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# Green Lands

Summer 1997





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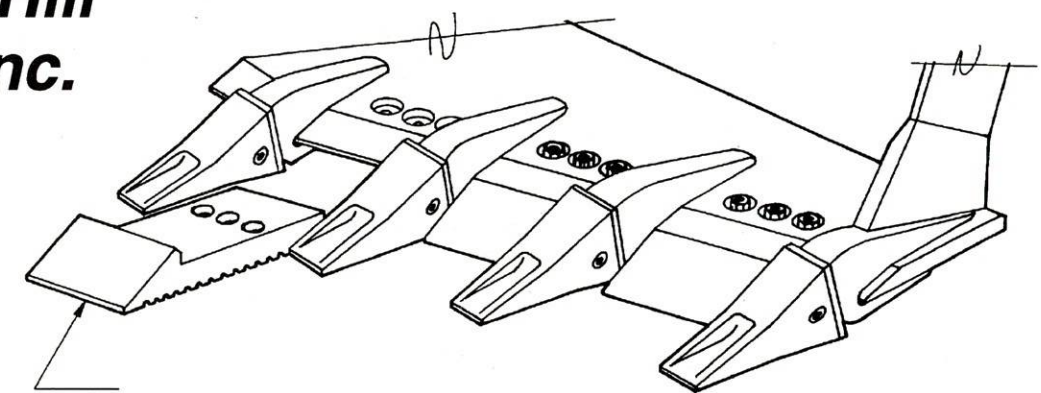


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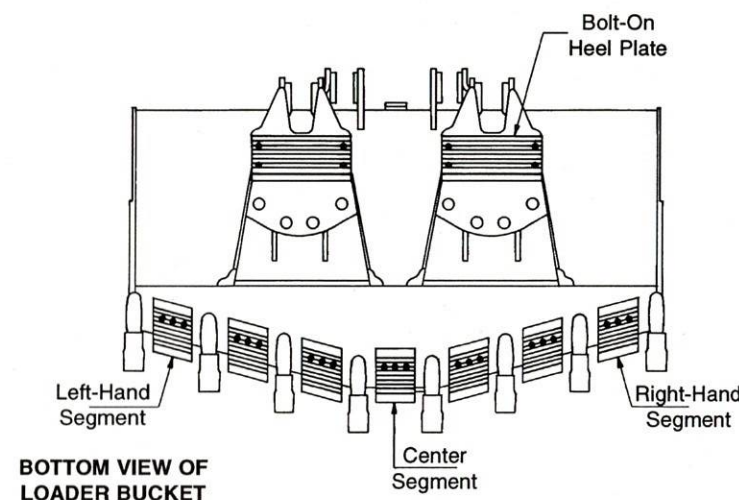
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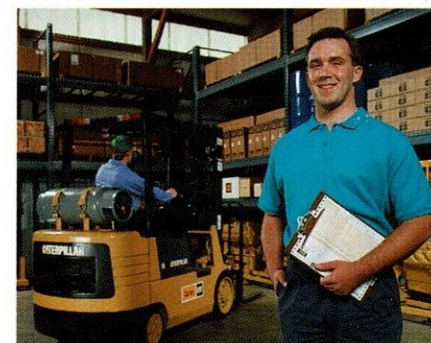
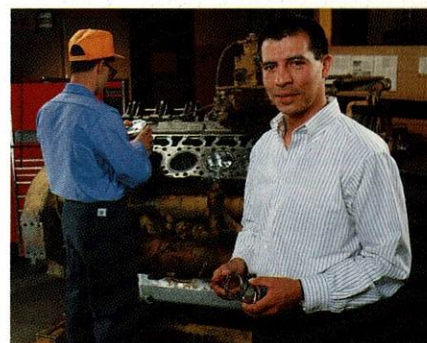
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# Green Lands

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*Green Lands* is a quarterly publication of the West Virginia Mining & Reclamation Association, with offices at 1624 Kanawha Boulevard East Charleston, West Virginia 25311 (304) 346-5318, FAX 346-5310.



**Our Cover**  
D&L Coal Company's reclamation of the Emmett Jones farm in Mineral County beautifully illustrates the West Virginia coal industry's success in post mining land use. Our cover story begins on page 8.

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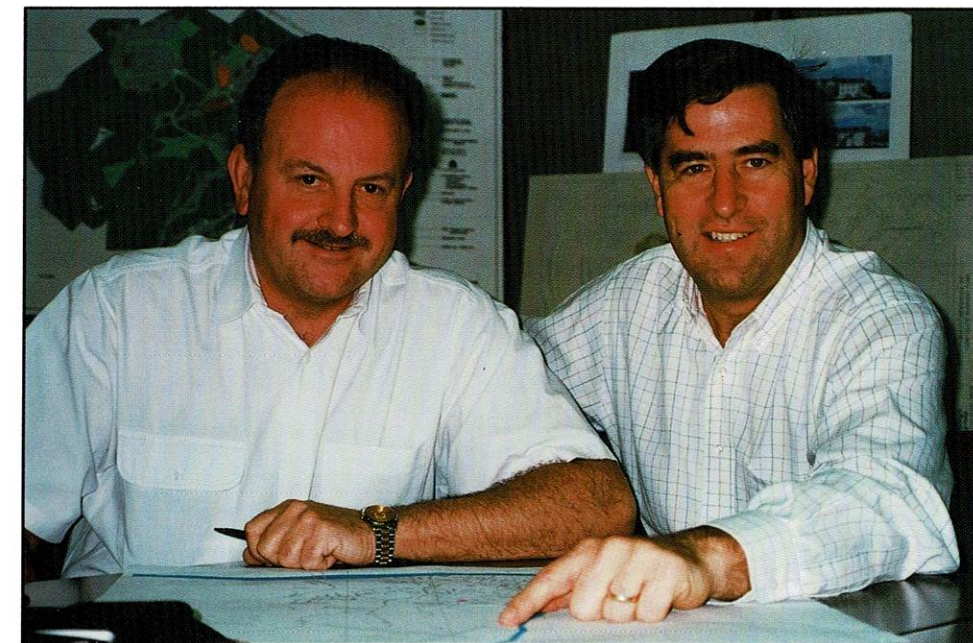
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Virtually no trace of mining remains on the beautiful Emmett Jones Farm in Mineral County, mined by D&L Coal Co. a decade ago.

## Skeptics proven wrong as post mining land use comes to pass

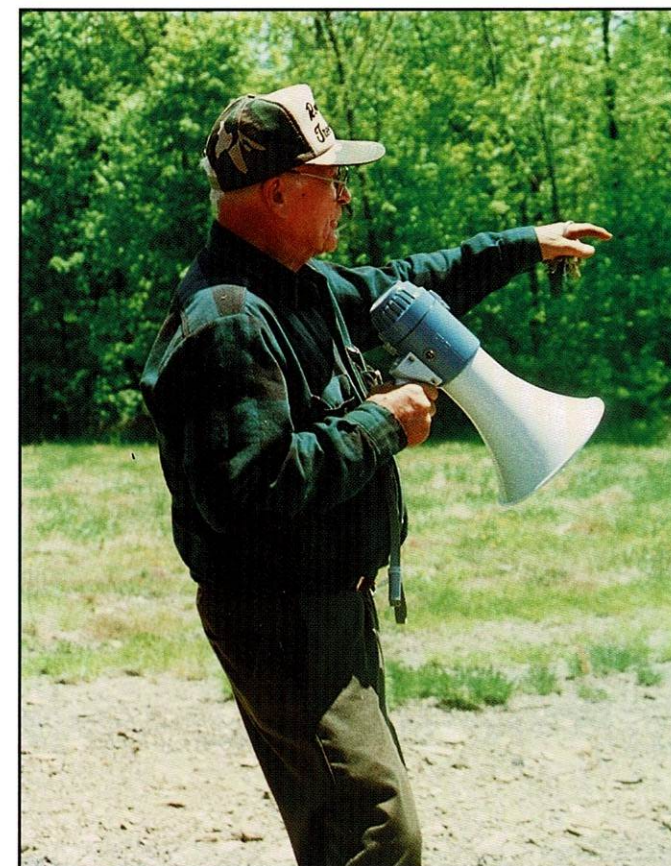
In the past three years since the West Virginia Division of Environmental Protection reinstituted its Interagency Evaluation Tour, it has selected an area of concentration for each trip. This year, the focus was on post mining land use, an area of some controversy in the past. Over the years, critics of the industry refused to accept the potential utility of post mining land use in conjunction with land reclamation.

The 1997 tour offered on-the-ground proof that the alternative uses of mined land in West Virginia are limited only by the imagination of developers and the specialized needs of the surrounding community. The tour did not, could not, get to all of the outstanding examples of productive post-mining land use in West Virginia. It passed by the dazzling Pete Dye Golf Club

in Bridgeport. Likewise the FBI fingerprint center just over the hill from Pete Dye. It didn't reach the flat top acreage of Mountain View High School in mountainous McDowell County. There are many more.

