APPENDIX A

Bernalillo Bridge Reach
Hwy 550 Bridge (old Hwy 44) to Corrales Flood Channel
Hydraulic Modeling Analysis
1962-2001

Middle Rio Grande, New Mexico
June 2003

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HYDRAULIC MODELING ANALYSIS

1962-2001

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PREPARED FOR:

US BUREAU OF RECLAMATION
ALBUQUERQUE, NEW MEXICO

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ABSTRACT

The Bernalillo Bridge reach spans 5.10 miles downstream from Highway 44 at Bernalillo to cross-section CO-33. This reach is included in the habitat designation for two federally-listed endangered species, the Rio Grande silvery minnow and the southwestern willow flycatcher. Restoration efforts for these species require the understanding of historic, current and potential future geomorphic characteristics of the channel. Analysis of water and suspended sediment data at the USGS gaging stations, aerial photos, cross-section surveys and bed material size, reveal the temporal and spatial changes in the processes acting on the channel.

Geomorphic analyses indicate that the general trends of the Bernalillo Bridge reach include a decrease in width, width-depth ratio, wetted perimeter, and velocity and an increase in cross sectional area and depth during the 1962 to 2001 time period. Water surface and friction slopes did not change during this time period. The channel planform has remained straight with a sinuosity close to 1.10. The channel width has decreased since 1918 and the rate of change in channel width decreased with time from 1918 to 1992.

The entire reach aggraded between 1962 and 1972, with sand deposits of d_{50} = 0.20 mm. Subsequently, the bed degraded between 1972 and 2001. This degradation resulted in a coarsening of the bed material from sand to sand-gravel sized material of about d_{10} = 0.36 mm and d_{50} = 2.4 mm. From 1992 to 2001, subreaches 1 and 2 coarsened, while subreach 3 exhibited an opposite trend, whereby becoming finer. This resulted in a non-homogeneous reach. This is indicative of a depletion of sand within the reach.

The sand-load (0.0625 mm < d_s < 2 mm) at a discharge of 5,000 cfs is 21,672 tons/day at the Albuquerque gage. The corresponding bed-material load (0.36 mm < d_s < 2 mm) is about 10,836 tons/day. The calculated sediment transport capacity using 6 different methods and the hydraulic geometry data of 1992 is on average 7,139 tons/day and no method exceeds 15,000 tons/day. This transport capacity is fairly comparable to the incoming bed-material load (0.36 mm <d_s < 2 mm). The method of Yang (d_{50} and size fraction) seems appropriate for the bed-material load calculations in 1992. According to the hydraulic geometry characteristics in 1992 and the above equations, the channel slope in 1992 is able to transport the incoming bed-material load of about 10,836 tons/day.

The calculated sediment transport capacities using 5 different methods and the hydraulic

geometry characteristics in 2001 are on average 401 tons/day and 997 tons/day for subreaches 1 and 2, respectively. These results are much lower than the bed-material load (10,836 tons/day) at the Albuquerque gage. The low transport capacities of these two subreaches are likely due to the significant coarsening of the bed from 1992 to 2001. The sediment transport capacity for the sand fractions (0.0625 mm to 2 mm) was calculated using 6 different equations and the 2001 channel geometry data for subreach 3. The averaged transport capacity of subreach 3 is 3,693 tons/day, which is less than 50 % of the bed-material load at the Albuquerque gage 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.