AMD Treatment
Cambria District Mining Operations

Mining and Reclamation Advisory Board
Meeting of April 25, 2016
“Engineered Wetlands”
to Filter Iron and Manganese
The Pump well produces 775 gpm that flows through a passive treatment system comprised of twelve pond units. Originally lime was applied to treat the high iron levels. Currently, No chemical treatment is used.

The treatment process consists of oxidizing the 40 mg/l iron and then settling the iron precipitate. In addition, two treatment units oxidize the 10 mg/l manganese in both the wetland and in the Mn-bed.

The 1.5 acre “Engineered Wetland” is key to settling the “residual” iron and to oxidizing the manganese. The Mn-bed polishes the remaining manganese. These two additional treatment units were constructed with an OSM grant of $312,905.

The major operating cost is the electric bill of $56,000/yr. and the labor bill of $12,000/yr.
A Borehole was drilled into old mine workings and the mine pool dewatered in order to prevent a discharge near the Fl-93 Impact site.
Key Components of Passive Treatment System

**Flight - 93**

*Pump Well Passive Treatment System*

- **Final Outlet**
- **Engineered Wetland**
- **Settling Basins**
- **Venturi**

*Google Earth Image*
Deep mine water contains 40 mg/l

Flow 775 GPM
pH 6.8
Alk 230 mg/l
FE 40 mg/l
Mn 10 mg/l
Four venturis add oxygen to the “reduced” well water in order to oxidize the ferrous iron Fe2+.
Large Settling Basins

Aeration ditch-line flows down to the series of large settling ponds with curtains
Engineered Wetland treats the residual iron and manganese
Forebay, outbay, and level lip spreaders: spread the 775 gpm flow across 1.5 acre wetland
Problems with Construction

Large width with a low edge allowed water to accumulate

Deeper water retarded vegetation growth in wetland
Dye is added to the wetland inlet

**Final Results**: surprisingly good flow distribution across wetland due to the series of four level-lip rock spreaders
Performance of Engineered Wetland

<table>
<thead>
<tr>
<th>INLET</th>
<th>OUTLET</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow</td>
<td>775 gpm</td>
</tr>
<tr>
<td>pH</td>
<td>8.0</td>
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<tr>
<td>Alk</td>
<td>170 mg/l</td>
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<tr>
<td>FE</td>
<td>1.7 mg/l</td>
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<tr>
<td>Mn</td>
<td>6.2 mg/l</td>
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</tbody>
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FE 76% removal  
Mn 77% removal

In the past winters, the final outfall climbed up to 6 mg/l of iron due to poor cold weather settling.

After wetland installation the highest reading at the final outfall was 0.7 mg/l.
Treats the residual manganese at end of system

Series of trenches to spread out flow
Both iron and manganese are treated fully
Color change through the system due to oxidation and settling of iron