of this restoration scheme.

Issues relevant to achieving the preferred environmental conditions or ecological goals include:

Success factors
- Easy to create because it is a pioneer habitat type
- Rapidly colonised because it is a pioneer habitat.

Failure factors
- Hydrology (too dry)

Key elements in succeeding or failing to take the process from the planning phase of the nature creation project to the implementation phase of the project include:

Success factors
- Low cost/ High effectiveness

Failure factors
- Hydrology (too dry)

In conclusion we can state that: it is an easily, relatively cheap and potentially successful habitat creation scheme.

19.7 Policy context

The Plain of Zwijndrecht is part of the compensation plan of the Deurganckdock-project (large infrastructure project of the left bank involving the creation of a new container dock, see also ***www.deurganckdok.be***).

19.8 Stakeholder involvement and policy and decision making process

The project is part of a compensation plan for the Deurganck Dock project and is an integral part of the Deurganck Dock project. The Deurganck Dock project was decided by the Flemish Government as being a project of strategic importance to the Flemish and Belgian economy. The project was initiated and carried out by the Flemish Government and the Antwerp Port Authority. Stakeholders were only involved in the site location process (decided through the Environmental Impact Assessment of the project). The involved stakeholders were: the Flemish Institute for Nature Conservation (a scientific institute of the Flemish Government) and *Natuurpunt* (the largest nature NGO of Flanders).

The cost was approximately € 15.000, financed by the Antwerp Port Authority.

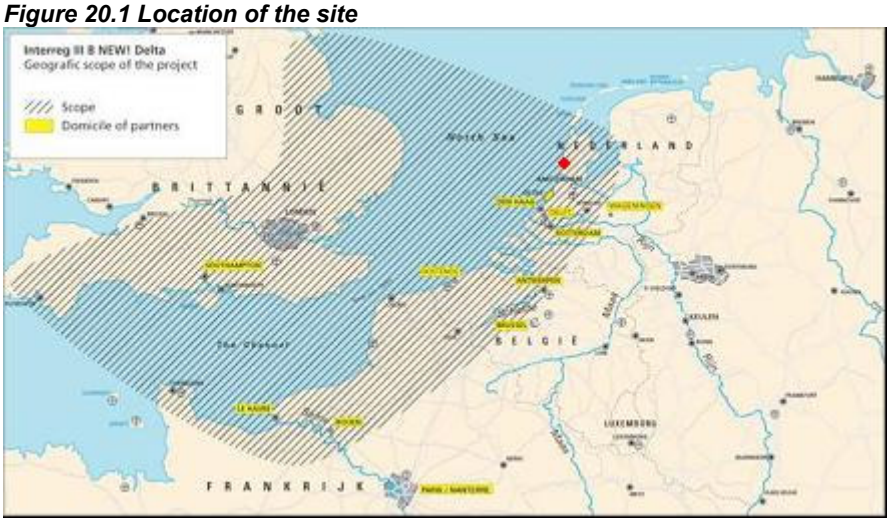
An information panel will be installed.

20 De Kerf

20.1 Identification of the site

De Kerf' is located in the dunes of the province of North Holland. It is situated in the former 'Parnassiavallei', part of an area of 100 ha, where natural sand drift processes occur. Both areas belong to the protected dune area 'Schoorlse Duinen', managed by the State Forestry Service (Staatsbosbeheer). The area is protected by the Nature Conservancy Act and has been applied as a Nature 2000 area (SAC) by the Ministry of Agriculture, Nature and Food quality (LNV).

Figure 20.1 Location of the site



20.2 Description of the site

Since the area is managed by the State Forestry Service it has no special land use, apart from nature. The dune slack called the 'Parnassiavallei' has always been a relatively quiet part of the 'Schoorlse Duinen'. A horse trail in the southern part of the valley was the only 'infrastructure' to access the area. The number of visitors was low.

Withdrawal from ground water for drinking water supply in the adjacent dunes by the water supply company for the Province of North-Holland (PWN Waterleidingbedrijf Noord-Holland), led to a decrease of the ground water level to more than 1 m below the surface.

An ongoing reduction of ground water use by the water supply company in the adjacent dunes will result in a higher ground water level. Continued monitoring of the water salinity and the vegetation is necessary to study the impact of this change.

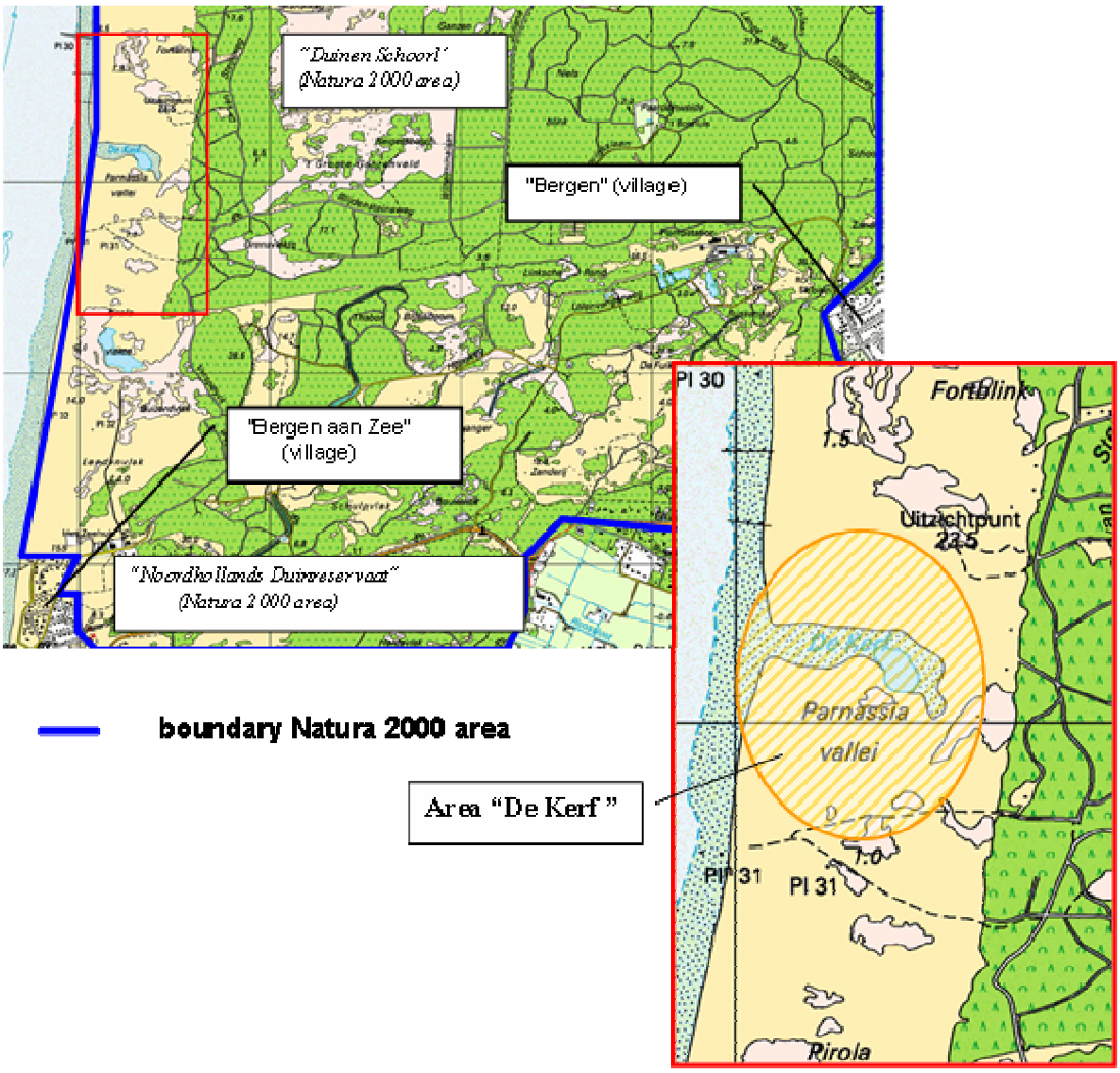
20.3 Methodology

The realised construction of 'De Kerf' was intentional, and the aim of the actions was to realise a (experimental) tool for dynamic coastal management. The scheme essentially represented a large scale experiment to allow wind and sea to become the natural forces forming the landscape again, in order to restore a dynamic sea and wind driven dune system. An aim of minor importance was to increase the recreational value of the area.

The 'Parnassiavallei' was considered a good location for this experiment, because it had:

- a stable coastline with a broad area of dunes, e.g. there was a minimal security risk of flooding of the adjacent inhabited land;
- been flooded by the sea in the past;
- a small shoreline with a natural sea wall and low lying, adjacent dune valleys;
- moderately developed ecological values, meaning a significant increase in ecological value could be expected;
- the absence of other functions like recreation and drinking water supply.

Figure 20.2 Details of 'De Kerf' and surroundings; grid 1 km² (adapted topographical map © 2006 Topografische Dienst Emmen)



After a series of studies to assess possible locations for the construction of a tidal inlet, a working group selected the area Bergen-Schoorl from the three remaining sites. Commissioned by the National Institute for Coastal and Marine Management (RIKZ), the NGO Dutch Society for Dune Conservation (Stichting Duinbehoud) wrote a project plan, in which the outlines of the construction of 'De Kerf' were sketched (Hees & Janssen, 1995).

Thereafter, the State Forestry Service took the initiative to keep up the subsequent administrative process that eventually resulted in the construction of 'De Kerf'.

In 1997 a tidal inlet was created by excavating the valley to 1.5 m above sea-level. The inlet has a minimum width of 50 m and a maximum width of 300 m. The topsoil of the valley was removed to allow the fresh water to reach the surface and to allow sand drift. To facilitate the expected increasing number of visitors some recreational facilities were created:

- a viewing point with information panels and a telescope;
- cycling track;
- two footpaths to the viewing point.

