Kempton Refuse and AMD AML Project

Kempton, Tucker County, WV

■ **Submitted by:**

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■ **Project start date:** Aug. 13, 2007

■ **Project complete date:** Oct. 31, 2009

■ **Construction cost:** $2,357,159
Including $439,292 in Appalachian Clean Streams Initiative funding

■ **Responsible agency for reclamation:**
West Virginia Department of Environmental Protection
Office of Abandoned Mine Lands and Reclamation

■ **Contractor:** Cowgirl Up Inc.

■ **Design engineer:** Michael Baker Jr., Inc.

■ **Submitted on:** April 19, 2011

Introduction

The Kempton Refuse and AMD AML Project is located near the historic coal mining communities of Kempton, Maryland and Thomas, West Virginia. This site is situated just outside of Kempton and approximately four miles north of the town of Thomas, off U.S. Route 219. Proximity to state and national recreational and historic areas, as well as a continental watershed divide, made this project a prime candidate for addressing health, safety, and environmental reclamation. The project is located near the gateway to the Potomac Highlands Region of West Virginia. Nearby recreation areas include Blackwater Falls State Park, Canaan Valley Resort State Park, Dolly Sods Wilderness Area, and the Monongahela National Forest. The Fairfax Stone, less than one mile to the southeast, is a surveyor's marker and boundary stone. It marks the headspring of the North Branch Potomac River, which delineates the state boundary between Maryland and West Virginia as it meanders its way eastward, eventually flowing into the Potomac River and through the capital of the United States, Washington, D.C. The project area drains into the headwaters of this river.

Background/Site Description

Coal mining in the area surrounding the Kempton Refuse and AMD AML Project increased rapidly near the end of the 19th Century with the arrival of the railroad. During this period, coal went from providing heat to producing electricity and steel, ultimately feeding the demands of two world wars. As mining progressed into the 20th Century, industry techniques and laws began to change. Most of these new laws were concerned with the health and safety of the workers, and little concern was given to the environment. As a consequence, many local mining operators left areas un-reclaimed … leaving future generations a legacy of scarred landscapes with polluted land, air and water. Many areas were left in conditions that posed dangers to both properties and lives.

The mined area now referred to as the Kempton Refuse and AMD AML Project was one of those legacies. It consisted of approximately 60 acres of land that had been underground mined, and then surface mined at a later date. Davis Coal and Coke and other smaller companies underground mined the Upper Freeport Coal Seam from the 1880s through the 1950s. Additional coal was surface mined by Douglas Coal Company. Dangerous conditions left behind included two partially collapsed portals, approximately 2,500 feet of exposed highwall, and two small impoundments of approximately one-half acre and one-fourth acre.

Collapsed mine portal

Exposed high wall

Except for small portions of the disturbed area that nature reseeded over time, most of the project was barren or sparsely vegetated. Mine spoil, consisting of coal refuse and toxic shale associated with the coal seam, was scattered and piled across the site. The overburden was sandstone that ranged from inert (with no neutralizing potential) to acid-producing. Large boulders littered the landscape. This unconsolidated surface material contributed to water quality degradation of tributaries of the North Branch Potomac River headwaters which flow within the project drainage area. Surface runoff during precipitation events increased sediment and acid loads to the receiving streams. Numerous drainage seeps existed within the project boundaries. Some were from collapsed mine portals and some were from the mined-out stream channels flowing below the porous material.

Example of water quality degradation

Water quantity was also affected by the combination of the land surface and underground fracturing. Tributaries flowing through the project disappeared and appeared again at various locations. Due to a steep geologic syncline in this area, portions of the flow may have been lost to underground mine voids.

Reclamation goals and objectives

The primary reclamation goal for the Kempton Refuse and AMD AML Project was to address safety issues by eliminating dangerous conditions. Standard, proven methods were used to accomplish the primary safety goal. The secondary reclamation goal was achieved using innovative and effective technologies to improve environmental conditions. These included restoring and enhancing land use, stream quality, and stream habitat. The hazards that were removed, and extra attention given to reclaiming the landscape and restoring the streams, make this project exemplary.

Objectives for achieving the primary safety goal included:

- backfilling, regrading, and vegetating 2,500 linear feet of dangerous highwall
- installing wetseals in two partially collapsed mine portals
- removing two surface impoundments.

Objectives for achieving the secondary environmental goal included:

- reshaping the landscape, placing soil cover material, reseeding, and reforesting
- lining tributary streambeds within the project boundaries
- adding limestone to tributaries and implementing natural stream channel design techniques
- installing a passive water treatment system.

The following section describes the objectives; their importance; and the standard and innovative methods used to accomplish them.

Reclamation and Benefits

Backfilling, regrading, and vegetating 2,500 linear feet of dangerous highwall

Dangerous highwall varied in height from 25 to 75 feet throughout the project. The possibility of someone slipping from the top edge of the highwall or being struck by loose rocks falling from the face of the highwall posed an impending liability. Because the project area is leased for hunting by a club with several thousand members, foot travel and ATV use are heavy, increasing the probability of someone being hurt. Backfilling, regrading, and vegetating the highwall eliminated this danger by replacing a sheer face with a stable, sloped surface.

