INSTABILITY IN RELOCATED AND RESTORED CHANNELS

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The U.S. Geological Survey, in cooperation with the Tennessee Department of Transportation, recently observed post-construction changes in channel relocation and channel restoration projects in Tennessee.

Most channel relocations are designed as threshold channels, which rely on a non-eroding channel lining such as riprap, synthetic fabric, or grass to protect the surrounding material. Stream restorations, by contrast, are intended to undergo gradual erosion and deposition while preserving their designed dimensions and profile in dynamic equilibrium. Many stream relocations include stone structures such as bank revetments and rock riffles intended to stabilize the channel until maturing trees reinforce the banks.

In threshold channels, movement or removal of the channel lining constitutes instability, and can take the form of erosion of the nominally non-erodible lining, or erosion of cohesive materials where the lining is damaged or absent. In stream restorations, erosion of and around stone structures is acceptable where growth of vegetation prevents downcutting and the development of high, bare eroding banks.

Erosion of cohesive materials around riprap structures, or erosion of the riprap, is part of the naturalization of the channel if bank vegetation grows to take the place of the eroding structures, but represents instability if the channel profile degrades or the area of bare, steep cohesive banks increases. Observed instability includes development of expanding areas of bare bank above, below, or within riprap revetments, or in cohesive material at the upstream and downstream ends of revetments, erosion of channels in cohesive material adjacent to profile control structures, and development of bare, downcutting channels in the cohesive material of the floodplain. Locations where flow has moved the riprap or eroded cohesive material from around a structure can be recognized in the field and documented with photographs. Where these changes have compromised the function of the structure, the development of erosional features such as mass movements and toppled trees, head cuts, or sharp bends with steep bare banks may also be observed.

In addition to the local effects of flowing water on channel boundaries, channels can be destabilized by unanticipated inflows of bedload and large woody debris, direct human disturbance (e.g. clearing of channel banks), beaver activity, and the toppling of trees growing on the banks.

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