SELF FORMING RIVER PROCESSES IN THE CONTEXT OF RIVER WIDENING AS AN EXAMPLE OF MODERN WATERMANAGEMENT MEASURE IN PRACTICE

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Watercourses are and always have been vital arteries for human settlements and economic activities in the country. "Proximity to watercourses", so often sought by people for transport, nourishment, etc., can also conceal hazards (e.g., flooding). For decades, Austria`s rivers have been manipulated and regulated with a focus on technology rather than ecology. The consequences are monotonous rivers and streams, unable to perform their vitally important natural functions. The emphasis lay in the range land reclamation ("10. Bundesland"), to create the basic conditions for intensive land use. The technical possibilities were overrated and missing retention area was underestimated. With the background of rising demand for an environmentally friendly concept of river protection and river stabilisation measures, the project on hand show an exemplary practical way how economical plans for flood protection and river bed stabilisation in the alpine regions can be carried out and at the same time, high ecological demands fulfilled. Instead of inclines or water breaks as made in the past measures to widen the cross-section of the river bed, re-opening a left bank side arm of the river and building methods on soil bioengineering have been carried out.

AIMS AND METHODOLOGY

The aim of this paper is to illustrate the effectiveness of "initiated" river measures without "fixed" boundary conditions in the context of a modern water management. The study shows that combined aims like river management and ecology can be obtained at the same time in practice. Furthermore it gives information about the interactions of self dynamic development of the river widening measure and the necessity of flood events for the hydraulic efficiency.
The possibility of dynamic morphological changes require new demands for river engineers in the planning process (pre-study) and after the realization of the river measures (post-study). Therefore combined methodology of monitoring and modelling was developed. The study shows that the dynamic development is manageable and essential river engineering measures can be accomplished in time - respecting the ecological conditions.

RESULTS WITH MAIN FOCUS ON AN INTEGRATED RIVER MANAGEMENT

In the course of the European Life Project "Auenverbund Obere Drau" a side channel was initiated without fixed regulation measures at the left bank (Figure 1) of the Drau River

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(Habersack et al., 2003). Only several covered groins for nature conservation purposes of the old arm on the left side were established. The monitoring results after the restoration measures demonstrated a very high variability in morphodynamic processes especially in the new side channel. Bank erosions which were causing massive enlargement of the river width and also sedimentation at the entrance of the new sidearm could be documented (Figure1).

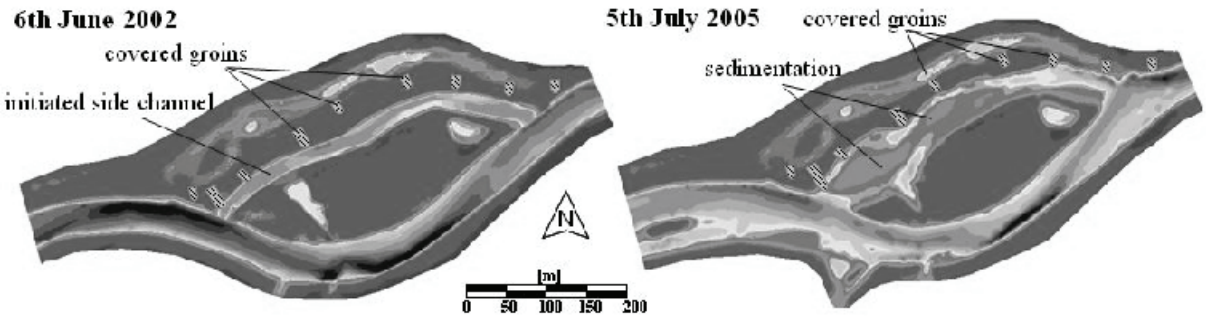

Fig. 1 Monitoring bed level changes: Morphological development and the covered groins - 2002 to 2005

A comparison of the mean river bed level between the years 2003 and 2005 shows sedimention up to 0.3m and depositions about 7,500m³. It has shown the usefulness of the covered groins. Some of them were excavated due to massive bank erosion, but the old side arm being under nature conservation and the adjoining premises for agriculture could be protected.
The 2D- numerical modelling results have documented a significant increase of the discharge in the sidearm in 2003. Between 2004 and 2005 the discharge decreased rapidly because of sedimentation, but the wide range in flow velocities indicates high structural variability, suggesting that there is an improved diversity of habitat. In the last 2 years first pioneer plants could be documented at the gravel bars (Egger et al, in press). Hydrodynamic numerical analyses about the side channel have shown that the actual sedimentation processes have no effect on water level changes. Flood events like a 10-year flood haven't occurred during the monitoring study. Thus, general erosion and transportation processes to maintain hydraulic efficiency of the cross sections were not possible.

CONCLUSIONS FOR RIVER WIDENING AS APPLICATION FOR MODERN RIVER MANAGEMENT

The analyses of the monitoring and modelling results have shown that combined aims like river management and ecology can be attained at the same time. For this purpose it was necessary to modify boundary conditions for self dynamic development rather than “design” the morphology. It has been shown that process of “Monitoring” should implement the process of “Modelling” for increasing data set. High morphodynamic changes avoided succession of vegetation in the first year. However, bank erosion caused a triplication of the river width, decreasing shear stresses and sediment transport capacity. Sedimentation in form of mid gravel bars took place, which deflected the flow and continued bank erosion. The amount of sedimentation was unexpected, but didn’t cause a problem for flood protection because of the balance between self dynamic river widening and sedimentation. It is expected that the succession of vegetation will develop to a white willow forest without extreme flood events (Egger et al, in press). Therefore, flood events are important for the balance between sedimentation and hydraulic efficiency.
A new European Life Project is started “Lebensader Obere Drau” from 2006 to 2010 for a river length of 6,0 km, in which the positive experiences of the first project to be continued.

Keywords: Restoration measure, Monitoring, Modelling, Self dynamic river widening.