GEOMORPHIC RESPONSE TO A DAM FAILURE IN THE DEAD RIVER WATERSHED, MICHIGAN: INTEGRATION OF EMPIRICAL AND ANALYTICAL TECHNIQUES IN A GIS FRAMEWORK

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Abstract: The Dead River in the upper peninsula of Michigan was subject to a large flood resulting from a reservoir fuse plug failure in May 2003. Approximately one million cubic meters of sediment was mobilized during the flood event, which was equivalent to a 500-year precipitation-driven flow event. Extensive redistribution of alluvial and bedrock material took place during the event as the river channel realigned, widened and deepened in response to the extreme flow. In places, material deposited on the floodplain in the middle reaches of the river exceeded 2 meters in depth. Processes of channel readjustment in response to the flood morphological adjustment, including bank erosion, avulsion and braiding are ongoing, and present significant challenges to channel and watershed sediment management. Removal of the storage basin (the dam has not been rebuilt) in the headwaters of the watershed has led to a flashier river regime in the upper reaches of the river system, upstream from the next major storage basin, which presents an additional challenge to assessing channel stability.

Several empirical and analytical techniques were applied in order to gain an understanding of the nature of river adjustment in the system, and to aid in producing a suite of watershed sediment management tools as part of the USACE 516e Great Lakes Tributary Modeling Program. A walking survey of the entire river system was undertaken to collect detailed, post-event geomorphic baseline data, including channel morphology, substrate, in-channel features such as bars, pools and riffles and the location, extent, and mechanisms of contemporary bank erosion. This information was combined in a geodatabase with hydrologic, hydrodynamic and sediment transport models, along with analytical assessments of channel stability based on established geomorphic principles. Results from the geomorphic analysis are presented, along with a discussion of the challenges and benefits of integrating water and sediment management tools on a single platform.