Step-Pool Creation to Restore Fish Passage and Riparian Health

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Project Background

• Reconstructing Utah Forest Highway 39 through Fishlake National Forest

• Led by FHWA in cooperation with Sevier County and the U.S. Forest Service
Step-Pool Feature

Mitigation Wetlands

Step-Pool Reach

- Channel instability caused by inadequate hydraulic capacity of existing culvert
Design Details - Step-Pool Reach

• Matches existing channel geometry
  – Invert elevation drop (2.4 meters)
  – Channel length (38.6 meters)
  – Slope (0.063)

• Meets fish passage criteria
  – 0.3 meters

• Morphometric features
  – $1 \leq \{(H/L) \text{ average} / S\} \leq 2$
    • Abrahams et al., 1995

Design Details - Step-Pool Reach

• Existing bankfull channel geometry
  – Bottom width (2.7 meters)
  – Top width (4.6 meters)
  – Depth (1.1 meters)

• Step-pool channel geometry
  – Bottom width (3 meters)
  – Channel and overbank side slopes (3:1)
  – Depth (1.0 meter over crests, 1.25 meter over pools)
Design Details - Step-Pool Reach

• Final proposed configuration:
  – 9 crests / 8 pools over the 40-meter reach
  – Pool spacing of 4.9 meters
  – 0.3-meter elevation drop from pool-crest to pool-crest

Design Details - Step-Pool Reach

• Final proposed configuration:
  – Boulder structures extend to the bankfull (1.5-year return interval discharge) stage elevation
  – Extend rock sill or key up to 2-feet above the 100-year discharge
Design Details - Step-Pool Reach

• Rock riprap and live willow cuttings
• Riprap sized to accommodate 100-year and 500-year flood events
  – Step-pool crests and footer rocks consist of 1-meter boulders
• Live willow stakes and deciduous tree plantings for long-term stability

Mitigation Wetlands

• Required to compensate for road realignments and several crossings of Gooseberry Creek
• Mitigation site is degraded reach upstream from culvert
  – Livestock grazing
  – Downstream undersized culvert
Design Details - Mitigation Wetlands

• Channel Characteristics
  – E5 Rosgen stream type
  – Bank Failure

Design Details - Mitigation Wetlands

• Bank Protection
  – ~198 meters of shoreline protected using local willow cuttings
  – ~17 meters of shoreline protected using willow fascines or coir logs
Design Details - Mitigation Wetlands

• Bank Protection
  – ~11.6 meters of shoreline protected using boulders

Design Details - Mitigation Wetlands

• Woody Species Plantings
  – 13 cottonwoods
  – 3 river birch
  – ~175 square meters of riparian area planted using willow cuttings
Design Details - Mitigation Wetlands

- Riparian Herbaceous Vegetation
  - Planting of ~242 square meters
- Upland Restoration
  - Restoration of ~226 square meters of degraded oak communities
- Site Fencing

Design Details - Mitigation Wetlands

- Performance Criteria
  - Riparian and upland vegetation monitoring
    - Percent canopy cover, survival, no invasive weed species
- Monitoring Methods
  - Baseline (before construction)
  - Yearly monitoring
  - Final measurements (Year 5)
Design Summary

• Site improvements
  – Step-pool feature
  – Slope stabilization
  – Revegetation of riparian and upland areas

• Relies on bioengineering wherever possible, and only uses rock revetments where necessary

Construction and Implementation

• Construction of roadway began in October 2004
• Two-year schedule for entire roadway project
Questions?