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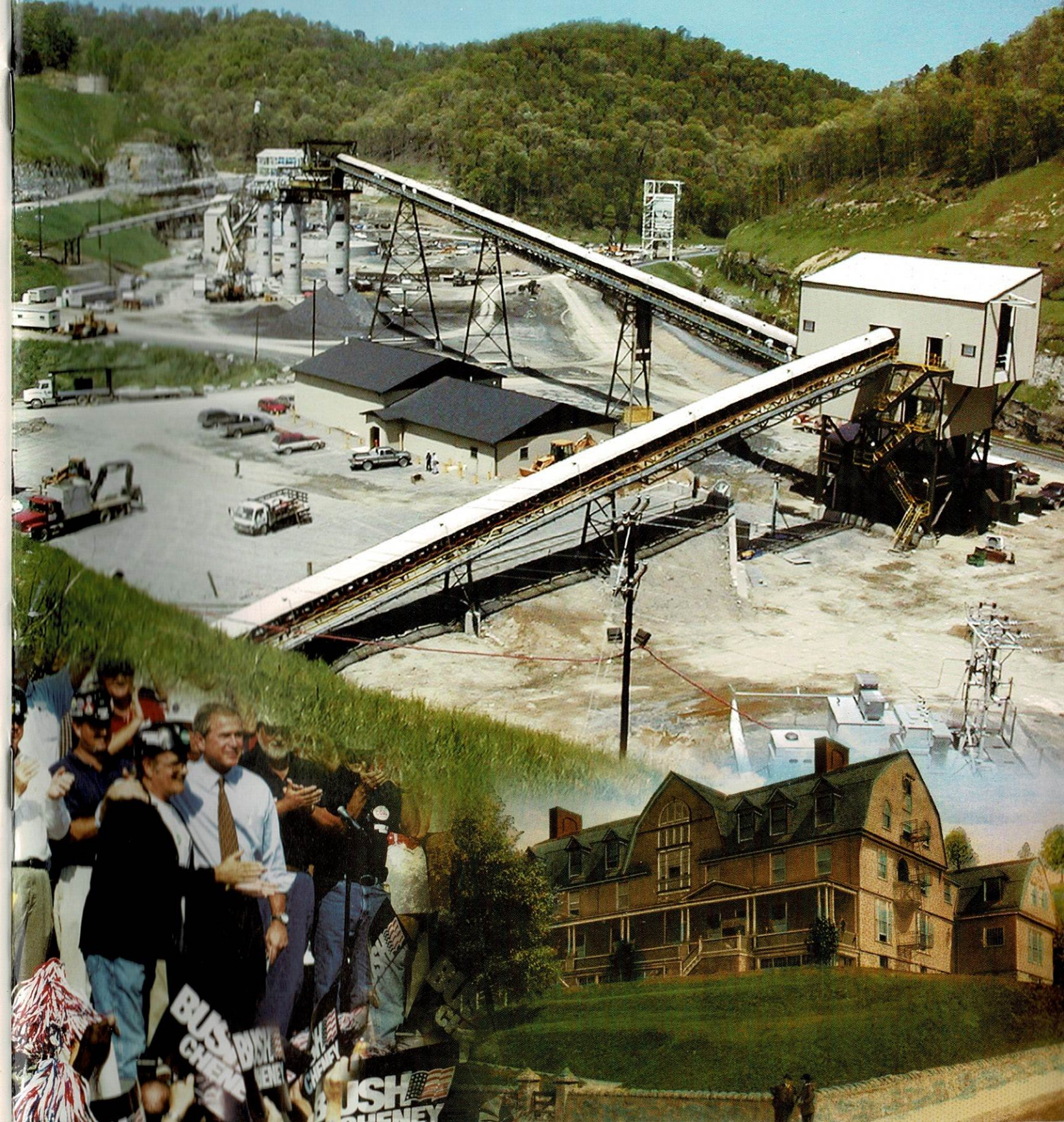
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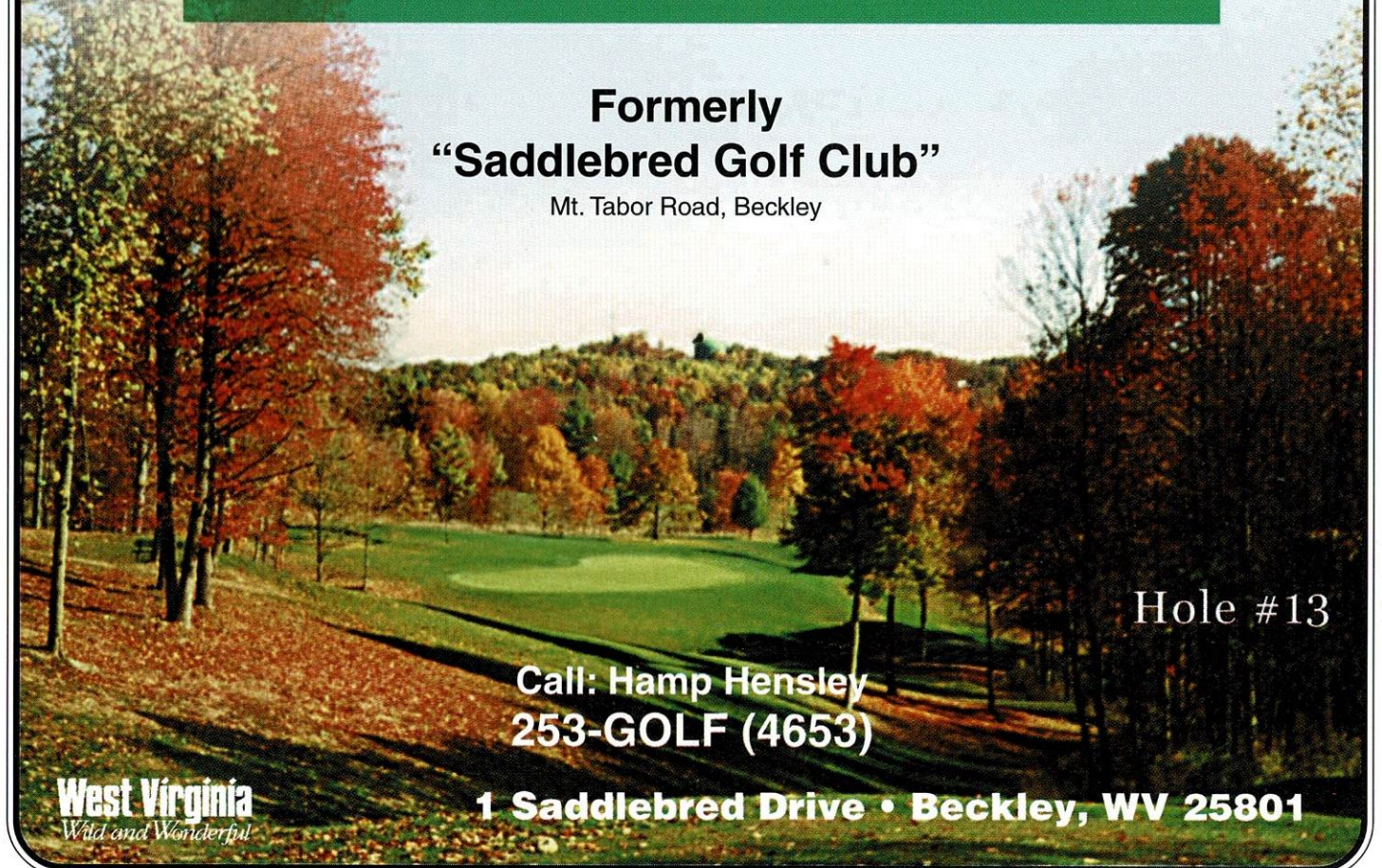
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# Green Lands

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## Green Lands

is a quarterly publication of the  
West Virginia Coal Association, Inc.,  
with offices at 1624 Kanawha Boulevard East,  
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## On the Cover

(Top photo) Overlooking Fork Creek Mining, Boone County, which is the recipient of the 2000 David C. Callaghan Award presented at the 28th Annual West Virginia Mining Symposium in Charleston, W.Va. - see pg 18. (Bottom left) President George W. Bush keeps the faith with West Virginia. - see pg. 7 (Bottom right) Old headquarters of Pocahontas Land Corporation now celebrating its 100th year anniversary. - see pg. 8

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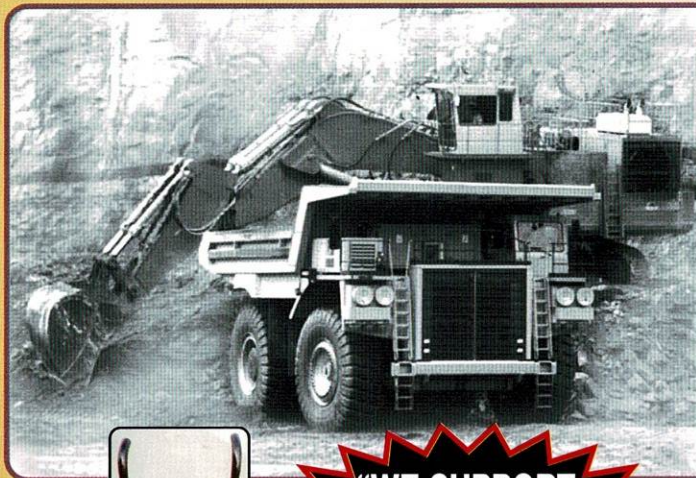
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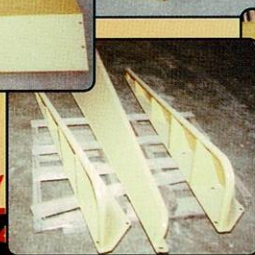
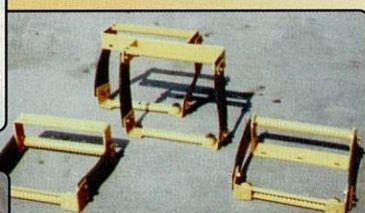
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# Going Underground to See the Light

March 12, 2001, will go down as one of the more historic days at the Campbells Creek Mine complex. It seemed like any average bright, sunny, spring day in Kanawha County, but it was like no other.

