Scheldt Sediment based groyne project Fort Sint Filips: modelling, construction and monitoring

Michaël De Beukelaer-Dossche[1], George Schramkowski[2]

[1]Flemish Waterway plc, Havenstraat 44,3500 Hasselt, Belgium
[2]Flanders Hydraulics Research, Berchemlei 115, 2140 Antwerp, Belgium

Phone: +32-(0)-3224-9366
E-mail: mdbd@vlaamsewaterweg.be

Introduction: The Fort Sint Filips project aims to create an estuarine nature area in the port area North of Antwerp. This location was covered with clean Scheldt sediment to cover a heavily polluted industrial waste site. An integrated soil remediation project takes care of this waste (through isolation and removal) so the area becomes available for nature development. In the river close to the banks a gully with high dynamics threatened the stability of the flood defenses. More specifically, an extension of the bank in conjunction with a near-bank groyne has been modelled and constructed to enable local sedimentation that will ultimately lead to the formation of tidal mudflats and tidal marches. A monitoring project was started to study the autonomous development of this estuarine area during the next 4 years.

Methods: To anticipate the effect of this groyne a hydrodynamic numerical model study was performed by using a three-dimensional Telemac model for the Belgian coast and the Scheldt estuary [1]. This model was refined locally to capture the detailed bathymetry of the groyne. Next, the change in bottom shear stress was used as a proxy to indicate whether sedimentation in the vicinity of the groyne would occur. The situation considered was typical of spring tide.

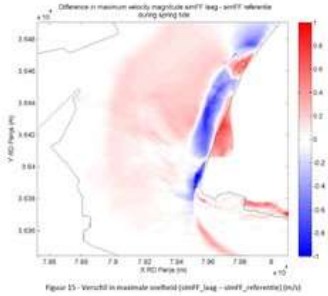

Fig. 1: Telemac Scaldis 3D simulation of a groyne.

The design of the groyne took the directions of the tidal movement in account and avoided sudden changes to avoid local. To construct the groyne with the historical sediments on site an innovative approach was used to design and build this hydraulic structure in challenging estuarine conditions. To withstand flood currents and waves we opted for the use of geotextile bags and willow mattresses covered with quarry stones (60-300kg) on one side of the groyne. With the smart use of the sediment we were able to cut costs and improve the sustainability of the project.

Fig. 2: Groyne during construction phase.

Results: The simulations of different configurations made it possible to choose the design with the least bottom shear stress close to the groyne. During construction phase the erosion was reduced as a temporary working strip was constructed with the sediment above high water levels. The first multibeam measurements indicates a good match to the modelling results, with possibly even larger nature development zones.

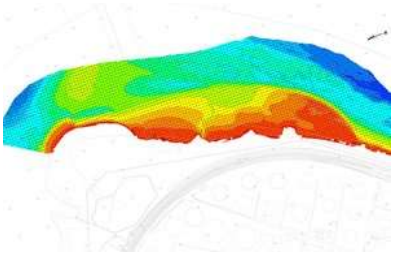

Fig. 3: Multibeam measurements after construction.

Discussion: Based on 3D simulations and expert knowledge, the reuse of sediments on site is a quick-win that reduces transport, the use of natural resources and can even reduce the need for dredging.

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References: [1] Smolders, S.; Maximova, T.; Vanlede, J.; Plancke, Y.; Verwaest, T.; Mostaert, F. (2016). Integraal plan Bovenzeeschelde: Subreport 1. SCALDIS: a 3D Hydrodynamic model for the Scheldt Estuary. WL Rapporten, 13_131. Flanders Hydraulics Research: Antwerp; [2] Dimas et al. (2004) *Wasserwirtschaft* **22**:222-233.