

Scour from the interstitial spaces in cobble-bed rivers

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Abstract

The periodic removal of sand from the interstitial spaces between cobbles is extremely important for ecosystem functioning in cobble-bed rivers. In order to flush fine sediments from the interstitial spaces between cobbles in river reaches downstream of dams, specific dam releases known as flushing flows or sediment maintenance flows are utilised. This paper describes the development and calibration of a mathematical model to predict the equilibrium depth of scour of fine sands from between cobbles in terms of applied stream power principles. The model was developed with the aid of physical model experiments and is founded on a stream power model which defines the condition of dynamic equilibrium in a deformed sand-bed river. Calibration was done in the laboratory under clear water conditions and with uniform cobble sizes. The scouring of fine sands in cobble-bed rivers is associated with an increase in absolute bed roughness and an associated decrease in the unit stream power applied along the bed as the cobbles become exposed. When scour ceases, the sand particles on the bed are at the movement threshold and critical conditions exist. In order to establish the relationship between equilibrium scour depth and bed particle characteristics, the power which is required to suspend sand particles under laminar boundary conditions is equated with the turbulent power being applied along the bed.

Keywords: cobble-bed, interstitial spaces, flushing flows, stream power, scour depth, environmental flow requirements