It's also a shame that more people didn't see these sites. DEP opens its annual tour to virtually all comers, but there were few takers. The total media representation was one reporter, one day, on one site. There was no one from the environmental community. Even the industry itself was under represented.

But this does nothing to diminish the accomplishments of the miners, reclaimers and developers, who have proved beyond all doubt that there is life in post mining land, that there is a way, there is a will and there is a purpose, to reclaimed land.



This 64 acre former Allegheny Mining Co. mine site is now a productive commercial tree farm owned and operated by 92 year old Carl Burgess, shown at left presiding over the tour of his property. In 1992, the Burgess farm, which maintains a growing inventory of 300,000 evergreens, provided 100 firs for the National Christmas Pageant of Peace treelighting ceremony on the Ellipse, near the White House in Washington DC.







The Knights of Columbus Community Park (below) covers about five acres of a 41 acre Buffalo Coal Co. mine near Davis in Tucker County.

On the other side of town is the Tucker County landfill (top right), which currently utilizes 60 acres of a 390 acre tract mined by Buffalo to serve five West Virginia Counties with modern refuse disposal.

Across the Grant County line is the Mt. Storm Power Plant Ash Disposal Facility (bottom right), also compliments of Buffalo Coal mining and reclamation.





When the Davis Town Cemetery was about to run out of space, Buffalo Coal went to extraordinary lengths to reclaim eight acres of its 53 acre permit to allow for cemetery expansion.



The hunting cabin shown below, owned and used by Buffalo employees, sits in a picturesque setting on an old company mine site.



In Harrison County, two year old Robert C. Byrd High School covers 70 acres of a site mined by K.W.D., Inc. in the late 1970's. The state-of-the-art educational facility, which consolidated two traditional Clarksburg schools, hosted President Clinton's town meeting during his spring visit to the central West Virginia community. At left is a display case in the front lobby depicting the school mascot, the eagle.







## Morgantown Mall

- 69 acres
- 85 Retail Outlets
- 800,000 square feet enclosed
- 2,000 employees
- \$150 million in annual sales

Reclaimed mine sites are ideal for mall and shopping center development. Two excellent examples are the Morgantown Mall in Morgantown, mined in the 1980's by Sandridge Coal Co. and Morgantown Energy Export Co., and Eastpointe Shopping Center in Bridgeport, mined in the late 1970's and early 1980's by Bridgeport Hills Development, Inc.



## Eastpointe Shopping Center

- 70 acres
- 31 Retail Outlets
- 300,000 square feet enclosed
- 1,000 employees
- \$100 million in annual sales



The Columbia Wood Mill, a timber processing plant covering 40 acres, opened six years ago near Craigsville, in Nicholas County. The 238 acre site permit was mined and reclaimed by Land Use Corp. Columbia already has tentative plans to double the size of the facility.



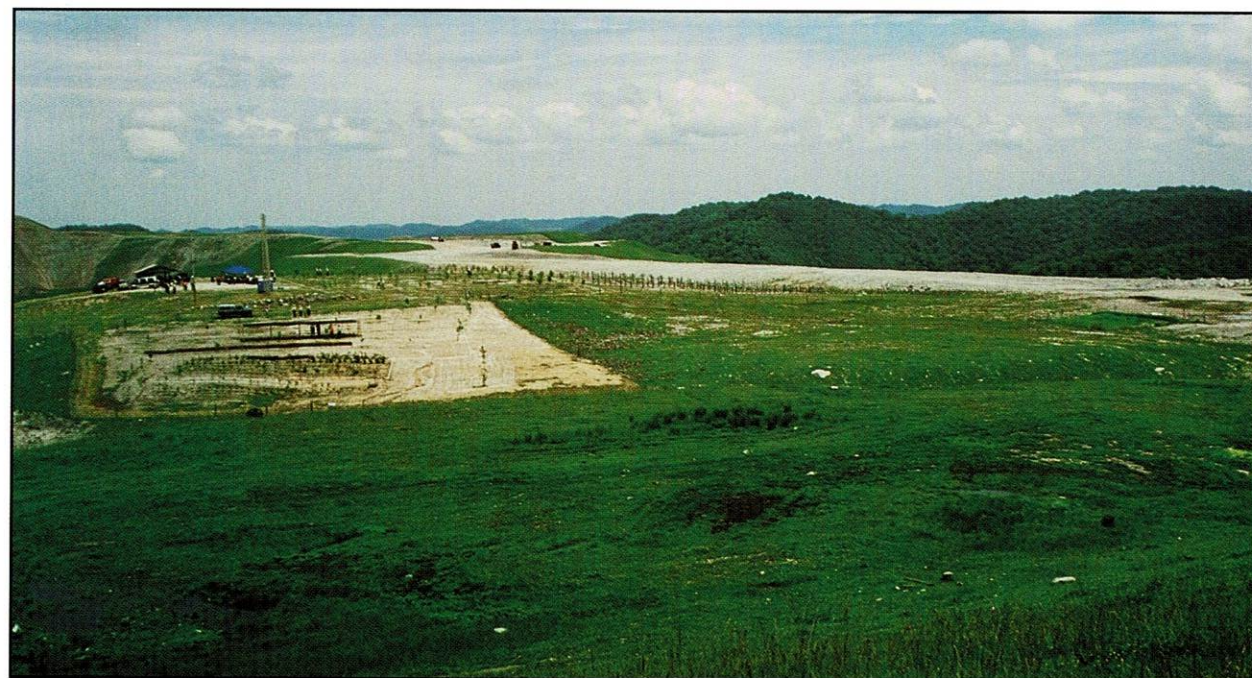
Logan County, where flat land is at a premium, is benefiting from two major public works projects, one already in operation and the other nearing completion.

The Logan Regional Airport (above), built on 75 acres of a mountaintop removal operation, was brought to fruition by the specialized reclamation and cooperative efforts of several coal companies.

The new regional jail near Holden (below) was formerly a Rebel Coal Co. mountaintop removal and contour mining job. An industrial park is also planned for this site.







On a mountaintop straddling the Mingo-Logan county line, landowner and mine operator Jim Simpkins is raising cattle and experimenting with a variety of crops to determine the most feasible agricultural uses for reclaimed lands.



Don Nicewonder is preparing this mountain top removal operation, near Wharncliffe in Mingo County, for a 600 acre golf course. Nicwonder knows golf as well as mining. He built and operates one of the finest golf facilities in Virginia.



Independence High School, above, is part of a three school complex near Coal City in Raleigh County, where construction was facilitated by an existing haul road from an adjacent Sterling Smokeless operation. The former mine site has since been converted into a golf driving range, shown below.







Just outside Sophia, a new and unique industry has sprung up on a former mine site. The company name, Minauqua, combines the terms and concepts of "mining" and "aquaculture." It uses cold, clear water from old underground mines to provide the proper environment for "farming" fish, particularly trout. The company is perfecting similar techniques to raise arctic char. The fish are raised here, in oxygen enriched holding tanks shown above, from fingerling size to a market weight of about one pound. Mining and reclamation, shown below, were carried out by Westmoreland Coal Co.



The 1997 tour concluded at the "Alderson Branch Refuse Project" an Abandoned Mine Lands project in Raleigh County, where industry dollars are at work, transforming a refuse pile, begun in 1958 and idle since 1981. Eastern Arrow, an award winning reclamation company, is turning the site into a rolling green meadow, which will result in bring a halt to erosion and runoff, cleaning up miles of local streams in the Guyandotte drainage area.





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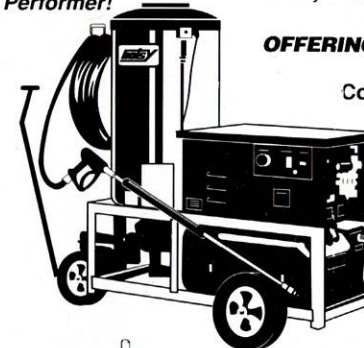
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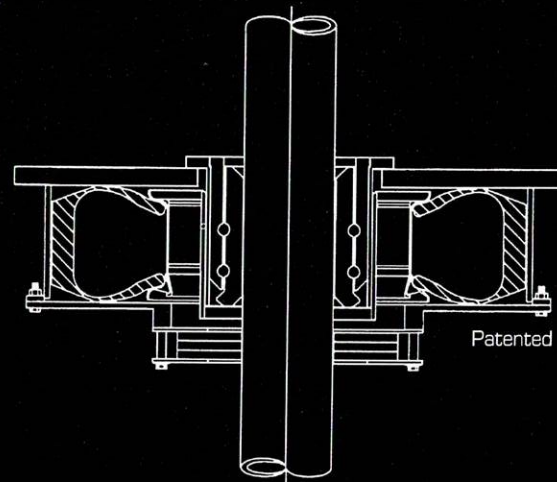
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This tank in Logan County is part of the Crooked Creek Waterline Project.

