BLACK CREEK WATERSHED RESTORATION PROJECT

WISE COUNTY, VIRGINIA

Roger L. Williams
Virginia Department of Mines, Minerals and Energy
Division of Mined Land Reclamation
Post Office Drawer 900
Big Stone Gap, Virginia 24219
276-523-8208
roger.williams@dmme.virginia.gov

Project start: October, 2000
Project completion: June, 2001
Construction costs: $577,115

Contractor:
J. & J. Contractors, Inc.

Engineer/Consultant:
D.R. Allen & Associates, Inc.

MARCH 17, 2005

The Black Creek Watershed Restoration Project is located approximately 2.5 miles northwest of the city of Norton in Wise County, Virginia. The Black Creek watershed consists of 2,300 acres located in the upstream reaches of the Powell River basin. The total Black Creek Watershed Project is approximately 15 acres, including roads and borrow/disposal areas.

Past coal mining in the Black Creek Watershed has impacted the watershed by the formation of acid mine drainage (AMD). The AMD was generated from discharges from abandoned underground and surface coal mined lands. Past mining practices, watershed topography, and stream gradient created an extensive wetland system in the valley floor in and around Black Creek. The natural wetlands had been in place for many years and had contributed to AMD impact mitigation. However, in recent years the wetlands had been increasingly inefficient in mitigation due to the heavy metal accumulations trapped in the wetland sediments. Metal-laden sediments were being transported out of the Black Creek watershed into the Powell River during rainfall events. Past and current research indicates that AMD pollutants had not only severely impacted Black Creek, but also potentially encumbered the biota of the upper Powell River.

The Powell River is the home of several threatened and endangered species of freshwater mussels and host fishes, which are adversely impacted by AMD. The Powell River system is the home of some 30 species of fish and mussels deemed to be at risk and some 13 species with U.S. Endangered Species Act status according to The Nature Conservancy.

The goal of the Black Creek Watershed Restoration Project was to lessen downstream impacts from storm runoff. Construction of two wetland control outlet structures located below each of two major wetland areas allowed the structures to control surge flows through the wetlands, by controlling water levels and providing significant water storage capacity.

Research by Dr. Donald S. Cherry and others from VPI and SU (Virginia Tech) reported in the "Environmental Impact and Reconnaissance of Abandoned Mined Land Seeps in the Black Creek Watershed, Wise Co., VA August 1996" documents the impacts in the Black Creek watershed. This study concluded AML seeps/discharges had an ecologically significant and hazardous effect upon Black Creek and it's wetland areas. Pollutants had devastated the physical, chemical, and biological constituents of the stream and may have encumbered the biota in the upper Powell River watershed (Cherry et al, 1996).

Analysis of AML underground mine seeps/discharge reported in the Virginia Tech study (Cherry et al, 1996) indicated pH ranges from 2.8 to 6.9 with iron ranges of from 0.1 mg/l to 22.9 mg/l, manganese ranging from <0.1 to 5.7 mg/l and aluminum of 0.5 to 31.90 mg/l.

Sediment sample analyses taken in the streambed and the wetlands indicated iron, manganese and aluminum levels of many thousands of mg/kg. Dangerously high levels of copper and zinc, known to be toxic to the biota, were also found in the sediment analyses.

Using the U.S. EPA Rapid Bioassessment Protocol for habitat assessment, nine sites in the wetland ecosystem were also sampled. Results of the sampling indicated severely (total absence), to moderately impaired benthic communities within the Black Creek watershed. Sediment toxicity testing in a laboratory using Daphnia magna and Chironomous tentans also revealed significant reproductive growth or impairments in these test organisms. The tests indicated a growing concern of metal loading from AML seeps and contaminated wetlands that were transported downstream to the Powell River at ecologically significant and hazardous levels to freshwater mussels and other biota. (Cherry et al, 1996)

Black Creek was included on Virginia's 303(d) list of impaired waters because the stream quality failed to meet the state's standard for aquatic life. Benthic macro-invertebrate surveys performed by the state's Department of Environmental Quality (DEQ) supported the Cherry study conclusions that the stream did not have a healthy aquatic community and was severely impaired. Black Creek was added to the 303(d) listing in 1998. The source of the impairment was identified as AMD from abandoned mines in the watershed.