Installing wetseals in two partially collapsed mine portals

Mine portals, ranging in various states of collapse, are always a hazard as they tend to entice the curious to enter or get dangerously close. Wetseals were installed in both mine openings and the drainage piped and channeled to a passive water treatment system. The mine openings were then backfilled in conjunction with the surrounding highwall.

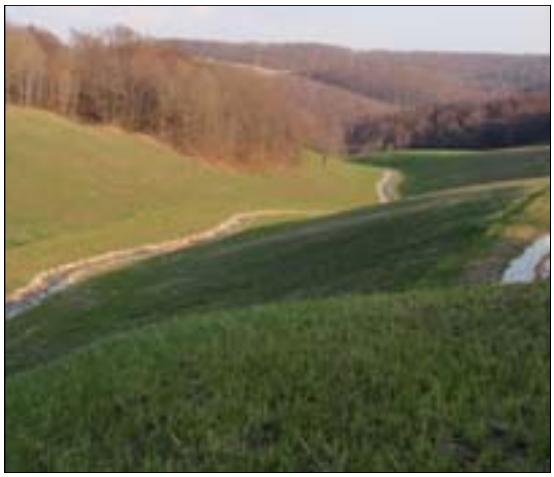
Removing two surface impoundments

Two surface impoundments on opposite ends of the project were easily accessible. An un-gated road passing through the project area within feet of both impoundments invited foot and vehicle traffic. The water level in one of the impoundments fluctuated between five and six feet, creating a safety hazard. The impoundments were drained and incorporated into the regraded area.

Surface impoundment

Reshaping the landscape, placing soil cover material, reseeding, reforesting

The uneven land surface, composed of piles of refuse and spoil, was regraded and capped with soil cover material from an on-site borrow area. Fifty acres of previously un-vegetated refuse and spoil is now vegetated with grasses and legumes to reduce soil loss and enhance wildlife. Trees were planted on three acres of the regraded area along streams within the project boundaries to create riparian zone buffer strips. Members of the Appalachian Regional Reforestation Initiative (ARRI) provided technical support to the West Virginia Department of Environmental Protection on the reforestation of a parcel using the Forestry Reclamation Approach. ARRI is a partnership among government agencies, universities, industry and citizen groups which promotes the reclamation of coal mined lands in Appalachia with hardwood forests. Five acres were reforested with a native upland hardwood and conifer mix. Trees reduce



Restoring the landscape

the negative effects of increased greenhouse gases produced by fossil fuels by sequestering carbon.

Close to 2,500 trees were planted

Tree planting

Tree selection was influenced by the ongoing effort to conserve and restore the red spruce ecosystem in the Potomac Highlands. Much of the red spruce habitat was replaced by hardwoods after extensive logging and fires in West Virginia. Remaining acreage, important for several rare, threatened and endangered species, is small and scattered. Concerned groups are collecting local seed cones, having the seeds grown by a commercial nursery, and selling the plugs for reforestation, primarily at elevations above 3,500 feet. In the spring of 2008 a five-acre area of this project was loosened to a depth of four feet by a large excavator. One thousand of these red spruce seedlings, as well as a mixture of Northern Red and White Oaks, Black Cherry, Sugar Maple, Black Locust, Eastern Red Bud, Dogwood and Black Walnut, totaling 2,500 trees, were planted.

The success rate was so significant that the contractor received the 2008 Excellence in Reforestation Award from AARI. The AARI Excellence in Reforestation Awards are presented each year to honor both active and abandoned coal mine reclamation operations from each state in the Appalachian Region that best exemplify the use of the Forestry Reclamation Approach in conducting reclamation operations. This award was presented to the contractor by Brad Edwards of the Federal Office of Surface Mining on July 16, 2009.

Contractor receives ARRI Excellence in Reforestation Award

Lining tributary streambeds within the project boundaries

Tributaries meandered through the project boundaries in disjointed fashion. Unconsolidated surface material allowed the stream to sink into the soils and rocks, and then resurface or infiltrate groundwater pools. This made measuring stream flows difficult. To correct the loss of flow from the stream channel, approximately one stream mile was relocated and contained within an impervious liner. A new substrate was created in the streambed by covering the liner with six inches of soil stabilized with filter fabric.

Adding limestone to tributaries and implementing natural stream channel design techniques

Stream channel design reduced acidities by one-third

As the tributaries were relocated and basic substrate established, natural stream channel design techniques were incorporated to establish sinuosity, stabilize stream banks, develop habitat, and improve water quality. Native inert sandstone was placed along the stream banks for stabilization. A mix of the sandstone and limestone was placed in the stream channel along with log cross vanes to direct flow; create step pools, riffles, runs, and glides and increase alkalinity. A one-time post construction water sampling showed the alkalinity increased slightly in the relocated tributaries when comparing upstream to downstream locations within each tributary. When compared to pre-existing conditions, the acidities were reduced by one-third.