## AML works on water in Logan County

by Colleen M. O'Neill, Public Information Specialist  
Public Information Office, WV Division of Environmental Protection

We use water every day. We drink it, bathe in it and wash our clothes in it. We often take this human need for granted.

"In the city, we take clean water for granted. That's not so in the booneywoods," said Rick Roberts, Managing Engineer from the Logan County Public Service District.

Roberts explained that some of Logan County's rural water is nasty, containing iron, sulfur, manganese and other contaminants, and fails to meet federal drinking water standards. "People would have to go to a laundromat because they didn't want to ruin their clothes," Roberts said. He also said many county residents have clean water today because of the West Virginia Division of Environmental Protection's Abandoned Mine Lands Program.

For approximately seven years, the AML Program has offered assistance to communities with water quality/quantity problems related to pre-1977 mining activities. Under an amendment to Public Law 95-87, Section 403 (b), up to 30% of AML's dollars may be used to assist county, state and federal agencies in supplying clean, safe water to all states and Indian tribes with problems which fall under the guidelines. DEP established the Water System Supply Advisory Committee to identify and recommend water supply systems. This committee consists of representatives from various governmental agencies that are concerned with the environment.

West Virginia's AML Waterline Program has provided water to approximately 8,600 residents in more than 23 communities in 13 counties at a cost of approximately \$39 million.

"We used to have a joke that the water was 99 parts iron and one part water," said Mrs. Roy McComas, a Logan



This hydrant marks the presence of water, courtesy of the Godby Branch Waterline Project in Logan County

County resident. "For 30 years, we've had bad water. I'd have to go to the beauty parlor and get my white hair bleached, the iron was so bad." Bad water is a thing of the past as the Crooked Creek Waterline Project supplies Mrs. McComas and 245 other people with clean water.

Another problem was the amount of water. Ninety-five percent of rural West Virginians depend on groundwater as their sole water source. Much of that groundwater is contaminated.

"It's hard when there's not enough water," said Julie Propst, a Logan County resident. "When there's four of you, only two can take a bath. The other two have to wait until morning." Not enough water is now an obsolete concept as the Cow Creek/Sarah Ann Waterline Project furnishes 810 residents with water.

Some residents have gone so far as trying to fix the water themselves. Logan County resident Ben Lowe had a water softening system put on his well. As his well ran

*'Most people hate  
paying their water bill.  
Not me. I just love it.'*

directly through a coal seam, the softening system would clog with coal sludge. After spending \$3,000 for the system, and \$40 a month service charge, the system didn't work. He, like many other rural West Virginians, needed help. AML offered help.

"This (clean water) was made possible by AML," Lowe said. "I wouldn't trade it even if it cost me \$60 a month." Water is worth more than money, as 335 residents realized when they were serviced by the Upper Rum Creek Waterline Project.

To be considered for this government program, an application must be filed. The assistance process goes like this.

- WSSAC solicits Waterline Project applicants from public service districts and/or townships.
- The applications are completed and returned to West Virginia Division of Environmental Protection's Office of Abandoned Mine Lands and Reclamation.
- The completed applications are evaluated on the Priority System; AML&R helps approximately 10 public service districts per year.

The Priority criteria can be found in Public Law 95-87, section 403 (a). Those chosen will undergo a feasibility study. The study will determine:

- 1) Number of residents with non-potable drinking water;
- 2) Water quality testing to indicate whether mine drainage is the cause;
- 3) The presence of significant pre-1977 mined areas;
- 4) Indications of community support.

If the feasibility study shows the need for assistance and how a system (new or repaired) will improve life, clearance to continue is granted and the process continues following the regular AML process.

"In this day and age, it's hard to believe there are West Virginians who don't have clean water," said Patrick Park, the Assistant Chief of the Office of Abandoned Mine Lands and Reclamation. "Water is a basic human need and AML is proud to be able to help furnish this need. I'm just glad that AML offers the Waterline Program."

"In '95 we got our water. Most people hate paying their water bill. Not me," McComas said. "I just love it."