Management considerations
The State Forestry Service has a management philosophy for 'De Kerf' of 'doing nothing'. Natural processes are considered to be the best possible management for this area. Management is restricted to minimizing human impact on the area, e.g. by removing garbage that floated in from the sea, and maintenance of recreational facilities.

20.4 Monitoring
Before the actual construction of 'De Kerf' took place in 1997 a monitoring plan was written. The proposed monitoring programme focused on both abiotic and biotic parameters. Success criteria to rfor the development were not precisely defined. Monitoring took place by professionals, students and volunteers.

Abiotic parameters
- In 1997-1999 more floodings occurred than in 2000-2002. The maximum number of floodings was 10 in 1998;
- Salinity of the water has been measured since 2000, and fluctuates as expected. Highest values were measured after flooding (19 g Cl/l e.g. seawater), the lowest values of 0.1 g Cl/l (e.g. fresh water) a few months later;
- Silt content of the soil was measured once in 2000. Since the silt content of the soil was still low, it was recommended to measure this content on a 5yr basis.

Aeolian influence
- Census of geomorphological aspects by means of interpretation of false colour aerial photographs on a yearly basis since 1997 (Arens, 2003a, 2003b). This census contained three main categories:
    - Geomorphological units, for instance beach forms, valleys, high dunes. In the studied period no new geomorphological units were formed
    - Dynamics, measured as sand drift. An increased was measured after 1997, followed by a stabilization or a slight decrease in 2001-02
    - Naturalness, in different classes from 1a fully natural, to 5 stable construction. After a strong decrease for 2002 the situation was 85-90% fully natural.

Furthermore calcium content of the top soil was measured on a yearly basis in transects. The boundary of sand containing calcium, moved eastwards. In the southern part of 'De Kerf' the area of calcium containing sand decreased.

Biotic parameters
- Vegetation has been surveyed, on a yearly basis since 1998, by means of interpretation of false colour aerial photographs, followed by field visits to check the boundaries and vegetation type. A classification of the vegetation types by natural value, showed a decrease of the most important class in 1998 compared with 1993 (before the construction of 'De Kerf'); e.g. a decrease of sand instead of heather and dune grassland. After 1998 a slow increase in natural values was measured, but the 2002-level was still lower than in 1993. On the other hand dynamic change increased in 1998, followed by stabilization (Ten Haaf & Kat, 2003).
- The survey of flora was focused on species on the national Red List, and species indicative for certain environmental factors, so called ecological groups. The occurrence of species on the Red List was more or less the same before and after the construction of 'De Kerf'.

  Some species disappeared, whilst other species were newly recorded. In 2002 an obvious increase was measured. It is not known yet if it is temporary or represents a permanent increase in stabilization (Ten Haaf & Kat, 2003).
- Species associated with saltmarsh, drifting sands and calcium rich dune grasslands showed an increase in numbers and occurrence.. Species characteristic of strandlines showed an initial increase, followed by a decrease in both number of species and occurrence. Pioneer species of moist dune valleys were present in the southern part of the valley, that was left intact. In the tidal inlet they showed an increase in the number of species.
- Fungi were surveyed by means of a yearly (qualitative) census of the whole area in 1997-2002, and a yearly (quantitative) census of 35 permanent plots in 2000-02. The number of species on the Red List increased from 11-14 in 1997-99 to 17-18 in 2001-02.

Species associated with strandlines, drifting sands, and calcium rich dune grasslands showed an increase as well. For strandline species the initial increase was followed by a subsequent decrease in 2002.

- Carabid beetles (Carabidae) were monitored using rows of pitfalls traps, the contents of which have been assessed every three weeks since 1997. The number of rows of traps monitored increased from 10 in 1997 to 16 in 1999. As a 'bycatch' amphibians were also caught on a regular basis, amongst others the Natterjack toad (Bufo calamita), an Annex IV species of the Habitat Directive.
- Sand lizard (Lacerta agilis). Though monitoring was intended on a yearly basis, the only survey was undertaken in 2002 which recorded the continued presence of this species.
- Breeding birds were surveyed once, in 2002. Data on the dunes north and south of the area were used to compare with the developments in 'De Kerf'. In order to visualize changes, data were compared with the data of a census of the entire Schoorlse Duinen by the NGO SOVON Dutch Centre for Field ornithology in 1993 (Vogel, 1994). The number of breeding birds is low, but the Ringed Plover (Charadrius hiaticula) a species breeding on beaches increased from 0 to 2 pairs. Other species showed a decrease, according to regional trends.

Vertegaal et al. (2003) summarized the results of the monitoring programme as in spite of some methodological drawbacks the measured developments pointed at the same ecological changes. Furthermore they recommended a decrease in the frequency of some surveys to once every three years instead of on a yearly basis. It was also recommended that monitoring of fauna should be implemented, using standardized census methods.

20.5 Factors for success and failure

There weren't any unintentional ecological effects or negative effects on the function as a sea wall. There was an unexpected increase in the number of visitors to the area though, especially from the beach side. Increased surveillance on the beach side should diminish the number of trespassers. On the border to the adjacent PWN-dunes a fence has been re-installed to prevent people entering a breeding area for birds.

Lessons learned from the 'De Kerf' case study are:

- It was possible to create new coastal habitats in the fixed shore of dunes as an example of 'dynamic coastal management'.
- It is currently unclear whether a sustainable system has been created; the monitoring programme should therefore continue.
- If the area had been designated as an SAC area before creating the new tidal inlet, this may have prevented the project from proceeding. In that situation the original heather vegetation (*Decalcified fixed dunes with Empetrum nigrum NATURA 2000 code: 2140) and fixed dunes (Fixed dunes with herbaceous vegetation (grey dunes) NATURA 2000 code: 2130) would have needed to be preserved.
- The combined effort, enthusiasm and co-operation of the stakeholders, supported by well organized communication - to each other and the general public - played an important role in realizing 'De Kerf'. Also strong effective project leaders within the organisations played a key role.

20.6 Policy context

In 1990 two government plans were published that were important for the realisation of 'De Kerf': by the Ministry of Transport, Public Works and Water Management (V&W, 1990) and the Ministry of Agriculture, Nature and Food Quality (LNV, 1990). Keywords in these plans are 'dynamic coastal management'. Meaning that the coastline should be fixed by means of sand recharge on the beach and in the shallow coastal zone instead of fixing the dunes itselves. As a consequence management of the shoreline could be more extensive, since it doesn't have to be stabilized and fixed anymore to protect the hinterland. The possibilities for natural sand drift and construction of a man made tidal inlet were studied for the entire Dutch coast in 1990-1994 (e.g. Van Gelderen & Löffler, 1994). The 'Parnassiavallei' near Bergen-Schoorl seemed to have to best chance of a successful restoration of a dynamic wind and sea driven dune system. An administrative process started, resulting in signing of a covenant in 1997, in which the stakeholders committed themselves to the realisation and subsequent management of 'De Kerf'.

20.7 Stakeholder involvement and financial issues

The initiator of the project were the Dutch Society for Dune Conservation, National Institute for Coastal and Marine Management.
The most important stakeholders in the process were the State Forestry Service, the National Institute for Coastal and Marine Management, the Dutch Society for Dune Conservation, the Water Board and the Province of North-Holland.

Commissioned by the National Institute for Coastal and Marine Management, the NGO Dutch Society for Dune Conservation wrote the initial project plan. The State Forestry Service took the initiative to keep up the subsequent administrative process, that eventually resulted in the construction of 'De Kerf'.

The general attitude of the stakeholders was positive. Initially, the municipality of Bergen objected, because of safety reasons (flooding). Subsequently they supported the scheme, since they were reassured that the location was safe. Furthermore the municipality expected a welcome boast in the number of tourists.

During the preparation of the construction of 'De Kerf' several parties were involved in both the administrative process, and the ecological 'engineering': the State Forestry Service, the Dutch Society for Dune Conservation, the National Institute for Coastal and Marine Management, and the Water Board (Hoogheemraadschap Uitwaterende Sluizen in Noord-Hollands Noorderkwartier) were crucial for this project. Due to their combined effort, enthusiasm and co-operation the breakthrough in thinking about coastal management led to the remarkably fast construction of 'De Kerf'. The Ministries and the Province facilitated the construction of 'De Kerf'.

The costs of 'De Kerf' were estimated at € 505,000, funded by the Ministry of Transport, Public Works and Water Management, the Ministry of Agriculture, Nature and Food Quality, and the Province of North-Holland. The costs for monitoring exceeded the estimated amount, due to higher costs for aerial photographs and more frequent monitoring.

