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RE: Preliminary Results, Design Guidelines for ELJs, Big Sioux River, SD

As a follow-up to recent communique, we summarize below some preliminary and very basic guidelines for the installation of engineered log jams (ELJs) along the Big Sioux River, SD. These guidelines are based on physical-scaled model experiments using both fixed- and movable-beds using two (2) different ELJ structures previously reported: (1) a bank-attached flow-deflector jam (ELJ-1), and a spur-style flow deflector jam (ELJ-2).

Parameters listed below for each ELJ structure are scaled to bankfull channel depth *H*, bankfull channel width *W*, and bankfull mean bed shear stress τ, and these relations are restricted to single structure installations. Please note that the ballasting of the ELJs, as typically done in field applications, would affect the porosity of the structure, and potentially the magnitude of the parameters listed.

Parameter	**ELJ-1**	**ELJ-2**
1. Drag coefficient	2.4	1.3
2. Maximum bed shear stress near outside edge of structure	6 to 9τ	3τ
3. Maximum near-bank bed shear stress downstream of structure	0.5τ	0.5τ
4. Wake length downstream of structure (fixed bed)	15 to 30H 1 to 2W	15 to 30H 1 to 2W
5. Length of bed deformation downstream of structure (movable bed)	22H 1.4W	17H 1W
6. Width of bed deformation downstream of structure	15H 1W	7H 0.6W
7. Potential length of bank protection	>30H >2W	15 to 30H 1 to 2W
8. Potential for erosion of opposite bank	High	Low

Explanation of parameters:

1. Drag coefficient is determined using $F_D = 0.5 C_D A_D \rho U^2$ where F_D is the measured drag force on the ELJ, A_D is the frontal area of the ELJ exposed to the flow, ρ is fluid density, and U is the spatially averaged mean downstream flow velocity in the absence of the ELJ.
2. This the maximum bed shear stress observed near the outside edge of the ELJ. The magnitude of this shear stress can be used as a proxy for the depth of scour to be expected in the region.
3. This is the maximum near-bank bed shear stress observed downstream of the ELJ.

4. This is the total distance downstream of the ELJ required for the near-bank flow to achieve similar velocities to those observed upstream of the structure.
5. This is downstream length of the bed that is deformed due to the presence of the ELJ.
6. This is the cross-stream distance or width of the bed that is deformed due to the presence of the ELJ.
7. This is the potential length of downstream bank protection due to the presence of the ELJ.
8. This is the potential for erosion to occur on the opposite channel bank due to the presence of the ELJ.