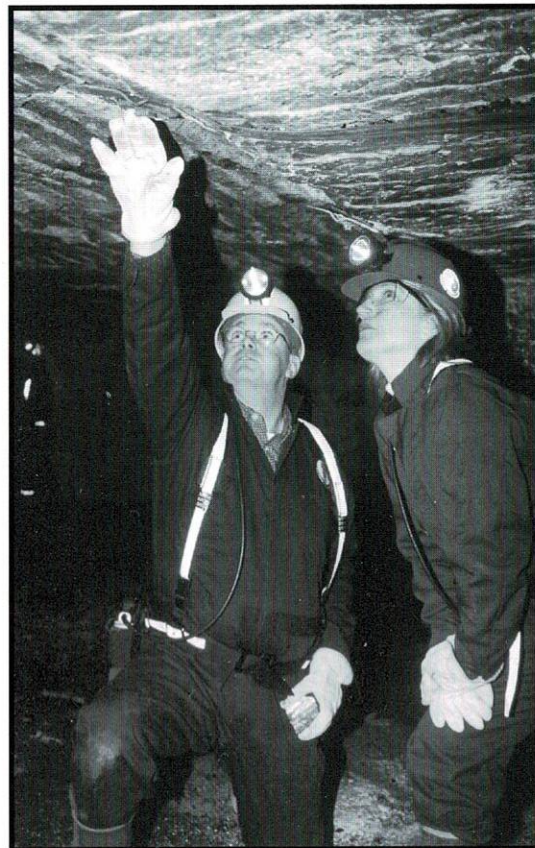
It was that morning Shelley Moore Capito, U.S. Congresswoman for West Virginia, ventured into an area where no other Congressional representative or any elected official has gone, the Campbells Creek #4 underground mine. Many elected officials support the state's coal industry and have visited both surface and underground coal mines throughout West Virginia, none have been to CC #4.

"I have a much greater appreciation for those working underground," Capito said. "Workers there have enormous pride in what they do. They are really like one big family here."

Capito, formerly a two term Kanawha County Republican delegate in the 30th district, was elected recently to represent West Virginia in the second district. She is only the second woman in history to represent West Virginia in Congress. The last woman to do so was Democrat Elizabeth Kee in 1962.

The seat was vacated by Governor Bob Wise after representing the state for 18 years in Washington, D.C.

Having supported the industry at the state level for years,



**Peter Lawson (left), president of Catenary Coal, shows Congresswoman Shelley Moore Capito the roof bolting techniques used at Campbells Creek #4 underground mine located in Kanawha County.**

Capito now touts West Virginia coal at the national level. Just a week prior to visiting CC #4, she testified before the subcommittee on Energy and Air Quality, in support of West Virginia coal and its role in solving the nation's energy problems.

"Coal is an important part of our economy," she said. "We need some type of comprehensive energy policy and coal is important to that role."

The Campbells Creek mine complex, located just outside of Charleston, is part of the Arch Coal's Catenary Coal operation and employs about 150 people.

The area was originally mined in the 1920's. Since then, two surface mining operations have operated in that area. In 1989, Arch Coal purchased the mineral rights from Lawson Hamilton. Amherst Industries currently owns the property.

Currently, the complex has two active mines, CC #4 and CC #5, which are both operated by contractors. Annual coal production averages 1.3 million tons at the complex.

Ninety percent of the coal is sold to domestic utilities and shipped by barge from the Amherst Industries, Inc. dock. The remaining 10 percent is sold to Dow Chemical in Charleston and is transported by truck.

Campbells Creek #4 is operated by Point Mining, Inc., which is owned by Roy Lucas. It began operation in 1994 and is the largest of the two mines in operation and its Stockton coal seams range from five to nine feet thick.

The West Virginia Coal Association, Inc. and the West Virginia Office of Miners' Health and Safety and Training recently recognized Point Mining Inc. for its safety programs and accomplishments.

"It was good to see the many safety precautions they have there," Capito said. "There were all kinds of preventative measures and it's clear to see that aspect of the job is not taken lightly."

President George W. Bush, who acknowledges the key role the Mountain State played in his election, demonstrated recently that he will keep the faith with West Virginia coal miners. The President decided against including carbon dioxide as a regulated pollutant.

In each of three visits to West Virginia during the campaign, the President promised to do what he could to promote coal as a major energy source and to protect the jobs of coal miners.

WVCA President Bill Raney was not surprised by the decision. "I believe this president is committed to protecting both the environment and the economy. This decision reflects that commitment. George Bush knows how business works. He knows how good jobs are created. He knows how to manage. And he knows how to lead."

"It is a simple fact," Raney continued, "that more than 55 percent of all electric power produced in this country is generated through coal-fired power plants. It is also a fact that the number of these power plants has diminished over the past two decades largely, because of scientifically unwarranted environmental concerns. This comes at a time when

## President Bush Keeps the Faith with West Virginia

there is an almost insatiable need for electric power in the U. S. that will only grow larger.

"While progress to reduce emissions has been successful, we agree that a more intense effort is needed to develop newer, more effective clean coal technology. President Bush's strategy to increase coal-fired electric power generation and simultaneously to insist on an aggressive research program to develop clean coal technology is a sound and prudent policy."

"In West Virginia, with a century's worth of low-sulfur coal reserves in the ground, we think the President's decision against mandatory emission reductions for carbon dioxide makes perfect sense. Further, we applaud President Bush for keeping a campaign promise he made to West Virginia coal miners and their families: to use coal as a significant component of a comprehensive and balanced national energy policy."

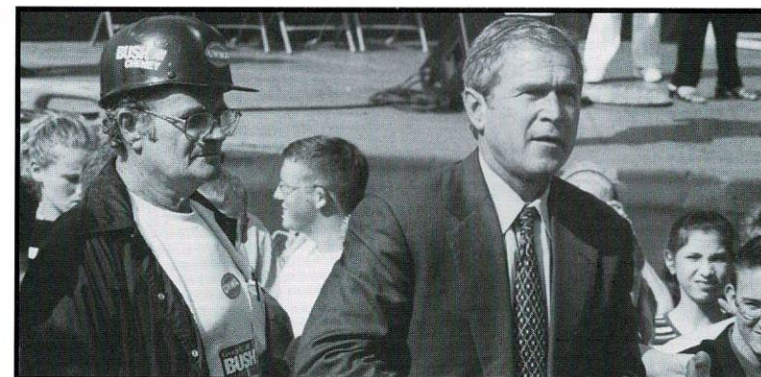
There are no commercially available technologies for removing and storing carbon dioxide. Including carbon dioxide as part of a multiple emissions strategy would almost certainly lead to higher electricity

prices and a serious energy shortage. Carbon dioxide is not listed as a pollutant under the Clean Air Act.

West Virginia Senator Robert C. Byrd and others in the Senate advocate the elevation of clean coal research to national priority status. President Bush is working with them in support of a \$2 billion, 10 year research effort to find more environmentally effective ways to produce coal-fired electricity.

Raney also praised the President's position on the Kyoto Treaty. "This treaty was negotiated over the unanimous objections of the U.S. Senate, which rejected it by a vote of 95-0," Raney pointed out. "It exempts 80 percent of the world, including major population centers such as China and India from compliance, and would cause serious harm to the U.S. economy."


"President Bush is keeping his campaign promise to West Virginia coal miners and their families," Raney concluded. "In keeping this promise, he is also insuring that our nation is using coal to make us more energy independent, and to insure that we can keep the lights on."



**Dick Kimbler, president of United Mine Workers Local 2935, escorts President George W. Bush onto the stage during a campaign stop in Huntington one month prior to the election.**



# Pocahontas Land Corporation



***Celebrating  
100 Years***

## *A Glance at History*

### ***Editor's note:***

*This is a brief history of Pocahontas Land Corporation. Dr. Stuart McGehee is writing a book containing a more detailed and complete version of the company's history and is scheduled to be released this fall.*

*Photographs are courtesy of the Eastern Regional Coal Archives, Bluefield, W.Va.*

This year, Pocahontas Land Corporation hits a company landmark, 100 years in business, which is quite a milestone by any standard.

PLC has quietly helped carve a piece of southern West Virginia's history, becoming an important part of the area's growth in the early 1900s.

Although PLC has been in business for a century, its roots go much deeper. PLC is a subsidiary of Norfolk Southern, which evolved from the old Norfolk and Western Railway Company.

In 1873, Captain I.A. Welch began exploring the undeveloped region of West Virginia for timber possibilities and found a blacksmith near Pocahontas, Virginia. There, behind the shop, Welch saw an outcrop of coal 13 feet high that burned without forced draft.

Back in Philadelphia, Frederick Kimball, president of the newly formed N&W had interest in the coal as a source of fuel for the company's steam locomotives. However, with that part of the state so rugged, an efficient way to remove the coal from the ground and the area had not been developed.

Around 1880, Kimball decided to buy the land that included the present-day McDowell, Mercer and Wyoming counties.

To oversee the purchasing and development of the land, Flat-top Coal Land Association, a direct predecessor of PLC, was created and headquartered in the town of Bramwell in Mercer County. It was during this time that 900 square miles of Pocahontas #3 coal seam was discovered in that area.

Kimball constructed new railroads that pierced southern West Virginia for the first time in order to transport the mineral out of the coalfields. In 1886, he completed his task that opened an area to modern transportation and new development.

As a result, many workers brought their families to the area. Towns sprung up and grew. McDowell County and the surrounding area grew to a population of 50,000 by the turn of the century with no sign of slowing down.

N&W/PLC provided about 100,000 coal miners with jobs and their families with homes throughout southern West Virginia.

In fact, it was Flat-top that constructed mines and moved the first N&W coal from Bramwell in 1885.

The Flat-top property amounted to 300,000 acres that was acquired by the N&W. On December 31, 1901, the company reorganized as Pocahontas Coal and Coke Company.



Until 1925, the company was headquartered in Bramwell, then moved to Bluefield, West Virginia, where it is today.

Then in 1939, Pocahontas Coal and Coke Company changed its name to Pocahontas Land Corporation.

Today, PLC and its subsidiary, Pocahontas Development Corporation, both headquartered in Bluefield, own or manage 1.05 million acres of natural resources properties in Alabama, Illinois, Kentucky, Tennessee, Virginia and West Virginia. It is the largest landowner in West Virginia.

