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Filtration stability of living brush mattresses at navigable waterways

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According to the guidelines of the Federal Waterways Engineering and Research Institute in Germany, waterway construction buildings, which include soil bioengineering structures, must be stable against soil displacements. Therefore, willow brush mattresses were tested for their filtration stability in a specially developed process which is based on the testing of geotextiles and armourstones used for navigable waterway constructions.

In March 2016 willow brush mattresses made of white (Salix alba L.) or basket willows (Salix viminalis L.) were planted in 16 sample boxes, each with a cross-section area of 30x30 cm. For the tests on filtration stability, the upper 20 cm of the box were separated and placed upside down into a device in which the sample box could be flowed through from below.

When a water column of 50 cm above the sample was reached, the water outlet was opened so the water flowed through the sample in the opposite direction, thus simulating drawdown. By the measurements of the pressure sensors above and below the sample, the coefficient of permeability k of the rooted soil during drawdown could be calculated.

After this hydropeaking cycle, the soil material that was rinsed out through the willow branches was collected, weighed after drying until weight constancy, and compared with the dry mass of the retained soil material to calculate the share of the total mass.

These filtration stability tests were carried out directly after planting the sample boxes, as well as one, three and six months afterwards, each test series with four reruns per willow species. Over time, the increasing root penetration resulted in a significant reduction in the permeability and in more retained soil material.