Combining Stream Restoration and Mine Reclamation Techniques to Improve Water Quality in Colorado Streams

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Stream Restoration within Mine Reclamation

• The combination of stream restoration principals within mine reclamation efforts can be effective to improve water quality.

• Diverse fields of stream restoration, mine reclamation and stormwater management must apply successful techniques within each discipline to increase the effectiveness of each.

• The ability to balance ecological remediation projects with a variety of tools is essential to enhance water quality in Colorado streams.
Example 1: Sneffels Creek eroding through Atlas Mill Tailings

The photo shows the Historic Atlas Mill and the Atlas Mill tailings and the length of the Sneffels Creek Bank Stabilization Project.

While relocating the channel WSW replicated an existing sinuosity ratio, created a multi staged channel profile and vegetated the riparian area on both sides of the stream.
Sneffels Creek Project Goals: (Photo June 2016)

1) Mitigate Sneffels Creek active erosion through Atlas Mill mine tailings

2) Increase water quality downstream

3) Restore single thread channel through braided reach - resulting from mining impacts and historic disturbance

4) Create three stage floodplain utilizing natural channel design principals

5) Replicate existing sinuosity in re-created channel 20’ to north

6) Slightly increase width to depth ratio of created channel (compared to upstream and downstream reference reaches) to help pass bedload transfer and mitigate deposition potential

7) Build three vane arms at bankfull stage to further mitigate sheer stress at high flow conditions by Atlas Mill tailings

8) Utilize log cribbing and rip rap as additional barrier to tailings interfacing with stream

9) Transplant willows, install willow bundles and stakes along both stream banks, seed area and add riparian shrubs to increase stream bank stabilization
Replicating existing bankful capacity grades WSW re-created a three stage channel design through eroded area.
Sneffels Creek Project
July 2016

Proactive:
Relocate channel to center of existing impacted channel with increased width.
Shape meanders based on the existing sinuosity ratio to naturally dissipate sheer stress most efficiently.
Remove natural deposition diverting channel to south. Create open low flow channel within 3 stage floodplain restoration.

Reactive:
Log cribbing to stabilize eroded channel within tailings.
Rip rap floodplain retaining sill parallel to channel (1-2.5’ boulders) to add long term structural integrity to established bankfull elevation.
Three vanes acting in unison (three points of contact to footers, 3.5’-6’ boulders) which roll thalweg center channel within varying discharge events.
Example 2: Silverbell Mine Reclamation Project

Tailing Retaining Wall above steeply incised channel within the Howard’s Fork of the San Miguel River above Telluride.

Stream Erosion Mitigation Project within a mine reclamation project.
Stabilizing tailing retaining wall with stream restoration techniques

WSW added a vane arm and bank stabilization from stream restoration techniques to protect the retaining wall holding back tailings on the side of the Howard’s Fork San Miguel River.

Photo: We lowered boulders with a 100’ steel cable attached to a long reach excavator.
Photo: Howards Fork of the San Miguel River below retaining wall.

The vane arm was installed to mitigate sheer stress erosion during peak flow discharge on the retaining wall.

After successive runoffs spawning habitat was created within a scour pool below the vane arm.
Example 3:  
Centennial Mine  
Channel Stabilization Project

Photo: the eroded channel with 30’ vertical side slope erosion. Continual slumping and eroding occurs during runoff events through this ephemeral channel and transports unstable uranium tailings.

WSW design completed for the State of Colorado Division of Mine Reclamation and Safety, under construction.