Installing a passive water treatment system

Passive system is successfully treating mine drainage

All drainage leaving the project prior to reclamation was acidic with that originating from the two mine portals being the worst. Drainage from the portal with the largest flow was also of the poorest quality with a pH value less than three. The average acid concentration was 286 mg/l. In addition, aluminum at this source was as concentrated as 23 mg/l at times. A passive treatment system was designed and installed to treat the combined drainage of the two portals. This system consists of a series of cells intended to treat the drainage in phases. The drainage is first captured in an "equalization pond" to settle solids before flowing from top to bottom through an alkaline producing cell containing a layer of mushroom compost over a limestone bed. The drainage is then collected by perforated pipes in the limestone substrate and channeled through an aerobic wetland. Quarterly sampling indicates the system is successfully treating the mine drainage. Not only is all of the acid neutralized, but the system continues to discharge an effluent exceeding 50 mg/L alkalinity. It successfully treats mine drainage ranging in pH from 2.8-3.4 to a pH ranging from 6.5 to 7.4. In addition, aluminum and iron concentrations are nearly zero. Appalachian Clean Streams Initiative funding of $439,292 was used to help pay for the construction of the passive water treatment system.

Construction difficulties

Geology, hydrology, and geography created several difficulties during construction on the Kempton Refuse and AMD AML Project. This project used standard earthmoving techniques utilizing heavy equipment to regrade nearly 400,000 cubic yards of mine spoil to a more desirable and stable configuration. The design required that most of the mine spoil be moved to an uphill location, and very large boulders existed throughout the excavated areas. These rocks were so prolific that many required a large tracked excavator to assist two large bulldozers in moving them. The contractor used a hydraulic hammer on an excavator to break up hundreds of these huge boulders into smaller pieces that could be used in step pool construction during stream restoration work. Multiple seeps were encountered that were not anticipated. Plans had to be adjusted to collect and channel this additional drainage into surface channels and designed treatment systems. Over 3,000 feet of underdrain was installed to prevent saturation and slippage of soils.

In addition, the project, possibly one of the highest Abandoned Mine Lands reclamation projects in the East, is located on Backbone Mountain with elevations over 3,000 feet above sea level. Harsh weather conditions related to the location hindered construction progress. The project started late in the year, with two very wet winter, spring and early summer seasons limiting ground work.

Summary

Pre-reclamation conditions of the Kempton Refuse and AMD AML Project were wide-ranging. They included safety features such as dangerous highwall, portals, and impoundments; and environmental features such as spoil, refuse, acid mine drainage, and stream flow loss. In addition to eliminating safety issues, reclamation reduced damage to the environment. Emphasis was placed on landscaping the land and water to complement the natural environment by incorporating natural stream channel design techniques and innovative tree planting methods. With the effective use of on-site materials, land reclamation:

- reduced erosion, sedimentation, infiltration, and contact time of surface water with toxic overburden and refuse
- improved wildlife habitat
- increased carbon sequestration.

Stream restoration and water treatment:

- decreased water loss and soil transport
- improved water quality
- restored aquatic habitat.

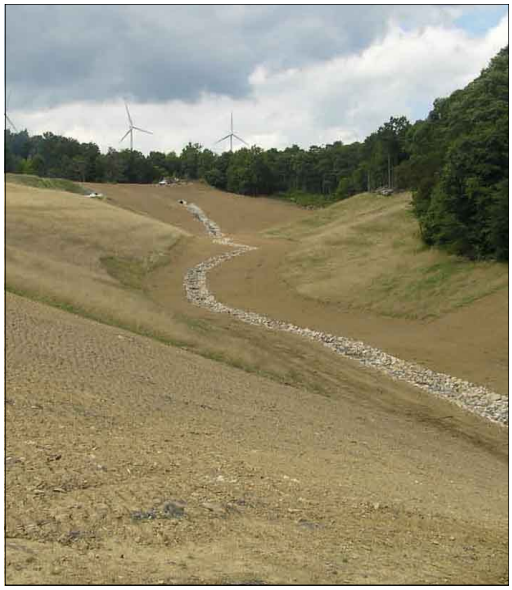
Exemplary reclamation of the Kempton Refuse and AMD AML Project was rewarded with two awards: 2009 West Virginia Mining Association Northern Reclamation Award for Outstanding AML Reclamation and Appalachian Regional Reforestation Initiative 2008 Excellence in Reforestation Award. The latter was achieved through partnerships with:

- members of ARRI who provided technical support and,
- the collaboration of seed collectors and commercial nurseries who provided seedlings to restore the ecosystem with endangered species.

Reclamation of this project was influenced by the livelihood of nearby communities which depend heavily on tourism and recreation within the surrounding area. Emphasis was placed on giving back to the land, air, and water what the legacy of past coal mining of a fossil fuel had taken away.

Stream restoration

Installation of relocated
impervious lined channel



Passive water treatment

System designed and installed to treat combined acid mine drainage from two mine portals