



**CONIFER DISCHARGE TREATMENT SYSTEM
GROWING GREENER GRANT
Project Number KD060298**

**FINAL REPORT
November 28, 2011**

The original Conifer treatment system was built in the summer of 1998 and comprised of an Anoxic Limestone Drain (ALD) (~4,000 ton of limestone) followed by an oxidation pond and aerobic wetland. The water chemistry changed in 1999 and the ferric iron and aluminum in the discharge led to premature plugging of the ALD. In fall of 2003, a small amount of limestone was removed and replaced with ~30 hay bales. The system continued to have problems and another rehabilitation effort developed in the spring of 2003. Approximately half of the limestone in the ALD was removed and replaced with a compost bed. The compost bed was installed in an attempt to lower the redox state of the water to prevent iron from oxidizing and clogging the system. Still, the system was providing very little or no treatment.

Funding from this Growing Greener Grant was used to construct a Fealmn bed treatment system. This treatment system was designed to precipitate and contain iron (Fe), aluminum (Al), and manganese (Mn) solids in a manner that would allow for periodic monitoring and maintenance of the treatment system. The bed is designed to progressively clog with precipitate and will require periodic agitation by an excavator to unclog the bed and restore permeability. This treatment system combines the advantages of ALDs (long flow path) and vertical flow ponds (VFPs) (large surface area, build up of head) into a single treatment system.

The treatment system is 85' wide by 250' long is graded so the limestone thickness becomes progressively thicker from the front (3' thick) to the end of the bed (5.5' thick) and contains 5,750 Tons of AASHTO #1 Limestone with a CaCO_3 content of >85%. Water is fed to the Fealmn treatment system via an existing 15" SDR 35 PVC pipe that travels 525' from the sealed mine entrance. Approximately 100' before the piping reached the treatment system two valves and a tee were installed in the event the piping needs to be flushed or pressure needs to be relieved on the mine. A 15" SDR 35 PVC pipe set at a -0.55% slope carries the discharge the remaining 100' to a manifold pipe that distributes the discharge evenly. The manifold pipe is a 12" SCH 40 PVC pipe with 10 - 1" diameter holes spaced evenly across the 85' wide treatment system. The manifold pipe sits on an elevated stone bed that is 0.5' higher than the stone located at the end of the treatment system so that no standing water will reach the manifold pipe.

The Fealmn bed outlet elevation is 0.5' lower than the lowest stone elevation so that the water is held below the top of the limestone. Thus, water is always in contact with limestone and in most cases the water must flow both vertically and horizontally through hundreds of feet of limestone before exiting the system. Secondly, the sloped surface provides a larger surface area to plug than either a VFP or ALD and, therefore, should prolong maintenance. Lastly, the sloped

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surface forces mine drainage to progressively plug sections of bed, from inflow to outflow, before water flows through unclogged sections of bed. When standing water is observed on $\frac{3}{4}$ of the treatment system, a surface maintenance event should be scheduled. Maintenance requires a mid-sized excavator to scoop and dump the stone allowing the precipitated minerals to slough from the stone. Once the stone is free from the accumulated material treatment is restored. Maintenance events were expected to be needed annually.

With the treatment system operating approximately 1 year it appeared, through visual inspections, maintenance events would be needed every 6-8 months. With the original cost of the project coming in under budget it was decided to use the available funds to augment the efficiency of the project so that maintenance events will not be needed as frequently.

Changes to the treatment system include the installation of a water control structure, valve, rock waterway outlet, subsurface piping and an additional 1.5' of rock added to the treatment system surface. A 12" SDR 35 PVC pipe was installed at a 2% slope on the treatment system floor at the exit of the treatment system; this piping penetrates the embankment and travels to a valve and water control structure. The valve and water level control structure gives the ability to shut off flow through this piping and control the water level in the treatment system thus controlling the discharge's contact time with the limestone.

With these additions there is the ability to flood and flush the treatment system frequently to loosen precipitates thus reducing maintenance costs dramatically. An excavator will still be needed periodically to agitate the stone, but on longer intervals.

The Fealmn bed is being monitored at the manifold, prior to the bed, and at the outfall to measure the pollution reduction from the Conifer discharge. System performance, represented in the table below, indicates the bed is neutralizing acidity, removing metals, and increasing alkalinity in the effluent to Beaver Run. Consistent neutralization of the discharge and removal of metal loading, will aide in the reestablishment of biological communities and in Beaver Run attaining the goals established in its TMDL.

<u>Chemical Analysis Report</u> November 29, 2011		
<u>Parameters</u>	<u>Manifold</u>	<u>Outflow</u>
TSS	15	3
TDS	722	822
Calcium	87.8	170
Iron	19.8	0.70
Manganese	1.50	0.997
Aluminum	6.52	0.515
Sulfate	702	538
pH (Lab)	3.35	6.86
Alkalinity	< 1	141
Acidity	92	< 1

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Limestone Bed



Outflow to Beaver Run



Secondary treatment pond

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FINANCIAL STATEMENT

Income:

Grant Funds \$ 300,000.00

In-Kind Match:

Salaries/Benefits \$ 10,603.50

Travel 1,278.00

Administration 3,043.45

Construction 70,531.70

Other 202.50

Total In-Kind Match \$ 85,659.15

Total Income \$ 385,659.15

Expenditures:

Salaries/Benefits \$ 10,603.50

Travel 1,278.00

Administration 3,043.45

Construction:

Treatment System Construction \$ 325,531.70

**Long-Term Maintenance 45,000.00

Total Construction 370,531.70

Other (Copies of Bid Pkgs.) 202.50

Total Expenditures \$ 385,659.15

**The Jefferson County Conservation District has contracted with the Redbank Creek Watershed Trust in the amount of \$45,000. This money has been put into escrow by the District to be used to provide administrative and technical services to insure routine maintenance of the treatment system.