In 1998, the Virginia Department of Mines, Minerals and Energy, Division of Mined Land Reclamation (DMME) through its Abandoned Mine Land Section began to pursue AMD mitigation alternatives to address the problems existing in Black Creek. In March 1998, the DMME selected D.R. Allen & Associates of Abingdon, Va. to study and design mitigation plans for the Black Creek Watershed Restoration Project.

There are three (3) landowners in the 2,300-acre Black Creek watershed. Red River Coal Company is the predominate landowner and was conducting a large (2,000 acres) surface coal mining operation in the upper and lower reaches of the watershed. All of the approximately 15 acres of wetland areas targeted for our project were owned by Red River Coal Company. Access and haulroads through the project area were to be affected by the construction. One road was temporarily closed and another roadway was constructed to allow mining operations to continue and reduce any interference with the proposed project construction. State Route 618 heading into the Black Creek area was also raised approximately six feet above the normal pool elevation for a distance of 400 feet adjacent to the wetland headwaters.

In September 2000, the Black Creek Watershed Restoration Project was released for bidding. The low bid was received from J & J Contractors, Inc. in the amount of $482,189.41. Construction was started in October 2000. One gas transmission line and one electric utility line were relocated. State Route 618 was raised, and re-constructed in order to facilitate the project work.

The restoration plan proposed to construct two outlet flow control structures to store a substantial portion of run-off from large precipitation events, in order to reduce the velocity of the water flowing through wetlands, reducing and/or eliminating the scouring of the metal laden sediments during peak storm periods. Borrow areas for clay type soils were identified and used for construction of the structures embankments. A drop log structure was proposed for the lowest downstream structure to control the watershed flow below the lower wetland. Another outlet control structure was constructed along the coal haulroad at the mouth of the upper wetland and at the headwaters of the lower wetland. Two 48" bituminous coated corrugated metal pipes were installed through the upper structure at an elevation to maintain wetland levels and flows compatible with the system.

During construction an abandoned gas well was encountered. A design modification was required to properly vent the well in the location of the embankment.

Adjacent to the upper outlet control structure, State Route 618 was raised out of the floodplain. Because this was the only access for landowners and mining personnel, the road had to be reconstructed in a manner that provided one lane access at all times. This complicated construction and required flagmen to ensure safety.

Because of potential impacts to the inlet and outlet control structures from beavers, special "beaver-proof" designs were incorporated. Riser-type inlet pipe structures were installed upstream and the outlets were totally submerged at the entrance to the drop log spillway box. This prevented any rushing water sound, which draws the attention of beavers. Large rock blankets and chain link fencing were installed on the control structure inlets to protect against beavers. Armorform Inc., articulating block mats (ABM) were installed as emergency spillways for both outlet control structures, capable of carrying a 100-year, six-hour storm event safely. Flow through Black Creek was maintained and sedimentation controlled by utilizing a large beaver dam just upstream of the lower outlet control structure. Large pumps controlled the stream flow around the construction areas.

Red River Coal Co. modified its mining permit in order that the project could continue. They agreed to remine areas where the sources of the AMD seeps were located to eliminate the seeps. Other mitigation practices were also included in the mining plans including construction and preservation of wetland and riparian areas in the upper reaches of the watershed. Remining in the watershed continues today.

Final control structure construction was completed in April 2001. The final project was accepted in June 2001, following all clean-up work, revegetation, and the planting of wetland species along the shore of the wetlands.

Final construction cost for the Black Creek Watershed Restoration Project was $577,115.00. Funding for the project came predominately from the Appalachian Clean Streams Initiative Funds (now Appalachian Clean Streams Program, ACSP) and an Environmental Protection Agency (EPA) 319 Non-Point Source grant through the

Virginia Department of Conservation and Recreation. OSM funding through the ACSP was essential to accomplish this project. Absent the ACSP funding, the AMD impacts to the stream and biota would almost certainly continue.

