ABSTRACT 119 – COASTAL MANAGEMENT AND DISASTER PLANNING ON THE BASIS OF FLOOD RISK CALCULATIONS

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A MASTER PLAN FOR COASTAL SAFETY

The Belgian coastline is merely 67 kilometres long, but every metre is optimally used. Many stakeholders have specific interests in this varied area: housing, tourism, harbour activities, nature reserves … as shown in Figure 1. To balance the needs and guarantee the future of all these interest groups, mutual cooperation is needed. In 2007, an integrated master plan for coastal safety was initiated in order to bring all these factors together. This plan will form the basis for the development of the seafront along the Belgian coast in the nearby and distant future (up till 2050) with safety against flooding as its main objective. The combined evaluation of environmental impacts, flood risk reductions and costs versus benefits will support the selection of integrated defence measures for every weak link. The implementation phase of the Master Plan for Coastal Safety is planned between 2010 and 2015. [1]

Figure 1. The Belgian coast is a densely populated area. Many coastal communities with a seaward position compared to the rest of the coastline form weak links in the sea defence. For example the town of Mariakerke as shown on this image.

EVALUATION OF WEAK LINKS

In the framework of this study all weak links have been determined based on stability and breaching calculations of the sea defences. The results indicate that one third of the coastline needs to be reinforced to withstand extreme storm floods, providing a minimum safety standard of once in 1000 year. Potential protection measures such as beach or dune nourishments, storm return walls, stilling wave basins (Figure 2) and storm flood barriers have been selected and are studied to account for their environmental impacts in an Environmental Impact Assessment (EIA), investment and operational costs, benefits in terms of reduced flood risk and potential impacts on tourism. Sea level rise is taken into account. Flood risk calculations constitute the main input parameter for the concept and planning phases.

Figure 2. Simulation of a stilling wave basin as a possible coastal protection measure. (simulation by POLYGON)

FLOOD RISK CALCULATIONS AS EVALUATION TOOL

Flanders Hydraulics Research performed flood risk calculations for several extreme storms to estimate the number of casualties and economic damage at the seafront and in the hinterland. [2]

A worst case extreme storm can result in 4000 casualties and € 3 billion economic damage. At all harbours and several coastal communities quay walls and dike levels are too low, resulting in overflow and breaches during extreme storms, thus causing major flooding for dozens of kilometres land inwards. See Figure 3 for an illustration of simulated large scale flooding of the coastal plain.

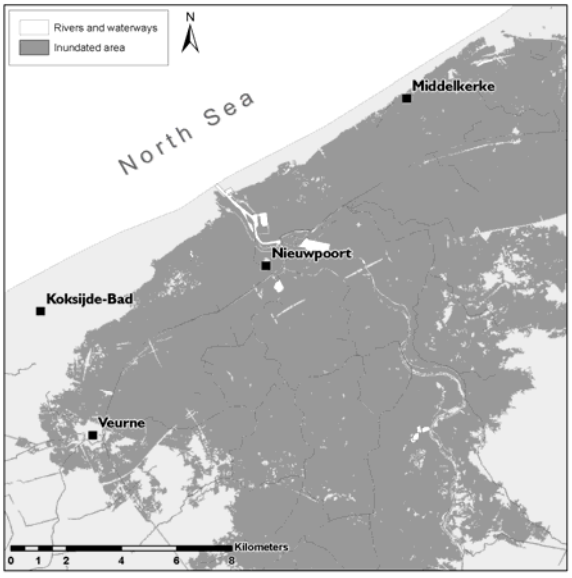

Figure 3. Flooding of the western Belgian coastal zone due to breaches in the sea defences caused by an extreme storm event (simulated with the MIKEFLOOD software package).

Locks and weirs need special attention, as structural strengthening or an adjusted operation is needed for these structures to resist the impact of water forces during storms. The contribution of each weak link to the overall number of risks enables us to prioritize specific defence measures in the final Master Plan.
As 100% safety can never be guaranteed, risk calculations are used to evaluate the risk reduction from and remaining risk after the implementation of a defence measure, which are used as an input for the cost-benefit analysis.

RISK BASED CONTINGENCY PLANNING

In the past contingency plans for flooding were mainly based on the principle "Where can we shelter the most people?" without taking into account the vulnerability of these areas. Current flood risk calculations provide specific information about potential floodable areas and casualty numbers in the hinterland and on the sea defence itself during extreme storms. This allows us to identify which coastal communities are more vulnerable and to define adequate procedures for the evacuation of citizens. A regional contingency plan for flooding is being set up based on these results in order to integrate and harmonize actions that have to be taken at the local level. This plan is being developed in cooperation with the Province of West Flanders and governmental organisations responsible for rivers and waterways.

FLOOD DIRECTIVE

As an extra input for disaster planning along the seaside, combined flood risk calculations for sea and river flooding as well as cross border flooding are taken into account for the implementation of the European Flood Directive. In this perspective a first attempt was made in the framework of the European projects COMRISK and Safecoast to link different flood risk models and develop cross border flood risk maps. Recent flood risk calculations for the Master Plan will be evaluated and compared with Dutch data as a starting point for future European flood risk maps.

REFERENCES

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