

## **Upper Missouri River Geomorphological Assessment Related to Bank Stabilization**

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**Abstract.** The overall objective of this study was to evaluate the potential impacts of bank stabilization on the morphologic processes in the Missouri River with a particular emphasis on the formation and persistence of habitat bars. This investigation addresses the following four open water reaches of the Missouri: (1) Fort Peck Dam to vicinity of the Yellowstone River (304 kilometers); (2) Garrison Dam to Lake Oahe (127 kilometers); (3) Fort Randall Dam to the Niobrara River (58 kilometers); and (4) Gavins Point Dam to Ponca (93 kilometers).

A detailed geomorphic, hydrologic, and sediment transport analysis of each study reach was conducted. A total of 655 sediment samples from the banks, bed, bars, islands and tributaries were collected and analyzed. In general, the gradations of the bed and habitat bars were similar with the bed being slightly coarser. The non-habitat bars were found to be slightly finer than the habitat bars, while the banks were generally finer than both the habitat and non-habitat bars.

Each study reach was divided into individual Geomorphic Reaches (GR), and a sediment budget was calculated for each GR as well as for the entire study reach. The sediment budget was calculated using comparison of historical aerial photography and cross sectional data from the late 1960s to 1998. From the sediment budget the percent of the total bed material load comprised of material supplied from the banks was calculated. The percent bank contribution varied considerably from GR to GR, ranging from as low as 3% to as high as 58%. The percent reduction in bank material supply resulting from various stabilization schemes ranging from stabilizing 10%, 20%, etc up to 100% of the eroding areas for each GR was calculated.

The supply of sediment from the banks is only one factor that affects bar morphology. Other factors, identified in this study, necessary for the formation and persistence of bars are a local channel geometry (channel width) and a stability status (aggradation, degradation, or equilibrium) that allows and promotes bar existence. Each bank stabilization project should be evaluated on a case by case basis in an engineering-geomorphic investigation that identifies and quantifies the impacts of channel width, reduction in sediment supply, and existing stability of the reach.