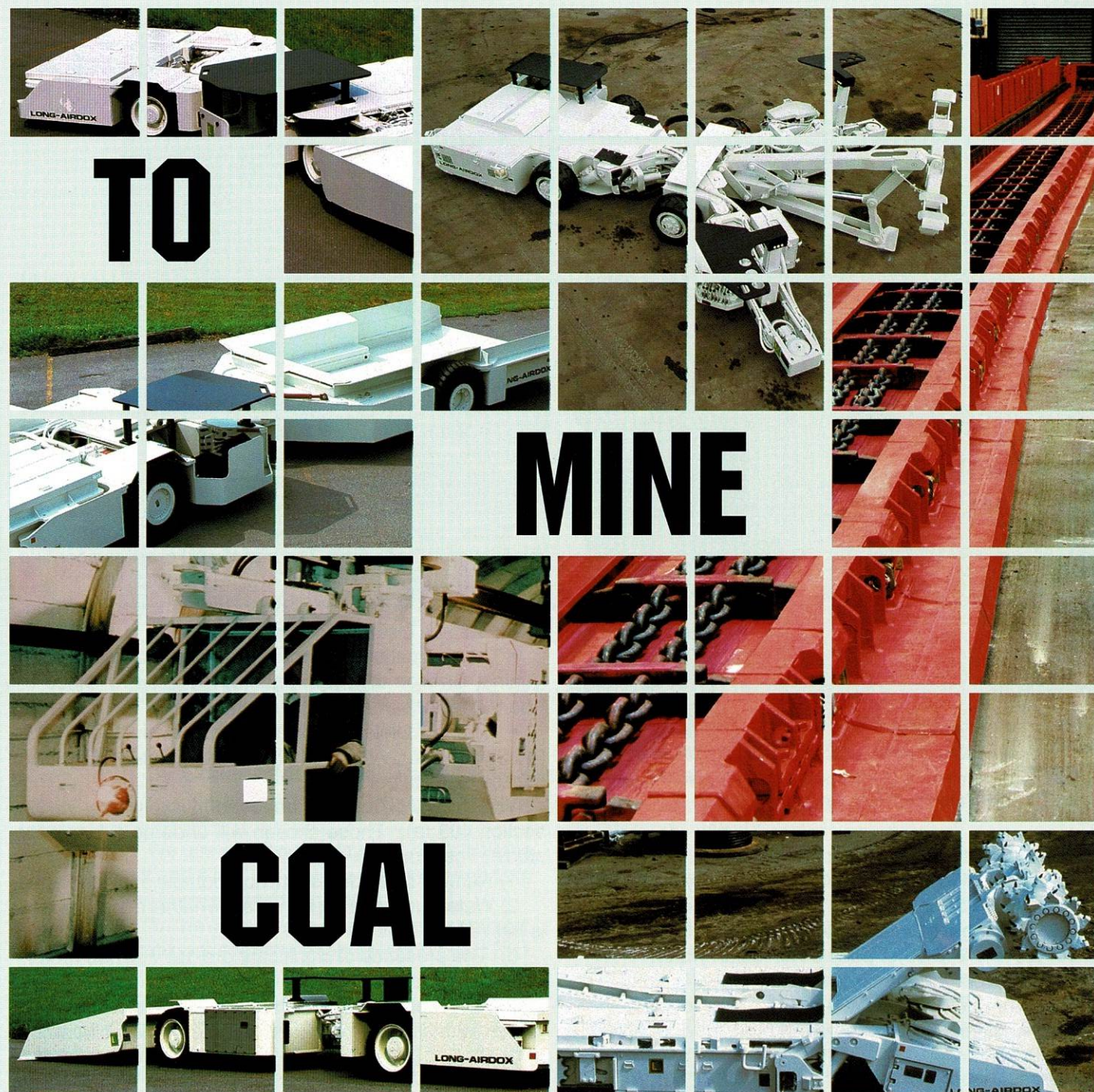


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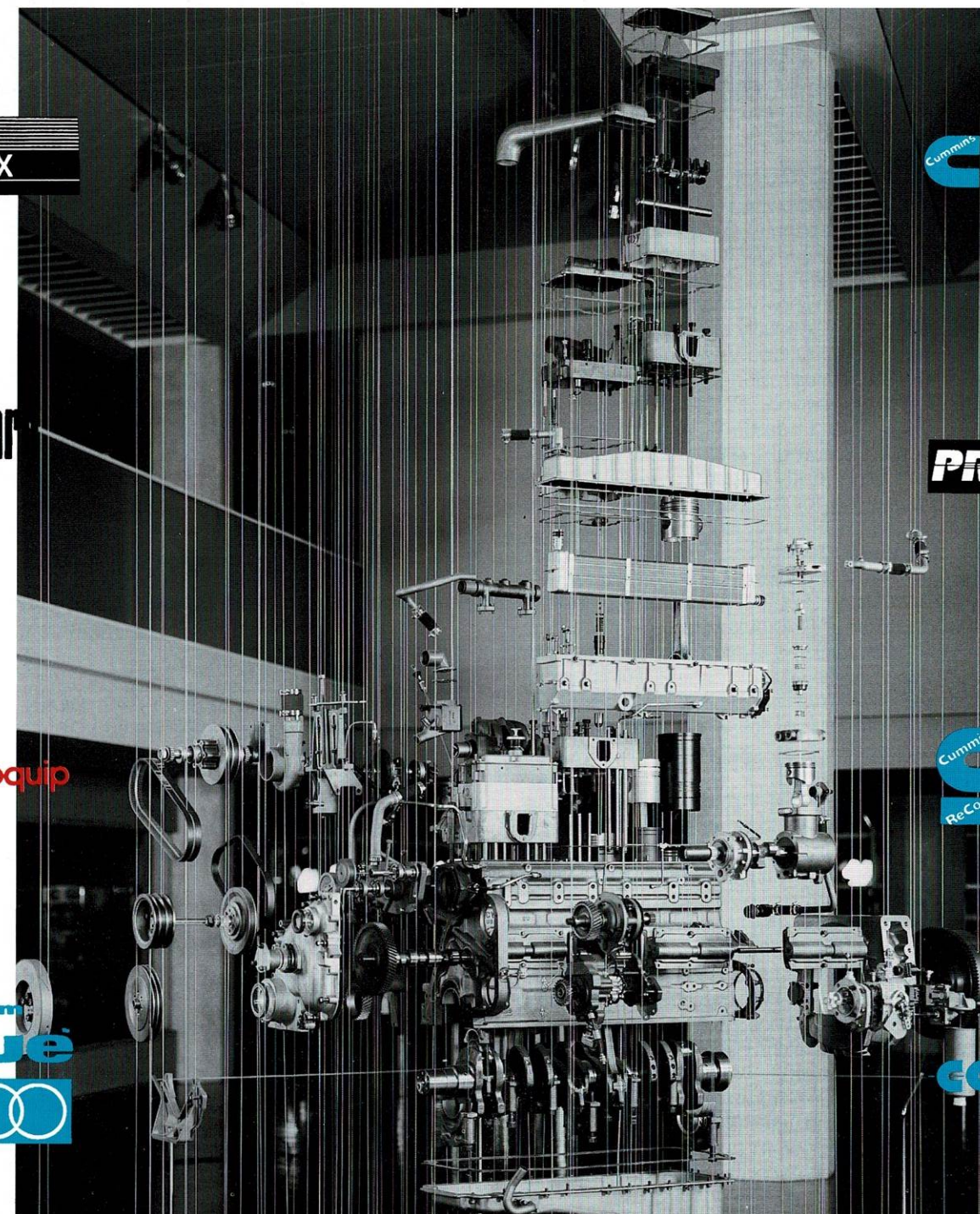
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# Association Notebook



## V&G honors long time employees

Vecellio & Grogan, Inc. celebrated Mike Sherwood's 50 years of service with a reception at Glade Springs Resort in Daniels. Approximately 100 former and present employees, family members and friends attended the reception held in his honor. The evening included a social hour and presentation of a specially engraved gold watch to Mike by President and CEO, Leo Vecellio, Jr. Additional comments and remembrances included words from Kesley Sherwood, Kenneth Sherwood, Project Manager Joe Mattlin, Executive Vice President of Construction Operations, John M. Conkwright and retired V&G Vice Presidents Malcolm Smith and Howard E. Lane.

In 1943, before leaving for the Navy at age 17, Mike worked for a brief period on a project in Quinnwood for Gilbert Construction, a predecessor to Vecellio & Grogan, Inc. Following his naval service, Mike began his career with Vecellio & Grogan in 1946. His first job with the company was as a dozer operator at Grandview, WV.

In his 50 years with V&G, he worked his way up from dozer operator to foreman to superintendent. He is known as the "finest dozer operator ever." As superintendent, he managed several multi-million dollar projects, including V&G's largest single project performed in 1989 at Cumberland, MD.

He managed its largest West Virginia project ever on Route 19 at Birch River, near Summersville until, after a struggle to come to a determination, he made the decision to retire. His last day of work was on October 25. Mike's expertise and contributions over his career are immeasurable to the company, and he is an example for the new generation of employees to follow.

Mike and his wife, Debbie, reside in Clendenin. They are the parents of five girls, Donna, Marsha, Beverly, Pamela and Heather, all residents of West Virginia.

Similar celebrations were held in Florida in honor of other long-term Vecellio & Grogan employees. Shelby D. Jarrell, with 40 years of service, was honored at a presentation held in North Palm Beach and Gene Shamblin, also with 40 years, was the guest of honor at a presentation in Fort Lauderdale. Shelby and Gene each also received a specially engraved watch.

Shelby began with V&G in 1956 as a laborer on a coal mining project at Brooklyn, WV. He progressed to superintendent and supervised road and coal mine projects. In May 1979, he moved to West Palm Beach, V&G purchased Rubin Construction, now Ranger Construction

Industries, Inc. He is now a Vice President of Construction for Ranger. He concentrates on golf course construction which includes many renowned courses throughout the Southeast, and he is proud of his personal and long-term relationship with Arnold Palmer.

Gene began his employment in 1956 at Black Rock Contracting, Inc., a V&G subsidiary, in Charleston, WV. In 1981, he made the move to another Vecellio company, PAVEX Corp., in Pompano Beach, FL where he serves as Vice President of Asphalt Operations. Gene's professionalism and hard work have helped establish PAVEX as one of the leading asphalt producers in south Florida.

Vecellio & Grogan, Inc. is a Beckley based corporation in its 58th year of business serving the Atlantic and southeastern United States. It is proud to honor these employees and include them as part of its rich history.

## Arch Sandy 1919-1997

Former Association Chairman Arch Sandy of Bridgeport, WV passed away June 6. He was 78.

Arch was the retired President of Barbour Coal Co. and a member of the original WVMRA Board of Directors, serving from 1966-1973. He was the third President (Chairman) of the Association.

Arch is survived by his wife, Ann, his daughter Cynthia and two grandchildren.

## Dates to remember

**Coal Foundation Golf** - The Coal Foundation will host its second and final 1997 event at Jim LaRosa's Pete Dye Golf Club in Bridgeport on Monday, **September 8**. Members who have not received Invitations should contact the Association office.

**Fall Board Meeting** - The Board of Directors will hold its fall meeting at Lakeview in Morgantown on the weekend of **October 24-25**, in conjunction with the WVU-Virginia Tech football game.

**West Virginia Mining Symposium** - The 25th Symposium is scheduled for the Holiday Inn - Charleston House, January 14-16, 1998.

**Semi-Annual Meeting** - The Semi-Annual Meeting will return to El Conquistador Resort & Country Club in Puerto Rico. The dates are January 27 - February 1, 1998.

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# Remining

## in Pennsylvania and West Virginia: Costs and Water Quality Changes

by Jeff Skousen, West Virginia University, Morgantown, WV;  
Robert Hedin, Hedin Environmental, Pittsburgh, PA;  
and Ben Faulkner, Bratton Farms, Princeton, WV.

### Abstract

Remining is the surface mining of previously-mined and abandoned surface and underground mines to obtain remaining coal reserves. Remining operations create jobs in the coal industry, produce coal from previously disturbed areas, and improve aesthetics by backfilling and revegetating areas according to current reclamation standards. Remining operations also reduce safety and environmental hazards by sealing existing portals and removing abandoned facilities, enhance land use quality, and decrease preexisting pollutional discharges. Ten sites in the Appalachian Coal Region were selected to 1) compare the costs associated with remining and reclaiming a site to current standards versus costs associated with reclaiming the site by abandoned mine land (AML) programs, and 2) evaluate water quality before and after remining. All of the remining operations in our study resulted in environmental benefits. Dangerous highwalls were eliminated, spoil piles were regraded, coal refuse left on the surface was buried, and sites were revegetated to provide productive post-remining land uses. In all but two cases, coal mined and sold from the remining operation produced a net profit for the mining company. While AML reclamation removes hazards and improves aesthetics on AML sites, remining these 10 sites saved the AML reclamation fund an estimated \$4 million. Water quality after remining improved in all cases. Impediments to remining AML sites should be removed so that mining companies will actively select previously-disturbed and abandoned sites for remining and reclamation.

### Introduction

According to state and federal records, approximately 220,000 acres in Pennsylvania and 160,000 acres in West Virginia (690,000 acres in Appalachia) had been disturbed by coal mining before 1977. The Surface Mining Control and Reclamation Act (SMCRA) of 1977 defined abandoned mine land (AML) as lands that were mined, left in an inadequate reclamation status and abandoned before August 3, 1977, with no continuing reclamation responsibility by any individual or company under state or federal laws. The vast majority of this AML acreage was in some stage of natural reclamation with various amounts of grass and tree cover on the site (Ashby 1984, Bramble and Ashley 1955, Hedin 1988, Skousen et al. 1994). A smaller acreage had serious safety and environmental hazards associated with them. Safety hazards included mine openings, unstable spoil and refuse piles, highwalls, abandoned facilities and water or slurry impoundments. Environmental problems included unvegetated areas, extensive erosion and sedimentation, acid soils, and polluted mine drainage.

