Leona Heights Sulfur Mine Cleanup

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San Francisco Bay
Regional Water Quality Control Board
Leona Heights Sulfur Mine

SITE DESCRIPTION
Site Description

Oakland Hills
Site Description

pyrite mined

Mine Tailing Piles
Leona Creek runs through the site
Upper Tailings Pile

Discharge of solid mining waste
Lower Tailings Pile

Discharge of solid mining waste
Acid Mine Drainage

Sulfuric acid produced on contact of mining waste with water

8
Leona Creek
### Evidence of Ongoing Discharge: Acid Mine Drainage

#### Leona Creek

<table>
<thead>
<tr>
<th>Concentration Range (µg/L)</th>
<th>pH</th>
<th>As</th>
<th>Ni</th>
<th>Pb</th>
<th>Zn</th>
<th>Cd</th>
<th>Cu</th>
<th>Hg</th>
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<tbody>
<tr>
<td>DRY SEASON</td>
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<tr>
<td></td>
<td>5</td>
<td>4</td>
<td>7</td>
<td>&lt;2</td>
<td>2,400</td>
<td>7</td>
<td>5</td>
<td>&lt;0.2</td>
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<tr>
<td></td>
<td>1.5</td>
<td>1,800</td>
<td>230</td>
<td>110</td>
<td>14,500</td>
<td>57</td>
<td>34,000</td>
<td>27</td>
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<tr>
<td>WET SEASON</td>
<td></td>
<td>10xWQO*</td>
<td>100xWQO</td>
<td>10,000xWQO</td>
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* WQO = water quality objective to protect human and aquatic habitat health
Evidence of Ongoing Discharge: Tailings

November 2012

April 2013
Dry Season – Baseline AMD

Sulfur Tailings + Groundwater = AMD
Wet Season – Maximum AMD

Sulfur Tailings + Groundwater + Stormwater = Max AMD
Approved Remedial/Restoration Design: Isolate Tailings from Groundwater
Approved Remedial/Restoration Design: Isolate Tailings from Surface Water
Leona Heights Sulfur Mine

PERMITTING
Permitting

- **City of Oakland**
  - Mitigated Negative Declaration (CEQA)
  - Creek Protection Permit
  - Grading Permit
  - Tree Protection Permit
  - Temporary Traffic Control Plan
  - Erosion Control Plan
  - Construction Management Plan
  - Alternative Materials and Methods
    - Wet season construction

- **Alameda County**
  - Well Destruction Permit

- **Army Corps of Engineers**
  - Clean Water Act Section 404 (Nationwide Permit)

- **San Francisco Bay Water Board**
  - Remedial Design/Construction Plan Approval
  - Monitoring and Maintenance Plan
  - 401 Water Quality Certification
  - Storm Water Pollution Prevention Plan

- **California Department of Fish and Wildlife**
  - Streambed Alteration Agreement
  - Incidental Take Permit (Alameda Whipsnake)
Permitting

City of Oakland saves ~ 85 Oak Trees

Image courtesy of E2C Remediation

Original design footprint
Revised design footprint
Leona Heights Sulfur Mine

REMEDY & RESTORATION
DESIGN AND CONSTRUCTION
Grading of tailings, preparation for slope and cap
Slope reinforcement (Geogrid) layer installation

Images courtesy of E2C Remediation
Slope construction and liner installation, terraces for stability
Next terrace constructed, topsoil over exposed liner

Images courtesy of E2C Remediation
Restoration Design Construction

Creek reconstruction, armoring rock placement

Images courtesy of E2C Remediation
Creek step-pools sedimenting in
Slopes hydroseeded with natives
Images courtesy of E2C Remediation
Leona Heights Sulfur Mine

PROJECT STATUS
It’s Done! - Upper Pile

Pre-Construction  

Post-Construction

Images courtesy of E2C Remediation
It’s Done! - Lower Pile

Pre-Construction

Post-Construction

Images courtesy of E2C Remediation
It’s Done! - McDonell View

Pre-Construction

Post-Construction

Images courtesy of E2C Remediation
Leona Heights Sulfur Mine

NEXT STEPS
What comes next...

- **Deed Restriction**
  - Due 180 Days after construction completion (completed 9/15)

- **Monitoring and Maintenance** (in progress w/ permitting agencies)
  - Post construction finishing touches
  - Slope stability
  - Creek stability
  - Native vegetation
  - Post earthquake inspections
  - Post large rain event inspections
  - Water quality improvement
It took a village...

- City of Oakland – Darin Ranelletti, Rebecca Tuden, Ed Manasse, Bill Quesada, Dave Mog, & Lesley Estes, David Harlan...
- CDFW – Marcia Grefsrud, Annee Ferranti, & Craig Weightman
- USACE – Greg Brown
- Project Design Team: E2C Remediation (especially Phil Goalwin and Aiguo Xu), Environmental, Olberding Environmental, LSA Associates