	Costs (€)
Preparation	12,000
Construction of 'De Kerf'	181,000
Recreational facilities	49,000
Communication & information	81,000
Monitoring	171,000
Evaluation	53,000
Total	547,000

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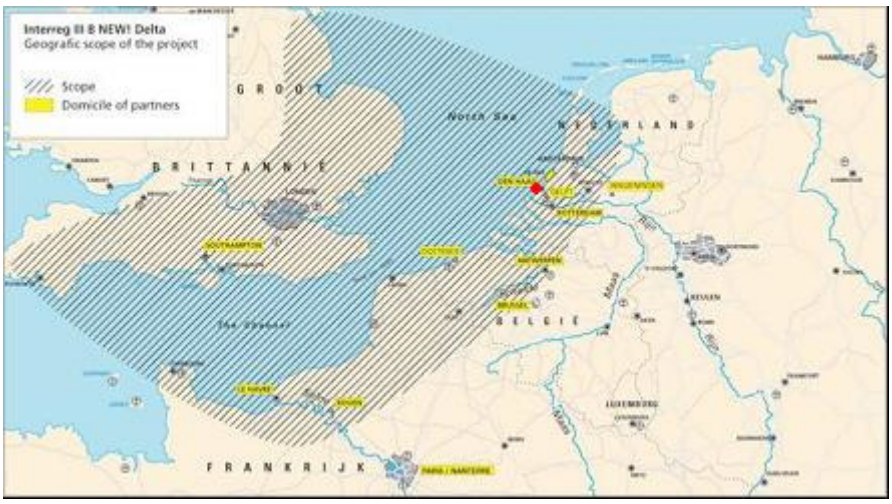
21 Dixhoorndriehoek

21.1 Identification of the site

Protected dune area, north of the jetty of Hoek van Holland, just near the entrance of the harbour of Rotterdam, province of South-Holland, The Netherlands. The size of the 'Van Dixhoorndriehoek' is 100 ha. It lies in the south(western) part of 'De Kapittelduinen', a dune area of 500 ha. This area has the protected status of a State Nature Reserve (Staatsnatuurmonument) by the Nature Conservancy Act (NBwet). No SPA or SAC are in the surroundings.

Figure 21.1 Location of de Van Dixhoorndriehoek



21.2 Habitat type

- Embryonic shifting dunes NATURA 2000 code: 2110,
- Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) NATURA 2000 code: 2120,
- Fixed dunes with herbaceous vegetation (grey dunes) NATURA 2000 code: 2130,
- Dunes with *Hippophae rhamnoides* NATURA 2000 code: 2160
- Humid dune slacks NATURA 2000 code: 2190.

21.3 Desciption of the site

The dune area at 'Van Dixhoorndriehoek' became established following construction of the 'Van Dixhoorndriehoek' in 1971 by Rijkswaterstaat (RWS, part of the Ministry of Transport, Public Works and Water Management).

A study of the ecological structure of the surroundings of Hoek van Holland by the consultancy OD 205 (Anonymus, 1994), drew the conclusion that the coastal dunes (e.g. 'De Kapittelduinen') were of great importance for nature conservation and biodiversity. The 'Van Dixhoorndriehoek' was considered the most valuable part of the dune area, due to the presence of moist dune valleys and sand drift with characteristics of primary dunes.

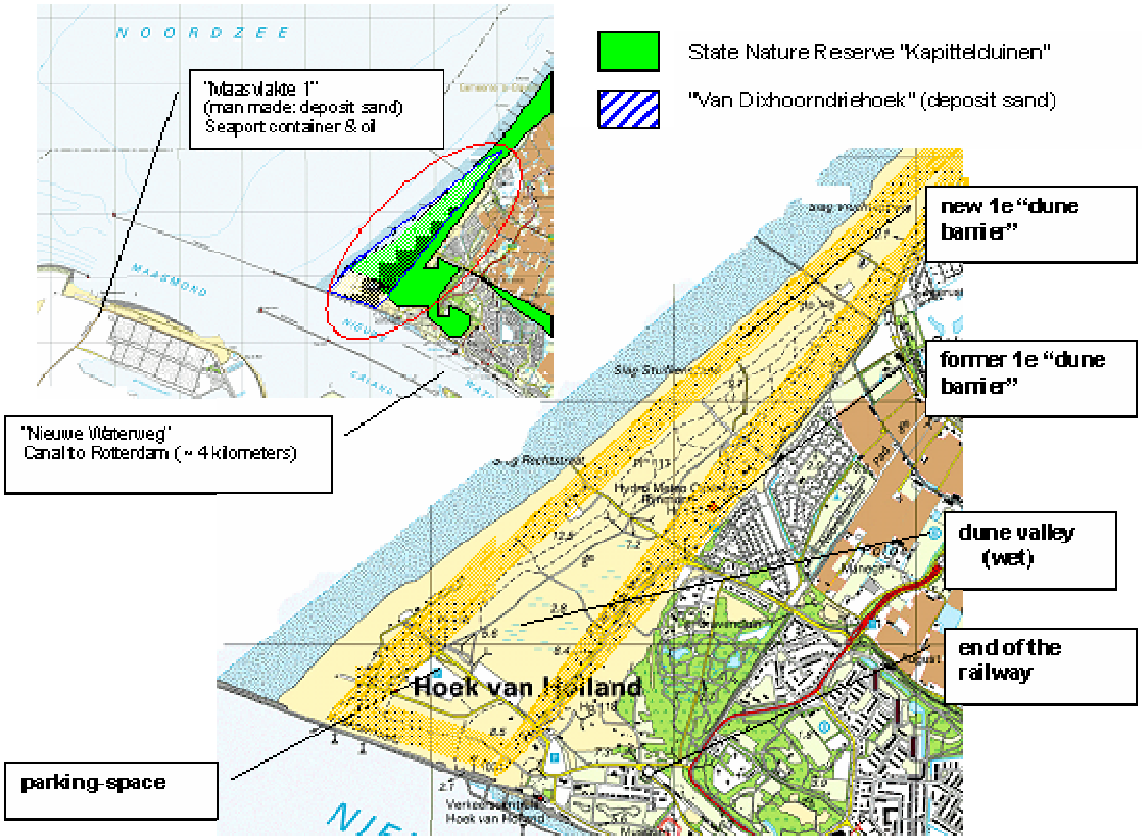
After the establishment of natural elements in the 'Van Dixhoorndriehoek', recreational facilities like foot paths, cycling tracks, a horse trail and benches were constructed in the 1980s. In the 1990s, 20 years after creation, the area was designated as a State Nature Reserve.

Hoek van Holland advertises itself as a seaside resort in a natural environment. This means that development of tourism and recreational activities has a high priority. Nature is more or less seen as a setting for these activities. Amongst the plans to achieve the development of tourism and recreational activities are:

- Extension of the railway from the actual railway station 'Hoek van Holland strand' to the beach. The railway will become the southern border of the 'Van Dixhoorndriehoek';
- Building houses south of the extended railway (the so called 'Waterwegcentrum'). Compensation (and mitigation) of the destruction of habitat of the protected Natterjack Toad (*Bufo calamita*) and Sand Lizard (*Lacerta agilis*) will take place in the 'Van Dixhoorndriehoek'.

Since 'De Kapittelduinen' are protected under the Nature Conservancy Act, activities along its borders should not diminish the quality of the area. e.g. the effects of traffic, light emissions and noise, etc. should be reduced below certain thresholds.
In order to protect the newly built houses from flooding, a new sea wall has to be established. For this activity an Environmental Impact Assessment (MER) is obligatory, the final report is due September 2006.

Figure 21.2 Details of the "Van Dixhoorndriehoek'; grid 1 km^2 (adapted topographical map © 2006 Topografische Dienst Emmen)



21.4 Methodology

The area was created in 1971 by the Ministry of Transport, Public Works and Water Management, with sand from harbour construction of the Maasvlakte, south of the Nieuwe Waterweg. The Nieuwe Waterweg is the main entrance to the Port of Rotterdam. The major aim of the actions commissioned by the municipality of Hoek van Holland was reclamation of land. To prevent sand drift and erosion of this new land a mixture of grasses was sown. However, a rapid spontaneous natural development took place in the 'Van Dixhoorndriehoek'. Grazing by Rabbits (Oryctolagus cuniculus) and treading by visitors were important factors shaping the landscape, because they initiated localized sand drift. In the lowest part of the area a moist dune valley with characteristics of a primary dune developed. In the future actions will be undertaken, aimed at the recovery of a dynamic ecosystem.

During the construction of harbours in the Maasvlakte in the late 60s, early 70s the area was selected to 'deposit' the sand that became available. In the 90s, a management plan was written for the different parts of 'De Kapittelduinen'. One of the resulting plans concerns the 'Van Dixhoorndriehoek', and is in the final stage now. Compensation for the loss of natural values as a result of the construction of the 'Waterwegcentrum' the area south of the parking-space, however, is still missing in this plan. It will be included before the plan can be officially approved.

To facilitate and to speed up vegetation development at the time of making the area, an additional fertile top soil was placed on the barren sand, Sea Buckthorn (Hippophae rhamnoides) was planted, and grasses were sown. It became apparent that these measures were not consistent with the natural development of the area.
The management plan aims to create a barren dune by removing part of the vegetation and the topsoil, followed by grazing with cattle to slow down the succession of the vegetation. The goal of this management is preserving a vegetation of pioneers and accompanying faunal elements. Another goal is to compensate for the destruction of habitat of the protected Natterjack Toad and Sand Lizard, due to the planned construction of the 'Waterwegcentrum' in the adjacent area.

21.5 Monitoring

At the time of writing, no monitoring schedule had been prepared. However, in 1994, Hoek van Holland commissioned the consultancy OD 205 to write a report on the ecological values within the boundaries of the municipality (Anonymus, 1994). Almost a decade later, the NGO Royal Dutch Society for Study of Wildlife (KNNV Waterweg-Noord) published a report, in which data on the occurrence and abundance of flora and fauna in 1991-2001 were summarized (Hoogervorst, 2002). In the near future a management plan will be presented, which contains a monitoring programme. The Province of South Holland is responsible for the realisation of this programme. It is unknown yet, how monitoring will take place. Questions like: which species, which methods and by who are not fully answered yet.

21.6 Factors for success and failure

Lessons learned from the construction of the 'Van Dixhoorndriehoek' case are:

- it was possible to create new coastal habitats in a former sea area;
- after 20 years subsequent succession high natural values developed, although this was unintended;
- resulting in a designated State Nature Reserve;
- populations of the protected Natterjack Toad and Sand Lizard (Annex IV species of the Habitat Directive) are accommodated;
- economical and natural development seems to be both possible in the 'new' area, although natural development was ignored in the beginning.
- the awareness of the ecological values of the area was the trigger for the final success.
- The natural environment of the area is considered an attractive setting for living, tourism and recreational activities by (most of) the stakeholders.