PLC is committed to being a responsible owner and steward of the properties it owns or manages. Through cooperative efforts with

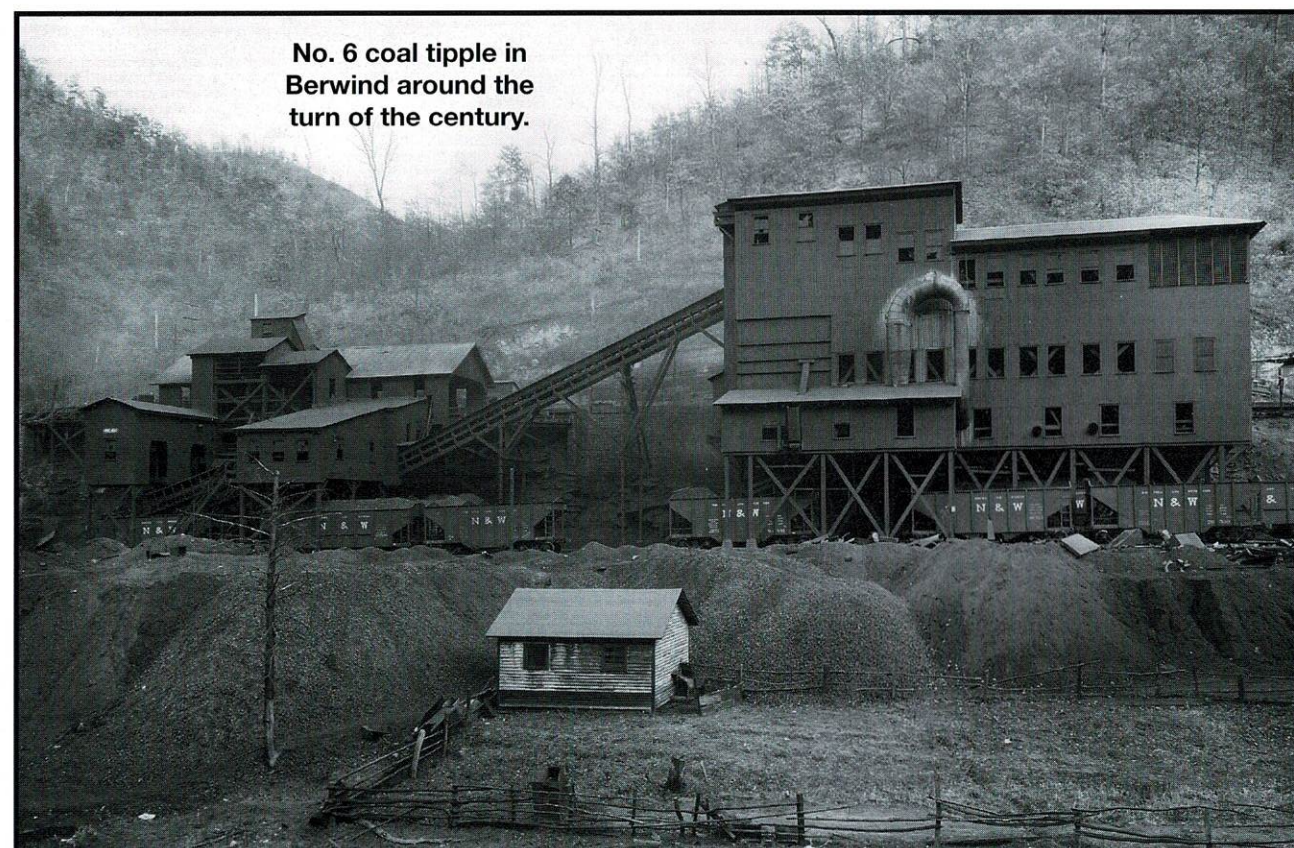


lessees, innovative methods in post mining land use and reclamation of abandoned mine lands have resulted in the conversion of formerly rough mountainous terrain into usable land.

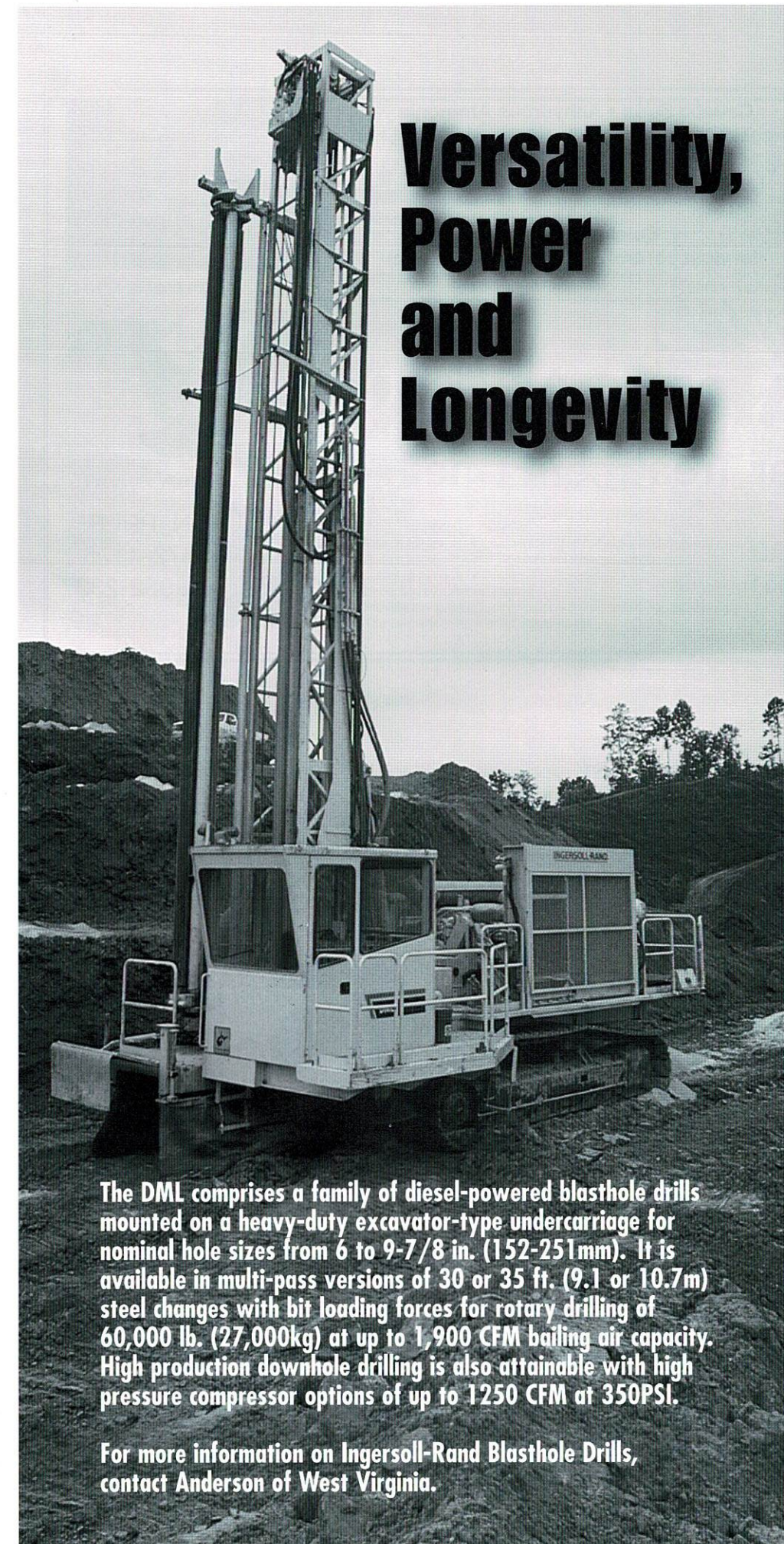
Over the years, much of PLC original land has been donated for the establishment of 33 towns and communities. In fact, since its inception, PLC

has provided more than 65,000 acres of surface and fee lands for numerous uses. It has donated about 5,000 acres within the last 25 years to economic development projects that include schools, churches, health clinics, fire departments, state parks, and recreational areas.

(Continued on page 40)



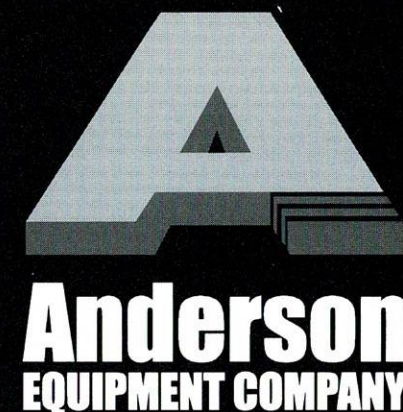
No. 6 coal tippie in Berwind around the turn of the century.



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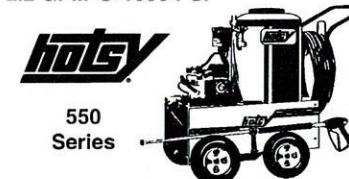


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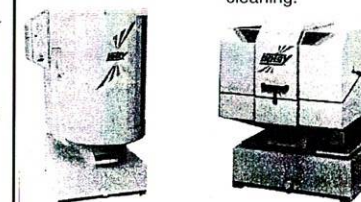
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# Mingo Logan Coal Company Recognized for Safety Program

Mingo Logan Coal Company grabbed top honors in safety at the 28<sup>th</sup> Annual West Virginia Mining Symposium held in Charleston in February.

While 28 "Mountaineer Guardian" awards were presented recognizing top quality safety programs, the award for the most outstanding safety program is the "Barton B. Lay Milestones of Safety Award," named for the former Director of the Department of Mines.

This year, the top safety award was presented to Mingo Logan Coal Company, for its outstanding safety record and accomplishments at its Mountaineer Mine in Mingo County.

The Mountaineer Mine is one of the largest underground mines in West Virginia, employing close to 300 people. It began operation in June 1991 and has produced more than 35 million tons of coal since that time.

The company has a violation rate of 0.8 and an accident frequency rate of 2.01 compared to the state's average of 5.58. As of February 15, the Mountaineer mine had gone 131 days without a lost time accident.

Mingo Logan attributes its positive safety record to "the quality of our people," said Rick Dillon, Manager of Safety for the Mountaineer Mine.



**Mingo Logan Coal Company was the recipient of the 2000 "Barton B. Lay, Jr. Milestone of Safety Award" during the 28th Annual West Virginia Mining Symposium awards luncheon on February 15th. Pictured are (l-r): Buddy Johnston; Jim Mullins; Doug Conaway, Director West Virginia**

"We are proud that everybody here is committed to the fact that safety is the core component of the overall business strategy of Arch Coal," he said. "Our employees work hard to make every day a safe day."

"It is fitting that with management and labor working together, the coal industry can continue to strive to be within striking distance of the ultimate goal of zero fatalities," said Doug Conaway, Director of the Office of MHS&T.

