DEP Growing Greener Grant
Lucerne 3A AMD Treatment System Construction Project
Document # 4100040061
Final Report

1) Description of the Project
   a) **What was the project suppose to accomplish?**
   To increase the pH and precipitate out the iron and aluminum found in the Lucerne #3A mine discharge.
   b) **What you did and how does it differ from the plan?**
   The high dissolved oxygen levels, metals and low pH required us to actively treat the discharge using hydrated lime, followed by a settling pond for the precipitated metals. The addition of lime was accomplished utilizing pivoting buckets driven by the mine water. As the buckets pivoted, paddles were activated that pushed the lime through adjustable gates into the raw mine water. The mine pool had to be raised to get the required head to drive the buckets. This was accomplished by adding a stand pipe to the mine discharge outlet. The system did not differ from our proposed designs.
   c) **What were your successes and reasons for your success?**
   The system effectively treated the mine discharge as evidenced in the after treatment discharge that averaged a pH of 6.3, elimination of acidity and a reduction in metals content.
   d) **What problems were encountered and how did you deal with them?**
   Treating with hydrated lime produced larger quantities of metal sludges than designed for, which resulted in our settling ponds filling up and the system discharging metal precipitates. Hauling the sludges to a landfill was not an option due to the high percentage of water. We solved the sludge disposal problem by injecting the material into an abandoned down dip mine complex adjacent to our treatment system. This involved excavating into the coal outcrop then horizontally drilling through the coal seam until we intercepted the mine entry below the mine seal. A 4" pvc pipe was then inserted and cement grouted. A three inch trash pump and a moveable ten foot pvc suction line was then employed to remove sludge from the settling ponds and inject it into the mine via the 4" pipe. The size of the settling ponds made pumping the sludges easy. However their shape, long and narrow, resulted in water flow speeds that prevented the metal sludges from settling. When flow rates exceed 100 gpm we would see metal precipitate carry over at the system outlet even when sludge levels were low.
   e) **How your work contributed to the solution of the original problem**
   We are effectively removing the metals and raising the pH to levels suitable for aquatic organisms during critical low flow periods.
   f) **What else needs to be done?**
   Twice yearly sludge removal is required for the settling ponds to work effectively. Increasing pond capacity would reduce speed through the system and may settle out more metals during higher flows.

g) **Plans for disseminating results of your work.**
The area has been turned into a county park. Informational kiosks have been installed explaining how ground water becomes polluted from mining and how our treatment system operates to remove metals and raise pH.

h) **How well did your spending align with your budget request.**
Construct of the settling ponds and silo pad came under cost projections. This was fortunate considering we had other expenses (horizontal drilling, pipe grouting and purchase of trash pumps) in dealing with the large amount of sludges produced.

2) **Summary**
Discharge from the Lucerne #3 mine began in the 1940's contributing 17 tons of metals into Two Lick Creek each year. The mine is still discharging today but the majority of the metals are now removed thanks to an innovative system that uses water power to add hydrated lime to neutralize the acidity and settling ponds to capture the metal solids.

3) Accomplishment worksheets attached.
4) Photo report attached.
5) Detailed technical report NA.
6) Operation, maintenance and replacement plans attached.

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Lime Dosing Silo
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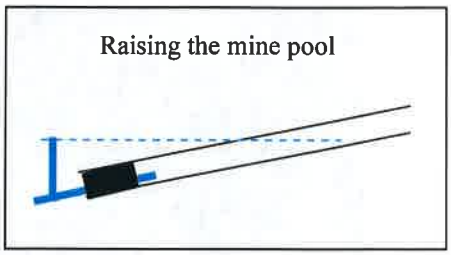
The bucket dosing system required a water drop of two feet for the unit to operate. The Lucerne #3A mine discharge originated from an up dip mine complex with a ten inch drain at the base of the mine seal. A "T" with a 30 inch riser and valve were installed. The riser permitted us to raise the mine pool while the valve provided the means to drain the mine pool if needed.



Maudie Excavating was contracted to do site excavation work and silo pad construction. The 12' x 12' x 4' thick silo pad designs were provided by Lime Doser Consultants who was also contracted to furnish and place the doser system.

One foot square metal plates were anchored into the concrete. The silo legs will be welded to these plates to secure the unit. Mine flow is diverted around the worksite.

A trapezoid channel with an eight foot depth, 25 foot top width and a length of 150' served as the settling basin for precipitated metals

A fifty-ton crane was used to place the silo. Adequate room is needed for silo delivery and placement.

The base of the silo was enclosed to protect the doser from rain. Rain water contacting the hydrated lime causes the lime to cake, rendering the dosing system inoperable.

Concrete lined channels convey the water to and from the dosing system. Rocks were anchored into the effluent channel to assist in mixing the hydrated lime. The site lacked adequate fall between the doser and settling basin to promote mixing.

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Metal precipitates and lime solids filled the basin much quicker than anticipated. After exploring different options it was concluded that the most cost effective way to remove solids was to pump the solids into the adjacent down dip mine complex. After reviewing mine maps it was decided that a horizontal borehole into the mine entry down slope of the mine seal was the best option.

We had to excavate eight feet to expose the coal out crop.

Winters Contracting then bored through the coal until they intercepted the mine entry.

Four inch schedule 40 pipe was inserted into the bore and grouted with concrete.

The suction line would effectively remove sludges form a twenty foot radius. The trash pump was capable of removing leaves that had blown into the pond.

The accumulated sludges had the consistency of gravy and were flow able.

After backfilling . The sealed pipe easily accommodates the discharge from our three inch trash pump.

A subsequent DCNR grant helped us turn this area into a county park where mining history, our remediation efforts, wetland importance, and the recreational opportunities of Two Lick Creek are promoted.