

BEACH NOURISHMENT AND THE IMPACT ON NATURA 2000

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The Belgian coastline: natural dynamics versus anthropogenic conservation

The Belgian coastline is a dynamic environment where currents, waves and wind interact with the natural coastal defense system of beaches and dunes. In some areas the net sand balance is in equilibrium or sand accretion takes place, but most coastal zones erode, dealing with sand deficits. In the past so called 'hard' infrastructures (dykes, quay walls and groins) were constructed to protect the land from the impact of the sea. Since more than 40 years however 'soft' measures were chosen to work together with nature in the protection against coastal flooding. Beach nourishments are the most common protection measure nowadays. The Belgian Coastal Division wants to guarantee a minimal protection against a 1000 year storm event, but in the weakest links only a 100 year protection level is reached at the moment. Pending the realization of the 'Master Plan for Coastal Safety', for which more than 10 million m³ of sand is needed to protect all weak links in the nearby future, these weakest beaches are maintained with annual nourishments of 550.000m³ sand. Belgian beaches contain fine sand (grain size 200-250 micron), whereas from a geotechnical point of view the nourished sand ideally has a grain size of about 300 micron creating more stable beaches, with less volume, which erode slower. From an ecological standpoint, however, it is recommended to use the same grain size as the natural beach. Clearly an optimization is needed.

Impacts of beach nourishments on the sandy beach ecosystem

The ecological effects of beach nourishments can be related directly to six factors, namely nourishment technique, timing and location, changes in beach slope, changes in grain size and amount of nourished sediment (Speybroeck *et al.*, 2006). Impact research focuses on macrobenthos, the seafloor inhabiting benthic forms larger than one millimeter, as these organisms play a key role in the wider beach ecosystem. They make up a large part of the diet of intertidal birds and fish and they act as good indicators of pollution and stress. Locally, strong negative impact effects are expected during and immediately following the nourishment. The layer of nourished sand usually has a thickness of around 1-2.5m and stays there for a long period. This reduces chances of survival of the original beach fauna and flora to almost zero (Harte *et al.*, 2002; Speybroeck *et al.*, 2004). Over the long term, the speed and degree of ecological recovery largely depends on the physical characteristics of the beach habitat. Macrobenthic organisms tolerate only small modifications in beach slope and their sediment preference falls within a range of 125-350µm. Recolonization will start with dispersion of juveniles from marine benthic organisms. Their larvae will settle on the sand if the conditions are suitable. Theoretically, the benthic communities can recover within a period of one to two years. However, some species don't have a pelagic stadium so the recolonization of those will be slower (e.g. Bivalvia and Echinodermata) (Speybroeck *et al.*, 2004). Total recovery of the beach might thus take four to five years. In general, phased nourishment with natural sediment and beach slope during winter should lead to positive effects for all intertidal flora and fauna (Van Tomme *et al.*, 2009).

Legal framework which regulates the impacts of beach nourishment on Natura 2000

When considering beach nourishment in the neighbourhood of European protected sites, one must take into account the strict regulatory framework with respect to Natura 2000, which is included in the Habitats Directive (Directive 92/43/EEC). Article 6 of the Habitats Directive is of the utmost importance for beach nourishment as it determines the relationship between conservation and land use. In particular, article 6, §§3-4 of the Habitats Directive contains a development regime, setting out the criteria under which plans and projects with possible negative effects on Natura 2000 may or may not be allowed. A precautionary approach is required when assessing the possible effects of a beach nourishment (“appropriate assessment”). In the Flemish Region this framework has been implemented in the Nature Conservation Decree in 2002, while the Royal Decree of 14 October 2005 contains the federal implementation for the Belgian part of the North Sea. Whilst the requirements of Article 6, §§3-4 of the Habitats Directive are quite straightforward, the application of them on beach nourishments proved to be quite burdensome the past years, partially due to the incorrect implementation of the Habitats Directive in the Flemish legislation.