Previously, mining operations won the Mountaineer

**Office of Miners' Health, Safety and Training; Larry Dameron; Dave Runyon; Matt Murray; Rick Dillon; Ken Woodring, Chairman of the Board, West Virginia Coal Association, Inc., Chris Hamilton Senior Vice President, WVCA; and David Vance, MHS&T Inspector.**

Guardian by reaching tonnage goals, based on employment levels, without having a fatality.

WVCA, Inc. Vice President, Dan Miller, noted the awards program was revamped in 1998.

"The safety program established by the State and carried out by the industry has progressed to the point where we felt it was time to significantly raise the standards for this award," he said. "There were many deserving operations, as there have been in previous years, but we think

*(continued on page 16)*

# Mountaineer Guardian Award Winners

*Presented during the  
28th Annual West Virginia Mining Symposium,  
February 14-16, 2001 in Charleston, WV*

COMPANY	FACILITY	COUNTY	INSPECTOR
Arch of West Virginia, Inc.	Ruffner	Logan	James Matthews
Bluestone Coal Corp.	Keystone No. 6	Wyoming	J. Eddie Miller
Catenary	Samples Surface	Kanawha	Terry Keen
Coal-Mac, Inc.	No. 5	Mingo	James Matthews
Consolidation Coal Co.	Robinson Run No. 95	Harrison	Brian Mills
Elk Run Coal Co.	Black Knight II	Boone	Eugene White
Elk Run Coal Co.	Laurel Alma Mine	Raleigh	Chuck Webb
Fola Coal Co., Inc.	Peach Orchard Prep Plant	Nicholas	Mike Armentrout
Hobet Mining, Inc.	Slab Fork	Logan	Bill Wolford
Independence Coal Co.	Twilight	Boone	Randall Bailey
Island Fork Construction, LTD	No. 32	McDowell	Steve Womack
J. F. Allen Co.	J. F. Allen Quarry	Randolph	John Meadows
Kanawha River Mining Co.	Sycamore South Surface Mine	Fayette	Terry Keen
Kingston Mining, Inc.	Glen Alum Mine	Fayette	Gary Wingrove
Marfork Coal Co.	Marfork Processing	Raleigh	Chuck Webb
Mingo Logan Coal Co.	Mountaineer Mine	Mingo	David Vance
Mystic Energy, Inc.	Candice No. 2	Boone	Ernie Pyles
New Land Leasing Corp., Inc.	Pax No. 2 Surface	Fayette	Terry Keen
Peerless Eagle Coal Co.	Lilly Fork Surface	Nicholas	Mike Armentrout
Pen Coal Corp.	Kiah Creek Prep Plant	Wayne	Richard Boggess
Point Mining, Inc.	Campbells Creek No. 4	Kanawha	Gerald Pauley
Pounding Mill Quarry Corp.	Mercer Crushed Stone	Mercer	J. Eddie Miller
Premium Energy, Inc.	No. 1	Mingo	J. Eddie Miller
Pritchard Mining Co.	Lens Creek No. 2 Surface Mine	Kanawha	Terry Keen
Roblee Coal Co.	Jesse's Run No. 2	Upshur	Bill Tankersley
Roxie Rebuild, Inc.	No. 1	McDowell	Bill Tucker
Simmons Fork Mining, Inc.	Surface	Wyoming	J. Eddie Miller
United Coals, Inc.	Rider No. 1	Harrison	Tom Shingleton
Wesley Leasing, Inc.	No. 1	McDowell	Milton Smallwood



## Mingo Logan from page 14

we've selected the most outstanding cross section whose safety records have set the standard for the state's entire industry."

The program is cosponsored by the West Virginia Coal Association, Inc. and the West Virginia Office of Miners' Health, Safety & Training. To be eligible for the award, a mine or preparation plant must have experienced no fatalities during the year and must be nominated by its local MHS&T inspector. Winners were selected on the basis of their overall safety programs.

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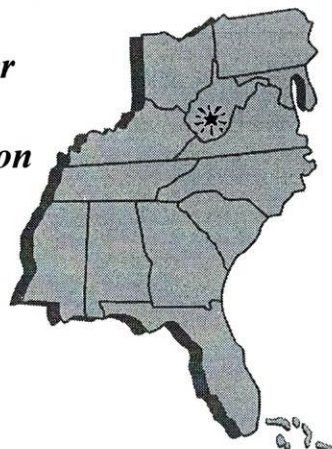
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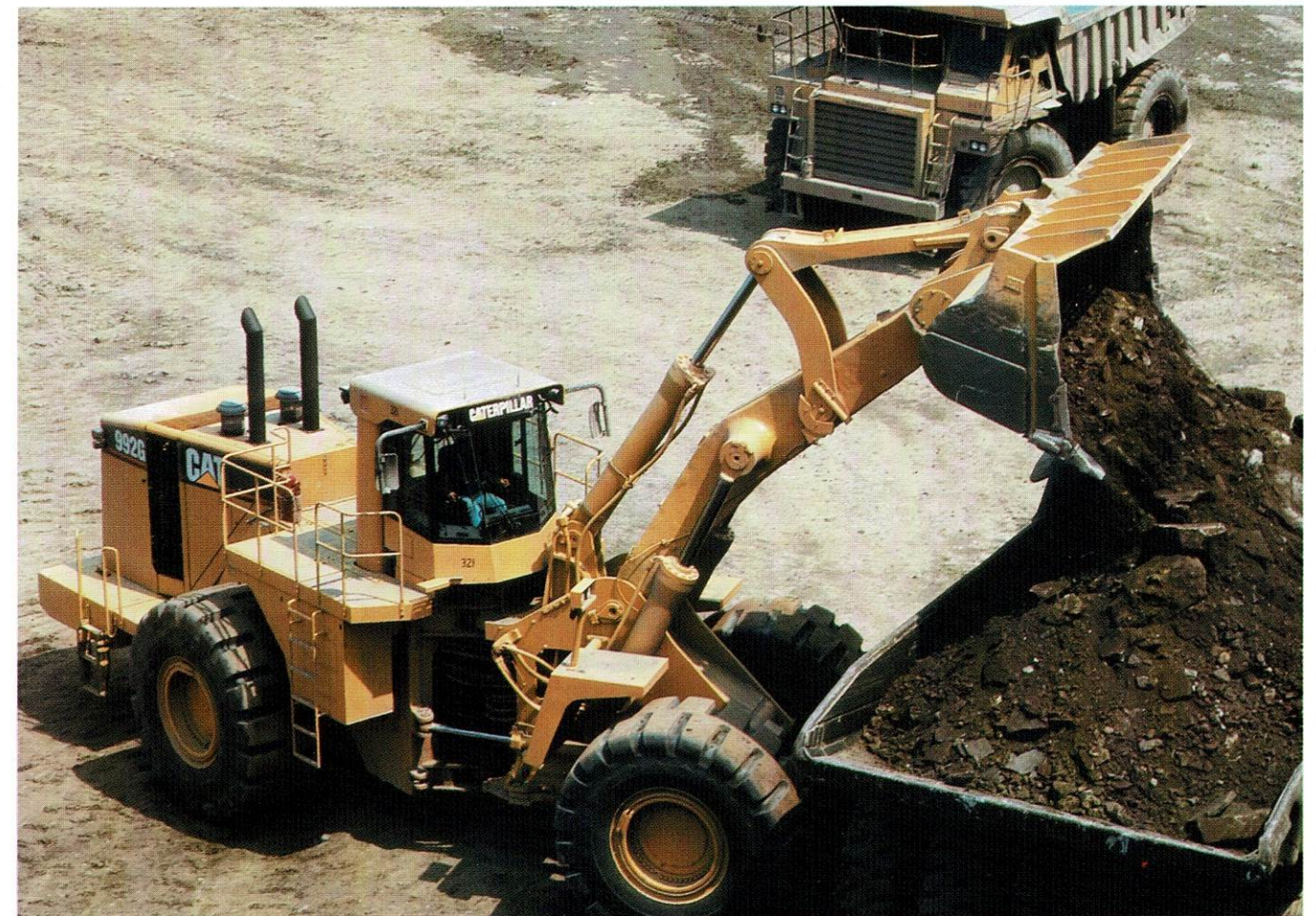
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# Fork Creek Mining Company Brings Home the 'Callaghan' for Reclamation

Fork Creek Mining Company's underground coal mine complex has been in operation for less than a year. Yet the company's reclamation efforts and accomplishments have stood out enough for people to take notice and earn the company the prestigious David C. Callaghan Award for 2000.

"We are extremely pleased for being recognized for this exceptional award," said Steve Capelli, senior vice president of Fork Creek Mining. "It's quite an accomplishment."

The company was one of 16 West Virginia coal and contracting companies recognized for their excellence in environmental enhancement during the 28<sup>th</sup> Annual West Virginia Mining Symposium in Charleston in February.

Sponsored by the West Virginia Coal Association in cooperation with the West Virginia Division of Environmental Protection, the reclamation awards are presented annually to companies that are judged to have outstanding achievements in mine development and construction, land reclamation, water quality enhancement and community involvement. To be considered for this award, a company must be nominated by its local DEP inspector.

The top honor, the David C. Callaghan Award, is named for the former director of the State



In recognition of its outstanding reclamation work, Fork Creek Mining Company was presented the 2000 "David C. Callaghan Award" during the 28th Annual West Virginia Mining Symposium in Charleston on February 16th. Pictured are (l-r): Phil Sims; Benny Campbell, DEP Inspector; Jim

Cook; Mike Callaghan, Director, Division of Environmental Protection; David Hancock; Howard Epperly; Steve Capelli, 1st Vice Chairman, West Virginia Coal Association, and Senior Vice President of Operations for Fork Creek Mining Co.; David Callaghan; and Don Del Bosco.

Department of Natural Resources, and later, of the State Division of Environmental Protection.

"The reclamation awards continue to be a source of pride for the state's industry," Ben Greene, association chairman of the West Virginia Coal Association said. "In addition to evaluating the nomination, the selection committee visited each of the award winning sites and I can attest that these operations reflect very well on mining and reclamation in West Virginia."

Fork Creek Mining Company, Boone County, was recognized for its commitment of more than \$100 million in a new operation that represents a sizeable investment in the future of West

Virginia with careful attention to the highest reclamation and water quality standards.

"The operations at Fork Creek demonstrate the highest standards and long traditions we have come to expect from the West Virginia coal industry," Greene, said.

