



A Profile in Using Green Remediation Strategies

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De Sale Restoration Area
Slippery Rock Watershed, PA

PA Voluntary Cleanup

Cleanup Objectives: Treat acid mine drainage (AMD) from abandoned surface and underground coal mines in western Pennsylvania

Green Remediation Strategy: Employ a sequential series of natural gradient-driven engineering steps involving settling ponds, vertical-flow ponds, and constructed wetlands to passively treat AMD

- Uses a 16- by 3-foot instream dam to collect contaminated stream water
- Diverts collected water to an 80,000-square-foot forebay to settle solids and debris
- Passes the partially settled water into parallel, flushable vertical-flow ponds constructed of limestone and spent mushroom compost to neutralize acidity, raise pH, and remove metals
- Transfers water next to a horizontal 0.2-acre, 5-foot-deep pond for additional settling
- Passes settled water to a 1.5-acre free-flowing, aerobic constructed wetland for precipitation of amorphous iron hydroxides
- Transfers the wetland water to a horizontal-flow limestone bed to remove and recover manganese and provide additional alkalinity
- Returns treated water to a rock-lined channel emptying into the watercourse approximately 1,000 feet downgradient of the intake point

Results:

- Uses natural intrinsic energy for operation of the multi-step treatment process
- Avoids air emissions associated with consumption of grid electricity during water treatment
- Uses passive-energy biological processes for treatment "finishing steps"
- Returns treated water to its natural hydraulic course
- Obtained limestone aggregate from a quarry three miles away, at a material and delivery cost of \$12 per ton
- Obtained spent mushroom compost from an agricultural producer 12 miles away, at a material and delivery cost of \$10 per cubic yard
- Completed construction of the treatment system within six weeks, with help from local volunteers, academic students, and mining companies and coordination by the (non-profit) Slippery Rock Watershed Coalition
- Neutralizes approximately 180 pounds of acid discharge each day
- Achieves 100% neutralization of the acid discharge and 99%, 99%, and 70% reductions of iron, aluminum, and manganese concentrations, respectively, as compared to intake levels
- Recovered 30 tons of material (containing approximately 25% manganese oxide) over eight years of operation
- Derives funds for future AMD treatment systems through sale of recovered manganese and iron oxides to artists or manufacturers specializing in green products

Property End Use: Natural resource conservation area under state programs

Point of Contact: [Scott Roberts](#), PA Department of Environmental Protection



Prior to treatment beginning in 2000, AMD contributed 42% of the acid load and 49% and 41% of the iron and aluminum loadings, respectively, into Slippery Rock Creek. Cleanup efforts focused on a tributary passing through a former 100-acre surface mining property.



Native plants in the De Sale Restoration Area wetlands include broad-leaved cattails, soft rush, and tussock sedge.

De Sale Restoration Area

http://www.cluin.org/greenremediation/profiles/subtab_d20.cfm



**United States Environmental Protection Agency
Office of Solid Waste and Emergency Response (5202P)**

For more information:
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