DESIGN AND PLACEMENT OF LEVEE BREACHES TO MAXIMIZE THE SUSPENDED SEDIMENT TRAPPING IN RIVERS

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The controlled breaching of existing levees has received considerable attention as a means of reconnecting formerly farmed lands to natural riverine and estuarine processes. The goal of such breaches is not only to establish hydraulic connection to these lands, but to provide a means of sediment accrual. However, little attention has been directed to the design and placement of such breaches from the perspective of sediment accrual. A two-dimensional descrite particle distribution model was developed to design levee breaches on the lower Mokelumne River. The model was verified using the time-concentration curves observed in the hypothetical sinuous channel, in which radius of curvature and breach widths were varied.

The model was verified using the time-concentration curves observed in the hypothetical sinuous channel, in which radius of curvature and breach widths were varied. Various flow velocity and breach/channel area ratios were also tested. Channel width and depth were set at 10m and 2.5m respectively. A single breach was located on the outside of the channel with dimensionless section as a fraction of the channel dimensions. Channel curvature was represented as a radius of curvature which curved values of the 100m, 200m, 400m, or ∞ (straight channel). The results of verification show that the peak concentration decrease s as average velocity decreases and the radius of curvature of channel increases. The mean time of the time-concentration passing through a levee breach is increases as the radius of curvature of channel increases.

The model was applied to a reach of the Mokelumne River, California, U.S.A. that has been proposed for deliberate levee breaching. Average stream discharge and water level in 1999 along the reach were 122.87m^3/s and 1.65m. The length of the total study reach is 700 m downstream of the injection site and 23 downstream stations of the injection site are used. Two levee breach placements at 155.6m and 360.5m downstream of the injection site are selected to test suspended sediment transport in the lower Mokelumne River, CA. These 2 sites have the maximum sinuosity. The comparisons of concentration distributions at each station downstream of the injection site in which the levee breach is placed in 155.6m downstream of the injection site are plotted in Fig. 1. This figure shows that the peak concentration decreases as levee breach width increases at each station downstream of the breach site. The comparisons of concentration distributions at each station downstream of the injection site in which the levee breach is placed in 360.5m downstream of the injection site are plotted in Fig. 2. This figure shows that the peak concentration decreases as levee breach width increases at each station downstream of the breach site. The concentration passing through a levee breach is increases as the levee breach width increases. The largest total concentration passing through a levee breach is presented in the levee breach placed in 155.6m downstream of the injection site.

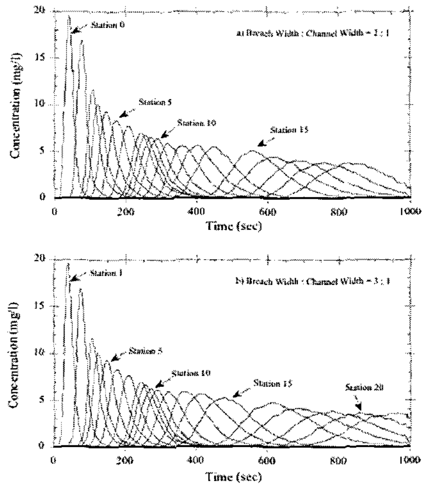

Fig. 1 Comparisons of concentration distributions at each station downstream of the injection site in which the levee breach is placed in 155.6m downstream of the injection site.

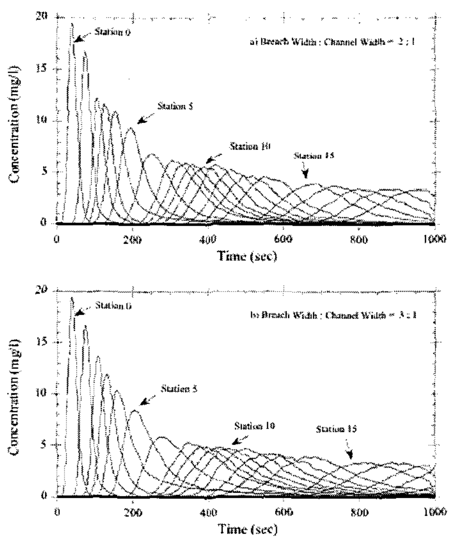

Fig. 2 Comparisons of concentration distributions at each station downstream of the injection site in which the levee breach is placed in 360.5m downstream of the injection site.