Proposition 204 Final Report (Ward Creek)

Background: The Ward Creek project was implemented on private land owned by the Neff family in Genesee Valley, Ca. Ward Creek drains a 14.5 mi^2 watershed that receives an annual precipitation of 45"- 50". A geomorphic reconstruction of the degradational history indicates that the channel was likely moved to the crown of the alluvial fan in the valley center, presumably for irrigation purposes. This realignment, without attendant channel structure, would have resulted in the rapid downcutting exhibited on the landscape. This downcutting resulted in a lowering of the shallow meadow water table and subsequent conversion from mesic (moist) site plants to a xeric (dry) site vegetative community. Extensive irrigation works were pursued in attempts to maintain vegetative vigor. Often the irrigation improvements contributed to further channel instability with diminishing results in sustaining the meadow.

The FR-CRM began restoration efforts on Ward Creek in 1985, with improved irrigation structures, vegetation planting and livestock management changes. These efforts, repeated in 1987 and 1992, had begun to show improvement. However, the next flood destroyed fences and obliterated the new plants. The flood damage was the result of the disconnect between the channel and the floodplain due to channel entrenchment. The FR-CRM, meanwhile, had been working with the concept of re-connecting stream channels with their naturally evolved floodplains (Big Flat, 1995; Bagley Creek, 1997; Boulder Creek, 1997). Ward Creek appeared to be a prime candidate for this treatment. To this end, at the request of the Neff Ranch, this project was incorporated into the Proposition 204 grant request and subsequent contract.

Implementation: Ward Creek was the first of the six Proposition 204 projects constructed. This is due to the Neff Ranch funding the initial data collection/analysis and conceptual design development prior to the grant submittal. The final design and permitting was accomplished in early 1999, with construction beginning in September 1999 and completion in mid-November 1999. The Ward Creek project was the first pond-and-plug project attempted on a stream system with a high, perennial baseflow. The effects of this condition on construction scheduling and material handling will be discussed below. The initial budget for the project was $180,685, including all final design, permitting and construction costs.

The Ward Creek final design was a first-of-its-kind system in that the channel was designed to flow through the ponds. All previous projects had the gully ponds off the design channel with surface flow only during floods. The technical challenge of designing a pond-to-pond channel is the loss of rejuvenating bedload that settles in the first pond. Through a process of sediment measurements, sediment transport calculations and modeling, a channel design was achieved that would not mobilize the material used in the new streambed. This was carefully monitored during the first flood event (Feb. 2000) and determined to be functioning as predicted.

The contract was advertised by the Plumas County Dept. of Public Works (DPW) and awarded to Joy Engineering of Portola, Ca. The project entailed re-construction of 4,300 feet of new channel and the excavation and placement of 89,000 yds^3 of fill for the gully obliteration. This resulted in six ponds and six plugs. Several hundred medium-aged alder, willow and cottonwood plants were transplanted with heavy equipment out of the gully to the new channel and on to newly-constructed plugs. These plants were sustained during the dry, warm fall months using a water truck and several large pumps for irrigation. As a consequence, the transplanting was 90% successful.

The main technical challenge encountered during implementation was water management. Surface water flow was relatively easy to manage. Difficulty occurred when the meadow itself began to fill rapidly with groundwater as soon as the first plug was completed at the upper end of the meadow. This infilling was far more rapid than would be anticipated from the surface inflow, which indicates that Ward Creek had a significant sub-surface flow component, even at the end of a dry summer. The meadow re-watering progressed down-valley and began to impact plug material handling at pond/plug #4-6.

A variety of equipment pairings were tested, including the use of 6-wheel drive dump trucks. The original equipment package of a medium excavator, two wheel loaders and a track loader ultimately remained the most effective. However, the wheel loaders could only transport the wet material and not work/compact the plugs. The track loader was the only piece that could work the saturated material into a sound plug. The unexpected water management problem caused this project to exceed its budget by 20%. Savings in other projects were ample to make up the difference.

Monitoring/Results:

Unlike other project monitoring under this grant, the objective of formal monitoring on Ward Creek was not to determine project effectiveness, but to determine what effect the pond-to-pond channel technique had on water temperature and the lack of rejuvenating bedload on channel stability. There was no formal vegetation monitoring, however, as mentioned above, observation monitoring showed a transplant survival of about 90%. Likewise, plug revegetation was not formally monitored. (NRCS conducted some informal vegetation monitoring in the meadow that was re-watered by the project, but their data were not available for this report.)

Construction of the pond-and-plug project was completed in November 1999. Water temperature data were collected from July 1, 2000 through September 13, 2000. Two hobotemps were placed in the project area; one just above the upper pond, and the other, in the lower pond near the outlet. In hindsight, more temperature loggers should have been used, and there should have been a control set, as well as a season of pre-project water temperature monitoring. With only two loggers, we only see the overall project's effect on temperature, and don't know if it's due to the ponds or not. Likewise, only surface water was measured, whereas there is a lot more deep water (cooler water) due to the ponds, than there would be if the channel were not connected to the ponds.

Figures 1 and 2 display the results of the temperature monitoring. Ward Creek is known to be an extremely cold creek, and the incoming temperature on both the daily max and daily min graphs show that. Daily minima barely peaked over 55º F, and the daily maxima peak didn't quite reach 65º F. For maximum temperatures, the average daily temperature difference from inflow to outflow of the project was 5.5º F. (For daily minimum temperatures, the average daily temperature difference was 11.2º F.) Daily maxima at the outflow exceeded 68º F on one day – August 7.

The data show that, overall, yes, the water temperature does warm as it moves through the project area. The amount of temperature change through the same area before the project is unknown. It should also be noted that irrigation diversion occurs from pond #5, which may also contribute to warmer water temperatures at the bottom end of the project. As vegetation recovers along the channel, shade will increase and is expected to have a cooling effect on water temperature through the project.

Much of the 4,300 feet of new channel was constructed from scratch. The entire channel was over-excavated by several feet then refilled back to design grade using coarse alluvium recruited from the gully. The particle size/weight distribution of this material was carefully analyzed for the purpose of designing a channel that would not mobilize more than the finest/lightest 35% of the alluvium before becoming "armored". The design maximum particle size to be moved was determined to be 45 millimeters (mm) with an average weight of 0.26 lbs. This was monitored during the first flood event in February 2000. When the flood receded, samples of the point bars were collected and analyzed to determine if the design parameters performed as predicted. Analysis of the point bar material in two locations indicated that the maximum particle sizes moved and deposited was 40 mm. Figure 3 displays pre- and post- project particle size distribution.