

# Effects of the disposal of dredged sediments on river bed volumes and morphological structures

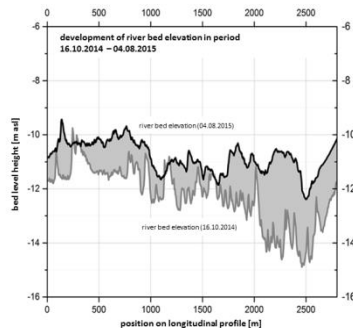
Axel Winterscheid<sup>1</sup>

<sup>1</sup>Federal Institute of Hydrology,  
Department Groundwater, Geology, River Morphology, Koblenz, Germany

Phone: +49-(0)-261-13065190  
E-mail: winterscheid@bafg.de

**Introduction:** The disposal of dredged material can cause a range of environmental effects which can be roughly categorized into chemical, biological and physical effects. Examples for physical effects are changes in sediment transport rates, river bed volumes and the disturbance of morphological structures. For example, strong water currents are spreading most of the fine grained sediments and their potential absorbed contaminants, which might accumulate in adjacent shallow water zones. Coarse grained sediments, however, mostly deposit on the river bed. This can alter the habitat for the benthic fauna on and in the vicinity of the disposal site. Furthermore, the more sediment volumes accumulate the more the water depth is decreasing, which endangers the accessibility of the site for hopper dredgers. Therefore, a core component for monitoring of any site is to carry out frequent surveys of the changing bathymetrical situation. Case study is the disposal site “VS 738” located in outer Elbe / German Bight. Multi-beam echosounder data from a long-standing monitoring will be presented with regard to morphodynamics and the development of river bed volumes [1].

**Methods:** Multi-beam echosounder data with a spatial resolution of 1m \* 1m have been analyzed. From May 2011 to September 2015 a total number of 19 surveys took place, from which we could generate a time series of 18 difference-models to study morphodynamics and changes in river bed volumes (see Fig. 1).



**Fig. 1:** River bed elevation as longitudinal profiles along VS 738, 16.10.2014 & 04.08.2015.

The comparison of changes in bed volume with the statistics on disposed volumes enabled us to differentiate “natural” morphodynamics from

impacts caused by disposal activities. Interim periods without or low disposal activities served as background situation to quantify the “natural morphodynamics”. Changes in the morphological structure of the river bed provide us information about the directions of the net transportation of the fine and coarse grained sediments.

**Results:** The disposal of dredged material has long lasting effects on the bathymetry and morphological structure of the river bed on VS 738. Stronger effects result from higher frequencies of disposal and greater volumes of coarse grained sediments. Fine grained sediments are predominantly spreaded in a south-eastern direction onwards to the adjacent wadden areas. Medium sandy and coarser sediments accumulate for longer times on the disposal site and have formed a several meters thick layer of disposed sediments. The data show that an average of 60 to 80 % of the non-cohesive dredged material volumes have remained on VS 738. Coarse sediments are transported very slowly in an opposite north-eastern direction with a speed of a few hundreds of meters per year. The actual shifting of nearby located wadden areas towards VS 738 is causing additional volumes of sandy sediments to accumulate. These volumes together with the disposed volumes endanger future capacities on VS 738.

**Discussion:** From a morphological perspective VS 738 is by far the most suitable site for the disposal of fine sediments. On all other active sites located in the outer Elbe estuary for a much greater proportion of fine sediments it is expected to be subject to transportation in upstream direction (intensification of sediment cycles). At the same time the remaining capacity on these sites is decreasing, which is a fundamental management challenge. Hence, frequent surveys of the bathymetric situation on all active disposal sites combined with the statistics on disposed sediment volumes are the required basis for monitoring the actual capacity development of the disposal sites and morphodynamics of the adjacent wadden areas.

**References:** [1] BfG (2017) *Auswirkungsprognose für die Unterbringung von Baggergut im Verbringstellenbereich VSB 730/740*, Bundesanstalt für Gewässerkunde, Koblenz (in prep.).