The tables below outlined the improvements in the water quality by measuring benthic macro invertebrates using qualitative data for habitat assessment (EPA Bioassessment Protocol). Three sample sites were selected for comparison. Site UBC-1 was located in the watershed's headwaters baseline station since it was located above all watershed activities. Site UBC-2 was established at a point just below the location of the lower outlet control structure site. Sites LBC-2 and LBC-3 were points established near the mouth of Black Creek at the confluence with Powell River.

Bioassessment for Selected Black Creek Sites
(Cherry's Study – 10/8/95)

	Black Creek Headwaters Above Black Creek Lake	**Directly Below Lower Wetland**	**Mouth of Black Creek**
Metric	**UBC-1**	**UBC-2**	**LBC-2**
Taxa Richness	**6**	**0**	**0**
HBI	**6**	**0**	**6**
Scraper to Filtering Collector Ratio	**6**	**6**	**6**
EPT/Chiromnomid Ratio	**6**	**0**	**6**
% Contribution of Dominant Family	**2**	**0**	**0**
EPT Index	**6**	**0**	**0**
Community Loss Index	**0**	**2**	**0**
Total Score (42 max)	**38**	**8**	**18**
% Comparison to UBC-1	**100**	**21.1**	**47.4**
Bioassessment	***Non-Impaired***	***Moderately Impaired***	***Moderately Impaired***

Bioassessment for Selected Black Creek Sites
(DMME– 10/09/01)

	Black Creek Headwaters Above Black Creek Lake	**Directly Below Lower Wetland and OCS**	**Near Mouth of Black Creek**
Metric	**UBC-1**	**UBC-2**	**LBC-2/3**
Taxa Richness	**6**	**3**	**3**
MFBI	**6**	**6**	**3**
Scraper to Filtering	**6**	**0**	**0**
EPT/Chiromnomid	**6**	**0**	**6**
% Dominant Taxon	**3**	**0**	**3**
EPT Index	**6**	**0**	**0**
Shredder/Total Abundance	**6**	**6**	**0**
Community Loss Index	**6**	**3**	**3**
Total Score (48 max)	**45**	**18**	**18**
% Comparison to UBC-1	**100**	**42.9**	**42.9**
Bioassessment	***Non-Impaired***	***Moderately Impaired***	***Moderately Impaired***

The 1995 data was collected by Dr. Cherry's study. The 2001 data was collected by Environmental Services and Consulting, LLC of Blacksburg, Va., at the request of the DMME. The 2001 samples reflect a post construction assessment less than six (6) months following construction.

The tables do indicate improvement in the macro invertebrate population below the wetlands and the outlet control structures as illustrated in samples UBC-2. The 1995 UBC-2 score was 21.1, which is at the low end of the moderately impaired bioassessment scale. A score of less than 20.0 would have classified this section of the stream as impaired. The 2001 bioassessment score for this same sample point was 42.9, which was a significant improvement.

A biological and chemical assessment for Black Creek completed in 2003, by Engineering Concepts, Inc. of Fincastle, Va., at the request of the DMME, indicated there had been improvements from the project. However, the reference site (UBC-1) showed a much greater overall biotic balance within the community as compared to the other sample sites indicating that some form of stress is occurring between the reference and sample sites along Black Creek.

A total maximum daily load (TMDL) study was completed in 2003-04. It was approved by U.S. Environmental Protection Agency and adopted by the Virginia State Water Control Board in August 2004. The TMDL study determined that the specific chemical stressors causing the benthic impairment were total manganese and dissolved solids and that these stressors were related to AMD. A significant reduction of these stressors would be needed to restore the stream aquatic life. A future AML project aimed at reclaiming the abandoned mines and restoring the stream's natural riparian zone would reduce mineralization and improve water chemistry.

The Natural Fish and Wildlife Foundation recently awarded the DMME a grant to restore the riparian zone along sections of Black Creek. The reconstructed riparian zone should facilitate the stream restoration process. The project will involve the DMME, the local coal industry, and The Nature Conservancy.