Buckeye Furnace Reclamation Project

Project Number JK-M1-18
Wellston, Ohio

Ohio Department of Natural Resources
Division of Mineral Resources Management
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Project Start Date: July 9, 1998
Project Substantial Completion Date: October 14, 1999
Project Cost: $1,090,530.79

Design Agent: BBCM Engineering, Inc.
Dublin, Ohio

Construction Contractor: Earth Tech, Inc.
Wilder, Kentucky

Submitted: March 6, 2001

(* insert BF1 photo)

INTRODUCTION

The Ohio Division of Mineral Resources Management, Abandoned Mine Land Program, completed restoration of the Buckeye Furnace Reclamation Project in October of 1999. The project is located in Milton Township, Jackson County near Wellston, Ohio. This 65 acre site, composed of coal refuse, underground mine discharges and mine seeps, offered numerous environmental and public health and safety challenges. Utilizing standard, as well as state of the art design and construction methods and materials, the Ohio AML Program achieved significant measurable success in accomplishing the goals. The project is named for a nearby historically restored iron furnace. **(Photo 6)**

HISTORY/ BACKGROUND

Deep mining in the early 1900's initially impacted the Buckeye Furnace project area. Numerous small mines operated in the Brookville #4 seam, which resulted in the perpetual discharge of acid mine drainage to Buffer Run, a tributary of Little Raccoon Creek. The surface area of the project site was significantly disturbed in the early 1970's as a result of strip mining and the operation of a modern deep mine and associated wash plant facility.

Coarse coal refuse was used to create holding cells for wash plant slurry in the pre-law spoil area. The failure of these cells led to massive downstream sedimentation and frequent consequential flooding of public roads, including Jackson County Road 58 and Milton Township Road 167. In addition, pyrite-rich refuse and the numerous underground mine discharges added 3732 pounds of acid, 789 pounds of iron and 273 pounds of aluminum per day to Buffer Run. This site was identified as one of the four worst sources of acid mine drainage in the Little Raccoon Creek watershed.

DESIGN GOALS AND CONSTRUCTION TECHNIQUES

BBC&M Engineering, Inc. of Columbus, Ohio, prepared the design plans with the following goals in mind:

- Reduce water infiltration into the coal refuse to minimize new AMD (acid mine drainage) production.
- To intercept and convey existing AMD to passive treatment systems prior to discharge from site.
- To minimize erosion from site and reduce sedimentation in receiving stream. to reduce flooding frequency of Buffer Run.

The Consultant design projected a 75% reduction in acid production and established a flood return interval of 10 years for Buffer Run.

The lowest and most responsible bid was received from Earth Tech, Inc. of Wilder, Kentucky in the amount of $887,341.61. Construction commenced July 9, 1998 and was substantially completed October 14, 1999 at a cost of $1,090,530.79. Ten percent of construction funds ($116,148.00) were from the Appalachian Clean Stream Initiative (ACSI), and were used in the development of the Successive Alkaline Producing System (SAP) and Alkaline Recharge System (ARS). **(Photo 2)**

Description of Reclamation Activity

- Reshaping the coal refuse for positive drainage (230,000 c.y.). The cut and fill plan was a critical component to project success in that the coal refuse fine beds needed to be protected from structural failure during construction. Three up-gradient ponds created when coal refuse blocked upstream drainage facilitated the infiltration of ground water into the refuse pile, accelerating acid mine drainage formation. These ponds were removed during construction. Two stormwater control impoundments were created to account for increases in runoff due to reclamation and to contain metals precipitants from the ARS.

- The subsequent placement of a compacted soil cap (115,000 c.y.) with clay material from three offsite borrow areas insured minimal infiltration of rainfall and runoff after reclamation.

- Paper pulp sludge (trade name BYPRO) from the Mead Corporation in Chillicothe, Ohio was placed at a rate of 100 dry tons per acre for revegetation (16,000 wet tons) of the reclaimed areas. This material, consisting of waste wood fiber and clay creates a superior environment for the establishment of vegetation. No lime, fertilizer or mulch is needed or used when applying this paper pulp sludge as a beneficial reuse of a waste product.

- Construction of drainage controls, included 4,000 tons of limestone rock channel protection structures, contributes alkalinity to Buffer Run.

- Construction of a flushable anoxic limestone drain (ALD) and a successive alkaline producing system (SAPS) to treat deep mine drainage.

During construction, a permit to install (PTI) for addition of 1750 tons of steel slag (calcium silicate) was approved by the Ohio EPA. This strongly alkaline material was placed in Ohio's first application of an alkaline recharge system (ARS) in

ponds designed with the help of researchers at the National Mined Land Reclamation Center (NMLRC) at West Virginia University. The purpose of the ARS was to add additional alkalinity to Buffer Run not accomplished by the source control reclamation. A pH of over 11 and alkalinity over 1400 mg/L has been recorded downstream of the ARS. Downstream mixing of the treated water with groundwater emanating from the toe of the reclaimed refuse yields water with a pH 5.5 and acidity averaging 50 mg/L. The combined waters subsequently enter storm water pond 002. Numerous underground mine seeps were discharging into an existing road ditch. This drainage was directed into a SAPS designed by the consulting firm Damriscotta of Clarion, Pennsylvania. The average acidity entering system is 176 mg/l. The average alkalinity leaving the system is 124 mg/l.

Project Effectiveness

Since construction was completed sampling shows that the average daily acid loading has dropped by 82% to 661 lbs./day. Iron dropped 75%, an average of 194 lbs./day, while aluminum has dropped 83% to 46 lbs./day. Post reclamation sampling, while routinely done on a project of this sort, has been required by OEPA to monitor the effects of the use of steel slag. Limits for heavy metals have not been exceeded in the ARS to date.

Flooding on the local road system has been significantly reduced to a 10-year interval. **(Photo 4 and Photo 5 in sequence)**

The project also utilized materials traditionally considered waste by-products to improve water quality, to lessen soil borrow area and to sustain the long-term viability of the vegetation. These materials included 1750 tons of steel slag and 16,000 dry tons of paper pulp sludge.

OTHER CONSIDERATIONS

Little Raccoon Creek is the subject of a watershed restoration effort by a citizens watershed group, the Raccoon Creek Improvement Committee (RCIC), the Division of Mineral Resources Management (DMRM) and various other agencies and private partners. Buckeye Furnace was identified by the RCIC as a primary source of acid mine drainage (AMD) to Little Raccoon Creek. Development of watershed management plans, guided by the Natural Resources Conservation Service (NRCS), local Soil and Water Conversation Districts (SWCD's) and Ohio University have identified and prioritized this and other project areas for reclamation in the near future. The goal of the group is to return the greatest amount of Little Raccoon Creek and it's receiving stream, Raccoon Creek to warm water habitat status for the economic and environmental health for the region's citizens. Funds for this work are being leveraged through several partners, including DMRM, the Ohio Environmental Protection Agency (OEPA) and OSMRE's Appalachian Clean Stream Initiative and others. **(Photo 3)**

The Buckeye Furnace reclamation Project was used as financial match by the RCIC to obtain an Ohio EPA #319 non-point source pollution abatement grant for other watershed restoration activities.

LONG TERM BENEFITS:

The Buckeye Furnace Reclamation Project's completion is an integral part of the RCIC and DMRM plans to reduce local flooding and AMD pollution of the Raccoon Creek watershed. Project expectations have been exceeded as acid loading has been reduced by 82%. Important demonstrations of new AMD abatement and reclamation technologies have been accomplished, including the use of steel slag, SAPS, ALD and capping and revegetation strategies.

Note: Photo1 should be considered for the "cover photo".