ADAPTIVE MANAGEMENT CASE STUDIES FOR RIVER ENGINEERING AND RESTORATION PROJECTS ON THE MIDDLE RIO GRANDE, NEW MEXICO

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Abstract: Applying adaptive management principles can provide flexibility to adjust to changing hydrologic and geomorphic conditions during and after construction of river rehabilitation projects. For three projects constructed by the Bureau of Reclamation along the Rio Grande in New Mexico, use of adaptive management resulted in a reduction of project costs and enhancement of wildlife habitat. Summaries of adaptive management practices are presented for each of the three projects. Primary project purposes are erosion control, improved water conveyance efficiency, restoration of fluvial processes, and wildlife habitat improvement. Activities associated with adaptive management practices encompass vegetation management, relocation of project features in response to changing groundwater levels, management of erosion and sedimentation, and modification of regulatory permits. Effective adaptive management requires timely response to unexpected developments and consideration of intermediate project conditions. It also requires that project participants understand adaptive management concepts and cooperate during implementation.

An erosion control and restoration project begun in 2000 at the Pueblo of Santa Ana includes a channel-wide bed elevation control structure, extensive floodplain lowering, and realignment of approximately 7,000 feet of river channel. An ongoing issue with this project has been the disposal of over 100,000 cubic yards of alluvial sediment generated by the floodplain lowering process. This material was originally placed adjacent to the realigned pilot channel with the intent that it would be removed by subsequent high flows during spring runoff periods. However, drought conditions have generally prevailed since the project's inception, so removal of this sediment has been much slower than expected. During the few periods when high flows have occurred, construction crews have been directed to continually reposition the material, concentrating it at points where erosion was most active,. As of late 2005, approximately two-thirds of the material has been removed. Another adaptive management action was redesigning two oxbow wetland areas to be intermittently flooded instead of being year-round stagnant pools when it was determined that the original design was not meeting habitat restoration goals. Finally, ongoing modifications to project features have been carefully planned to accommodate and sustain the development of cottonwood seedlings that were established by natural seeding due to an unintended breach of a berm in spring 2001.

At a restoration project begun in 2001 at the Bosque del Apache National Wildlife Refuge, the intent was to widen a 6,000-foot reach of the Rio Grande from an initial width of about 150 feet to 600 feet to provide improved habitat for the endangered Rio Grande silvery minnow. Owing partially to the absence of large spring runoff flows following the project's initial construction, the channel was unexpectedly slow to widen. In this case, patience and understanding from the Refuge management and other stakeholders was important in avoiding premature conclusions that the project had failed. The channel banklines were periodically cleared of vegetation to prevent them from stabilizing before larger flows occurred. Eventually, during the high spring runoff of 2005, the channel widened considerably, though not to the full 600-foot design width. Subsequent investigation revealed that a previously wider reach immediately upstream had narrowed because of changes in hydrologic conditions. This led to the conclusion that it was unrealistic to expect that the project reach would achieve the initial restoration goals; the final width would likely fall somewhere between the initial 150 feet and the intended 600 feet. It was decided that the remaining width would be managed to encourage development of desirable native vegetation in an area that had previously been monotypic saltcedar.

Construction began in 2000 on a temporary channel through the delta of Elephant Butte Reservoir to maintain connectivity between the Rio Grande and the upstream end of the reservoir pool. The project was seven miles long and took several years to construct, owing to its size and the difficult working conditions in the delta. Upon completion of the project, it was clear that maintaining a 250-foot-wide channel, as specified in the original design, would be excessively time consuming and costly. Field observations indicated that the channel was naturally developing a diverse habitat system of point bars and islands. An adaptive management plan was developed around the channel’s natural conditions to minimize maintenance while preserving the design capacity and flow connectivity to the reservoir pool. To that end, the plan called for dredging a narrower channel around the naturally

developed point bars and islands and for clearing vegetation from point bars and islands to prevent permanency of those features.