



# RAAK-PRO PROJECT BUILDING WITH LIVING NATURE NEWSLETTER JANUARY 2012

Toegepast onderzoek op het grensvlak van ecologie, civiele technieken watermanagement ten behoeve van de ontwikkeling van duurzame multifunctionele oplossingen waarbij waterveiligheid in Delta regio's gewaarborgd is

Applied research on the interface between ecology, civil engineering and water management for sustainable development of multipurpose solutions to assure safety in Delta regions

## Introduction

This newsletter has the purpose of keeping you informed about the most important results and developments in the RAAK-PRO project Building with living Nature.

The main idea of RAAK-PRO project Building with living Nature is to disclose, to professionals, the available knowledge on building with nature. The project is conducted in collaboration with multiple parties such as Project Sea Defenses, Deltares, Ecoshape, Rijkswaterstaat Zeeland and Hogeschool Zeeland.

You can find more information, about the project, on the website of the Delta Academy [www.hz.nl](http://www.hz.nl), research group Building with Living Nature.

## Workshop's

In the previous workshop (July 6, 2011) as an overall direction for the coming year, it was concluded that a link of each work package to the upcoming BWN Oesterdam project would be sensible, in order to guarantee output that has practical value and to enable partners to create synergy with the work that needs to be done for this new BWN project anyway.

In two workshops held on October 6 and October 20 the focus was mainly the definition of field related researches activities that are useful to strengthen the output generated in the work packages 1 (BwN concepts) and 2 (guidelines and protocols).

### The Oesterdam Project

The Oesterdam is a dam located in the SW of the Netherlands between Tholen and South Beveland in the eastern part of the Oosterschelde. The dam is 10.5 km length and it is the longest dam of the Delta Works.

The construction of the Oesterdam began in 1979 and it was finished in 1986. However it was only opened in 1989 after the road (N659), over the dam, was finished.

Nowadays it is necessary to reinforce the Oesterdam in order to ensure the safety of the region. For the new project to the traditional dike (Oesterdam Dike) a 'soft structure' is going to be added in the foreshore.

The Oesterdam dike is designed to reach the intended safety standard of the region. The soft structure, placed in front of the dike, is going to provide extra safety, and presumably also a reduction of the maintenance of the dike.

The previously mentioned soft structure is going to be mainly constituted by a sand nourishment. Additional structures, like Eco dynamic structures, can be added to the sand nourishment with several benefits for the project. The Eco dynamic structures considered in this solution are mainly oyster reefs and hanging structures. The main purposes of the Eco dynamic structures considered in this project are to dampen the waves and trap sediment behind them, stabilizing the sand nourishment in place for a longer period.

