Long-term Monitoring Shows the Importance of Floodplain Reconstruction in Restoration of a Placer-mined Stream

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A multi-year interdisciplinary study of techniques for the restoration of a placer-mined watershed began in 1988 at Glen Creek in Denali National Park and Preserve. A primary focus of the study has been long-term monitoring, with quantitative measurements at one to five year intervals, and qualitative observations in between. This paper reviews the original hydraulic design process, and describes the importance of establishing proper floodplain geometry in such restoration projects, which is often ignored in favor of channel design considerations.

Construction of the Glen Creek channel/floodplain restoration design began in 1991 and continued for several years. The original design focused on stream and floodplain geometry using hydraulic capacity and shear stress equations. Slope and sinuosity values were based on regional relationships. Design requirements included a channel capacity for a bankfull discharge; a key feature of the design was the construction of functional floodplains with capacity for a 1.5- to 100-year discharge. Most of the work along the study reaches involved recontouring artificially raised floodplains to a lower elevation and leaving the existing channel undisturbed except for minor bank modifications. This effort served to reconnect the channel to the floodplain, by restoring natural floodplain processes and bringing the desired riparian/floodplain surface closer to the water table.

Several bio-engineering techniques were tested to dissipate floodwater energy and encourage sediment deposition along the newly constructed floodplains; these included anchored brush bars, stream bank hedge layering, cuttings, root wads, and coir logs. The constructed floodplains above were left to revegetate naturally. Mine spoil piles above the constructed floodplain were recontoured and planted with alder, white spruce, and soapberry seedlings with unplanted control areas. The design for long-term monitoring included permanently monumented cross-sections installed throughout the project site.

Reconnaissance of the study area was conducted in 2005. Some reaches of the original channel design configuration have changed substantially in the 15 years since construction was completed. For example, early erosion was noted in areas where the bank was constructed through non-cohesive processed mine tailings. However, the geometry of the reconstructed floodplains has allowed the channel to move and evolve toward a stable predisturbance geometry, including the increase of sinuosity and a decrease in the width/depth ratio. Furthermore, the floodplains have revegetated with stands of alder and willow. Areas where bioengineering structures designed to capture sediment during flood events have developed a diverse community of grasses and forbs. Most recontoured spoil piles above the active floodplain have revegetated with and without planting, but after 18 years, unplanted processed spoil is still barren.

To obtain more information on this study, many of the papers previously published by the authors are available at http://alaska.usgs.gov/science/biology/restoration/.

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