SMCRA provides for an "abandoned mine land reclamation fund", which is to be used for reclamation of areas affected by past mining. This fund is generated by taxing current coal operations on every ton of coal mined. The money is returned to states with coal regulatory reclamation programs (primacy) to reclaim AMLs that have a high priority rating. Sites with the potential to affect public health or safety receive the highest priority. While many hazardous sites have been reclaimed since 1977, still more sites need attention and require reclamation, but the money

necessary to correct all AML problems far exceeds the amount that may be collected. In fact, the Office of Surface Mining (OSM) is concerned that only an estimated 10 percent of the nation's AML problems will be corrected over the life of the AML reclamation program (originally scheduled from 1977 to 1992). In 1992, Congress reauthorized the coal production tax to generate AML funds from 1992 to 2004. Even with this reauthorization, alternative solutions must be found to reclaim remaining AML sites.

Remining provides an alternative mechanism to reduce safety and environmental hazards, improve aesthetics, enhance land use quality and decrease preexisting pollutional discharges on AML. Remining allows an operator to remove remaining coal reserves that were left on the site from previous surface or underground mining and reclaim the entire AML site to current reclamation standards. Therefore, remining operations provide income through coal production, create jobs in the coal industry, and afford environmental enhancement through reclamation of previously-affected areas. Remining has been documented to improve water quality (Hawkins 1994a, 1994b, and 1995) primarily due to reductions in flow from the reclaimed site, which in turn reduces contaminant loadings. Water quality is also improved by removing or burying high sulfur coal wastes and shale, fragmenting and mixing overlying alkaline overburden with unreclaimed acid spoils, and regrading and revegetating the mine site (Skousen and Larew 1994). Indeed, remining may reduce the pressure on mining virgin areas. Remining can also clean up a wider diversity of AML sites than the current priority system for selecting AML reclamation sites in state and federal programs.

Remining, however, is not without risks. Pre-remining coal estimates are often incorrect due to inaccurate underground mine maps and unknown surface augering activities. Therefore, less coal may be available for removal from the site than was anticipated. Most mining companies are also wary about mining sites where there is the possibility of a significant long-term water treatment liability. Although remining is occurring, remining companies generally avoid sites that contain preexisting pollutional discharges because the remining company may be required to chemically treat the AMD for an indefinite period. Recently, these concerns have been lessened by the issuance of "remining NPDES permits" (National Pollutant Discharge Elimination System) that assign no liability unless the remining operation degrades preexisting water quality.

This study was conducted to 1) compare costs of reclaiming remined sites to current standards and costs estimated for AML reclamation, and 2) evaluate water quality between pre- and post-remining discharges. Five of the sites are located in western Pennsylvania and the other five are in West Virginia.

### Materials and Methods

Coal operators and consultants were contacted to gather information on 10 remining sites. Surface mine permits were also used for gathering information. Based on diagrams of slope and acreage in the mining and reclamation plan in the permit, we calculated volumes of overburden moved during remining, and these volume estimates were confirmed by interviewing personnel on-site during remining operations. Costs for moving material were estimated at \$1.00 per cubic yard for material regrading, and \$1.25 per cubic yard for excess overburden handling. During this interview with on-site personnel, operators were also asked to explain special reclamation procedures used on the site during remining and the costs for these activities. Topsoiling and revegetation costs were estimated at \$2,500 per acre. Total reclamation costs for the remining site were then determined. Tons of coal removed from the site were also determined from coal records and income received from coal sales was calculated based on the tonnage sold and the selling price of the coal at the site (varied between \$25 and \$32 per ton). Net profit or loss was estimated by subtracting mining and reclamation costs from coal sales. Using basic formulas from the West Virginia Division of Environmental Protection (WVDEP) AML Office and interviews, we calculated the costs of reclaiming these sites to AML standards. This calculation was based on the acreage previously disturbed (not on the size of the remining permit), and included estimates of overburden volumes and the cost of regrading, elimination of highwalls, topsoiling, and revegetation.

Water quality changes were evaluated based on documentation of preexisting discharges (the flows and quality) versus post-remining discharges (flows and quality). Costs for treating pre- and post-remining discharges were calculated on a spreadsheet. The spreadsheet calculates the tons of acidity per year based on average flows and acid concentrations and the amount of chemical necessary to treat the discharge (Skousen et al. 1996). Costs for chemical treatment were based on 20% liquid caustic (NaOH) at \$0.60 per gallon for discharges less than 50 gpm, and calcium oxide (CaO) at \$240 per ton for flows greater than 50 gpm (Skousen and Ziemkiewicz 1996). The costs to treat AMD per year were determined by doubling the chemical costs for caustic systems and tripling the chemical costs for CaO systems to account for sludge handling costs, pumping, and other incidental costs.



**Table 1.** Characteristics of sites remined for coal in Pennsylvania and West Virginia.

Mine	County & State	Permit Numbers	Year Issued	Mining Period	Mined Acreage	Highwall Linear ft.
Hooks	Butler, PA	10823013	1987	87-89	8.7	—
Dellich	Butler, PA	10830109	1984	84-86	12.9	4,500
Beal	Butler, PA	10840103 et al.	1984	84-86	22.5	2,000
Solar	Allegheny, PA	2669BSM4	1969	70-91	450.0	—
Rider	Allegheny, PA	02803001	1980	84-89	190.0	—
Fairfax	Tucker/Grant, WV	S-25-81	1981	81-90	101.0	8,400
Benbush	Tucker/Grant, WV	S-26-81	1981	81-86	211.2	12,300
Big Mountain	Greenbrier, WV	S-3070-88	1988	89-95	67.0	2,400
Buffalo #2	Harrison, WV	S-21-85	1985	85-89	177.0	17,832
Buffalo #1	Harrison, WV	S-76-83	1983	83-85	145.0	13,000

Mine	Coal Seam	Receiving Stream	Previous Mining
Hooks	Clarion	Slippery Rock Creek	Surface & Underground
Dellich	Middle Kittanning	Findlay Run to Slippery Rock Creek	Surface & Underground
Beal	Middle Kittanning	Glade Run to Slippery Rock Creek	Surface, Refuse, Underground
Solar	Pittsburgh	Potato Garden Run to Raccoon Creek	Surface & Underground
Rider	Pittsburgh	Potato Garden Run to Raccoon Creek	Surface & Underground
Fairfax	Morantown/Little Pittsburgh	Little Camp Run	Surface & Underground
Benbush	Upper Freeport	Snyder Run & N. Fork of Blackwater	Surface & Auger
Big Mountain	Sewell/Castle	Brown Creek & Little Clear Creek	Surface & Auger
Buffalo #2	Pittsburgh/Redstone	Buffalo Creek & West Fork River	Surface & Auger
Buffalo #1	Pittsburgh/Redstone	Buffalo Creek & West Fork River	Surface & Auger

## Results and Discussion

Table 1 contains general information for each remining site. These sites were located in western Pennsylvania and north-central West Virginia. The majority of remining activities occurred in the 1980's, and the sites varied in size from 8.7 to 450 acres. All of the sites showed the effects of past surface mining activities including abandoned highwalls, coal refuse on the land surface, and unreclaimed spoil piles. During remining, some or all of the underground mine workings were daylighted and surface mining auger holes were remined.

The **Hooks** site is located in Butler County, PA. About 8.7 acres of land previously disturbed by surface and underground mining were remined for the remaining Brookville coal reserves (lower Allegheny formation, also referred to as the Clarion coal). Prior to remining, the site consisted of an open surface cut, unreclaimed spoil, and coal waste (gob) associated with abandoned underground mining operations. The site was remined under a subchapter F remining permit approved in 1987 by the State of Pennsylvania. Mining occurred between October 1987 and September 1989. During reclamation, spoil piles and highwalls were regraded to approximate original contour, one clay seal was constructed in a deep mine opening, and

all disturbed areas were revegetated with grasses and legumes. All bonds associated with remining have been released. The site currently has an excellent vegetative cover and there are no visual remnants of the past or recent mining activities. Total mining and reclamation costs for the site were estimated at \$375,000 (Table 2). The permit application estimated that the recoverable coal reserves to be 53,500 tons, but more deep mine workings were encountered than expected and the actual total coal recovery was approximately 40,000 tons. An estimated net profit of about \$625,000 was obtained by remining this site. Estimated AML reclamation expense was \$56,500.