In November 1997, Fork Creek purchased 28,000 acres in Boone, Lincoln and Kanawha counties and began the planning and development of the area in early 1998. In May 2000, the first coal was removed from the underground mine.

Fork Creek employs 157 people with active plans to hire 100 more. The complex has a slope and shaft operation that mines the #2 gas seam and a drift



*In Boone County, for overall excellence in all phases of planning, design, construction and operation of a major mining complex. This new commitment of more than one hundred million dollars represents a sizeable investment in the future of West Virginia, its citizens and our nation's critical energy needs. With careful attention to the highest reclamation and water quality standards, this new complex represents the best of our modern, high technology coal industry.*



operation that mines the 5 block seam. There is an estimated 25-year life to the mining project.

When constructing the underground operation, officials at Fork Creek went far beyond minimal requirements to ensure there was only minimal impact.

When a small fish pond had to be removed in order to build the preparation plant, company officials went to great monetary expense to preserve the 53 bass and three catfish and relocate them to Rock House Lake in Boone County.

"The bass ranged from three to five pounds," said Jim Cook engineering manager at Fork Creek.

The relocation of 9,000 feet of stream was also completed during the construction of the mine.

"Extreme care was taken when relocating the stream," Cook said. "We reseeded and planted trees and shrubs along the stream banks to get it back to its natural condition. As the trees and shrubs grow, they

will overhang the streambed and provide shade."

Prior to Fork Creek locating in the area, several portions of the streambeds were used as a roadway for vehicles. When planning the relocation, officials made sure that these streams would be protected from all vehicle traffic.

Biologists conducted extensive studies on the streams before and after the relocation and enhancement and all reports were positive, proving that Fork Creek did an outstanding reclamation work.

"Basically, we planned and designed the construction and operation of this facility to ensure that we would meet and exceed the environmental requirements," Cook said.

Fork Creek's \$100 million investment places a lot of trust in the future of West Virginia's economy. And, as the industry works to see that coal is the fuel of choice for the nation's energy, this is a major step of confidence.

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## Alwood Company

In Lewis County - Presented by Ducks Unlimited for outstanding accomplishment in the creation and preservation of wetlands wildlife habitat.



Pictured are (l-r): James Allen; Spencer Wooddell; Ron Haymond; Rusty Eaton, Ducks Unlimited; Jim Baczuk, DEP Inspector; and Steve Capelli, WVCA, First Vice Chairman.

## U.S. Steel Mining Company Bluestone Coal Corp. (Contractor)

In Wyoming County - Presented by the West Virginia Chapter of the Society of American Foresters for the commitment to planning, growing and management of premium commercial woodlands on mining sites.



Pictured are (l-r): Jerry Quesenberry, DEP Inspector; Steve Capelli, WVCA, First Vice Chairman; J.D. Higginbotham, Bluestone Coal; and Bob Beanblossom, West Virginia Chapter of the Society of American Foresters.





## Arch of West Virginia

*In Logan County, near Yolyn, in the creation of a 10.3 acre impoundment, fed by constructed flumes, complementing a massive acreage post-mining land use of hay and pasture. This wildlife-enhanced area has general diversity, ranging from fruit trees to dogwood with a lush cover of mixed grasses and legumes.*



Pictured are (l-r): Danny Robison; Ron Sheets, DEP Inspector; Ken Hodak; Jim Constant; Charlie Hall; Mike Day; Mike Callaghan, DEP Director; Steve Capelli, WVCA, First Vice Chairman; and James Plumley.

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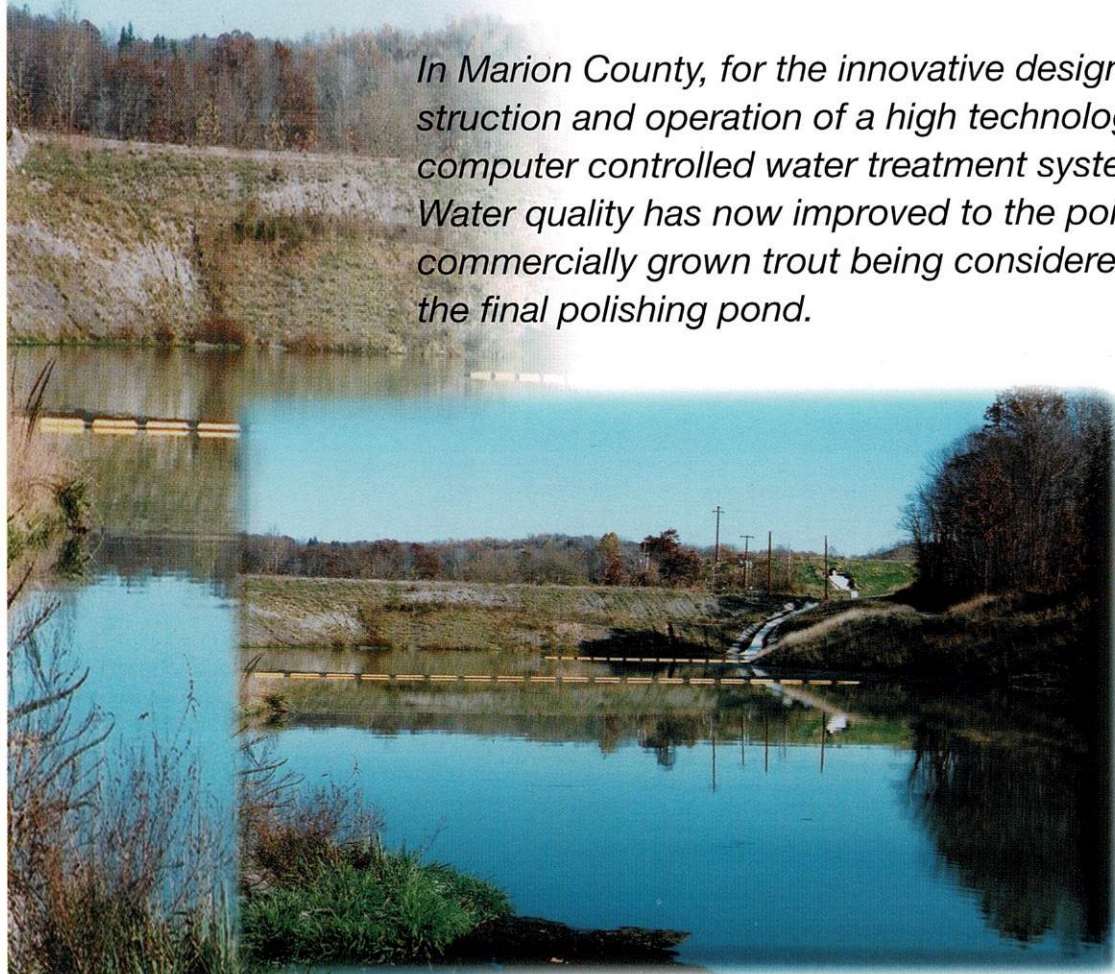
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## Eastern Associated Coal Corporation *Martinka Coal Company*

*In Marion County, for the innovative design, construction and operation of a high technology, computer controlled water treatment system. Water quality has now improved to the point of commercially grown trout being considered for the final polishing pond.*



Pictured are (l-r): Terry Fleming, DEP Supervisor; Gary Timms; Steve Capelli, WVCA; First Vice Chairman; Mike Callaghan, DEP Director; Fred Conner; and Mike Nunan, DEP Inspector.

## Green Valley Coal Company

*In Nicholas County, near Nettie, for the complete reclamation of the Little Laurel Creek Refuse Pile that had been dormant for more than fifteen years. In acquiring the property just three years ago and honoring the landowner's request, property values have increased with excellent productive pasture now being provided.*



Pictured are (l-r): Albert Rodebaugh, DEP Inspector; Steve Capelli, WVCA; First Vice Chairman; Frances Meadows; and Mike Callaghan, DEP Director.





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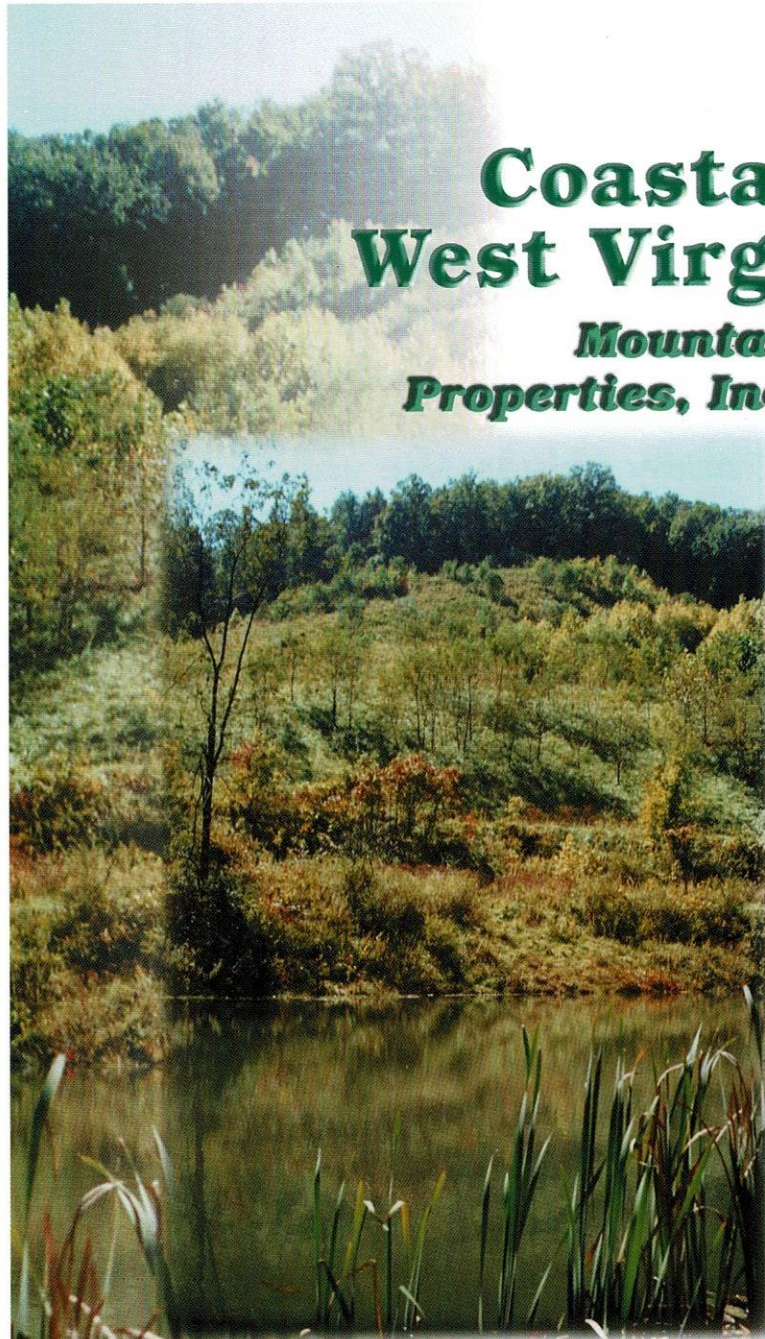
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## Coastal Coal- West Virginia, LLC

**Mountain Haus  
Properties, Inc. (Contractor)**



*In Braxton County, for the extraordinary attention to detail in returning two underground mining operations to the original contour, blending with the steep sloped surrounding area. This wildlife paradise is now home to numerous white tailed deer and other small game species.*



Pictured are (l-r): Gary Tinnel; Joe Myers; Mark Workman; George Skidmore; Steve Capelli, WVCA, First Vice Chairman; Dave Martin; Mike Callaghan, DEP Director; Keith Evans, DEP Inspector; and Jim Copley.

