7 SUMMARY

This work pertains to the hydraulic modeling analysis of the Bernalillo Bridge reach of the Middle Rio Grande, which spans 5.10 miles from New Mexico Highway 44 (agg/deg 298) to cross section CO-33 (agg/deg line 351). This report characterizes the historic conditions of the study reach and evaluates potential future equilibrium conditions. The general trend of the study reach includes decrease in width, width-depth ratio, wetted perimeter, and velocity and increase in cross sectional area and depth during the 1962 to 2001 time period. Water surface and friction slopes did not change during this same time period. The main conclusions are:

1. The entire reach aggraded approximately 1.3 feet between 1962 and 1972 and degraded approximately 2.6 feet between 1972 and 1992. The bed degraded as much as 2 feet in subreaches 1 and 2 and aggraded as much as 1 foot in subreach 3 from 1992 to 2001.
2. The active channel width of the study reach decreased from 954 feet in 1918 to 378 feet in 2001. The largest change in channel width occurred between 1918 and 1935. After 1949, the channel width remained fairly constant until 1992 (Figure 3-13). A slight increase in channel width occurred as a result of the river bed aggradation between 1962 and 1972. Bed degradation after 1972 induced some narrowing of the channel. The channel width has narrowed from 1992 to 2001, likely due to the coarsening of the bed. Subreach 3 has been narrower than subreaches 1 and 2 throughout the entire period analyzed.
3. Hyperbolic and exponential equations fit the historical width data from 1918 to 1992 well. Both models indicate that the channel width did not change significantly between 1962 and 1992.
4. The four downstream hydraulic geometry equations (Julien-Wargadalam, Lacey, Klaassen and Vermeer, Simons and Albertson) shown in Figure 5-4 under predict the historical channel widths.
5. Planform geometry of the entire reach is a straight single-thread channel with few vegetated islands at bankfull discharge of 5,000 cfs. The channel sinuosity for the entire reach remained nearly constant at 1.10 throughout the entire period analyzed, indicative of a nearly straight channel.

6. According to the modeling results from HEC-RAS, the 1962, 1992, and 2001 channels have greater capacity to convey the modeled discharge (5,000 cfs) without overbank flow than the channel in 1972. The simulated decrease in flow velocity from 1992 to 2001 reduced the capacity of the reach to transport the bed-material load (0.36 mm < d_s < 2 mm) in 2001. This decrease in flow velocity is likely due to the increased roughness in the channel.
7. At the Albuquerque gage, at a flow discharge of 5,000 cfs, very fine and fine sand particles (0.0625 mm < d_s < 0.36 mm) behave as washload. The bed-material load is about 50% of the sand-load (21,672 tons/day). Therefore, the incoming bed-material load is 10,836 tons/day and the washload is 10,836 tons/day.
8. The sediment transport capacity for the sand fractions (0.0625 mm to 2 mm) was calculated using six different equations (Laursen, Engelund and Hansen, Ackers and White, Yang, Einstein and Toffaleti) and the 1992 channel geometry data. The results shown in Tables 5-7 and 5-9 give an average capacity of 7,139 tons/day and vary from 591 tons/day to 14,315 tons/day. None of the calculations exceed 15,000 tons/day.
9. The sediment transport capacities calculated with these equations are comparable to the incoming bed-material load at the Albuquerque gage (10,836 tons/day). The equation that yields closer results to the bed-material load is Yang's equation for sand (d_{50} and size fraction) for all reaches. These results suggest that the measured channel slope in 1992 is appropriate to transport this bed-material load.
10. The transport capacities for the coarse sand and gravel fractions were calculated using five different equations (Yang for gravel, Yang for sand and gravel, Einstein, Meyer-Peter and Muller, and Schoklitsch) and the hydraulic geometry data of 2001 for subreaches 1 and 2. The results shown in Table 5-8 give an average capacity of 401 tons/day and 997 tons/day for subreaches 1 and 2 respectively. None of the calculations exceed 4,000 tons/day.

    The sediment transport capacities calculated with these equations are lower than the bed-material load (10,836 tons/day) at the Albuquerque gage. This is likely due to the coarsening of the bed material.

11. The sediment transport capacity for the sand fractions (0.0625 mm to 2 mm) was calculated using six different equations (Laursen, Engelund and Hansen, Ackers and White, Yang, Einstein and Toffaleti) and the 2001 channel geometry data for subreach 3. The results shown in Table 5-9 give an average capacity of 3,693 tons/day for subreach 3. None of the calculations exceed 8,000 tons/day. The transport capacity of subreach 3 is less than 50 % of the bed-material load (10,836 tons/day) and is about half of the capacity of that subreach in 1992. This reduction of capacity is likely due to the decrease in velocity and water surface slope from 1992 to 2001.

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