Presentation Outline

• Placement data

• Stability
  – Compaction
  – Inspections
  – Slope monitoring

• Water level data

• Precipitation and flow data

• Water quality at internal monitoring sites

• ABA data

• General site management
2009 Satellite Photograph
Site 23/D, Mill Site and 1350
### Table 3.1 Site 23 Placement Data

**PRODUCTION ROCK PLACED AT SITE 23**

<table>
<thead>
<tr>
<th>Date</th>
<th>Surveyed (cy)</th>
<th>Surveyed (tons)</th>
<th>Hauled To Tails from Site 23 (tons)</th>
<th>From UG Truck Counts (tons)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Monthly</td>
<td>Cumulative</td>
<td>Monthly</td>
<td>Class 1</td>
</tr>
<tr>
<td>*1/31/2009</td>
<td>0</td>
<td>0</td>
<td>938</td>
<td>2,040</td>
</tr>
<tr>
<td>*2/28/2009</td>
<td>0</td>
<td>0</td>
<td>1,135</td>
<td>1,740</td>
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<tr>
<td>3/31/2009</td>
<td>2,564</td>
<td>2,564</td>
<td>4,019</td>
<td>6,092</td>
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<tr>
<td>4/30/2009</td>
<td>1,086</td>
<td>3,650</td>
<td>2,380</td>
<td>8,472</td>
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<tr>
<td>5/31/2009</td>
<td>0</td>
<td>3,650</td>
<td>877</td>
<td>9,349</td>
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<tr>
<td>6/30/2009</td>
<td>1,834</td>
<td>5,484</td>
<td>170</td>
<td>9,519</td>
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<tr>
<td>7/30/2009</td>
<td>922</td>
<td>6,406</td>
<td>558</td>
<td>10,077</td>
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<tr>
<td>8/31/2009</td>
<td>2,830</td>
<td>9,236</td>
<td>262</td>
<td>10,339</td>
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<tr>
<td>9/30/2009</td>
<td>1,668</td>
<td>10,904</td>
<td>3,009</td>
<td>13,348</td>
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<tr>
<td>10/30/2009</td>
<td>2,030</td>
<td>12,934</td>
<td>190</td>
<td>13,538</td>
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<tr>
<td>11/30/2009</td>
<td>468</td>
<td>14,302</td>
<td>0</td>
<td>13,538</td>
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<tr>
<td>12/31/2009</td>
<td>1,459</td>
<td>14,861</td>
<td>574</td>
<td>14,112</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td>14,861</td>
<td>25,157</td>
<td>14,112</td>
<td>18,030</td>
</tr>
</tbody>
</table>

* No survey taken due to equipment failure or excessive snow

Remaining capacity ~558,000 cy
were does class 1 placed and "less tails haul" come from?
ballouc, 4/28/2008
Site 23/D Stability

• Compaction
  - Method specification includes spreading in less than 24” lifts with at least one pass with bulldozer and four passes with vibratory compactor

• Inspections
  - Results of operator, engineering, environmental and regulatory inspections revealed no visible signs of instability
  - No issues of non-compliance were noted in 12 USFS and 5 ADEC/ADNR inspections

• Slope monitoring
  - 12 survey hubs monitored with GPS
    • No large movements were identified
  - Inclinometer readings
    • Minor creep at 85’ (~3mm/yr)
Figure 3.30 Inclinometer Incremental Displacement
Site 23/D Water Level Data

- Water table is below base of pile
- Well-drained pile and foundation indicate pile stability is maximized
- Perched water tables in colluvial wedge and alluvial sands
- Braided flow paths
- Distinct seasonal pattern, especially in alluvial sands
- Silt/clay till below colluvial wedge inhibits downward water movement
Figure 3.1 Pressure Data for Piezometer 52

Ground surface ~932'

Base of pile ~908'

Transducer elevation ~905'

HEAD (ft)

0.0 5.0 10.0 15.0 20.0 25.0 30.0

01/01/96 01/02/96 01/03/96 01/04/96 01/05/96 01/06/96 01/07/96 01/08/96 01/09/96 01/10/96
Figure 3.9 Water Level Data for Well MW-23-A4

Ground surface 925'  
Base of pile ~904'  
Base of screen 876'

Data points from 1/13/1995 to 1/13/2010
Figure 3.11 Water Level Data for Well MW-94-D3
Table 3.2 Monthly Summary of Site 23/D Climate Data

<table>
<thead>
<tr>
<th>Month</th>
<th>Avg Temp (°C)</th>
<th>Precipitation (in)</th>
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</thead>
<tbody>
<tr>
<td>January</td>
<td>-4.4</td>
<td>6.7</td>
</tr>
<tr>
<td>February</td>
<td>-3.5</td>
<td>2.0</td>
</tr>
<tr>
<td>March</td>
<td>-2.6</td>
<td>2.2</td>
</tr>
<tr>
<td>April</td>
<td>2.4</td>
<td>1.5</td>
</tr>
<tr>
<td>May</td>
<td>7.2</td>
<td>2.1</td>
</tr>
<tr>
<td>June</td>
<td>11.0</td>
<td>3.1</td>
</tr>
<tr>
<td>July</td>
<td>14.7</td>
<td>1.3</td>
</tr>
<tr>
<td>August</td>
<td>12.3</td>
<td>6.9</td>
</tr>
<tr>
<td>September</td>
<td>8.9</td>
<td>9.1</td>
</tr>
<tr>
<td>October</td>
<td>4.8</td>
<td>6.2</td>
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<tr>
<td>November</td>
<td>0.0</td>
<td>7.7</td>
</tr>
<tr>
<td>December</td>
<td>-3.1</td>
<td>3.7</td>
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<tr>
<td><strong>2009</strong></td>
<td><strong>4.0</strong></td>
<td><strong>52.3</strong></td>
</tr>
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</table>
Site 23/D Internal Monitoring Sites: Water Quality Data

