River stabilisation by local widening

Local widening at the Emme River

Since the training of the river Emme at the end of the 20th century, continual riverbed erosion has taken place. This progressive erosion of the river bed led to the study 'Studie Emme 2050', in which a reduction of slope in the order of 1.8 ‰ is predicted for equilibrium to be achieved in the reach Utzenstorf (between two sills at the river kilometers 9.250 and 8.100). As an alternative to conventional stabilization using sills or boulder ramps, local widening of the river bed has been proposed

The proposed widening of the river bed was investigated using a hydraulic model to a scale of 1:55. The optimal location for the widening lies in the center between the two sills. In order to stabilize the river bed at its level of 1982 the existing 30 m wide channel has to be enlarged to a width of 65 to 85 m over a length of 460 m. If the bank protection is removed, the formation of the local widening can be left to the dynamics of the river Emme. This process can be sped up by the lowering of a 7.5 m wide strip along both floodplains then using this material to narrow the main channel. The slope of the reach with local widening with the chosen design will be in the order of 6 ‰ in a dynamic equilibrium condition. Therefore, the predicted slope reduction of 1.8 ‰ for the remaining reach of the section Utzenstorf can be compensated for.

Four, 36 m long guiding embankments in both floodplains have to be built to prevent uncontrolled widening and especially to protect the existing levees from erosion. No measures are necessary at the expansion zone between upstream channel and local widening. At the contraction zone downstream of the widening an additional funnel shaped guiding embankment has to be constructed. Relative to the river bed level of 1982, maximum scour depths of 2.7 m were measured at the guiding embankments. Maximum scour did not necessarily occur with the peak discharges. Local flow conditions were mainly responsible for scour depths.

If the formation of the local widening is left up to nature, its development will depend strongly on the magnitude, duration and sequence of floods. It is predicted that at least one decade will pass before the local widening becomes completely effective. To ensure flood protection during this period, the construction of the local widening should be divided into two stages. The second stage commencing only when the natural development of the first stage is nearly completed.

Compared to the conditions of 1982, the flood protection provided will be slightly improved with the local widening completely developed. During the formation of the local widening the sediment input to the downstream reach will increase slightly, thus impeding the erosion here temporarily.

A meandering, partly braided river with pool-riffle systems and variable flow velocities will develop due to the increased river bed width. The ecological value will increase as a result of the varying river morphology. This is especially true when compared to conventional river bed stabilization methods.

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