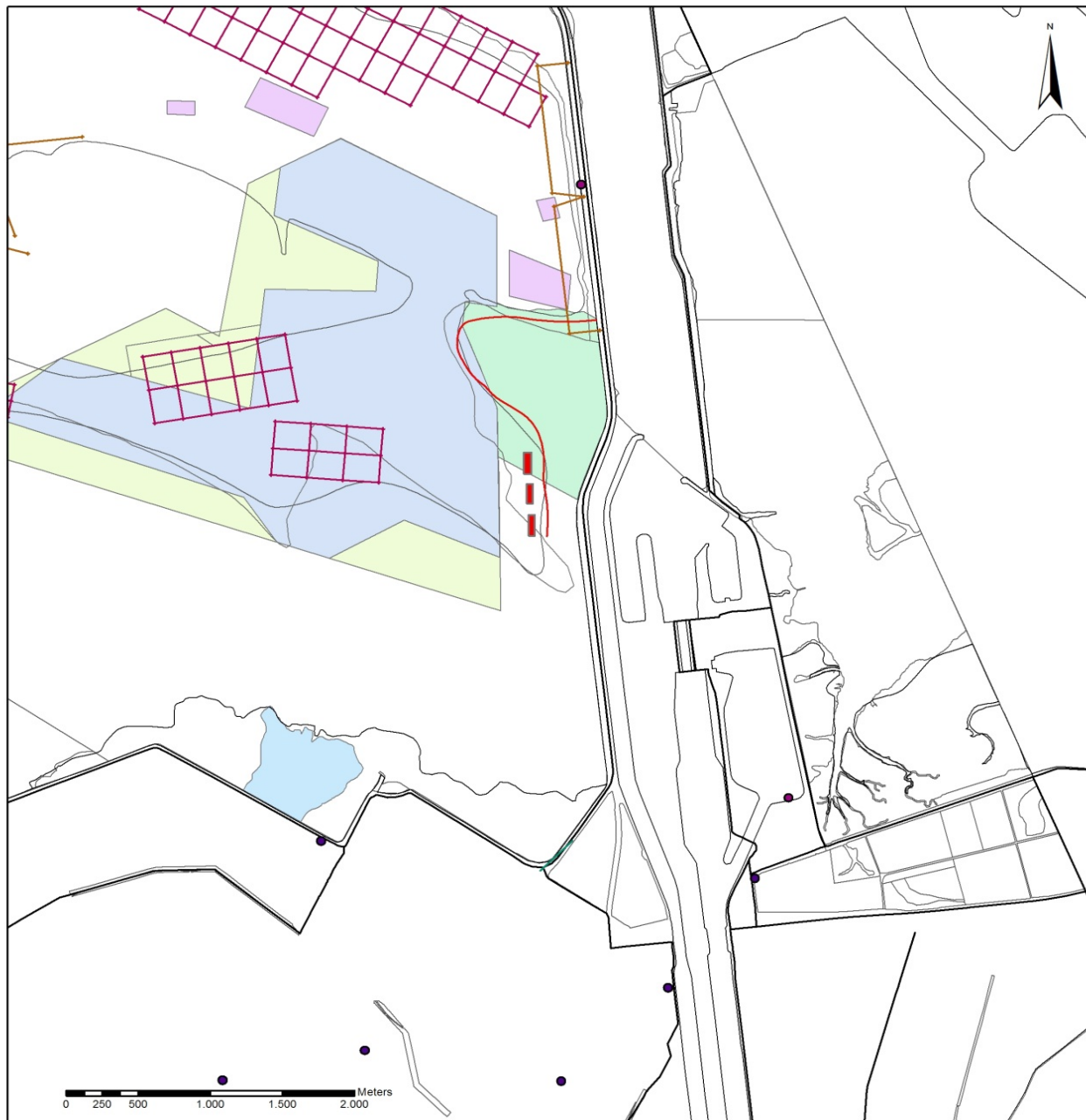
### WORKSHOP RAAK-PRO PROJECT Building with Living Nature: Work package I, (6<sup>th</sup> October 2011)

Participants: BWLN project team, Tom Ysebaert (Imares/Ecoshape), Bregje van Wesenbeeck (Deltares), Eric van Zanten (RWS).

The main question for this workshop was: How can we link work package1 of RAAK-PRO to the Oesterdam project, and what kind of research is interesting/useful (for RWS and the RAAK-PRO ) and can be done by HZ.

Carla Pesch opened the workshop by stating that so far Bw(L)N applications are mainly related to safety (inhibition wave, wave damping) and that in the approach chosen in the RAAK-PRO project, the BwLN concept is looked at from the point of view of the ecosystem as a whole. Consequently, the ecosystem services (ESS) supplied by the target ecosystem, may also be affected by the BwLN solution chosen. BwLN and BfN solutions exert their effects by means of affecting (ideally: reinforcing) functional groups. In this respect, functional groups are not only defined in the more traditional sense of e.g. trophic functions, but also in the sense of groups that facilitate ESS.

The presentation of Carla Pesch was followed by the presentation of Eric Van Zanten which was mainly focused on the Oesterdam project and its requirements. During this presentation was also pointed out the activities and services around the Oesterdam and the several stakeholders that are present in the area. In order to give a clear idea of the project the following map was designed during the presentation (Figure 1).



