Topographic Comparison Of Traditional And Geomorphic Reclamation Approaches At A Surface Coal Mine In Northwestern New Mexico

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Navajo Mine
Navajo Mine

- Operations began in 1963
- Open-cut dragline operation and sole supplier to Four Corners Power Plant (FCPP)
- Annual production 7-9 million tons (through December 2013)
- Annual production 5-6 million tones (post June 2013)
Navajo Mine final surface configuration (FSC) design objectives:

1. Achieve mass balance while maximizing contemporaneous regrade between pit ramps

2. Achieve positive drainage from all areas including pits and ramps

3. Develop an adequate drainage density, while aligning with pre-mining or offsite drainages

4. Allow development of stable drainage channels, and

5. Support the approved post mining land use.
Traditional Reclamation Approach

Typified of FSC surfaces dependent on rip-rap, gradient terraces, or other “hard engineered” structures to stabilize drainages and control erosion.

Confluence of a series of typical gradient terraces with a drop structure connecting to a reclaimed channel.
Geomorphic Reclamation Approach

FSC surfaces designed utilizing fluvial geomorphic principles such as;

- Utilizing geomorphically appropriate slopes, drainage densities, and channel profiles;
- Constructing geomorphically appropriate channel slopes, channel meander lengths, and cross sections; and
- Configuring reclaimed channel configuration based on bed and bank (substrate) material.
Area 3 Contours

Area 3 Original FSC Contours

Elevation (ft)

- 5635.556 - 5690
- 5581.111 - 5635.556
- 5526.667 - 5581.111
- 5472.222 - 5526.667
- 5417.778 - 5472.222
- 5363.333 - 5417.778
- 5308.889 - 5363.333
- 5254.444 - 5308.889
- 5200 - 5254.444

Mining Lease and ROWs
Study Area
Intermediate Contour
Index Contour

0 0.2 0.4 0.8 Kilometers
Area 3 Contours

Area 3 Revised FSC Contours

- **Elevation (ft)**
  - 5635.556 - 5690
  - 5581.111 - 5635.556
  - 5526.667 - 5581.111
  - 5472.222 - 5526.667
  - 5417.778 - 5472.222
  - 5363.333 - 5417.778
  - 5308.889 - 5363.333
  - 5254.444 - 5308.889
  - 5200 - 5254.444
Area 3 Aspect
Area 3 Aspect

Area 3 Revised FSC Aspect

- Mining Lease and ROWs
- Study Area

Aspect:
- Flat (-1)
- North (0-22.5)
- Northeast (22.5-87.5)
- East (87.5-112.5)
- Southeast (112.5-157.5)
- South (157.5-202.5)
- Southwest (202.5-247.5)
- West (247.5-292.5)
- Northwest (292.5-337.5)
- North (337.5-360)

Distance Scale: 0 km, 0.2 km, 0.4 km, 0.8 km

Kilometers
Area 3 Aspect Histogram

Original FSC

Revised FSC
Area 3 Slope
Area 3 Slope

Area 3 Original FSC Slope

Legend:
- Mining Lease and ROWs
- Study Area

Percent Slope:
- 0 - 3%
- 3 - 6%
- 6 - 9%
- 9 - 12%
- 12 - 15%
- 15 - 18%
- 18 - 21%
- >21%

Kilometers
Expected Benefits of Geomorphic Surfaces

Erosional stability

• Geomorphically designed channels will provide for reduced long-term maintenance costs.

Revegetation community

• The varying slope and aspects will promote greater revegetation species diversity.

Wildlife community

• The varying slopes, aspects and drainages will promote increased wildlife habitat by providing opportunity for viewing, hiding and resting.
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