

# Stream Channel Designs for Riparian and Wet Meadow Rangelands in the Southwestern United States

Roy Jemison<sup>1</sup> and Daniel G. Neary<sup>2</sup>

**Abstract.**—Inappropriate land uses have degraded wetland and riparian ecosystems throughout the Southwestern United States. In 1996, the Cibola National Forest in New Mexico implemented a channel relocation project, as part of a road improvement project, to determine the feasibility of restoring wet meadow and riparian ecosystems degraded by inappropriately located roads and drainage structures. Results show that channel relocation can provide the hydrologic inputs needed to restore these degraded ecosystems.

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## Introduction

Wet meadows and riparian ecosystems in the Southwestern United States comprise less than 10% of the landscape. Despite their small size, they can support higher diversities of plant and animal species. Inappropriate land uses, such as roads, grazing, borrow pits and recreation, can contribute to the degradation of these areas and adjacent lands. Degraded wetland and riparian channel conditions can include incised channels, wide-braided, undefined channels, low channel sinuosity, dry or abandoned channels, flashy uncontrolled flows, and minimal water infiltration into surrounding soils.

The watershed management practices of public and some private land management agencies aim to protect and restore degraded wetland and riparian ecosystems. A permanent soil-water supply is a requirement in the restoration process. If degraded by incompatible uses, wetland and riparian ecosystems can often be restored and improved by modification or elimination of the incompatible uses. When elimination is not an option, stream channel restoration can provide opportunities to reinstate degraded hydrologic conditions.

Attempts to restore and relocate stream channels have yielded mixed results from increased runoff flows with longer durations and more habitat created for terrestrial and aquatic species to further site degradation (Kondolf and Micheli 1995). Documented successful and failed attempts at stream channel manipulations help managers

and researchers understand why information about watershed hydrologic principles and practices are necessary (Rosgen 1996). Knowledge and information needs include precipitation and runoff relationships; soil characteristics include texture, depth and surface exposure; channel characteristics include width-depth ratios, sinuosity and slope; and vegetation characteristics include type, percent cover and root structure (Branson et al. 1981).

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## New Mexico Experience

### Cibola National Forest

The Cibola National Forest in New Mexico implemented the Agua Fria riparian meadow reestablishment project as part of a forest road improvement program in 1995 (Jemison et al. 1997). An assessment of the impacts of the old road on meadow ecosystem suggested that construction of the roadbeds altered the hydrologic conditions of the meadow surface where they were crossed. Before the project, an entrenched channel ran lengthwise down one side of the meadow passing below the road through a cement bridge, then diverting to the other side of the meadow (figure 1). Steps taken to implement the project included removal and earth fill of the bridge crossing; earth fill of the old channel in areas where it could be flooded by overland flow from the new channel; construction of a shallow, sinuous channel down the center of the meadow with a broad floodplain on each side; and installation of rock weirs at the beginning and end of each bend in the channel to create a step pool sequence.

## Results

Results from 1996 to the present indicate runoff flowed in the constructed channel during the spring of 1996 and 1998 from snow melt at higher elevations. Over-bank flooding occurred for extended periods during those events. The water table below the meadow never in-

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<sup>1</sup> Hydrologist, Rocky Mountain Research Station, U.S. Department of Agriculture, Forest Service, Albuquerque, NM

<sup>2</sup> Project Leader, Rocky Mountain Research Station, U.S. Department of Agriculture, Forest Service, Flagstaff, AZ

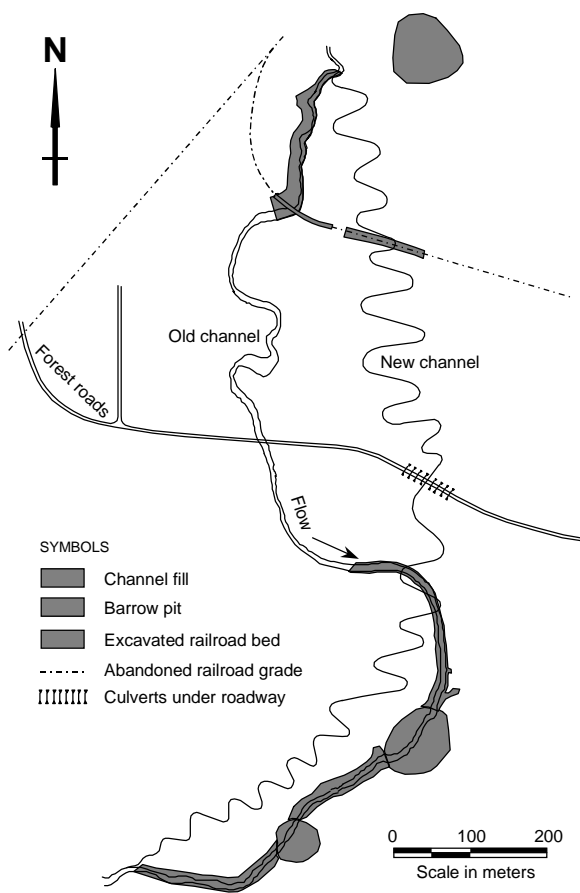


Figure 1. Layout of the Agua Fria channel reconstruction site.

creased to within 10 m (deepest well recorder) of the surface. Above the road crossing, the channel directed the water through the meadow as expected. However, below the road, water that flowed over the channel banks was diverted away from the channel by earth fill where it crossed a section of the old channel. The diverted water flowed along the fill and caused extensive head-cutting and surface erosion of the lower meadow. Results will be expanded upon as data are analyzed for runoff, channel profiles, soils and vegetation. These results will assist land managers and road engineers to design and build roads that are compatible with wetland and riparian ecosystems.

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