

Project Description

In order to prevent erosion and other negative effects resulting from hydraulic load due to navigation in the long term, the banks of federal waterways in Germany are usually protected over long stretches with technical revetments such as riprap or sheet-pile walls. Selection and dimensioning of the appropriate revetments in Germany are based on comprehensive codes and guidelines by the German Federal Waterways and Shipping Administration (Wasserstraßen- und Schifffahrtsverwaltung, WSV). Since the EU Water Framework Directive (WFD) came into effect in 2000, ecological aspects have become more and more important in new constructions and development measures along German federal waterways. Technical and ecological aspects also need to be considered for maintenance measures. This means that technical-biological bank protection measures should be applied more frequently as a more environmentally friendly alternative than ordinary riprap revetments. However, only little experience and no codes and guidelines exist so far for their use along waterways. Therefore, studies on the hydraulic load-bearing capacity of technical-biological bank protection measures have been carried out for several years, taking into account the impact of navigation; furthermore studies on the ecological potential of these construction methods have been undertaken. The aim has been to develop application recommendations and dimensioning principles for their use along German federal waterways.

So far, experiences with bank protection measures using plants have only existed for smaller running waters. Within the scope of the WSV, some local test stretches – which are typically short distances – do exist where vegetation components have been applied within bank protection measures for testing and monitoring purposes. However the experience gained in these sections have so far not been bundled and interpreted in a central place. So far, no systematic studies of the hydraulic load-bearing capacity of alternative bank protection measures under the load due to shipping have been undertaken. Within a joint research project, the Federal Waterways Engineering and Research Institute (BAW) and the Federal Institute of Hydrology (Bundesanstalt für Gewässerkunde, BfG) are investigating for the first time the applicability of technical-biological bank protection measures along waterways with regard to technical, ecological and nature conservancy aspects.



*River Rhine, right bank, km 441.000 - km 441.110
(reed gabions, stone mattresses)*



*River Rhine, right bank, km 440.820 - km 440.950
(willow brush mattresses)*



Lower Havel Waterway, right bank, km 35.70

Alternative Technical-Biological Bank Protection Measures Applied on Inland Waterways

The long-term objective is to provide the planning staff of the Federal Waterways and Shipping Administration (WSV) with well-founded principles and recommendations on the use of this type of bank protection measures along German federal waterways. The results of this research project are of particular importance for the water-management-related maintenance of the German federal waterways in the context of implementing the EU Water Framework Directive (WFD). Water management requires not only consideration of technical aspects, but also maintenance and promotion of the ecological functionality of the waterbodies. Both needs – bank protection as well as the conservation and creation of animal and plant habitats – can be met accordingly.

The research project “Studies on Alternative Technical-Biological Bank Protection Measures Applied on Inland Waterways” has been carried out jointly by the BAW sections G4 “Earthworks and Bank Protection” (responsible for project management) and W4 “Interaction Ship/Waterway, Field Investigations” and the departments U3 “Vegetation Studies, Landscape Management” and U4 “Fauna and Ecology” of the Federal Institute of Hydrology (BfG).

Detailed analyses and assessments regarding the factors bank stability and protection from erosion as well as vegetation, fauna and ecology are performed at selected waterway stretches where technical-biological bank protection measures have been implemented in the last 20 years. In doing so, the particular geotechnical and hydraulic boundary conditions present at the different test stretches, especially the hydraulic loads on the banks as a result of navigation are taken into account. The results of these analyses and assessments serve as a basis for first quantitative estimations on the load-bearing capacity of bank protection measures with vegetation components. In parallel, laboratory tests and model experiments are performed to examine the mode of action of biological bank protection measures in more detail and to deduce theoretical dimensioning principles. In 2011, a test stretch on the right bank of the river Rhine near Worms was planned and constructed, to examine various technical-biological bank protection measures in a field test under defined boundary conditions, in this case high traffic frequency and water level fluctuations of more than 6 m. Within the scope of a 5-year monitoring until 2016, the load-bearing capacity of those bank protections with vegetation as well as their efficiency in terms of bank protection and ecology will be examined.



Lower Havel Waterway, right bank, km 35.70 (installation)



Weser river, right bank, km 241.55 - km 242.30



Mittelland Canal, left bank, km 189.50 - km 190.00