

Review of Sediment Plug Factors - Middle Rio Grande, NM

Jonathan S. Rainwater and Pierre Y. Julien

Department of Civil and Environmental Engineering, Colorado State University,

Abstract. The Middle Rio Grande covers a one hundred eighty mile stretch of the Rio Grande in New Mexico. In the past 25 years, four major sediment plugs formed at two locations on the Middle Rio Grande. These plugs refer to excessive sediment aggradation which completely blocks the original channel. This greatly reduces downstream conveyance to the Elephant Butte Reservoir. Expensive dredging through the plugs has therefore been practiced to clear the sediment plugs and resume normal flow operations. Consequently, a better understanding of the process associated with the formation of the sediment plugs is needed to predict and prevent their occurrence. There are many hypotheses regarding the factors that were significant to their formation. These factors have been divided into the following stages: causing factors, resulting effects, accelerators, and end process. The causing factors represent the elementary conditions that led either directly to the sediment plug or the resulting effects. The completion of the Elephant Butte dam at the downstream end of the Middle Rio Grande led to both a flatter slope and channel aggradation and the completion of the Cochiti dam at the upstream end also contributed to a flatter slope and therefore channel aggradation. Also, variations in the discharge contributed to aggradation following periods of drought as well as greater overbank flows during periods of high magnitude discharge. The accelerators represent the conditions that enable a plug to form within a single year but are not essential to their formation. Based on simulations, sharp bends located downstream from one plug location and a bridge located downstream from another plug location would have significantly increased the rate of plug formation by contributing to local backwater and lowering the sediment transport capacity. In addition, simulations also demonstrated that aggradation would be accelerated as a result of an increased sediment concentration due to a high Rouse number during overbank flows. The end process then represents the formation of a short-term plug due to the accelerators or a long-term plug.