## Coastal Coal- West Virginia, LLC

**Greenbrier Operations**

*In Greenbrier County, on the headwaters of the environmentally sensitive South Fork of Cherry River, where special care and attention to detail has eliminated old contour disturbance and enhanced wildlife habitat, while maximizing coal production adjacent to the Monongahela National Forest.*



Pictured are (l-r): Nancy Hieb, DEP Inspector; Charlie Cutlip; Steve Capelli, WVCA, First Vice Chairman; Mike Callaghan, DEP Director; and Jim Copley.





## Pen Coal Corporation

*In Wayne County, for particular attention to stream restoration and enhancement, with emphasis on benthic habitat population. This underground complex has been totally restored with water quality greatly improved over that of the pre-mining conditions.*



Pictured are (l-r): Monty Hieb; Robert Marsh; Steve Capelli, WVCA, First Vice Chairman; Mike Callaghan, DEP Director; Bruce Short; Scott Eggerud, DEP Inspector; and Randy Maggard.

## Level Land Mining, Inc.

*In Nicholas County, near Calvin, where multiple-seam mining has enhanced and greatly improved the previous land use. The landowner now enjoys high quality timothy-alfalfa hayland producing excellent quality forage for several head of livestock.*



Pictured are (l-r): Cam Ford, DEP Inspector; Bill Keeney; Steve Capelli, WVCA, First Vice Chairman; Tim Keeney; and Mike Callaghan, DEP Director.



## Virginia Energy Company

*In McDowell County, straddling the West Virginia-Virginia border, this unique operation will transform more than 1,500 acres to a post-mining use of improved pasture, potential residential and recreational activities. With complete sediment control around the perimeter, water quality is always given high priority for compliance with all applicable standards.*



Pictured are (l-r): Richard Kennedy; Kevin Nicewonder; Steve Capelli, WVCA, First Vice Chairman; Kenny Nicewonder; Mike Callaghan, DEP Director; and James Rose, DEP Inspector.

## White Mountain Mining Company, LLC

*In Raleigh County, near historic Stotesbury, for the complete transformation of several old underground permits to modern day standards, including complete renovation and improvements to the local community church. Operating in close proximity to local residents, this complex is truly a positive environmental influence under most adverse conditions.*



Pictured are (l-r): Mike Furey, DEP Inspector; Steve Capelli, WVCA, First Vice Chairman; Butch Stallard; and Mike Callaghan, DEP Director.





## Virginia Energy Company

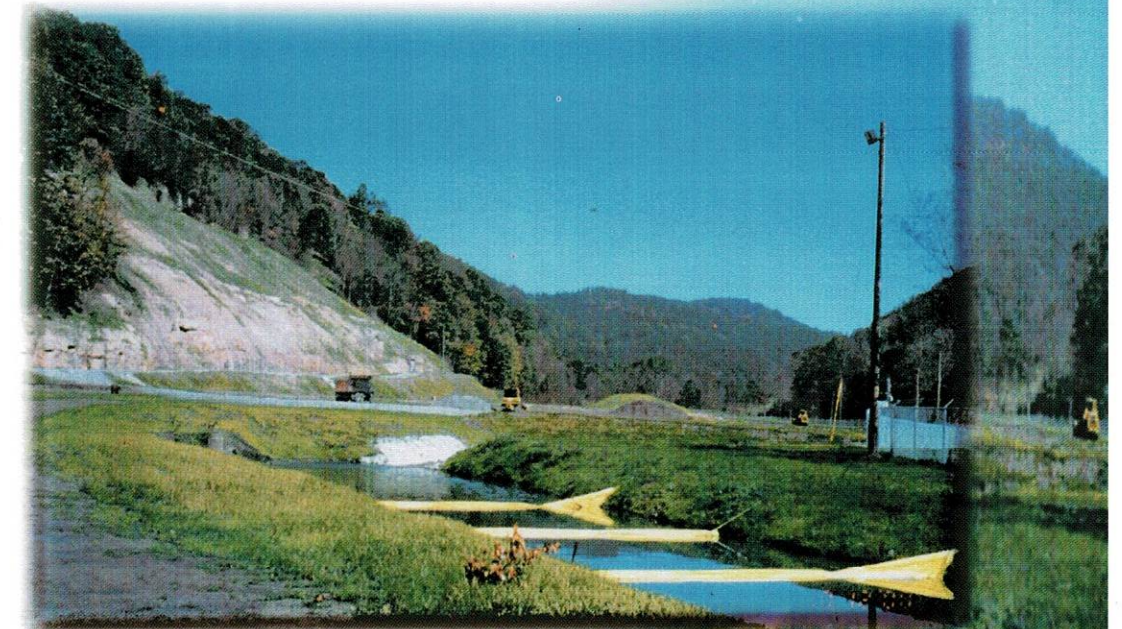
*In McDowell County, straddling the West Virginia-Virginia border, this unique operation will transform more than 1,500 acres to a post-mining use of improved pasture, potential residential and recreational activities. With complete sediment control around the perimeter, water quality is always given high priority for compliance with all applicable standards.*



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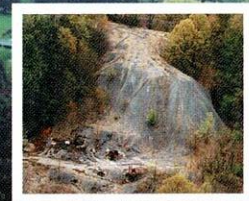


Pictured are (l-r): Mike Furey, DEP Inspector; Steve Capelli, WVCA, First Vice Chairman; Butch Stallard; and Mike Callaghan, DEP Director.



## Ground Breakers, Inc.

*In Marion County, directly adjacent to the West Fork River in the City of Fairmont where three coal refuse piles, numerous hazardous facilities and seven abandoned, partially submerged barges were removed and the thirteen acre site returned to an aesthetically pleasing original contour.*



Pictured are (l-r): Dave Pybus, DEP Inspector; Steve Capelli, WVCA, First Vice Chairman; Pete Pitsenbarger; Dennis Elbon; and Mike Callaghan, DEP Director.

## Green Mountain Company

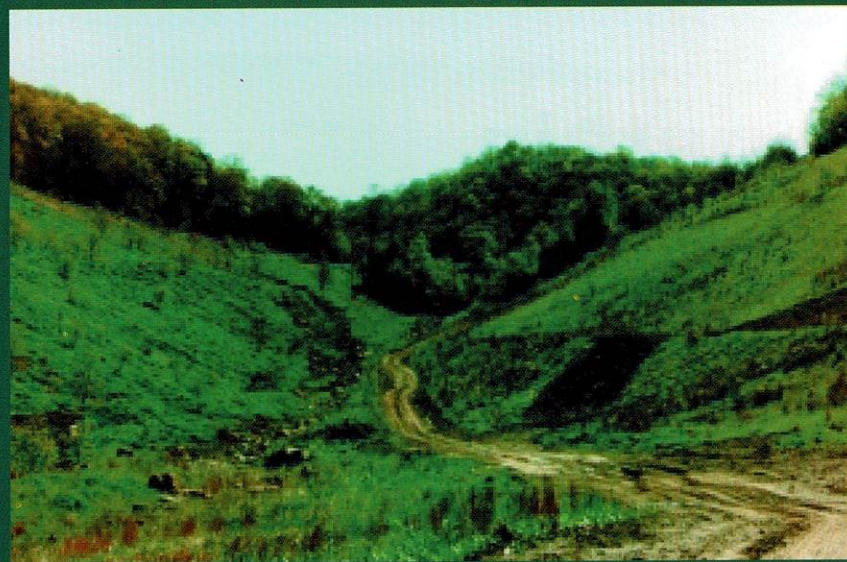
*In Wyoming County, near the community of Bud, where three coal refuse sites, several dilapidated structures and a series of unstable slopes have all been transformed to modern day reclamation standards, completely eliminating all erosion and sedimentation to Barker's Creek.*



Pictured are (l-r): Ron Withrow, DEP Inspector; Steve Capelli, WVCA, First Vice Chairman; Pete Pitsenbarger; Rod Clay; Dave Bowman; and Mike Callaghan, DEP Director.