**Legend**

- RECREATIE\_Zwemwaterplaatsen
- RECREATIE\_Duikplaatsen
- NATUUR\_ZeehondenTellingen
- INFRA\_Gemalen\_Waterschap
- NATUUR\_Zeldzame\_dijkplanten
- NATUUR\_Dijken2009
- ECONOMIE\_Vistuig\_Oosterschelde
- ECONOMIE\_Visserijpercelen\_Oosterschelde
- RECREATIE\_Moterboten
- ECONOMIE\_ZeegroenteSnijgebieden
- ECONOMIE\_ZeeasWingebied
- ECONOMIE\_Sportvislokaties\_Oosterschelde
- ECONOMIE\_Spitolokaties\_Oosterschelde
- ECONOMIE\_Schelpdieren
- ECONOMIE\_JapanseOesters
- Oesterdam Project

Figure 1. Actual situation and location of the nourishment and possible Eco dynamic structures at the Oesterdam

The Ecological design of the nourishment and stabilization of the sediment was prioritized in order to achieve an optimization of the services. For that reason other solutions could be needed for the project in addition to the dike and the sand nourishment. Solutions such as oyster reefs, the cascade and hanging structures for damping waves and trap sediment provide not only safety but also some more benefits like mussel farming.



Figure 2. Oyster reefs and Hanging structures as possible Ecodynamic structures to be applied in the Oesterdam

During this last presentation was suggested that this project should avoid standardization and uniform landscape. In that way habitat diversity could further be increased, by increasing gradients in sediment composition and bed elevation .

#### Outcome of the Workshop and future actions:

- During this workshop HZ and the other research institutes expressed that they want to be deeply involved in all the phases of Oesterdam project, mainly in the design (where the knowledge contribution will be more important to achieve the goals), but also in the building phase and after that by monitoring actions. In accordance to the previous facts RWS stated that is really interested on the co-design with the research institutes.
- In order to apply the Eco dynamic structures in the Oesterdam project further research and optimization in design and in materials is necessary. As a result several experiments in relation to oyster reefs, hanging structures and Ecological design were suggested.
- Creation of a design framework to help RWS creating BWN related designs and requirements (EDD and BWN) in other projects in the future.

## WORKSHOP RAAK-PRO PROJECT Building with Living Nature: Work package II, (20<sup>th</sup> October 2011)

Participants: BWLN project team, Tom Ysebaert (Imares/Ecoshape), Yvo Provoost (Zeeweringen), Lies de Graaf (afstudeerder TUD).

The main question for this workshop was: How can we link work package 2 of RAAK-PRO to the Oesterdam project, and what kind of research is interesting/useful (for the partners for example RWS and the RAAK-PRO) and can be done by HZ and HZ students.

Ruud de Boer started the workshop by making a brief presentation about the work package 2. Yvo Provoost continued by stating that in the Oesterdam project Natura 2000 is the problem and not safety. Another aspect highlighted is that the sand nourishment is not taken in account in the safety check. However it can be considered for the maintenance or in the fore shore for overall protection.

In the case of the Oesterdam the sand nourishment can reduce the wave impact or strengthen the dike and therefore increase the project time frame for a longer period time than the usually considered in these kind of projects.

Besides the wave reduction aspect the sand nourishment also has positive effects on the natura 2000 issues. Due to the increase of the bed level it keeps the area available for feeding birds for a longer time, in each low tide.

### Outcome of the Workshop and future actions:

- Create a catalogue with BwN solutions and related background knowledge (available models and field tests, We will take this up with Deltares/Imares and Ecoshape).
- Evaluate how BwN solutions can be tested and how this can be integrated in the VTV?
- Evaluate research related to rich revetments and pools located in the toe of dikes
- Possible activities of research group in relation to the Oesterdam project:
  - Elaborate the Natura 2000 aspects of the BwN design
    - what is the relation between Natura 2000 and present and future bed level and sediment composition.
    - Analysis of the influence of artificial reef structure on Natura 2000.
  - Bird watching in relation to Natura 2000 (TO and after)
  - Sea grass restoration/ salt marsh formation experiments
  - Stabilizing Oyster reef design and effect on morphology
  - Effect of oyster reef introduction on production capacity of system)
  - Identification of presence of shallow peat layers are present in the Oosterschelde, that may influence benthos composition
  - Invasive species analysis

### Overview of activities since September 2011

• Since the beginning of September three study projects, one minor and a final internship are taking place under the BwN research group.

- There are three groups of second year students working on building with nature study projects. The Oesterdam group is starting from Ecosystem services (ESS) available in the area and trying to connect them with the functional groups, identifying the available species on the way.