21.7 Policy context

The driving force behind the creation of the Van Dixhoorndriehoek was not nature but sand recharge and land reclamation.

After the appearance of valuable nature values the area was designated as a State Nature Reserve.

21.8 Stakeholder involvement and financial aspects

The Ministry of Transport, Public Works and Water Management created the area, subsequently the Municipality of Hoek van Holland initiated plans to develop the area .
Most important stakeholders in the process were the Municipality of Hoek van Holland (a part of the lager Municipality of Rotterdam), Water board 'Rijnland', Province South Holland, Landscape South Holland, Society for Dune Conservation and the Royal Dutch Society for Study of Wildlife 'Waterweg-Noord'.

First of all, the Ministry of Agriculture, Nature and Food Quality, the Ministry of Transport, Public Works and Water Management, the Province of South-Holland, and the Water Board 'Rijnland' determined the conditions that outlined the plans. The Municipality Hoek van Holland took the initiative to develop plans for the area, in which both economical and ecological values were integrated. The NGO's Dutch Society for Dune Conservation, Landscape South Holland and 'KNNV Waterweg-Noord' tried to 'defend' the ecolocigical values.

Conflicting points of view became apparant, after the designation of areas for development and areas for nature conservation.

The management of the nature conservation areas will be jointly financed by the Province South Holland and the Municipality of Hoek van Holland.
After the creation of a barren dune, the area will be managed by means of grazing cattle. Since the management responsibilities and arrangements have not yet been determined, it is currently not possible to estimate these costs.

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22 Dunes The Hague-Hoek van Holland

22.1 Identification of the site

The site concerns the dune area between The Hague and Hoek of Holland in the Province of South Holland, the Netherlands.

22.2 Description of the site

Currently: In general a narrow strip of coastal dunes, locally wider (Solleveld and Westduinpark). A part of the area is an artificial sand dike. A large part of the area has been designated as a Natura 2000 area under the Habitat Directive. Only the southern part near Hoek of Holland (with a wet dune slack) does not form part of the designated area.

Figure 22.1 Current situation

After the implementation of a coastal defence scheme: For coastal defence reasons, the dune area will be either widened or heightened. When the widening becomes large enough, wet dune slacks will be created.

Figure 22.2 Possible situation after the implementation of a coastal defence scheme

22.3 Methodology

An Environmental Impact Assessment study is currently being conducted, based on national law (Environmental Management Act).

22.4 Monitoring

No details available.

22.5 Policy context

Due to its designation as a Habitat Directive area, and also under regional law, possible losses of natural values have to be compensated.

23 Kennemerstrand

23.1 Identification of the site

Location: protected dune area, south of the jetty of IJmuiden, just near the entrance of the harbour of Amsterdam, province of North-Holland, The Netherlands.

Figure 23.1 Location of the site Kennemerstrand

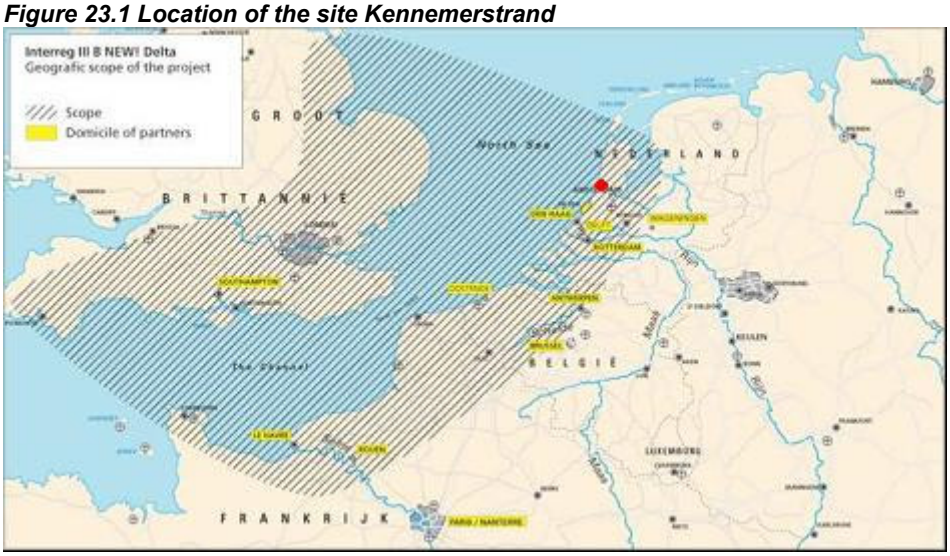
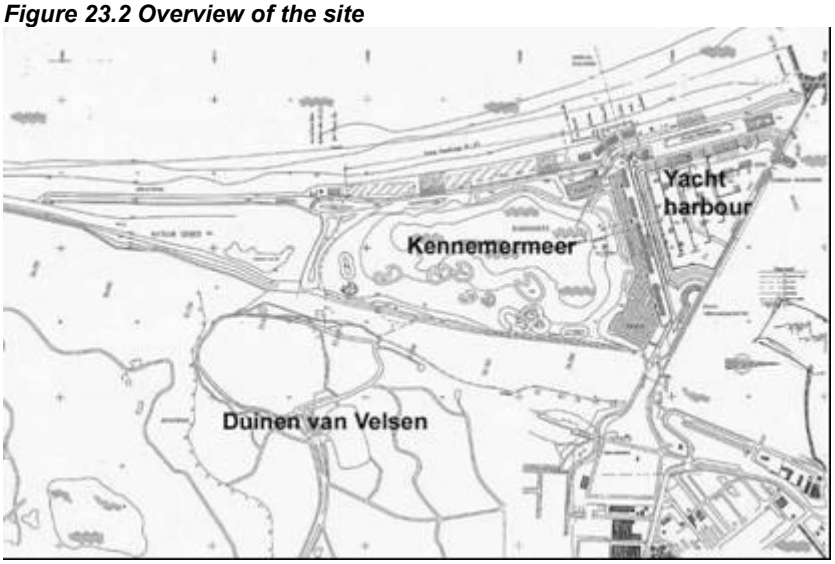
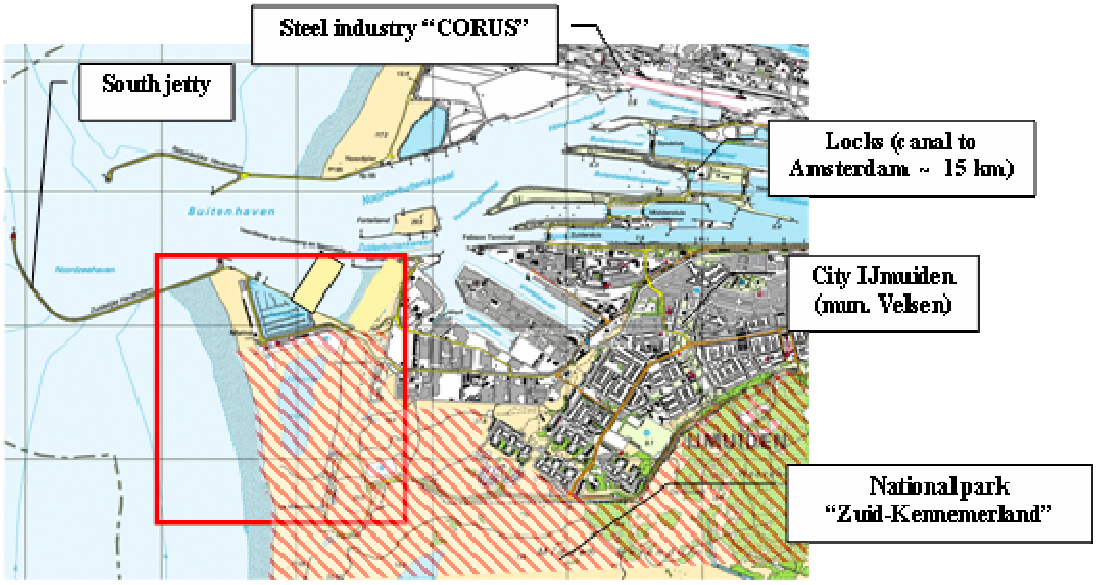