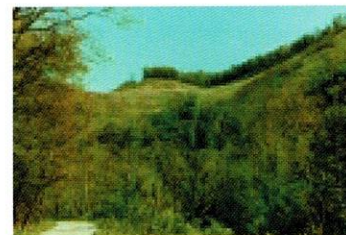


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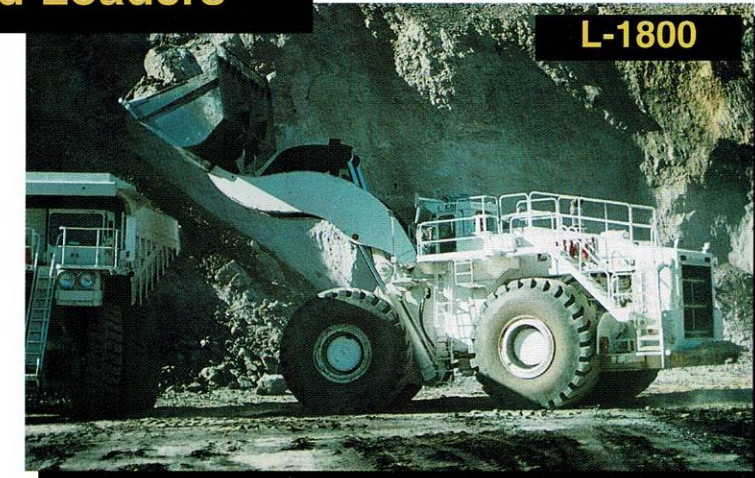


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Standard	17 yd <sup>3</sup> (13.00 m <sup>3</sup> )	22 yd <sup>3</sup> (16.82 m <sup>3</sup> )	28 yd <sup>3</sup> (21.4 m <sup>3</sup> )	33 yd <sup>3</sup> (25.2 m <sup>3</sup> )
High Lift	16 yd <sup>3</sup> (12.00 m <sup>3</sup> )	20 yd <sup>3</sup> (15.29 m <sup>3</sup> )	26 yd <sup>3</sup> (19.9 m <sup>3</sup> )	31 yd <sup>3</sup> (23.7 m <sup>3</sup> )
Dump Heights				
Standard	18'-5" (5.61 m)	18'-10" (5.74 m)	21'-6" (6.55 m)	22'-0" (6.71 m)
High Lift	19'-10" (6.04 m)	20'-0" (6.10 m)	23'-6" (7.16 m)	24'-0" (7.32 m)



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## Pocahontas Land

from page 10

For example, PLC was the first company to donate portions of its land to the Hatfield-McCoy Trail, which provides riding areas for four wheelers, bikes and horses with trails in Boone, Lincoln, Logan, McDowell, Mingo, Wayne and Wyoming counties.

Without reclaimed surface mine land, much of this trail may not have been possible.

In 1995, PLC, formed a partnership with Mingo Logan Coal Company and Premium Energy, Inc. to construct a links style public golf course on part of a surface mine reclamation site. Twisted Gun Golf Course is slated for completion in 2002.

Also in Mingo County, PLC donated land and worked closely with local officials in constructing a unique fish hatchery that raises Arctic Char with mine water from a former Mingo Logan Coal Company mine.

Pocahontas Land Corporation made its mark in history by being a leading corporate citizen and working closely with surrounding communities to enhance West Virginia's future.

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## Progress Coal Company Wins Bradbury Safety Award

Progress Coal Company, Inc., of Madison, W.Va., is the winner of the 2000 Raymond A. Bradbury Safety Award. National Mining Association President Jack Gerard and Ben Hatfield announced the award winner on February 20, at Massey Energy's annual safety awards ceremony in Charleston, W.Va. Gerard delivered the ceremony's keynote address. Hatfield is executive vice president and chief operating officer of Massey Energy.

Established in 1993, the Bradbury Safety Award is presented each year to the Massey Energy subsidiary that has achieved the best safety performance record. Among those attending this year's award ceremony were: Raymond Bradbury, former president of Martin County Coal Corporation, and the award's namesake; E. Morgan Massey, president of Evan Energy and retired chairman of A.T. Massey Coal Company, Inc.; James "Buck" Harless, CEO of International Industries; Bill Raney, president of the West Virginia Coal Association; Don Blankenship, chairman, CEO, and president of Massey Energy, and officials of state and federal mining agencies.

Progress Coal Company achieved a Non-Fatal Days Lost (NFDL) incidence rate of 0.69 for fiscal year 2000. This means the company experienced less than one lost-time injury for every 200,000 hours worked. The U.S. coal industry's NFDL rate for the period January 1, 2000 through September 30, 2000, was 5.44. The NFDL rate



Progress Mining Company was presented the Bradbury Safety Award at Massey Energy's annual safety awards ceremony in February in Charleston, W.Va. Pictured are (l-r): Ben Hatfield, executive vice president and chief operating officer of Massey Energy; Jim Gay, president of Progress Mining Company; and Jack Gerard, president, National Mining Association.

for all Massey Energy operations during fiscal year 2000 was 2.45.

"There is no greater honor among Massey Energy companies than winning the Bradbury Award. And, winning it is a tough assignment," said Drexel Short, senior vice president of group operations for Massey Energy, and chairman of Massey Energy's safety development group. "The winning members not only have to comply with regulatory agency safety rules, but must also meet Massey Energy's stringent safety standards — which in many cases are stricter than federal and state requirements. I congratulate the members of

(Continued on page 42)



## Coal Calendar 2001

### May

10-12 **West Virginia Coal Association, Inc./West Virginia Coal Mining Institute Annual Technical Meeting**, Glade Springs Resort, Daniels, WV. Contact Royce Watts (304) 293-5695 or Sandi Davison (304) 342-4153.

11 **West Virginia Coal Hall of Fame Induction Ceremony**, Glade Springs Resort, Daniels, WV. Contact Sandi Davison (304) 342-4153.

### July

9 **Coal Foundation Summer Golf Outing**, The Virginian, Bristol, VA. Contact Patty Bruce (304) 346-5318.

14-19 **Carbon 2001 Conference**, Hyatt Regency, Lexington, KY. Contact Geaunita Caylor (859) 257-2820.

### August

2-4 **West Virginia Coal Association, Inc. Annual Meeting**, The Greenbrier, White Sulphur Springs, WV. Contact Patty Bruce (304) 346-5318.

### September

12-14 **The Bluefield Coal Show**, Brushfork Armory-Civic Center, Bluefield, WV. Contact the Bluefield Chamber of Commerce (304) 325-3085.

24 **Coal Foundation Fall Golf Outing**, Pete Dye Golf Course, Clarksburg, WV. Contact Patty Bruce (304) 346-5318.

### October

5-7 **West Virginia Coal Association, Inc. Membership Meeting**, Lakeview, Morgantown, WV (Virginia Tech vs. WVU). Contact Patty Bruce (304) 346-5318.

## Progress Coal

from page 41

Progress Coal. Their exemplary performance proves working safely is the top priority for everyone there," Short said.

"Members at Progress are sincere and conscientious in their desire to ensure a safe work place," said Jim Gay, president of Progress Coal Company. "During fiscal year 2000, our team members worked 575,920 hours and produced more than 4.3 million tons of coal, while incurring only two lost-time accidents. We certainly recognize that two accidents are two too many. However, I think it is an impressive accomplishment, especially considering the large size and complexity of the surface mine operations at Progress," Gay said.

Although Progress Coal took the top honors, four other Massey Energy operations were close

contenders for the Bradbury prize: Bandmill Coal Company of Stollings, W.Va.; Elk Run Coal Company, Inc., of Sylvester, W.Va.; Peerless Eagle Coal Co., of Summersville, W.Va.; and Performance Coal Company, of Naoma, W.Va.

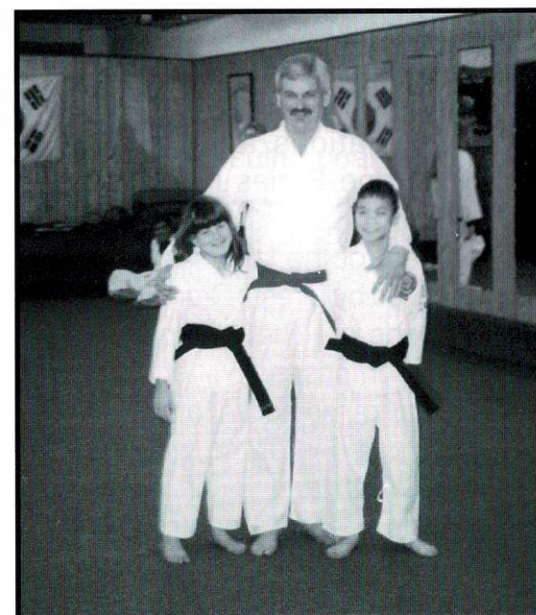
Along with a commemorative plaque for permanent display, Progress Coal Company will take the Bradbury trophy home for one year. The company's team members will receive gold Super Bowl-style rings in honor of their commitment to safety.

The Bradbury Safety Award is named for Raymond A. Bradbury of Prestonsburg, Ky. Bradbury served as president of Martin County Coal Corporation for more than 23 years until his retirement in 1992. During his years of service, Bradbury's leadership and dedication to safety personified Massey Energy's commitment to the highest safety standards.

## After Hours



(Above) President George W. Bush visited the national guard units in Charleston, W. Va. in February. President Bush, talks with Army Guard Colonel and WVCA President, Bill Raney. Former Secretary of Defense, Donald H. Rumsfeld looks on during a roundtable discussion with local employers.



(Left) Chris Supcoe, president of Crown Hill Equipment, shares a proud moment with his children, Stephanie, age 8 and Andrew, age 11. Stephanie and Andrew recently earned their 1st Degree Black Belt in Tae Kwon Do, awarded by Grand Master Sok Ho Kang in South Charleston. Chris earned his 2nd Gup Red Belt the same day.



# Changes in Water Quality in Deckers Creek from 1974 to 1999-2000

Jason Stewart and Jeff Skousen  
West Virginia University

## Abstract.

The Deckers Creek drainage basin covers approximately 62.9 square miles (16,600 hectares) in Monongalia and Preston Counties of West Virginia. Throughout the twentieth century, this watershed has received high levels of pollution in several forms. A 1974 study examined the water chemistry in Deckers Creek over a six-month period at 29 sample points. Water samples from the same sites were collected and analyzed monthly from March 1999 through October 2000 for acidity, alkalinity, total iron, aluminum, manganese, and other metals, as well as for fecal coliform concentrations. Most of the tributaries sampled in 1999-2000 showed reduced metal loads and acidity as compared to 1974, as did the main stem of Deckers Creek above the town of Richard. By contrast, little improvement was detected in the portion of Deckers Creek below Richard due to the input of untreated mine water from an underground mining complex. Decreased mining activity, increased reclamation, and improved quality of deep mine discharge have led to improved water conditions in the upper portion of Deckers Creek. Improved chemical properties in the majority of the creek may, however, present more noticeable biological contamination such as fecal coliforms and could present a new water quality problem.