The oyster reef group has a different approach and it is starting from the species and the services that can be provided in an oyster reef to identify the different functional groups available in this kind of habitat.

The third study project is focusing on the relation between rich revetments and Natura 2000, and trying to identify how the rich revetments can help to achieve the goals of Natura 2000. At the same time the group is assessing which material is the most suitable to be used as revetment in order to improve biodiversity and productivity in the Oosterschelde.

-A minor research is also being conducted at HZ by two students. The minor research is focusing mainly on ESS inventory, quantification, and valuation (€) for the area of the Oosterschelde.

As support for the programs previously explained there were two Excursions to the Oosterschelde and some Research group meetings including all the students, the BwN researchers and Dr. Tom Ysebaert.

The first excursion was focused on the artificial oyster reefs, at Viane, and in the Rich revetments experiments near Ouwerkerk. In this first excursion Brenda WallesMsc, a phd student, also joined in the field and gave a better insight about the oyster reefs and about the system. The second excursion was focused in the Oesterdam and also in some rich revetments at the Dikes between Yerseke and wemeldinge.



Figure 3. Excursions and field work in the Oosterschelde

- In Autumn 2011 we were pleased to welcome Dr. Ronald Waterman who gave a lecture during lunchtime for over 100 students, giving an introduction regarding Building with Nature. Students from Water Management, Civil Engineering, and Delta Management were present. The topics discussed by Ronald Waterman were presented in such a way, that it was relevant and interesting for all the students of the Delta Academy.

After this lunch session, Dr. Waterman continued with a lecture about criteria to be taken into account to make a choice between hard or soft defenses. Although this lesson was meant for students of Civil Engineering, following the course 'Dredging and Ecology', many students from Delta Management and Water Management stayed for this interesting lesson.

- Dr. Ronald Waterman has also joined an excursion for students of Civil Engineering to the Second Maasvlakte, the land reclamation for the Port of Rotterdam, (Maasvlakte 2) and the coast of Hoek van Holland, where extra sand has been applied to make an extra dune valley on the beach. This so-called nature compensation is necessary because of the construction of the nearby Maasvlakte 2. Ronald Waterman himself has been participating in these projects, so he could explain aspects of these projects in detail.

- Ruud de Boer has attended the conference 'Dredging and beyond', organized by CEDA (Central Dredging Organisation), where one of the two themes 'Building with Nature for soft and hard dredging solutions (coastal and inland)' was. Amongst others, the next presentations were held: 'Introducing guidelines for eco-dynamic development and design', 'Handling the knowledge challenge in Building with Nature projects – Lessons from the pilot sand engine Delfland', and 'Biogeomorphological interactions on a nourished Tidal Flat: Lessons learned from Building With Nature'.

- On Thursday 22 December 2011, Dick de Jong, Ecologist at Rijkswaterstaat Zeeland, gave a presentation on the ecology of the Eastern Scheldt. In this presentation, a general idea of estuary was given, and then the focus was on the Eastern Scheldt and the Western Scheldt in particular. The presentation also focused on how such complex systems can be approached in a more practical way.

## Future activities:

For the upcoming months several assignments from the Research group are also going to be available. The assignments are divided in three main subjects Resilient ecosystem functioning, soft engineering techniques and testing and hard structures on dikes and safety tests. The assignments are in most cases easily adapted to feed into study projects, minors or even internships. Below is a brief description of research topic and assignment.

### - Resilient Ecosystem Functioning: Foundations for Building with Living Nature

Both natural and modified ecosystems provide Ecosystem Services that are essential to man. Ecosystem Services include Provisioning Services, Regulating Services, Habitat Services and Culture & Amenities Services (TEEB 2010). From the point of view of sustainable management, it is important to keep the ecosystem in a state that will provide essential ecosystem services on the longer term.

Building with Living Nature solutions are part of building with nature concepts, and are implemented in the Netherlands with the aim to create infrastructure that provides multifunctional solutions.

Building with Living Nature solutions deliver ecosystem services, by creating or extending habitats for functional groups of species that facilitate these services. For example, an artificial oyster reef is delivering provisioning services, regulating services and habitat services. In this way a regulating service, such as providing safety through sediment stabilization and wave attenuation, is combined with a provisioning service (food) and a service that could improve ecosystem functioning by providing area of valuable spawning, nursery, sheltering and feeding habitats for key species of the ecosystem.