Figure 23.2 Overview of the site



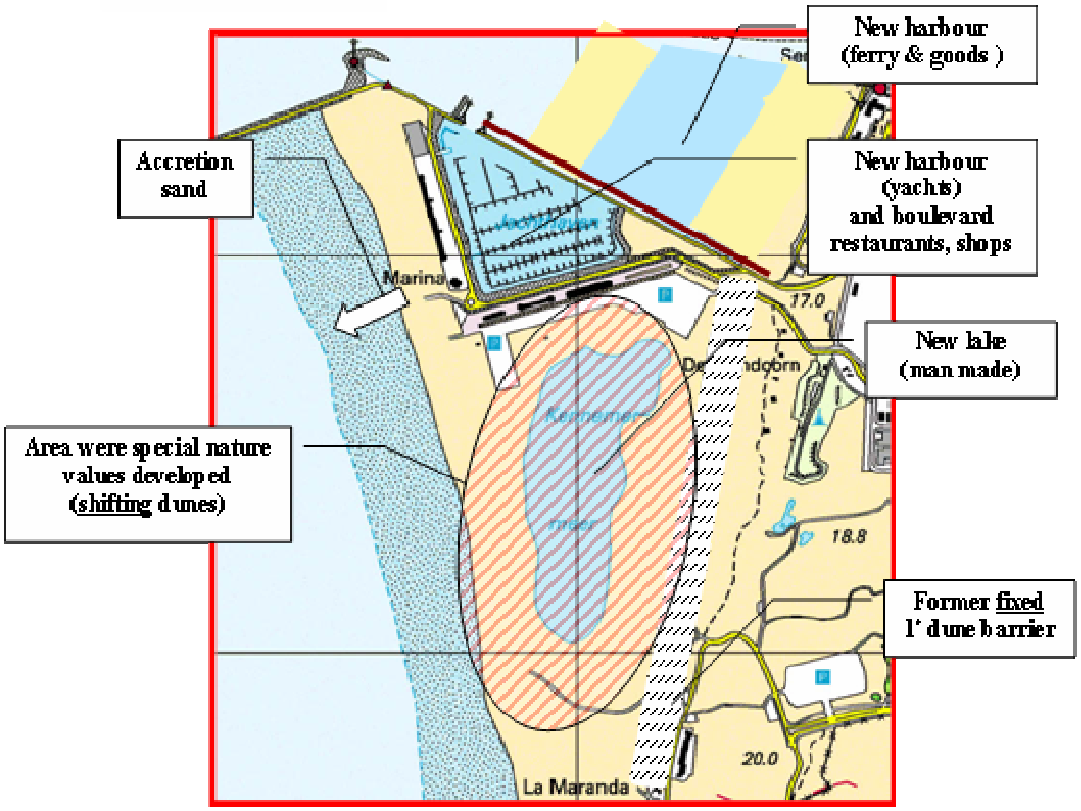
24.2 Habitat types and species

- Originated habitats are Embryonic shifting dunes NATURA 2000 code: 2110, shifting dunes along the shoreline with Ammophila arenaria (white dunes) NATURA 2000 code: 2120, fixed dunes with herbaceous vegetation (grey dunes) NATURA 2000 code: 2130, dunes with Hippophae rhamnoides NATURA 2000 code: 2160 and humid dune slacks NATURA 2000 code: 2190.
- Populations of the Habitats Directive protected Fen Orchid (Liparis loeselii) (Annex II & IV), the mosses Orthotrichum rogeri and Hamatocaulis Hamatocaulis vernicosus (Annex II), and Natterjack Toad and Sand Lizard (Annex IV), and also a wide range of Red List plant species are accommodated.



"Kennemerstrand" and surroundings (grid km 2) Bewerkte topografische kaart © 2006 Topografische Dienst Emmen.

Natura 2000 area



23.3 Description of the site

The size of the 'Kennemerstrand' is approximately 60 ha. The southern part of the area was designated to become a part of the National Park 'Nationaal Park Zuid-Kennemerland (NPZK)'. The exact boundary of the National Park is still disputed by the municipality of Velsen. The same applies for the adjacent 'Duinen van Velsen', an area appointed as a protected State Nature Reserve (Staatsnatuurmonument), in the north-western part of the NPZK. A majority of the town council of Velsen wanted to withdraw these dunes from the National Park. The largest parts of this park are owned by the NGO nature conservancy organization 'Vereniging tot Behoud van Natuurmonumenten (NM)', the drinking water supply company for the Province of North Holland (PWN Waterleidingbedrijf Noord-Holland, PWN), and the State Forestry Service (Staatsbosbeheer). Smaller parts, e.g. estates, are in the possession of private owners and of municipalities such as the municipality of Velsen.
The entire dune area 'Kennemerland-Zuid', of which NPZK forms a part, were submitted in 2003 submitted as a Natura 2000 area, by the Ministry of Agriculture, Nature & Food quality (LNV). This application has been approved by the EU. However, the Ministry of Agriculture, Nature & Food quality has not yet ratified the site as an SAC.

23.4 Methodology

The area was created from the sea as a result of the construction of two jetties in the mouth of the North Sea Canal which gives access to the Port of Amsterdam. After the extension of the jetties in the 1960s, a beach plain developed south of these jetties. It became the only site along the Dutch mainland coast, where uncontrolled formation of primary dunes took place. Since the beach plain was not strictly protected, recreational activities were not restricted, and therefore a wide array of beach related activities took place year round. Subsequently various development proposals were brought forward for housing and recreation and tourism activities.

The construction of the 'Kennemerstrand' was part of a series of plans that were made after 1981 to boost the development of tourism, recreational activities, and employment in the nearby city of IJmuiden. It consisted of the construction of amongst others a marina, a boulevard with hotels and resorts, and a lake, 'Kennemermeer'. West of this 'Kennemermeer' a new sea wall has been made. To compensate the loss of ecological values on the former beach plain, south of the 'Kennemermeer' a small nature reserve was planned. The northern half of the lake was designated for recreational activities, the southern half for nature conservation. No entrance was allowed to the latter fenced area. On the other hand, entrance to the 'Kennemermeer' was not prohibited. Thus, a segregation of functions was aimed at, with a focus on intensive forms of tourism in the north and a focus of extensive use by day trippers in the south.

As a consequence of the main goal of the construction of the 'Kennemerstrand', development of tourism and recreational activities, management schemes focused on economic parameters. The management plan for the Kennemerstrand (Burger, 1999) listed four restraining conditions for the Kennemerstrand:

- it has to be accessible, and it has to offer enough facilities (utility value);
- it has to look appealing (experience);
- it has to be technically in good shape, and it has to be managed efficiently (technical value);
- it has to consist of 'clean' substrates, and it has to offer space for ecological development (environmental value).

Soon after the formation of the beach plain south of the jetty, the area was selected as a place where houses could be built, or other economic activities could be planned.

A further plan is due to be developed in 2006 as a partnership between all important stakeholders.

23.5 Monitoring

In the plan for the construction of the 'Kennemerstrand' no monitoring programme was included. Monitoring of birds, however, took place by volunteers, most of them members of the local NGO bird watching group 'VWG Zuid-Kennemerland'.

Migrating and wintering birds counts were organized by 'VWG Zuid-Kennemerland' on a monthly basis in 1988-1990. From 1996 onwards the frequency of these censuses was intensified (Groot, 2001). The results of these bird counts could be compared with data on the abundance and occurrence of birds on the former beach plain, summarized by Geelhoed et al. (1989).
Breeding birds in and around the 'Kennemermeer' were surveyed in 2003 and 2005, also by volunteers. In 2004, the area was censused by NGO Dutch Centre for Field Ornithology (SOVON) as part of a large scale census of the NPZK.

Members of the local NGO bird watching group 'VWG Zuid-Kennemerland' and NGO Royal Dutch Society for Study of Wildlife (KNNV Haarlem) collected information on various species groups, especially in 2003-05. The results of these surveys will be published shortly. A preliminary report was published by Diemeer & Plug (2004). Furthermore De Boer & Van Eekelen (2002) described the ecological value of the area, based on limited fieldwork and their expert judgment. They confirmed the occurrence of various protected plant species (see annex), Natterjack Toad (Bufo calamita) and Sand Lizard (Lacerta agilis). Some plant species are protected under Annex II & IV, and toad and lizard under Annex IV of the Habitat Directive.

Figure 23.3 View of the area. From front to back, dunes with Sea Buckthorn (Hippophae rhamnoides), Kennemermeer, and recreationial facilities with the hotel and marina are on the left

23.6 Factors of success and failure

Lessons learned from the 'Kennemerstrand' case are:

- Construction of breakwaters in the vicinity of sluices/ports and subsequent spontaneous development of nature can lead to a terrestrial nature area of high quality in a former sea area.
- Nature and economic development can lead to contradictions that lead to a frustrating process for all stakeholders.
- Involvement of nature conservation specialists to oversee nature conservation projects is helpful. , and agreements concerning use of the new area with nature conservation organization (state or NGO's) must be made as early as possible in the planning process.
- Wildlife and environmental organizations, and even individuals played an important role in identifying and preserving the ecological value of the area. This results in a much larger protected nature area than had been originally planned. This led to a stagnation and restriction of plans by Kennemerstrand NV to get more economic benefit from the area.
- The ecological development of the site over 40 years since its creation, has resulted in an area of international nature conservation importance

In the vicinity of the 'Kennemerstrand' a number of activities (will) take place, that could have an impact on the development of the area:

- Corus steel factory: the area lies partly within the contours of noise and particles emitted by the extensive Corus factories, restricting human activities in the 'Kennemerstrand' area.
- A third marina developed between the jetties. Construction of this harbour led to a displacement of the beach houses, formerly situated between the jetties, to the beach south of the Kennemermeer.

- Application of the dunes as a Natura 2000 area. This means that activities along its borders should not diminish the quality of the Natura 2000 area. e.g. the effects of traffic and the emission of for instance light and noise, etc. should be restricted. This was a main restriction for further (building) plans near the north shore of the lake.

23.6 Policy context

After the extension of the jetties a broad beach plain was formed. For this Kennemerstrand a series of plans were made after 1981 to boost the development of tourism, recreational activities, and employment in the nearby city of IJmuiden. It consisted amongst others of a lake 'Kennemermeer'. West of this 'Kennemermeer' a new sea wall has been made. To compensate the loss of ecological values on the former beach plain, south of the 'Kennemermeer' a small nature reserve was planned. The northern half of the lake was designated for recreational activities, the southern half for natural development.

The municipality Velsen started investigating the feasibility of building houses on the recently formed beach plain in 1981. The investigation resulted in a plan for the economic development of the beach, in order to compete with seaside resorts like Zandvoort and Scheveningen. The zoning scheme 'IJmuiden aan Zee' (Anonymous, 1988) anticipated opportunities and possibilities offered by the beach plain. A segregation of functions was foreseen, with a focus on intensive forms of tourism in the north and a focus on extensive use in the south. This segregation was elaborated in the 'Kennemerstrandplan' (1991), which resulted in a covenant signed by the municipality Velsen and property developer 'J.G. Nelis Projekt Maatschappij B.V.', in 1992. They are owners of the area, for 51 and 49% respectively. After the realization of this 'Kennemerstrandplan', the 'Kustvisie IJmuiden aan Zee' was published (Anonymous, 1999). This plan provides an integrated view of future developments in the different parts of Velsen. The administrative process has been summarized by Van Os (2003).

