Approximate pre-mining locations of Soda Butte Creek and Miller Creek
The diagram illustrates the geology and features of a tailings dam cross-section. Key points include:

- **1969 soil cap**
- **1990s work to stabilize dam toe**
- **Multiple seeps of contaminated water**

The geology layers are labeled as follows:

- **Silty clays**
- **Silty sands**
- **Sands with silts, gravels and cobbles**

The diagram shows the elevation in feet along the vertical axis and the horizontal distance in feet along the horizontal axis.
Reclamation Challenges
Site Reclamation Overview

- Dewater the tailings by pumping the underlying aquifer
  - Intercept clean water
  - Treat contaminated water to DEQ water quality standards
- Stabilize tailings using lime
  - Reduce moisture and strengthen tailings
  - Reduce metal mobility
- Implement seasonal shut down BMPs
  - Interim repository liner
  - Water and sediment control
- Complete site reclamation
  - Soil amendment and revegetation
  - Stream reconstruction
Construction Dewatering

- Alluvial Aquifer
- Granitic Bedrock
- 2 Ft Soil Cap
- 25 Ft Tailings
Construction Dewatering System
Water Treatment System
## System Discharge vs. DEQ Standards

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Target</th>
<th>2012 Maximum</th>
<th>2012 Average</th>
<th>2013 Maximum</th>
<th>2013 Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron</td>
<td>1.0</td>
<td>1.2</td>
<td>0.50</td>
<td>0.60</td>
<td>0.34</td>
</tr>
<tr>
<td>Manganese</td>
<td>(0.050)</td>
<td>0.096</td>
<td>0.028</td>
<td>0.14</td>
<td>0.059</td>
</tr>
<tr>
<td>Aluminum</td>
<td>0.087</td>
<td>&lt;0.03</td>
<td>&lt;0.03</td>
<td>0.050</td>
<td>&lt;0.03</td>
</tr>
<tr>
<td>Copper</td>
<td>0.012</td>
<td>&lt;0.005</td>
<td>&lt;0.005</td>
<td>0.018</td>
<td>0.0053</td>
</tr>
<tr>
<td>Cadmium</td>
<td>0.00033</td>
<td>0.002</td>
<td>&lt;0.00008</td>
<td>0.00008</td>
<td>&lt;0.00008</td>
</tr>
<tr>
<td>Zinc</td>
<td>0.15</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
<td>0.01</td>
<td>&lt;0.01</td>
</tr>
</tbody>
</table>

Concentrations in mg/L
26 weekly sampling events between June 13, 2012 and October 10, 2012 and from June 5, 2013 to July 24, 2013
Antimony, arsenic, barium, chromium, lead, mercury, nickel, and silver have not been not detected in discharge
2013 Project Milestones

• August 28 – 29: Soda Butte Creek diverted into its reconstructed channel
• September 7: Final section on tailings excavated and placed in the repository
• September 12: Miller Creek diverted into its reconstructed channel
• October 2: Repository HDPE liner installation complete
2014 Reclamation Work

- Install repository cap – 3 feet of soil
- Improve soil productivity using compost
- Cover project with one foot of compost-amended soil
- Monitor performance of reconstructed stream channels
- Construct water collection features
- Seed in September
Repository Construction

- Contains approximately 240,000 cubic yards of compacted lime-stabilized tailings and ore rock
- Capped with a geochusion, 60-ml HDPE liner, drainage geocomposite, and 3 feet of cover soil.
- Side slopes are 5:1 horizontal to vertical based on seismic stability analysis for the area
Repository Compaction

July 2011
Repository – Final Grading and Compaction
Repository – Liner Installation
Repository – Soil Cap

July 2014
Repository – Pending Seeding

August 2014
Stream Reconstruction

- Initiated in July 2013
- Approximately 1,500 linear feet of Soda Butte Creek
- Approximately 525 linear feet of Miller Creek
- Willow brush, root wads and boulder clusters
- Coconut fabric to stabilize banks
- Riparian seeding
- Planting of willow stakes
Soda Butte Creek Reconstruction

August 2013
Soda Butte Creek Reconstruction

August 2013
Soda Butte Creek Reconstruction
Soda Butte Creek Reconstruction

August 2014
Soda Butte Creek Reconstruction

August 2014
Miller Creek Reconstruction

July 2014
Water Features

August 2014
2014 Project Status

• Sampling indicates water quality in Soda Butte Creek meets DEQ water quality standards with majority of metals below laboratory detection limits
• Expect work to approach completion in 2014 – as always weather dependent
• Received reports of significantly improved fishing in Soda Butte Creek
• Remaining work includes seeding and the planting of aspen, fir, and thimbleberry
Remaining work

- Seeding grass species and mulching
- Planting of aspen, fir, and thimbleberry
- Construction of final surface water control features
- Continued monitoring of water quality
- Monitoring of vegetation and general reclamation work
Conceptual Project Completion
Questions

Contact:
Tom Henderson
Montana DEQ
thenderson@mt.gov
(406) 841-5052
McLaren Tailings Contribution to Total Loads in Soda Butte Creek

Monitoring point SBC-2 near Cooke City

<table>
<thead>
<tr>
<th>Metal</th>
<th>Low Flow</th>
<th>High Flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copper</td>
<td>60 - 90 %</td>
<td>&gt; 5 %</td>
</tr>
<tr>
<td>Iron</td>
<td>70 - 95 %</td>
<td>20 - 40 %</td>
</tr>
<tr>
<td>Manganese</td>
<td>80 - 95 %</td>
<td>20 - 40 %</td>
</tr>
</tbody>
</table>

Monitoring point SBC-4 near Yellowstone National Park

<table>
<thead>
<tr>
<th>Metal</th>
<th>Low Flow</th>
<th>High Flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copper</td>
<td>? - 90 %</td>
<td>?</td>
</tr>
<tr>
<td>Iron</td>
<td>25 - 30 %</td>
<td>5 - 10 %</td>
</tr>
<tr>
<td>Manganese</td>
<td>80 - 95 %</td>
<td>&lt; 5 %</td>
</tr>
</tbody>
</table>

DEQ Water Quality Restoration Plan for the Cooke City TMDL Planning Area