One mine water discharge existed on the site previous to remining (Table 3). Four years of monitoring indicated that the discharge was slightly degraded (average acidity=10 mg/L, average sulfate=164 mg/L). The discharge flowed at an average 188 gpm, but surged during wet periods to more than 500 gpm. The applicant considered more rapid runoff and less infiltration due to reclamation a highly positive consequence of remining. As part of the remining application, costs of chemical treatment were estimated. Costs for a calcium oxide treatment system followed by a sedimentation pond for sludge collection were estimated for the pre-



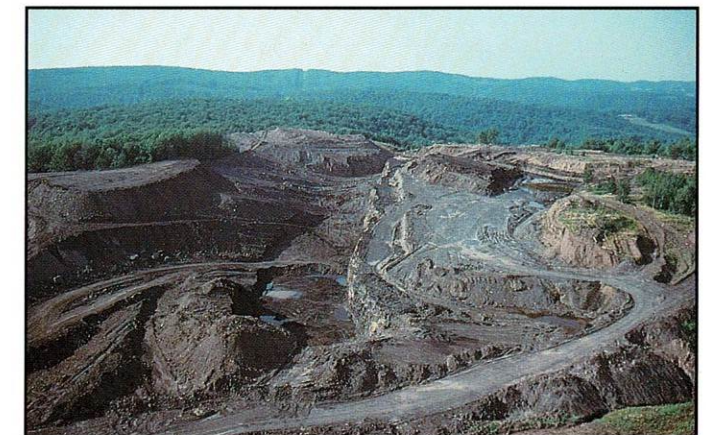
The Fairfax site was a 100 acre remining site in West Virginia. The previous mining operation left highwalls, coal refuse on the surface and extensive underground workings. Moderately acid water was found on the site. (Note the power line right-of-way in the background). Picture taken March, 1985.

remining discharge at \$2,980 per year.

Remining at the Hooks site successfully eliminated hazardous remnants of past mining and created a productive, visually attractive site. Water quality, which was marginally contaminated before remining, was improved and estimated chemical treatment costs were reduced by two-thirds. Average flow rates decreased by 43%, which was largely due to the elimination of extremely high flow events. Acidity and metal concentrations were similar in both pre- and post-mining data sets. Sulfate concentrations doubled with remining. Contaminant loadings decreased overall because of lower flow rates.

The **Dellich** site is located in Butler County, PA. The site was an abandoned surface mine with a highwall, open final cut and unreclaimed spoils below the entire remining area. The company reclaimed 13 acres of surface spoils, eliminated 4,500 linear feet of highwall, daylighted 3 acres of underground mine, mined 10 acres of solid Middle Kittanning coal and augured an additional 17 acres. The site currently has no visual vestiges of the AML conditions and is being used by the landowner for livestock grazing. The total cost of mining and reclaiming the site was \$879,000, while the estimated AML reclamation expense was estimated to be \$84,500. The mining operation produced about 76,000 tons of Middle Kittanning coal. The 3 acres of daylighted underground mine produced 5,000 tons, 34,000 tons were recovered by surface mining solid coal, and 37,000 tons were recovered from auguring operations. Over \$1 million in estimated profit resulted from the remining of this site.

Three discharges existed on the Dellich site before remining. The discharges were characterized by low to



The Fairfax site was remined and the underground mine was daylighted by mountain top removal surface mining. The operator buried refuse and other excess spoil, and removed about 240,000 tons of coal. Picture taken August, 1986.

moderate flows of marginally acidic (9 mg/L) water. Remining improved water quality at the site primarily by decreasing flow. Flow from one discharge was completely eliminated by remining, while the flows from the other two discharges were decreased by ~70% and ~25%. Concentrations of Fe, which were <2 mg/L before remining, remained low. Concentrations of acidity decreased slightly. Concentrations of sulfate increased by ~450 mg/L at each discharge point.

The **Beal** site is located in Butler County, PA. Prior to remining, the site consisted of unreclaimed spoils, piles of refuse associated with an abandoned underground mine, subsidence depressions, and collapsed mine entries. The remining job consisted of 22.5 acres of Middle Kittanning coal and was mined between August 1984 and July 1996. During mining and reclamation, 3 acres of deep mine workings were daylighted, refuse was reburied using special handling techniques, 2,000 feet of highwall were eliminated, 6 acres of spoil were recontoured, and the site was vegetated with grasses and legumes. A total of 19.5 acres of solid Middle Kittanning coal were also mined. All bonds associated with the remining were released. The site is currently being used as a hayfield and pasture. Total mining and reclamation costs for the site were about \$1.1 million and the estimated AML reclamation costs for the original 6 acres of disturbed area were estimated at \$39,000. The mine produced approximately 75,000 tons of Middle Kittanning coal for an income of almost \$1.9 million. Three acres of daylighted underground mine produced 5,000 tons and 70,000 tons of coal were recovered from 19.5 acres of solid coal. A net profit was estimated at close to \$800,000.





Fairfax was regraded to approximate original contour. Picture taken June, 1990.

Previous to remining, three discharges were identified at the Beal site. One discharge, which flowed at an average rate of 26 gpm before remining, was eliminated by mining activities. Flow rates at the other two discharge points were decreased, but not eliminated with remining. One of the two discharges was marginally contaminated before remining (pH 5, acidity=23 mg/L) and improved slightly with remining. Resulting contaminant loadings were about 50% less than pre-remining. Sulfate concentrations increased slightly with remining. The second discharge carried the bulk of pre-remining water pollution. The eight pre-remining water samples from this discharge averaged 110 mg/L acidity, <1 mg/L iron, 15 mg/L manganese, and 388 mg/L sulfate. Remining improved the discharge by decreasing flow by 50%, acidity concentrations by 65%, and manganese concentrations by 40%. Sulfate concentrations increased by 50%. Contaminant loadings were markedly decreased by remining. Acidity loadings, in particular, decreased by 88%.

The **Solar** job is located in Allegheny County, PA. The area was the site of the abandoned Solar underground mine and extensive surrounding surface mining activities. All mining was in the Pittsburgh coal bed. Prior to remining, there existed approximately 380 acres of underground coal workings and 450 acres of unreclaimed surface mines (generally ringing the site along the coal crop line). Waters flowing from the underground mine and surface refuse piles were all extremely acidic. The site was remined under a cost-plus contract with a local utility. The terms of the contract allowed remining of coal with much higher overburden:coal ratios than is normally the case. In this area, remining operations generally take no more than 50 feet of overburden cover, but the average overburden cover for this job was approximately 120 feet. When the



Revegetation of Fairfax consisted of forage grasses and legumes. Picture taken June, 1991.

contract expired and was not renewed, remining ceased. Approximately half of the underground mine workings was removed during the remining operations.

Much of the pre-remining data for the Solar Mine was obtained from an Operation Scarlift report prepared for Pennsylvania by Ackenheil and Associates (1976). The Operation Scarlift report considered the cost of subsidized daylighting of the Solar mine. In particular, the net cost of daylighting 87 acres of deep mine and reclaiming 200 acres of AML was evaluated. The remining subsidy proposed by the Operation Scarlift report in 1976 was estimated at about \$10 per ton of coal mined. This subsidy, which was proposed to be paid by the Commonwealth's AML program, was subsequently paid by the electrical utility. The coal operator reports that remining operations in this area typically recover about 5,000 tons of coal per acre. Based on the 180 acres that were mined, total mining and reclamation costs were \$17.8 million, and the AML reclamation expense of the original 450 acres of unreclaimed area was estimated at \$2.9 million. The 180 acres of remined Solar Mine produced approximately 900,000 tons of coal, for a total income of \$22.5 million. The difference between costs and income brought an estimated net profit of \$4.7 million. Remining eliminated dangerous highwalls, pits, and spoils and created a well vegetated, gently rolling site that blends in with the surrounding landscape. Part of the reclaimed site is being used for a livestock operation.

One major mine water discharge flowed from the Solar Mine, and this source was identified in the Operation Scarlift report as the single largest contributor of AMD to Raccoon Creek. As part of the Operation Scarlift investigation, water treatment costs were estimated at \$250,000 per year for a hydrated lime treatment plant designed to treat the AMD. The treatment plant was never

constructed. Our estimate of water treatment costs with calcium oxide was more than double the estimated hydrated lime treatment costs. Water quality was dramatically improved as a result of remining. Improvement resulted from decreased flow rates and contaminant elimination. With the completion of remining activities, discharges developed at three locations and all three discharges are currently alkaline with negligible metal concentrations. These estimates indicate that flow from the site decreased by about 50% with remining and reclamation of AML.

Not all the Solar Mine was remined. A small discharge currently flows from the southern portion of remaining Solar underground mine workings. This discharge is highly acidic and is chemically similar to the pre-remining discharge. The dramatic improvement of water quality in the remined Solar Mine is attributable to the removal of coal and associated black shale, and the fragmentation of a limestone bed that lies above the coal bed.

The **Rider** Mine was located adjacent to the Solar Mine in Allegheny County, PA. It was mined between 1984 and 1989 under the same cost-plus contract used for the Solar job. The site consisted of an 80-acre underground mine (Pittsburgh coal) ringed by approximately 110 acres of unreclaimed surface mines. Water discharging from the Rider Mine was highly acidic and polluted the headwaters of Potato Garden Run. The overburden averaged 60 feet and ranged as deep as 120 feet. The underground mine was completely remined. Refuse from both the Rider and Solar operations was disposed of on the Rider site. The remining aspects of the job are completed and most bonds are released. The site is well vegetated and blends into the surrounding landscape. The processing plant is currently being dismantled and one large coal fines pond still requires reclamation.