The concept of “project”, as used in the Flemish Nature Decree (Schoukens *et al.*, 2007), appears to be too narrowly defined in the light of the Habitats Directive. Only interventions in nature which are made subject to a prior license are to be considered as project with a potential effect on Natura 2000, while, in some cases, beach nourishments are exempted from a prior license and assessment. In order to allow also these cumulative effects to be assessed, during the past years, appropriate assessments had to be carried out on a mere facultative base.

More on a substantive level, the authority competent for nature conservation has a clear tendency to consistently widen the scope of the appropriate assessments needed for the bigger cases of beach nourishments. Though not directly linked to the species and habitats of the nearby Natura 2000-sites, also effects on other species or habitats need to be taken into account, even when this is not as such required by the general rules on nature conservation. Yet, on the same time, there is restraint to adopt a more strategic approach, allowing for offsite mitigation and compensation. The difficult and, in some cases, very incoherent application of the rules on nature conservation on beach nourishment, illustrates the need for a more coherent legal framework, in which a more ecosystem based approach should be adopted.

A case study: Raversijde-Mariakerke and the Master Plan for Coastal Safety

One of the weak links of the Belgian coastline is the area between Raversijde and Mariakerke. The Master Plan for Coastal Safety foresees a beach nourishment in combination with a storm return wall which will result in the aimed protection. The current beach slope (<5m TAW: 1/45~1/50) and grain size (medium sand with $d_{50} \approx 350 \mu\text{m}$) will be preserved as much as possible. Due to the beach nourishment, the supratidal beach zone will enlarge (23ha) while the intertidal zone will reduce modestly (0.7ha) and 87ha of the subtidal area will be buried underneath a feeder berm with a thickness of 0.05m up to 2.50m.

The subtidal part of the nourishment will take place in 0.6% of the Natura 2000 Special Protection Area SBZ-V2 (14468ha) and in 0.1ha of the Special Area of Conservation ‘Flemish Banks’ (Vlaamse Banken – 100994ha), which is negligible regarding to surface-intake. The Conservation Goals (Degraer *et al.*, 2010) for the species and habitats in these parts of the Natura 2000 network are not opposed by the nourishment.

The intertidal and supratidal part of the beach do not fall within the Natura 2000 area, but the external impacts of the nourishment might negatively affect the Conservation Goals of the Natura 2000 species and habitats present in nearby Natura 2000 areas, like e.g. Habitat 1140: Mudflats and sandflats not covered by seawater at low tide. In Belgium, 2110ha belong to this habitat type, though only 16% lies within a Natura 2000 area (Paelinckx *et al.*, 2009). The local conservation status is not determined yet, but the global conservation status seems to be favourable (Paelinckx *et al.*, 2009). To investigate

whether the intertidal beach nourishment in Raversijde-Mariakerke has a significant negative impact on the global conservation status, a threefold approach was followed. Firstly, a reference framework (IMDC, 2011) was written containing all the relevant available information regarding the status of this habitat along the Belgian coast.

Secondly, the Marine Biology Research group of Ghent University gathered, analyzed and compared seasonal field samples (spring and autumn) alongside other well-known intertidal Belgian coastal ecosystems. This revealed a moderate macrobenthic density with distinct dominance of *Scolelepis squamata*, and as a result, low macrobenthic diversity (Vanden Eede & Vincx, 2012).

Thirdly, the results of the reference framework and the field investigations of Ghent University were discussed in an ecological study group with representatives of ANB (Agency of Nature and Forests), BMM (Management Unit of the North Sea Mathematical Models), the Belgian Coastal Division, IMDC and Ghent University.

Finally the appropriate assessment for this beach nourishment (IMDC, 2012) was performed which concluded that the beach nourishment in Raversijde-Mariakerke will result in limited temporary effects. No significant effects can be predicted for the Natura 2000 habitats, species and conservation goals.

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