- Internal site waters are captured, treated and discharged per HGCMC’s NPDES permit

- pH values are between 6.0 and 8.5 (high buffering capacity)

- Conductivities are between 200 and 5000 umho/cm

- Variations in conductivity reflect differences in contributions of groundwater and infiltration, seasonal fluctuations

- Zinc concentrations are variable (typically less than 5 mg/l)

- Precipitation, mixing and sorption mechanisms determine metals concentrations
Finger Drains

Site 23

FD-2
FD-3
FD-4
FD-5
FD-6
FD-7
FD-8
Figure 3.14a Site 23 Finger Drains

pH

1/2/99 1/2/00 1/1/01 1/2/02 1/3/03 1/2/04 1/3/05 1/2/06 1/3/07 1/3/08 1/3/09 1/3/10
Figure 3.17a Site 23 Finger Drains Conductivity
Figure 3.20a Site 23 Finger Drains
Dissolved Zinc

Site 310 (ug/L)

All sites except 310 (ug/L)

FD3 (311)
FD4 (312)
FD5 (313)
FD6 (314)
FD7 (315)
FD8 (316)
FD2 (310)
Site 23/D Wells and D Pond
Figure 3.14b  pH
Site 23/D Wells and D Pond

Figure 3.17b Conductivity

MW-23-A4 (51)
MW-23-A2D4 (50)
MW-23-D3 (53)
Pond D (331)
**Figure 3.28 ABA Data**

**Underground Rib Sampling**

![Graph showing Underground Rib Sampling data with different classes based on Neutralization Potential (tCaCO3/kt) vs. Acid Potential (tCaCO3/kt). Classes are differentiated by color and marker style.]

- **Class 1 (NNP>+100)**
- **Class 2 (NNP>100, <+100)**
- **Class 3 (NNP>-100, <-100)**
- **Class 4 (NNP<-300)**

Visual designations:
- Class 1: Blue diamonds
- Class 2: Magenta squares
- Class 3: Green triangles
- Class 4: Red crosses
Site 23/D General Site Management

- Designated placement zones are marked on the active lift of the site and production rock is placed according to class.
- Outer surfaces have at least two feet of Class 1 rock.
- Class 2 and 3 rock are blended and placed in the center of the pile.
- Use of interim storage area for reclamation activities:
  - 1350
  - B Pond berm
  - Pipeline excavation
  - D Pond berm
# Cover Design

[Image: Cover Design]

<table>
<thead>
<tr>
<th>Layer</th>
<th>Height</th>
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<tbody>
<tr>
<td>Growth Medium</td>
<td>2 meters</td>
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<tr>
<td>Capillary Break</td>
<td></td>
</tr>
<tr>
<td>Barrier Layer</td>
<td></td>
</tr>
<tr>
<td>Capillary Break</td>
<td></td>
</tr>
</tbody>
</table>
Site 23 Cover Excavation
Cover Performance Monitoring

- Greater than 85% water saturation in barrier layer minimizes oxygen ingress
- Water percolation through barrier layer 15-20% of annual precipitation
- Barrier layer does not freeze during the winter
- About 85% of the water collected in the chalet trench system reported via the upper capillary break, 15% from growth medium.
- The lag time between peak precipitation and peak trench flow is about 6 hours for dry conditions and 2 hours for wet conditions
- Modeling with Hydrus-2D/3D software compares favorably with field results
- Numerical modeling of alternative cover designs indicates that the upper capillary break is necessary to maximize lateral flow and prevent buildup of head pressures in the growth medium and barrier layer
- OSU vegetation assessment expected 2010
## 960 Site Waste Rock Removal

<table>
<thead>
<tr>
<th>Site 347</th>
<th>Parameter</th>
<th>Unit</th>
<th>Before Removal</th>
<th>After Removal</th>
<th>After Removal</th>
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<tr>
<td></td>
<td>pH</td>
<td>s.u</td>
<td>9/12/95</td>
<td>9/28/06</td>
<td>8/17/09</td>
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<tr>
<td></td>
<td>Sulfate</td>
<td>mg/l (tot)</td>
<td>1300</td>
<td>161</td>
<td>230</td>
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<tr>
<td></td>
<td>Calcium</td>
<td>mg/l (diss)</td>
<td>412</td>
<td>64</td>
<td>102</td>
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<tr>
<td></td>
<td>Magnesium</td>
<td>mg/l (diss)</td>
<td>164</td>
<td>21</td>
<td>28</td>
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<td>Iron</td>
<td>mg/l (diss)</td>
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<td>0.2</td>
<td>&lt;.027</td>
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<tr>
<td></td>
<td>Manganese</td>
<td>mg/l (diss)</td>
<td>7.1</td>
<td>0.4</td>
<td>0.272</td>
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<td>Zinc</td>
<td>mg/l (diss)</td>
<td>11</td>
<td>0.1</td>
<td>0.054</td>
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<tr>
<td></td>
<td>Lead</td>
<td>mg/l (diss)</td>
<td>0.004</td>
<td>&lt;0.0001</td>
<td>.00008</td>
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<td></td>
<td>Nickel</td>
<td>mg/l (diss)</td>
<td>0.3</td>
<td>0.005</td>
<td>0.007</td>
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