The Benbush abandoned mine site was used as a trash dump. Picture taken December, 1981.

Pre-remining data for the Rider job was obtained from the 1975 Operation Scarlift Report. The report recommended the partial daylighting of 35 acres of underground mine and the regrading of 110 acres of unreclaimed surface mines. The subsidy for partial daylighting of the Rider Mine and reclamation of surrounding AML was estimated in 1976 at approximately \$16 per ton of coal recovered. In actuality, the entire 80 acre underground mine was daylighted. The total cost of mining and reclaiming the 190 acre site was \$9.3 million. Reclaiming the 110 original acres by AML reclamation was estimated at \$715,000. Approximately 240,000 tons of Pittsburgh coal were recovered from the Rider daylighting operations. Because the operation was a cost-plus contract, the operator realized a net profit due to the subsidy. Because of high mining and reclamation costs on this site, we estimated that a subsidy of about \$3.3 million was needed for this operation to break even (or about \$14 per ton).

Two discharges flowed from the Rider site before remining. Both discharges were acidic, but flows, acidity concentrations, and loadings were considerably less than for the Solar Mine. Remining caused both discharges to become neutral to alkaline.

Remining eliminated most of the dangerous highwalls, pits and spoils and created a well vegetated, gently rolling site. Two water-filled pits, which were sources of water used in coal processing, remain on site and await reclamation. The water quality problems associated with two pre-remining discharges were completely eliminated. Both points now discharge neutral water with negligible contaminant concentrations. According to the mine inspector, no other major discharges developed after remining was completed. The refuse pile, which was capped with a waste lime product and spoil, discharges alkaline water with very low metal concentrations.



The trash dump at Benbush was buried and reclaimed during the remining operation. Picture taken August, 1982.



The **Fairfax** site is located in Tucker and Grant Counties, West Virginia. The site was ringed by a 40-ft highwall for the Little Pittsburgh coal with extensive abandoned underground works. The company daylighted 94 acres of underground workings by mountaintop removal and reclaimed the abandoned highwalls and spoils between 1981 and 1990. The site currently is an attractive landscape that is revegetated with grasses, legumes and trees. Total mining and reclamation costs were estimated at \$6.9 million, while reclaiming the original 54 acres of disturbed land by AML were estimated at \$351,000. The operation produced 244,360 tons of Little Pittsburgh and Morantown coal, which produced almost \$7.3 million in income. Net profit was estimated at \$330,000.

Six discharges existed on the site before remining. The flows of these discharges were not determined before remining and, according to the operator, all discharges were about pH 6.0 (for comparison, we assumed an acidity of 10 mg/L). After remining, water quality was measured for 14 months and showed the discharges to have an average flow of 1,088 gpm, pH of 6.5, average acidity of 5 mg/L, and an iron concentration between 0.5 and 1.0 mg/L. It is hard to conceive of the water actually becoming worse on this site due to remining. The calcareous shale overlying the Little Pittsburgh coal was specially handled and placed on the Little Pittsburgh pavement to seal it from water and to neutralize the acidity. Since there was no definitive data taken from point sources before remining, it is believed that water quality coming from the site has been improved.

The **Benbush** site is located in Tucker County, West Virginia. The site had been surface mined and augered by a previous operator. The remining operator recut the 12,000 linear feet of highwall to economic limits (to an average of about 70 feet of overburden cover), daylighted preexisting auger holes, augered further into the hillside from his final highwall, eliminated the new highwall and reclaimed the entire site to current standards. The 211-acre site is beautifully vegetated and no visual signs of AML conditions are apparent. The total cost of mining and reclamation for this site was about \$14.5 million. Estimated AML expense for the 205 original disturbed acres was \$1.3 million. About 514,800 tons of Upper Freeport coal were produced from the operation, producing an income of \$15.5 million. Net profit on the site was estimated at nearly \$1 million.

A 12-month baseline study reports nine discharges from the site. Like Fairfax, no flows were measured before remining, but the water pH was around 5.5 with an average of 10 mg/L acidity concentrations. Four of the discharges

were eliminated and others that have appeared or remain have a pH of 6.1 and a slightly decreased average acid concentration of 7 mg/L.

The **Big Mountain** site is located in Greenbrier County, West Virginia. The Sewell coal bed had been surface mined previously, leaving a highwall. The remining operator recut the highwall along the Sewell coal and augered the coal, and also surface mined the Castle coal bed 150 feet above the Sewell. The spoil generated from the overlying Castle coal bed and the recut of the Sewell coal was used to eliminate highwalls and cover preexisting spoil piles. The operation was 67 acres and the total cost of mining and reclamation was about \$7.1 million. The AML expense to reclaim the original disturbed 35 acres was estimated at \$227,500. The operator reports 188,581 tons of coal were removed with an income of about \$6 million. A net loss of about \$1 million was estimated on this operation.

Only one pre-remining discharge was recorded on the site and it flowed at an average of 10 gpm with an average acidity concentration of 40 mg/L, and iron concentration of 5 mg/L. After remining, the discharge increased in flow to an average of 20 gpm, but no acidity or metals were found in the water. The operator was estimated to lose money on this remining operation, but the remining activity greatly improved the visual appearance of the site and improved the water quality of a mildly acidic seep.

The **Buffalo #1 and #2** sites are located in Harrison County, West Virginia. The Pittsburgh and Redstone coals had been mined previously in this area. This area is known for producing alkaline water after surface mining due to the abundance of alkaline red shales in the overburdens of both coal beds. Underground mining of these two coal beds often produces slightly acidic to neutral water, but laden with suspended iron. The remining operator recut the highwall of the Pittsburgh coal and completely removed the Redstone coal by mountaintop mining on both sites. The Buffalo #2 site mined an area of 177 acres, while the Buffalo #1 site mined approximately 145 acres. Total mining and reclamation costs were \$8.3 million at Buffalo #2 and \$7.3 million at Buffalo #1. The cost of reclaiming these sites by conventional AML programs was estimated to be \$910,000 on 140 acres at Buffalo #2 and \$780,000 for 120 acres at Buffalo #1. About 828,000 tons of coal were removed on Buffalo #2 (income of \$23 million with an estimated net profit of \$14.8 million) and 669,000 tons were removed on Buffalo #1 (income of \$18.7 million and an estimated net profit of \$940,000). No water quality problems existed on the site prior to or after remining.

**Table 2.** Estimates of overburden materials moved, total reclamation costs, coal tonnage and income, and estimated AML expense.

Mine	Overburden Regrading (\$1.00/cu.yd)	Excess Overburden Handling (\$1.25/cu.yd)	Surface Water Control (\$/site)	Topsoiling & Revegetation Costs (\$2,500/acre)	Total Cost Reclamation
Hooks	\$211,000	\$138,750	\$3,000	\$21,750 for 8.7 acres	\$375,167
Dellich	\$484,000	\$363,000		\$32,250 for 13 acres	\$879,250
Beal	\$756,400	\$264,500		\$56,250 for 5 acres	\$1,077,150
Solar	\$14,520,000	\$1,700,000	\$1,193,000	\$450,000 for 180 acres	\$17,863,000
Rider	\$8,873,000			\$475,000 for 190 acres	\$9,348,000
Fairfax	\$5,488,314	\$1,192,750		\$252,500 for 101 acres	\$6,933,564
Benbush	\$12,100,000	\$1,865,253		\$528,000 for 211.2 acres	\$14,493,253
Big Mountain	\$3,630,000	\$4,448,772		\$167,500 for 67 acres	\$7,134,079
Buffalo #2	\$7,139,000	\$1,865,253		\$442,500 for 177 acres	\$8,350,600
Buffalo #1	\$5,848,000	\$1,443,867		\$362,500 for 145 acres	\$7,293,400

Mine	Tonnage Removed	Income Received	Net Profit	Estimated AML Expense For Area
Hooks	40,000	\$1,000,000	\$624,833	\$56,550 for 8.7 acres
Dellich	76,000	\$1,900,000	\$1,020,750	\$84,500 for 13 acres
Beal	75,000	\$1,875,000	\$797,850	\$39,000 for 6 acres
Solar	900,000	\$22,500,000	\$4,637,000	\$2,925,000 for 450 acres
Rider	240,000	\$6,000,000	-\$3,348,000	\$715,000 for 110 acres
Fairfax	244,360	\$7,260,800	\$327,236	\$351,000 for 54 acres
Benbush	514,800	\$15,487,000	\$993,747	\$1,332,500 for 205 acres
Big Mountain	188,581	\$6,074,000	-\$1,060,079	\$227,500 for 35 acres
Buffalo #2	828,000	\$23,184,000	\$14,833,400	\$910,000 for 140 acres
Buffalo #1	669,000	\$18,732,000	\$942,500	\$780,000 for 120 acres

