

### Building with Nature in Wadden Sea ports

The Wadden Sea is a listed Unesco World Heritage site. So sustainable port development is even more important here. The BwN Wadden Sea Ports programme looked at how port development and nature development can go hand in hand by Building with Nature to deliver added value for both the economy and nature. Most of the knowledge in this brochure was developed as part of the the BwN Wadden Sea Ports programme, a co-production of the EcoShape Foundation, the Wadden Sea Ports and the 'Towards a Rich Wadden Sea' programme. The individual projects involve collaboration with the municipal authorities of Harlingen and Delfzijl and the It Fryske Gea nature protection organisation. The projects were co-financed by the Wadden Fund.

### Sustainable Port Development

Ports are often located in or near valuable ecosystems. Can we develop ports further using nature's help and create opportunities for nature at the same time? EcoShape develops solutions for ports using the ecosystem and the environment as the guiding principle.

The functional requirements for ports result in technical designs with hard transitions between land and water: breakwaters, vertical pile walls, deepened channels or lock complexes, for example. In the Building with Nature approach, the designer takes natural gradients (transitions from fresh to salt water) in the ecosystem into account, which is good for both the economy and the nature in the port area.

The approach begins with a sound understanding of how the local ecosystem works and how this system affects the port and its functioning. We make use of the forces of nature, such as currents and wind and plant growth. Where possible, we create room for ecosystem development in locations where the port allows it. By doing so, we encourage things like salt marsh formation and create a richer habitat for animals. In that way, port and nature development go hand in hand.

#### Optimising currents

Breakwaters are indispensable port structures that make shipping traffic possible and protect the quays. However, they also affect currents and sediment transportation inside and outside the port. Designing breakwaters on Building with Nature lines reduces sedimentation in the port and improves the flow of sediment to salt marshes and sandbanks. This breakwater design makes the most of natural forces.

#### Optimising dredging strategies

Maintenance dredging is very expensive. In addition, depositing the dredged sediment outside the port often has a negative impact as well: life on the bed is disrupted and turbid water is spread. Not only that, some of the sediment flows back into the port and it needs to be dredged again. It is possible to establish a win-win situation by using the dredged sediment in a smart way for nature restoration or as a building material. Natural currents can also be used to transport some of the material to the desired location. This approach has been tested at the Mud Motor.

#### Creating a fresh-salt transition zone

Ports are often the places where a freshwater system (polders, drainage systems and canals) meets a salt-water system. A lack of space often means that there is no gradual transition (or 'gradient') from fresh to salt and the two are kept separate by hard systems such as locks or pumping stations. Even though this transition zone is actually important for animal and plant species that live in these areas. Creating a fresh-salt transition zone immediately alongside a port creates a natural connection ('connectivity') between these ecosystems, resulting in more natural variation and more animal and plant species. This is seen in the Marconi project near Delfzijl (Pier van Oterdum).

#### Encouraging salt marsh development

Salt marshes are very important ecosystems. They are breeding and resting places for birds, and spawning grounds for fish. They reduce wave impact and therefore protect the coast against erosion. They also trap sediment so that the coast grows. In addition, salt marshes capture CO<sub>2</sub>, and the local

people use them as pastures. Salt marshes are under pressure worldwide due to human activities such as land reclamation and the effects of climate change such as sea level rise. Creating the right conditions for salt marsh growth or transporting more silt in the currents leading to a salt marsh make it possible to restore salt marshes in a natural way. This process been tested at the Mud Motor and it is part of the Marconi project at Delfzijl (salt marsh development).

#### Hanging structures

Hanging structures are an attractive habitat for a range of flora and fauna. These underwater structures made from concrete and nylon provide a home for species such as mussels, oysters and weeds that filter the water and improve water quality. They are a good habitat for fish: there is food in abundance.

#### Enrichment of hard banks

Quays and dikes are usually designed for the purposes of flood risk management. The ecological function of the transition between land and water is lost. The ecological value of dikes or quays can benefit when banks are enriched with special types of revetment. The connection between ecosystems improves, allowing animal and plant species to move freely from one habitat to another. In addition, the enriched banks are interesting for divers because of the range of fish, plants and crustaceans that live there.

#### Foreshore solution

Foreshores are located in front of dikes, creating a soft transition from land to water. A foreshore reduces the impact of the waves, making it possible to build smaller dikes. Foreshores in the form of a sandbank or a salt marsh in front of a dike are more flexible and adaptable to changing circumstances than a quay or dike made from rock or concrete. They are appealing habitats for animals and plants that are found naturally on the shore and they also offer opportunities for leisure activities.

#### Interested?

For more information and contact details visit [www.ecoshape.org](http://www.ecoshape.org).



# Sustainable Port Development

# Smart design for sustainable port development



**1. Optimising flow patterns**  
The design of a port using Building with Nature principles exploits currents in, through and around the port to reduce sedimentation and improve the supply of sediment to salt marshes and sandbanks, for example by smart design approaches for the breakwaters.



**2. Optimising dredging strategies**  
It is possible to establish a win-win situation by using the dredged sediment in a smart way for nature restoration or as a building material.



**3. Creating a fresh-salt transition zone**  
A gradual transition from fresh to salt water systems determines the connection between ecosystems. Within ports there is often lack of space for this. Creating a fresh-salt transition zone immediately alongside a port creates a natural connection ('connectivity') between these ecosystems.



**4. Encouraging salt marsh development**  
When ports are located on the coast, disrupting the currents, there are opportunities for salt marsh development. In the right conditions, salt marshes grow in a natural way. Smart management ensures, for example, the transport of the required sediment to the salt marsh by using the natural currents.



**5. Hanging structures**  
The space and water below quays or floating jetties are an attractive habitat for plants and animals. Hanging structures are a good addition to this habitat.



**6. Enrichment of hard banks**  
The ecological value of dikes or quays can benefit when banks are enriched with special types of revetment. The connection between ecosystems improves, allowing animal and plant species to move freely from one habitat to another.



**7. Foreshore solution**  
The traditional approach to protecting ports from waves and currents is to build breakwaters of stone or concrete. The creation of a foreshore in front of stone or concrete structures produces a double benefit: the structure behind the foreshore does not have to be as heavy and an appealing natural area is created.



This project has a positive effect on:

