Restoration Effectiveness in Blackwood Creek – Reach 6

Research shows that Blackwood Creek has one of the highest sediment loads to Lake Tahoe. A Blackwood Creek TMDL (adopted by the EPA in 2008) supports actions to restore aquatic habitats in degraded stream segments. The Lake Tahoe TMDL (adopted by the EPA in 2011) also identifies Blackwood as one of two priority streams for stream channel restoration in the Lake Tahoe Basin.

Historic aerial photos, dating back to 1939, indicate that much of the main stem channel in the valley was a narrow, sinuous stream with vigorous riparian vegetation and a well-connected floodplain. Cumulative impacts of historic grazing, road building, logging, and in-stream gravel mining in the 1960's set the stage for widespread channel and floodplain destabilization during flood events. By 2007, channel and floodplain destabilization resulted in a straightened channel flowing through a sparsely vegetated gravelly inset floodplain bordered by vertical cut banks. Channel erosion processes resulted in floodplain incision of up to 8 feet in depth and over 100 feet in width, with over 70 % of the channel banks in an unstable condition.

In 2008 and 2009, the USFS reconstructed .75 miles of channel within 40 acres of adjacent inset floodplain, within the most degraded reach in Blackwood Creek. To maintain flow dynamics within the reconstructed channel and floodplain, 13 rock-log flow deflection structures and 28 log-based floodplain roughness structures were installed. Existing vegetation was transplanted and augmented by riparian vegetation planting to provide a seed source for future vegetation recovery.

Restoration was designed to achieve the following objectives.

- Restore dynamic geomorphic channel stability to achieve and maintain Blackwood TMDL targets for sinuosity (1.6:1) and bank stability (80% stable banks).
- Restore functional channel/floodplain relationship with, floodplain inundation occurring every two to three years.
- Improve downstream water quality by increasing volume of fine sediment retained on floodplains and preventing wide spread cut bank terrace collapse.
- Create aquatic habitat features important to support various forms and life stages throughout the year, sufficient to restore Lahontan Cutthroat Trout to Blackwood Creek.

As a result of restoration this reach has changed from one dominated by processes of net degradation (channel erosion), to one dominated by processes of net aggradation (floodplain deposition). Post project measurements of sinuosity (2.1:1) and bank stability (95%) indicate the restored reach currently exceeds the Blackwood TMDL targets. Figures 1 and 2 illustrate the increase in channel sinuosity as a result of restoration. Post project observations during spring runoff also indicate that floodplain inundation has occurred to some degree every year since the project was completed. Overall, the increases in pool quality metrics (depth, frequency, and ratio to riffles), lower % riffle fines, lower cross section width-depth ratios, and significantly less relative channel confinement, all suggest aquatic habitat has been significantly improved. Habitat metric values in the project area are statistically comparable to established reference reaches in

Blackwood creek, as well as values considered healthy in scientific literature. Positive trends in habitat metrics are expected over the longer term as woody shrub and tree vegetation recovers providing more food, shade, and rearing habitat, for all life stages of aquatic organisms. Although visual observations indicates transplanted and replanted vegetation is surviving, there is not yet substantial change in the degree of riparian vegetation recovery within the project area in terms of its influence in either providing floodplain and channel stability, riparian habitat, or channel shading. It is expected to take approximately 5 to 10 years post project before a substantial degree of riparian vegetation change occurs.

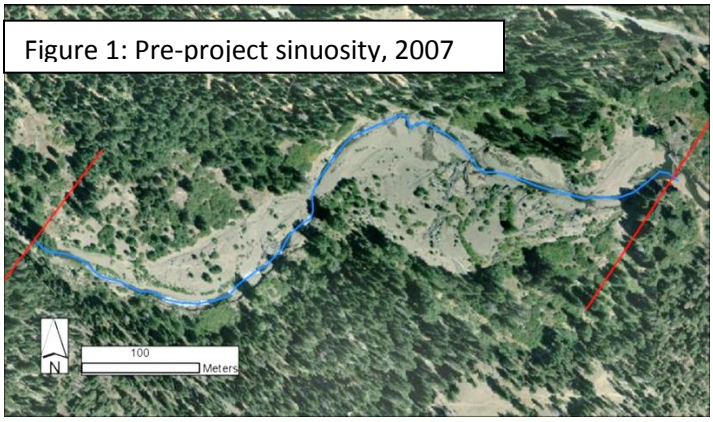
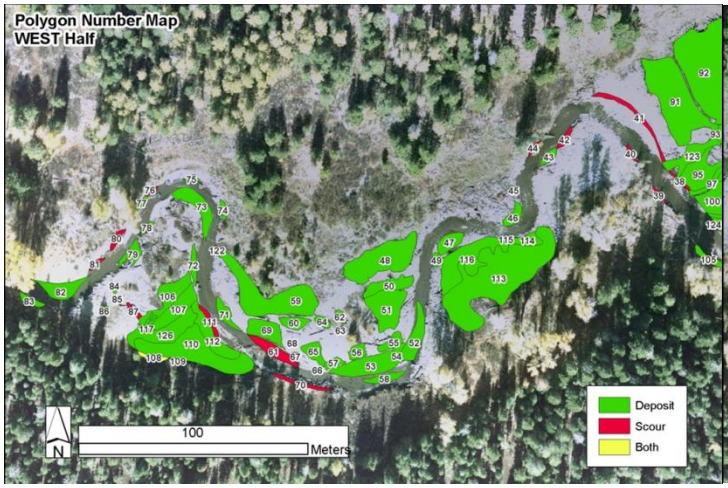
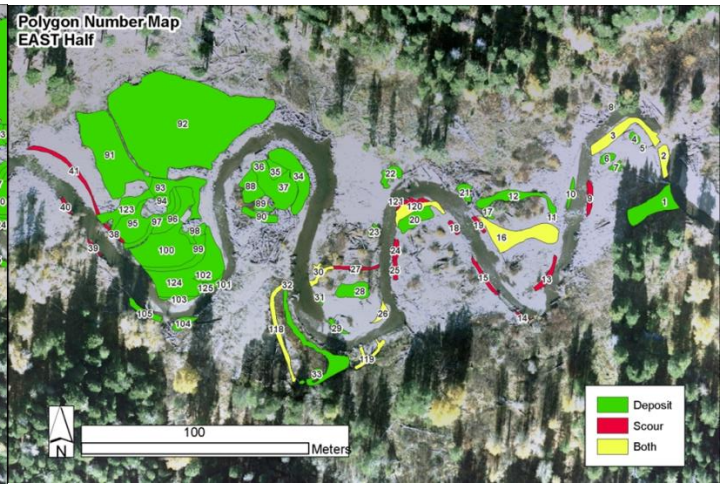


Figure 1: Pre-project sinuosity, 2007

Figure 2: Post-project sinuosity, 2010

In addition, measurements of sediment retained on the floodplain the first year after restoration indicates retention of 142 tons of silt and clay sized particles. Fine sediment retention is expected to continue as vegetation on active floodplains surfaces becomes better established. Areas of floodplain deposition and scour post-project are illustrated below.





A report documenting the short term construction impacts of restoration activities on sediment loading is posted on the LTBMU website: http://www.fs.usda.gov/main/ltbmu/maps-pubs (Blackwood Creek Reach 6 Restoration, Project Impacts Analysis,2012). A comprehensive evaluation of restoration project effectiveness is also available on this website (Blackwood Creek Restoration Reach 6 Effectiveness Monitoring Report, 2014).