In 2003 members of local wildlife and environmental organizations founded the NGO Friends of the Kennemerstrand (Stichting Vrienden van het Kennemerstrand). Their aim was the preservation of the vegetation, e.g. Caricion davallianae (Humid dune slacks NATURA 2000 code: 2190), and accompanying fauna by means of (nature) management, surveys and publications. They made a plan to remove excess bushes and shrub in the winter of 2003/2004, on a voluntarily basis. The owner(s) of the 'Kennemerstrand' did not grant them permission to undertake the management due to the existing bad relations with nature organisation at that time. In 2004 though, firm 'Hoek' and in the winter of 2005/6 volunteers commissioned by the NGO's Landscape North Holland (Stichting Landschap Noord-Holland) and Dutch Society for Dune Conservation (Stichting Duinbehoud) mowed some bush encroachment. The costs of this work are unknown.

Costs for the technical management of the 'Kennemerstrand' are made for:
municipal

- maintenance of sewage system: costs unknown;
- maintenance of roads, pavements and entrances to the beach: € 60,000/yr;
- cleaning of the beach, and removal of garbage: estimated at € 90,000 in 2003.
- municipal employees (Velsen) involved > € 60.000.

23.7 References

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  Afstudeeropdracht, TU Delft.

24 Maasvlakte 2

24.1 Identification of the site

The Maasvlakte 2 is located near the Port of Rotterdam, The Netherlands.

Figure 24.1 Location of the Area Maasvlakte 2 in the scope of the NEW!Delta project

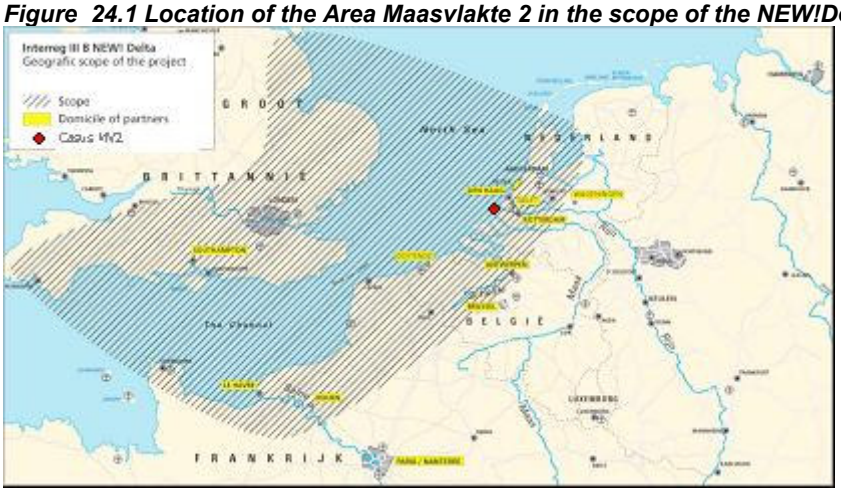
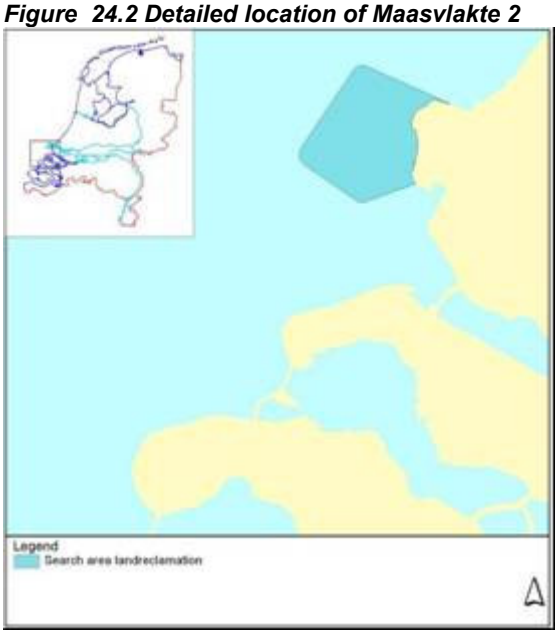


Figure 24.2 Detailed location of Maasvlakte 2



24.2 Description of habitat types

The Maasvlakte 2 is located in the SAC and SPA Voordelta. The SAC Voordelta covers 88,942 ha, the SPA Voordelta 82,245 ha. Other SAC's and SPA's in the vicinity of Maasvlakte 2 are SPA and SAC Voorne's Dunes and SPA and SAC Dunes of Goeree. Habitat types affected are Shifting dunes along the shoreline with ammophila arenaria (2120), sandbanks which are slightly covered by seawater all the time (1110) and fixed coastal dunes with herbaceous vegetation (2130). Affected qualifying species are slavonian grebe (Podiceps auritus), scaup (Aythya Marila) and fen orchid (Liparis loesilii).

24.3 Description of the site

Maasvlakte 2 takes up 1000 ha land reclaim leading to a loss of 2500 ha of sea plus an area of 625 ha sea being constantly and severely disturbed due to changes in sand-transport and tidal flows. In total 3125 ha will be severely affected.

Maasvlakte 2 is located in the Voordelta SAC/SPA which will suffer from direct effects, and nearby the Voorne's Duin and Duinen van Goeree SAC/SPA's, which will suffer indirect effects. Probable indirect effects of Maasvlakte 2 on the Waddenzee SAC/SPA are still part of research and therefore not further mentioned here.

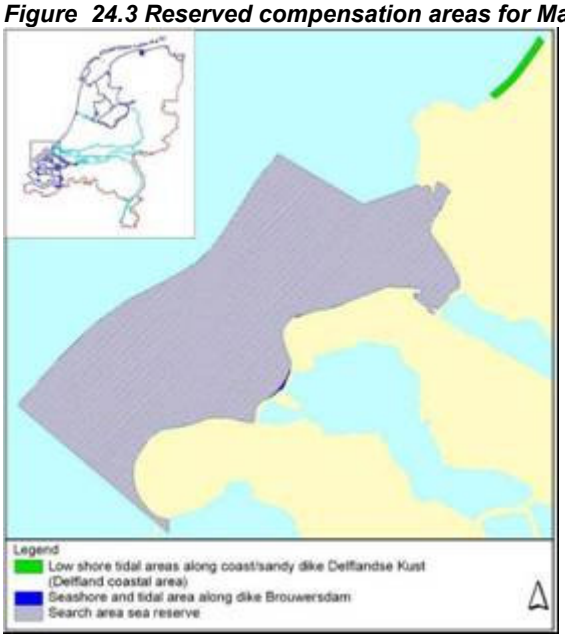
within addition to the land-reclamation as part of the development of Maasvlakte 2, a large sand-winning campaign will begin in the North Seato provide fill material for the reclamation.. Sand-winning will take place outside the Natura 2000 area Voordelta. Land-reclamation as well as sand-winning could lead to significant negative effects on Natura 2000 areas in the neighbourhood. So far only plans for compensation of land-reclamation have been presented. The ongoing EIA-procedure for obtaining a concession for the reclamation and a permit for extracting the necessary sand will provide more insight into possible effects on nature conservation interests.

It is anticipated that development of Maasvlakte 2 will start in 2008. However it is clear that negative effect on the SPA's and SAC's have to be compensated.

The areas reserved for compensation are now:

- Part of the North Sea (31250 ha of sea-reserve, compensation of habitattype 1110)
- Low shore tidal areas along coast/sandy dike Delflandse Kust (100 ha compensation of habitattype 2130 of 100 ha including 10 ha of habitattype 2190)
- Seashore and tidal area along dike Brouwersdam: (15 ha compensation of habitattype 2120)
- Part of the North Sea (8 ha compensation of habitattype 2120, along new land reclamation)

Figure 24.3 Reserved compensation areas for Maasvlakte 2



24.4 Methodology

Land-reclamation and sand-winning will be executed in phases. This makes it easier to monitor the negative effects. Mitigation and compensation measures will be adapted to effects foreseen and monitored. The spatial reservation for compensation is based on maximum negative effects. For some habitat types a multiplier of 10 is taken into account, because new nature values may achieve only 10% of the existing quality.

Actual mitigation proposals of land reclamation consists of:

- Mitigation of the decrease of the sea-shore by construction of the same length of 'soft seawalls including underwater sea-level biotopes' of the land-reclamation.
- Mitigation of the decrease in the dynamic interaction between the sea and the dunes by preventing a more negative effect during the operation than foreseen in reference studies.

Actual mitigation proposals of sand-winning consists of:

- Mitigation of negative effects by: a) using sand coming up from enlarging the channel b) using more environmental-friendly methods for sand-winning c) restricting the period and range of the sand-winning location.

Actual compensation measures of land-reclamation consists of:

- Development of a sea-reserve of 31250 ha within the existing Natura 2000-site Voordelta
- Development of new nature conservation areas consisting of 100 ha grey dunes including 10 ha of humid dune slacks near the location Delflandse Kust
- Development of new nature conservation area consisting of 15 ha white dunes along the Brouwersdam
- Development of new nature conservation area consisting of 8 ha white dunes along the coast of the new land reclamation.

24.5 Monitoring

Baseline monitoring studies are being commissioned in 2005 . The studies will monitor the negative effects of the land reclamation as well as the positive effects of the nature compensation measures. The baseline studies coer the Voordelta and North Sea (VN) and dunes and outer dunes (DU). The baseline studies must be completed before the construction of the land reclamation starts and include:

Lots	**number**	**Effect studies**
Benthic fauna	VN 1	Direct and indirect loss of habitat due to land reclamation
	VN2	Effects of the compensatory marine protected area
Fish and fish larvae	VN1	Direct and indirect loss of habitat due to land reclamation
	VN2	Effects of the compensatory marine protected area
	VN4	Potential effects on the transport of fish larvae
Coastal birds	VN1	Direct and indirect loss of habitat due to land reclamation
	VN2	Effects of the compensatory marine protected area
Human activities (in marine area)	VN2	Effects of the compensatory marine protected area
Marine silt transport	VN3	Potential effects on marine silt transport
Physical and ecological parameters in dune areas	DU1	Effects of salt spray reduction
	DU2	Effects of sand spray reduction
	DU3	Effects of changes in water tables
	DU4	Effects of dune compensation

The baseline studies should be completed in 2006.

According to the European Commissions advisory report on compensation, measures to be taken for compensation will have to be:

- implemented before the construction of the land reclamation starts for VN;
- taken simultaneously with the construction of the land reclamation for DU.

The Monitoring and Evaluation Programme is intended to ascertain whether the effects of the land reclamation on species and habitats are compensated sufficiently and in time by the effects of the nature compensation projects. The MEP will, as a minimum continue for the duration of the entire project MV2.

Evaluation of success and failure
An evident success-factor was the consultation of stakeholders on the compensation and mitigation measures. This led to an agreement on the measures accepted by all involved parties. In turn this made it easy to decide formally about spatial reservations for compensation.

24.6 Policy context
The main procedure of Maasvlakte 2 consists of a spatial procedure for planning (Key Planning Decision plus or PKB+) followed by procedures to implement the plan in order to determine the final shape and structure of Maasvlakte 2 (concession for the reclamation; permit for extracting the necessary sand; assessment for defining a zoning plan for the reclaimed land).

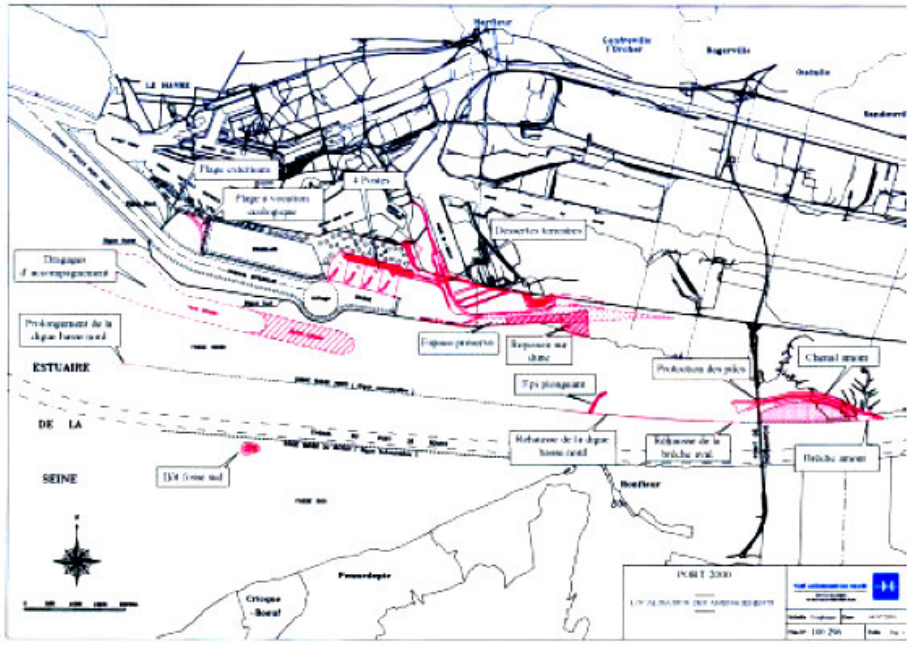
1. Key Planning Decision plus procedure (PKB): procedure based on national law (Spatial Planning Act). Is still in process; some of the main decisions of PKB part 4 have been overturned by the Council of State. In particular, the possible effects on the Waddenzee SAC/SPA now require investigation. Also a better juridical guarantee of the establishment of a sea-reserve is needed. Resolution of these issues will take place in 2005. Decision-making of the restored PKB is foreseen in 2006/2007.
2. Environmental Impact Assessment study, based on national law (Environmental Management Act). Is finished on the scale of planning. An EIA for construction is still being carried out, as part of the restored PKB. Starting notation and Scoping guidelines are published. Research will be undertaken in 2005. Decision-making is foreseen in 2006/2007 resulting in concessions for sand winning or land reclamation and the finalization of a development plan.
3. Assessment on the provisions of article 6.3 and 6.4 of the Habitats Directive (as part of the EIA) based on the EU Habitats Directive. Process is completed. Positive advice from the European Commission was received in 2003.
4. Consultation of stakeholder's i.e. public and non-public organisations about mitigation and compensation for land reclamation as part of the PKB. Agreement has taken place in 2001.

24.7 References
www.mainport-pmr.nl or
www.maasvlakte2.com

25 Artificial mudflats, Seine estuary

25.1 Identification of the site

Figure 25.1 Location of the site



The site concerns the immediate upstream side of the Normandie bridge. It is included in a Natura 2000 area and in the natural reserve of the Seine estuary.

25.2 Description of habitat types

1130-1: estuary – Tidal flat in sea with tide

25.3 Description of the site

The site is a muddy strand from the marshland until the submersible embankment from the port of Rouen. Benthic fauna is quite poor with only 4 or 5 species including*Hediste diversicolor*, and *Corophium sp*.The site is considered as being in a bad state of conservation.

25.4 Methodology

Modelling simulations of the scheme were completed in 2003 (carried out by SOGREAH with DIREN as the contracting party and under supervision of a committee of experts), and the works for the restoration of the mudflats were completed in late 2005. Several stages have been necessary in order to give time to nature to take its course again.

Figure 25.2 Normandie bridge mudflats

The first step consisted in creating the substructure of the groyne, in the summer of 2003, in the northern part of the estuary at right angles with the radar tower in Honfleur. The changes noted in situ (reduction in bottom depth and beginning of a mudflat) confirmed the studies, which permitted to launch the second phase of work. From September to December 2004, the groyne was raised along most ots length (500 metres) and the lower Northern breakwater on a length of 2,000 metres (downstream the Normandie bridge, between the opening and the groyne).

The third and last stage of this programme aims at improving the water circulation and creating additional mudflats upstream of the Normandie Bridge to protect fish nurseries. The work, which commenced in late 2004, includes the digging of an environmental channel and the creation of an opening at the upstream outlet of the channel while raising the present opening. The invitations to tender for this last stage were launched during the summer of 2003, and the tenders were addressed for this contract of design/completion in December of the same year. In early 2004, a selection committee made up of PAH, PAR, DIREN, the 'Maison de l'Estuaire' and the Le Havre Chamber of Commerce and industry (CCIH) met to study the tenders. The SODRANORD Company, a subsidiary of the Dutch group VAN OORT, expert in studies and completion of dredging works, was selected, as its technical solution was the most respectful for the environment especially because putting dredged materials ashore were carried out by pipes and the placing and removing of the pipes takes place before the nesting period and after the young birds have left the nest.

Figure 25.3 Environmental channel

SODRANORD made the most of the summer of 2004 to complete the studies of the project and the specifications, on the basis of the guidelines provided by the Port Autonome du Havre. As prime contractor and work contractor for this work site, SODRANORD began the works at the end of 2004 by the development of a deposit area, north of the Estuary Highway. Connected to the dredger by 2.5 km of pipes (including a shore part and a floating one), this deposit area received the materials collected by the stationary suction dredger "AEGYR". After settling of the sediments dredged from the docks, the water received in the deposit area is pumped towards the Seine estuary, thus re-supplying the existing 'filandres' (local name for the drainage channels of the slikke) to better guarantee their long-term existence.

Figure 25.4 Deposit area

Prior to the dredging of the environmental channel, additional protection of the northern access piles of the Normandie bridge was carried out. This meant digging an underwater excavation, between February and mid-March 2005, at the foot of the piers and, afterwards, a pontoon brought rock-fills there, to provide erosion protection.

Dredging works then commenced involving 1.8 million cubic metres of sediments on-site (mixed materials made up of sand and mud), corresponding to the dredging of a channel 100 metres wide (from north to south) and a length of 2,800 metres (from west to east). The last stage of this work site, scheduled for the autumn of 2005, involve the creation of a new opening at the upstream outlet of the environmental channel and raising of the downstream opening in order to facilitate the free flow. All the works are were completed by the 3rd quarter of 2005.

Figure 25.5 Normandie bridge piers protection

25.5 Monitoring

Monitoring is done by the “Maison de l’Estuaire”, the natural reserve manager, chosen for its very good knowledge of the field and the quality of its scientific staff.
Monitoring began in 1997 as a part of the reserve management and has been increased over time.

The programme will continue until 2010 funded by the port of Le Havre as part of the measures linked to Port 2000.

Measurements are made of morphology, currents and benthos.

Morphology

From 2003 until the end of 2005, monitoring was undertaken on a monthly basis because of the rapid changes being observed. Since 2005, monitoring has been reduced to bi-monthly.
The monitoring programme assesses mudflat elevation, grain size and topography along a series of transects

Currents

Once a year, at the end of summer during a high tide, currents are measured during a joint campaign between the Maison de l’Estuaire, the port of Le Havre and the port of Rouen .

Benthos

Zoobenthos is examined every year in September.

25.6 Policy context

This project forms part of the measures agreed with theEuropean Commission for the impact of Port 2000.

Therefore, its realisation was an obligation towards Europe.