The research on the foundations for the Building with Living Nature approach connects BwLN to Ecosystem Services and to Ecosystem Functioning & Resilience via functional groups, and is looking for a clear definition of these functional groups for the Eastern Scheldt ecosystem. The resulting framework will serve as a basis for developing tools to assess the impact of BWLN on resilient ecosystem functioning for ecosystem management.

**Assignment 1:** Description of the Eastern Scheldt Ecosystem

**Assignment 2:** Ecosystem services supplied by the Oyster Reefs

**Assignment 3:** Safety as an ecosystem service

**Assignment 4:** Functional groups for ecosystem functioning and resilience

### - Design a Dike using soft engineering techniques and test it for safety

Human strategies on the coast have been heavily based on a static engineered response, whereas the coast is in, or strives towards, a dynamic equilibrium. Solid coastal structures are built and persist because they protect expensive properties or infrastructures, but they often relocate the problem downdrift or to another part of the coast. Soft options like beach nourishment, while also being temporary and needing regular replenishment, appear more acceptable, and go some way to restore the natural dynamism of the shoreline. However in many cases there is a legacy of decisions that were made in the past which have given rise to the present threats to coastal infrastructure and which necessitate immediate shore protection.

Soft engineering techniques (e.g. sand nourishments), building with natural processes and relying on natural elements such as sands, dunes and vegetation to prevent erosive forces from reaching the backshore. These techniques include beach nourishment and sand dune stabilization. By soft structures the normal coastal processes can occur and give rise to a more diverse landscape.

A great part of the Netherlands coast line is naturally protected by sandy beaches and dunes, which need to be revised at times and checked for safety.

**Assignment 1:** Design a Dike using soft engineering techniques and test it for safety

### - Hard structures on Dikes and safety tests

Increasing urbanization in all over the world has resulted in extensive replacement of natural habitats with man-made habitats. A good example is the artificial seawall that has become a current feature of the coast-line. Being vertically very steep, and structurally quite simple, this compressed intertidal region represents a very stressful habitat that does not support the kind of diversity expected at the seashore.

The Rich Revetments concept is based on the idea that it is possible to enrich coastal hard structures such as dikes, dams and sea walls providing a valuable habitat for brackish and saltwater species. These structures can have an increased ecological and recreational value and at the same time enhance the quality of the (adjacent) ecosystem by increasing diversity and quality of habitats.

**Assignment 1:** Design a Dike using hard structures and test it for safety

**Assignment 2:** Design Blocks for optimizing ecological value on them

## Expertise management

Part of RAAK-PRO project is the process of capturing knowledge about Building with Nature and the way this knowledge can be disseminated by means of a well-structured web-site, such as a wiki. The knowledge that is captured is not restricted to a systematic ordering of existing documents. Instead, the focus is on capturing practical knowledge about Building with Nature, in projects such as the Oesterdam, that can be used later on by civilians and professionals on other sustainable multipurpose solutions to assure safety in Delta regions.

The term knowledge management is often used to describe the afore mentioned activities. However, this term does not capture all aspects we are trying to cover. In particular, we are looking for practical "how-to" knowledge. For that reason, we prefer the term expertise management, which includes knowledge and using that knowledge in daily routines.

The approach for establishing the expertise knowledge infrastructure consists of three separate, but related activities:

- A.The process of developing a expertise management backbone. This entails the development of a skeleton that can be fleshed out with content;
- B.Implementing the skeleton in a semantic wiki ;
- C.The process of content acquisition, i.e., determining the kind of expertise that is required for various stakeholders and describing the expertise according to the principles laid down in the expertise management backbone. The content type is not restricted to written documents, but may include images, video's and oral histories.

Although the three activities can be cleanly separated, one common method will be used to make sure the results of these activities can be interwoven. The HZ University of Applied Sciences has developed an expertise management method that is based on the Soft Systems Methodology (SSM). The method has been proven its value in practice for capturing, amongst others, expertise about embankments and home care. SSM can be seen as a group learning process. An important outcome of the method is that good practices are discovered.