**Table 3.** Water quality on 10 sites before and after remining.

BEFORE						
Mine	GPM Flow	pH	Acid (mg/L)	Fe (mg/L)	Yearly Cost*	Chemical
Hooks	188	6.0	10	1.0	\$2,980	CaO
Dellich	57	5.5	9	1	\$1,060	20% caustic
Beal	128	4.2	57	<1	\$6,470	CaO
Solar	503	2.9	1,490	404	\$673,000	CaO
Rider	121	3.1	415	30	\$44,540	CaO
Fairfax	1,088	6.0	10	<1	\$9,650	CaO
Benbush	1,926	5.5	10	<1	\$17,000	CaO
Big Mountain	10	3.0	40	5	\$830	20% caustic
Buffalo #2	Good quality					
Buffalo #1	Good quality					

AFTER						
Mine	GPM Flow	pH	Acid (mg/L)	Fe (mg/L)	Yearly Cost*	Chemical
Hooks	108	6.0	10	<1	\$960	CaO
Dellich	21	5.5	4	<1	\$175	20% caustic
Beal	71	4.9	25	<1	\$1,570	CaO
Solar	263	6.5	0	1	\$0	CaO
Rider	19	6.0	0	1	\$0	CaO
Fairfax	1,088	6.5	5	1	\$4,825	CaO
Benbush	1,926	6.1	7	<1	\$12,000	CaO
Big Mountain	20	6.0	0	<1	\$0	20% caustic
Buffalo #2	Good quality					
Buffalo #1	Good quality					

\*Costs for calcium oxide (CaO) were estimated at \$240 per ton and 20% caustic (NaOH) was \$0.60 per gallon (Skousen et al. 1996). Cost to treat/yr were determined by calculating tons of acid per year (flow x acid x 0.0022) times conversion factors (780 for caustic and 0.56 for calcium oxide) and costs for each chemical to treat the acid per year. These costs were then doubled for caustic and tripled for calcium oxide.

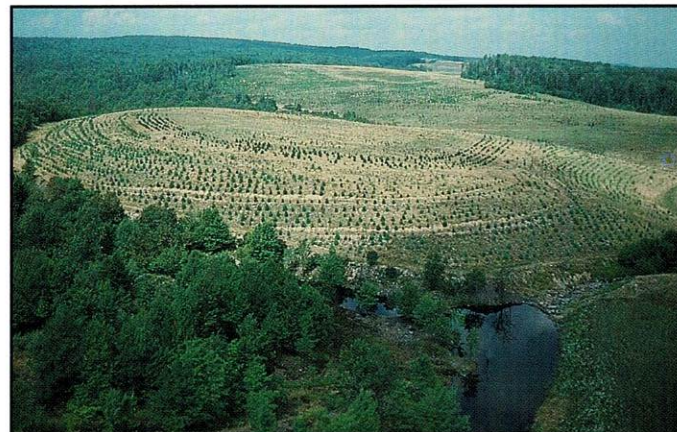




The remining operation at Benbush was 211 acres, daylighted old auger holes from previous surface mining and eliminated old highwalls. Picture taken March, 1983.

## Summary

All of the remining operations described in this paper resulted in significant environmental benefits. Previous to remining, all sites were characterized by dangerous and unsightly AML conditions with vertical highwalls of heights varying from 30 to 70 feet, barren landscapes, and poor water quality. Remining eliminated most of the AML scars and produced productive, valuable land. In addition, in all but two cases, remining produced significant profit to the remining operator and, in the process, provided jobs and state and federal tax money. The remining of the Solar and Rider sites in Pennsylvania were subsidized by a local utility. The Solar and Rider remining operations had spectacular water quality results. Highly acidic discharges were replaced with alkaline discharges. The refuse pile, where pyritic wastes from the Solar and Rider sites were buried, also discharges alkaline water. Most importantly, the receiving stream, Potato Garden Run is now alkaline and the quality of Raccoon Creek, which was dead in the 1970's, is significantly improved. For the three Butler county sites in Pennsylvania, pre-remining water quality problems were minor, so the improvements were not remarkable. Water quality at Fairfax and Benbush in West Virginia was improved slightly, and the acid water at Big Mountain was eliminated. No pre-remining water quality problems were known at the Buffalo #1 and #2 sites and post-remining water quality is also good.



The Benbush remining job is beautifully vegetated with grasses and trees. Picture taken September, 1990.

The cost of these environmental improvements differed among sites as a result of the problems encountered on each site and their size. For the Hooks, Dellich and Beal sites, the full costs of mining and reclamation of the site were born by the coal companies. The same was true of all the West Virginia sites. Total reclamation costs amounted to \$75 million and excess overburden were \$12 million. A total of 3.8 million tons of coal were removed at an income of \$105 million. If these 10 sites were reclaimed by state AML contracts, the cost would have been \$8 million. Considering that each operation paid \$0.35/ton in coal tax, an additional \$1.3 million went into the AML fund. Clearly, remining and reclamation is preferred to federal and state AML-financed projects. The Rider and Solar operations were conducted under a unique cost-plus mining contract that likely cost the utility rate payers ~\$10/ton of coal mined. While expensive, the net cost of the two operations was still considerably less than other reclamation options. In particular, the daylighting operations that caused the water quality improvements would never have been undertaken by a government agency. The results suggest privately-financed remining projects are highly cost effective, and that subsidized remining activities can be another tool to be considered in stream restoration projects.

## Acknowledgments

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High Lift .....	16 yd <sup>3</sup> (12.00 m <sup>3</sup> )	20 yd <sup>3</sup> (15.29 m <sup>3</sup> )	26 yd <sup>3</sup> (19.9 m <sup>3</sup> )
Dump Heights			
Standard .....	18'-5" (5.61 m)	18'-10" (5.74 m)	21'-6" (6.55 m)
High Lift .....	19'-10" (6.04 m)	20'-0" (6.10 m)	23'-6" (7.16 m)



# COAL CALENDAR



## September

- 8 Annual Coal Foundation Golf Tournament**, Pete Dye Golf Club, Bridgeport, WV, contact Patty Bruce, WVMRA, 1624 Kanawha Boulevard East, Charleston, WV 25311, (304) 346-5318, FAX 346-5310.
- 8-12 Acid Mine Drainage Formation and Abatement Technology**, Penn State University, University Park, PA, contact Chriss Schultz, 225 Penn State Conference Center Hotel, University Park, PA 16802, (814) 863-5130.
- 10-12 Bluefield Coal Show**, Brushfork Armory-Civic Center, Bluefield, WV, contact Greater Bluefield Chamber of Commerce, P.O. Box 4098, Bluefield, WV 24701, (304) 327-7184, FAX 325-3085.
- 14-16 42nd Annual Canadian Conference on Coal**, Empress Hotel, Victoria, BC, contact The Coal Association of Canada, 502, 205 9th Ave. SE, Calgary, Alberta, Canada T2G 0R3, FAX (403) 265-7604.
- 15-16 Coal Marketing Days**, The Doubletree, Pittsburgh, PA, contact Pasha Publications, 13111 Northwest Freeway, Suite 230, Houston, TX 77040, (713) 460-9200, FAX 460-9150.
- 16-17 1997 Kentucky Nonpoint Source Conference**, Holiday Inn North, Lexington, KY, contact Geaunita Caylor, OISTL/College of Engineering, Lexington, KY 40506, (606) 257-2820, FAX 257-2173.
- 22-26 Review Course for the Professional Engineering Examination of Mining/Mineral Engineers**, Penn State University, University Park, PA, contact Chriss Schultz, 225 Penn State Conference Center Hotel, University Park, PA 16802, (814) 863-5130.
- 28-1 National Mining Association, Annual Convention**, Buena Vista Palace Resort Hotel, Lake Buena Vista, FL, contact Dianne Taylor, NMA, 1130 17th St. NW, Washington, DC 20036, (202) 463-2607.

## October

- 2-4 Kentucky Coal Association, Annual Membership Meeting**, Marriott Griffin Gate Resort, Lexington, KY, contact KCA, 340 S. Broadway, #100, Lexington, KY 40508, (606) 233-4743, FAX 233-4745.
- 6-10 Professional Engineer Exam Review**, Mining Resources Bldg, WVU Campus, Morgantown, WV, contact Department of Mining Engineering, College of Engineering & Mineral Resources, WVU, P. O. Box 6070, Morgantown, WV 26506, (304) 293-7680, FAX 293-5708.
- 9-10 58th Annual Meeting, Kentucky Mining Institute**, Lexington Center Heritage Hall, Lexington, KY, contact Geaunita Caylor, OISTL/College of Engineering, Lexington, KY 40506, (606) 257-2820, FAX 257-2173.
- 24-25 West Virginia Mining & Reclamation Association, Fall Board Meeting**, The Lakeview Resort & Conference Center, Morgantown, WV, contact Patty Bruce, WVMRA 1624 Kanawha Blvd. E., Charleston, WV 25311, (304) 346-5318, FAX 346-5310.

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