25.7 Stakeholders, finance and communication

The partners of the project were: the Port of Le Havre as the contracting authority, The natural reserve manager and the DIREN as experts, The French State, Europe, Study offices and works companies.

The funding of the project comes from Europe. Its total cost is around 21 millions of euros.

Communications were done by the port of Le Havre to show the experimental interest of the project, through publications, exhibitions and seminars.

25.7 Factors of success and failure

Factors of success

- Creation of mudflats is very important for the Seine estuary because the natural ones are now declining when their function as a food resource needs to be preserved.
- The location of the project contributes to the continuity of a natural mudflat, which should in theory ensure good functioning and rapid colonization fauna.
- The creation of the artificial mudflat was based on a mathematical and physical model. The reality is similar to model predictions except for the grain size of the sediments (see factors of failure).
- There was extensive communication with stakeholders to secure support for the scheme

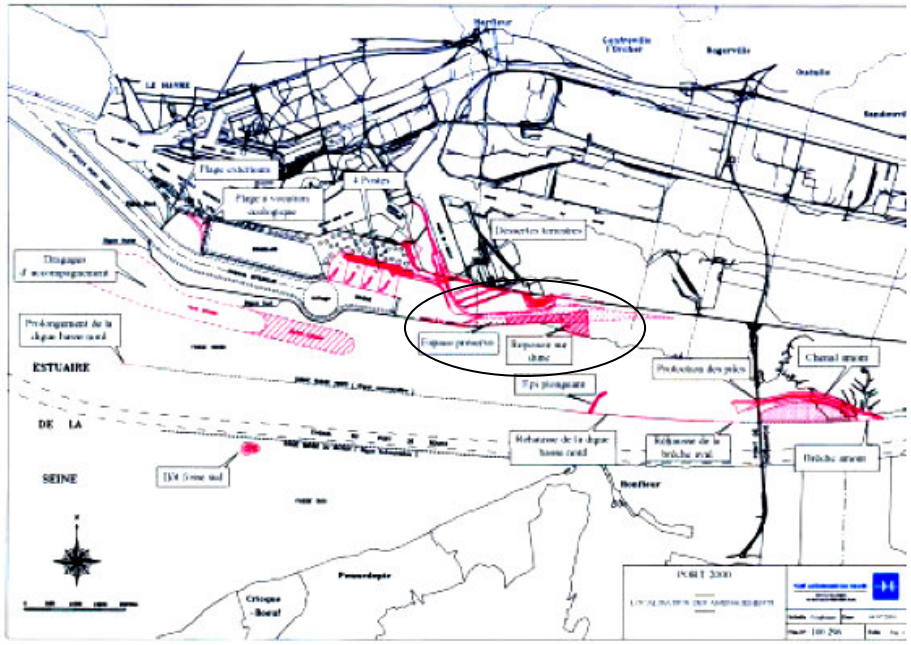
Factors of failure

- From 2003, hot summers and lack of floods caused more sedimentation than expected, but the sediments comprised sand instead of mud. It is unclear whether a mudflat of adequate quality has been created.
- The channel is now functional but the potential for the channel to become blocked remains Rapid remedial works would be necessary if this happened.
- Mud has a bad image for ordinary people and even politicians. It is difficult to interest them in this kind of implementation.

26 Dune Sanctuary for bird, Seine estuary

26.1 Identification of the site

Figure 26.1 Location



The site is in the south west of the port of Le Havre. It is included in a Natura 2000 site and in a "preserved area" which is a part of the port area where no port installation will be built.

26.2 Description of habitat types

1130: Estuary, 1310-1: Tidal flat in sea with tide, 2110-1: embryonic shifting dunes, 6430-5.

26.3 Description of the site

The interest of the site comes from the varying nature of its environment (ponds, reed beds, willows, dunes…)

It is the only place in the Seine estuary where there are dunes. As such, it isn't really representative of a typical Seine estuary environment but was chosen to replace a resting place for birds located in a deposit area for dredging products that was to be destroyedby Port 2000 implementation.

26.3 Methodology

As the first environmental measure to be implemented, the works for the creation of the dune sanctuary for birds were completed as early as February 2002.

Four existing ponds and a stretch of water were created. A ditch network was created to connect them. This made an island of about 2,75 hectares. A 16 meter wide and 2750 meter long canal was built to provide hydraulic circulation from the west to east.

Since then, a further survey to assess the functioning of the scheme has been carried out by DIREN and the 'Maison de l'Estuaire', the manager of the Nature Reserve of the Seine Estuary. The survey suggested the scheme was underperforming and it was necessary to define a few additional measures to improve the functioning, especially the management of the water levels of the dune sanctuary.

Figure 26.2 General view of the site

In order to improve the functioning of the dune sanctuary, additional works were undertaken in mid-July and August 2003 in the North-Eastern part of the sanctuary to provide sites for nesting avocets. The reshaping works included the digging of a network of permanently submerged ditches around five islets with gentle slopes. This system is separated from the rest of the sanctuary by earthworks, a duct equipped with a non return valve makes it possible to manage water levels (in and out) and to remain independent of the water management of the rest of the sanctuary.

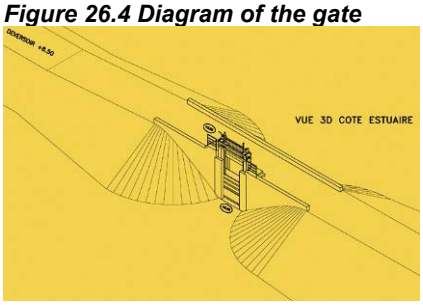
This management requires setting up a structure of water level management for the sanctuary. Two locations for the structure were studied by an external project manager within the scope of the preliminary design study.

After study of all advantages and drawbacks of each of the two sites, the 'A' site was selected by the steering committee (DIREN, MDE, PAH) as it favourably meets the requirements of the structure and the environmental conditions. The aim is to be able to set water levels which can vary according to the period.

Figure 26.3 Water level management gate

The water analysis and the feasibility study have made it possible to define a mobile structure (see 3-D diagram) whose main characteristics are as follows:

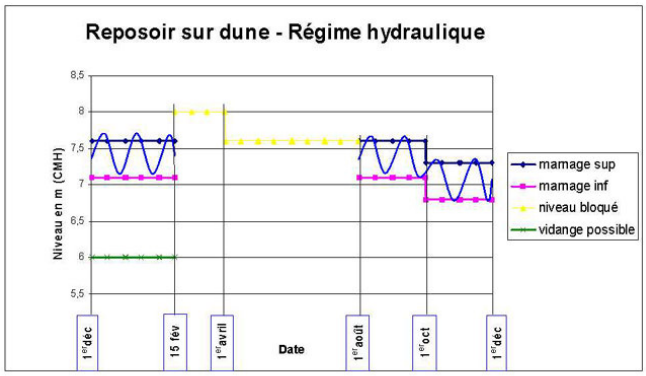
Figure 26.4 Diagram of the gate



- A flat gate, made up of two mobile parts, independent of each other and making it possible to get fixed water levels, irrespective of tidal state.
- A rise to maintain the water level (during spring tides) at the minimum level of + 8.50m (according to Le Havre Marine Chart Data).

Of course, with a high tidal coefficient and a water level higher than + 8.50 m (according to Le Havre Marine Chart Data), all the zone will be flooded. The table below sums up the functioning of the structure according to the various situations considered: (see diagram)

Figure 26.5 Hydraulic management



The project design stage was presented to the steering committee by the service company BRL/ISM (prime contractor) on April 8th, 2004. The invitation to tender was launched in the fall of 2004. The works were carried out from December 2004 to mid-May 2005. They included the construction forward of a sea breakwater of about 133m with a rise of 50m, a civil engineering structure in prefabricated elements and a gate structure.

26.4 Monitoring

The water management is done by the “Maison de l’Estuaire”, the natural reserve manager.

Bird observations are undertaken by “birds observatory” which is a joint work of Maison de l’Estuaire and the Regional Natural Parc staffs.

Monitoring will continue until 2010 funded by the port of Le Havre as a part of the compensatory measures for Port 2000.

26.5 Policy context

This project forms part of the compensatory measures agreed with the European Commission for the impact of Port 2000..

26.6 Stakeholders, finance and communication

The partners of the project were: The port of Le Havre as the contracting authority, the natural reserve manager and the DIREN as experts, the French State, Europe, Study offices and works companies.

The funding for the project comes from the port of Le Havre. Its total cost is around 2 millions of euros.

Communications by the port of Le Havre sought to highlight the environmental interest of the project trough publications, exhibitions and seminars.

26.7 Factors of success and failure

Factors of success

- The different functions of the resting place destroyed (rest, feeding…) were present in the chosen site for the project with about the same surfaces. Furthermore, the sanctuary is next to mudflats where birds can feed.
- bird usage was improved through better water level management.
- measures were taken or are going to be taken to ensure quietness for birds (prohibition of hunting in a 500 meters wide area in the vicinity of the sanctuary, control of access and sources of noise).
- A “ preserved area” including the dune sanctuary for birds was created in the vicinity of the port’s installations.
- The proximity to the town of Le Havre is an advantage for educational use. The implementation of an educational trail and the building of two shelters for birds observation are in progress.

Factors of failure

- The observations made about bird usage are encouraging but it is still performing below expectations. The reasons and solutions need to be found.
- The implementation of a gate was essential for water level management but leads to an artificial functioning of the site. This means that ongoing activemanagement, with its attendant costs, is necessary.
- The management of vegetation is one important condition for success but is a difficult issue. The land is wet and soft and cannot carry heavy plant circulation. Grazing could be a solution to some extent but still has to be implemented.
- The site used to be a leisure area (walk, 4x4, hunting…). Measures taken to ensure quietness for birds can be a source of local conflict. It is already contentious with hunters.

Annex 2

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