## Introduction

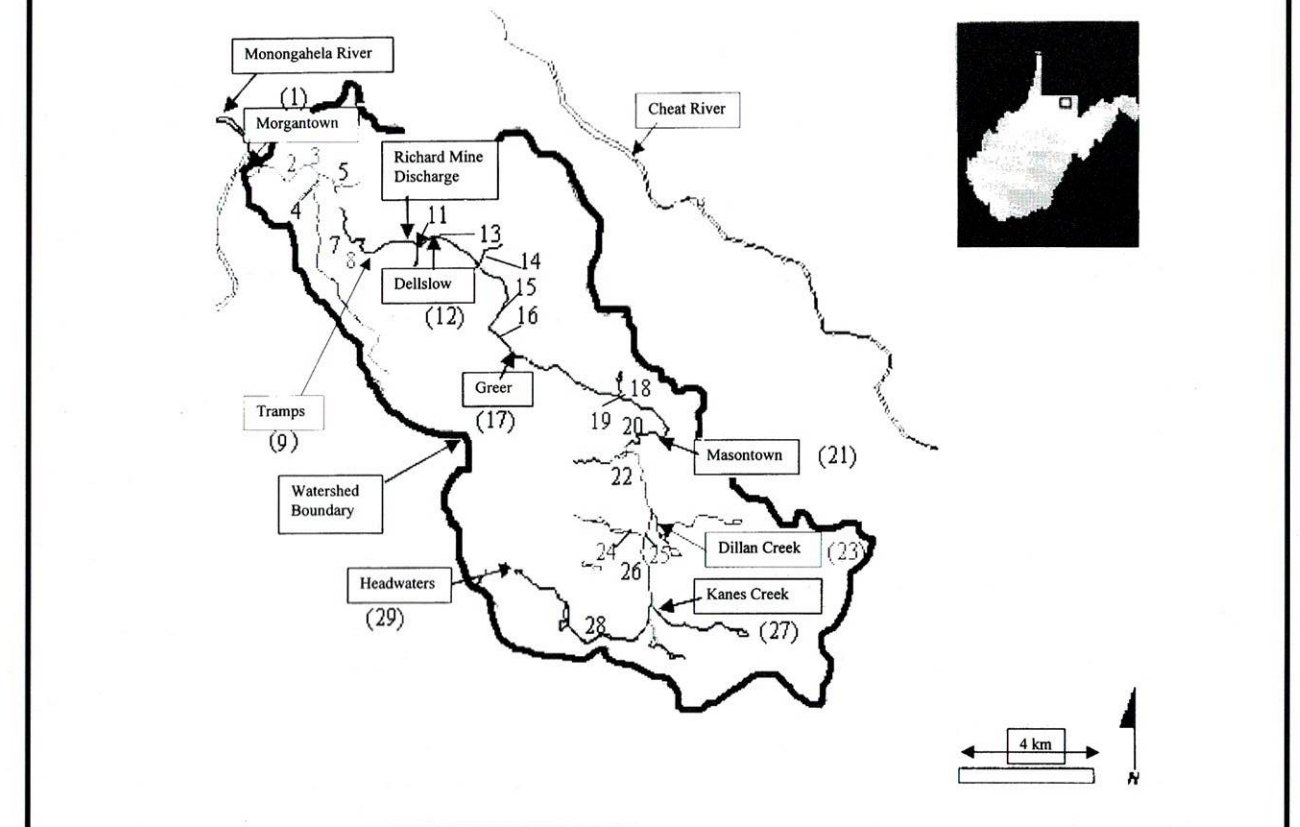
The Deckers Creek watershed lies within the drainage basin of the Monongahela River

in western Preston and eastern Monongalia Counties in northern West Virginia. The stream is approximately 23.6 miles (38.1 km) in length, originating in the southeast corner of Monongalia County at an elevation of 2,427 feet (737 m). The creek flows southeast to Reedsville, where it loops to the northwest (Figure 1). Relief is very gradual from the headwaters to Masontown before becoming steep from Masontown to Dellslow. After Dellslow, the creek again flows over gently sloping terrain until reaching the Monongahela River at an elevation of 793 feet (237 m) (Teti 1974).

Most of the exposed geology is part of the Pennsylvanian Period, namely the Monongahela, Conemaugh, and Pottsville Groups and the Allegheny Formation (Natural Resource Conservation Service 2000). The dominant rock types include sandstone, siltstone, shale, limestone, and coal (Teti 1974). Major soils in the area include the Gilpin and Dekalb Series in the higher elevations and the Atkins, Brinkerton, and Pope Series in the bottomlands (NRCS 2000).

Seventy percent of the land surface in the watershed is covered by forest. Oak-hickory and northern hardwoods are the dominant timber types. Farmland comprises 15% of the watershed, with nearly all of the active farming occurring in the upper portions of the watershed in Preston County. Urban land, found in the lower half of the watershed near Morgantown, makes up roughly 10% of the area. Mined lands account for the remaining 5% (NRCS 2000).

Figure 1: Deckers Creek from the headwaters to its confluence with the Monongahela River at Morgantown. The 29 sampling sites visited in 1974 and 1999-2000 are shown. Eight sampling sites, along with the Cheat and Monongahela Rivers, are named which represent different sections of the stream.



Deckers Creek and its tributaries flow through a high-sulfur coal region of West Virginia, where the coal and associated strata contain high levels of sulfur in the mineral form of pyrite. When exposed to water and oxygen, pyrite undergoes a series of chemical reactions, ultimately resulting in the release of sulfate, proton acidity, and iron (Banks et al. 1997). This phenomenon may be observed throughout Appalachia. Thirty-five percent and twenty-two percent of 318 stream sites sampled in Pennsylvania, Kentucky, West Virginia, and Ohio in the mid 1960's had higher

iron and sulfate, respectively, than U.S. Public Health Services drinking water standards (National Research Council 1979).

Acidity and iron serve to accelerate normal geochemical weathering in a self-perpetuating sequence of reactions, and much of the metal oxyhydroxides precipitate out of solution upon contacting natural waters (Younger 1998). These precipitates form coatings in stream channels, smothering native biology (Gray 1995). The accompanying increase in weathering can also lead to the dissolution of silicate minerals, causing the release of met-



als such as aluminum and manganese into the environment in more reactive forms (Younger 1998). Tests on the short-term toxicity of coal mine drainage water to two sunfish (*Lepomis machrochirus* and *Lepomis gibbosus*) have shown that the sunfish experience respiratory distress within a few hours after being introduced into water having pH values between 3.0 and 3.5 and total acidity values of 50 mg/L (Pegg 1984). A large-volume input of untreated mine water enters Deckers Creek near the town of Richard (Figure 1). The pH of the Richard mine water is usually less than 3.5 and the acidity values are much higher (1200 mg/L) than these waters tested for fish, rendering the creek unfit for fish over its remaining four miles to the confluence with the Monongahela River in Morgantown.

Numerous small acid mine drainage inputs can be located throughout the Deckers Creek watershed, but the discharge flowing from the Richard Mine, a large abandoned underground mining complex, dominates any examination of other deleterious impacts to the stream due to its volume, chemistry, and proximity to population centers.

Another source of pollution in Deckers Creek is the input of fecal bacteria from agricultural fields and bordering residential areas. The extent to which natural waters have been impacted by fecal matter from warm-blooded organisms may be determined through the isolation and subsequent enumeration of indicator bacteria. High counts of fecal coliforms are directly linked to sewage inputs and indicate the possible presence of other, more harmful bacteria and viruses (Edwards et al. 1997). Surface run-off from agricultural fields can also carry harmful microbes into stream water. Fecal material from grazing livestock and the land application of sewage-sludge increase the levels of indicator organisms in streams and may create bacterial reservoirs

in soils. These reservoirs could possibly serve as sources of bacterial contamination when temperature and moisture conditions are favorable (Hunter et al. 1999).

In 1974, James Teti, a graduate student in the Geology Department of West Virginia University, conducted a water quality study of Deckers Creek (Teti 1974). He located 29 sampling points along the creek and collected water samples during a six-month period. The purpose of this study was to revisit the sites that were sampled 27 years ago and, after conducting water quality analyses, determine changes in water quality between 1974 and 1999-2000.

## Methods

### 1974 Sampling Procedures

Samples were collected in collapsible, plastic 1-quart bags at 29 established sample sites along Deckers Creek and its tributaries (Figure 1) on eight occasions between January 1974 and June 1974. Teti (1974) reports withdrawing each sample from a flowing part of the stream in order to avoid any increases in ionic concentrations due to evaporation from standing pools. Sample containers were filled completely to minimize any reaction between the water and atmospheric gases trapped in the container. Water samples were put on ice and later analyzed in the laboratory for total acidity, total alkalinity, specific conductance, and dissolved metals (total iron, calcium, magnesium). Teti did not measure flow when he collected water samples during the 1974 sampling period.

### 1999-2000 Sampling Procedures

Beginning in March of 1999, water samples were collected at 29 sites along Deckers Creek and several of its tributaries on a monthly basis, corresponding to sites originally sampled by Teti (Figure 1). A YSI 3500 Water Quality Meter was used to measure temperature, elec-

trical conductivity, and pH in the field. Two water samples were collected at each site. Each sample was collected from the same point in the creek each month. The water bottles were filled completely to eliminate interactions between the sample and any air left in the head space. The first sample was collected in a 250-ml plastic bottle and was neither filtered, nor acidified. A second sample of 20 ml was filtered with a 0.45µm filter and acidified to pH 2.0 with 0.5 ml of concentrated hydrochloric acid. Both samples were placed on ice and transported to the laboratory. The first sample was analyzed for pH, acidity, and alkalinity using a TitraLab autotitrator (Radiometer/Copenhagen, Denmark), while the second sample was analyzed for Fe, Al, Mn, Mg, Zn, Ba and Ca using an Inductively Coupled Spectrophotometer, Plasma 400 (Perkin Elmer, Norwalk, CT). All titrations were performed within six hours of sample collection. Alkalinity titrations were carried to an endpoint pH of 4.2, while acidity titrations proceeded to an endpoint pH of 8.2.

Flow determinations were also made at the same time water samples were taken. At the beginning of the study at each point, the bottom of the stream channel was delineated from the high water mark on one bank to the corresponding mark on the opposite bank. A reference point was chosen near the center of this transect in the stream. The point was marked either by driving a steel post into the streambed or by placing a brightly colored brick. At subsequent sampling times, the depth of the water was measured at this reference point and used to calculate depths across the stream transect and a water velocity measurement was taken. Water velocity readings were taken using a Global Water Flow Probe FP101 (Global Water, Gold River CA). This probe features a function that computes an average velocity over a ten-second period. The probe was moved vertically through the creek at the

reference point to compute an average velocity for the entire stream column. Multiplying the cross-sectional area of the water in the stream by velocity provided a good estimate of flow.

### 1974 Flow Estimation

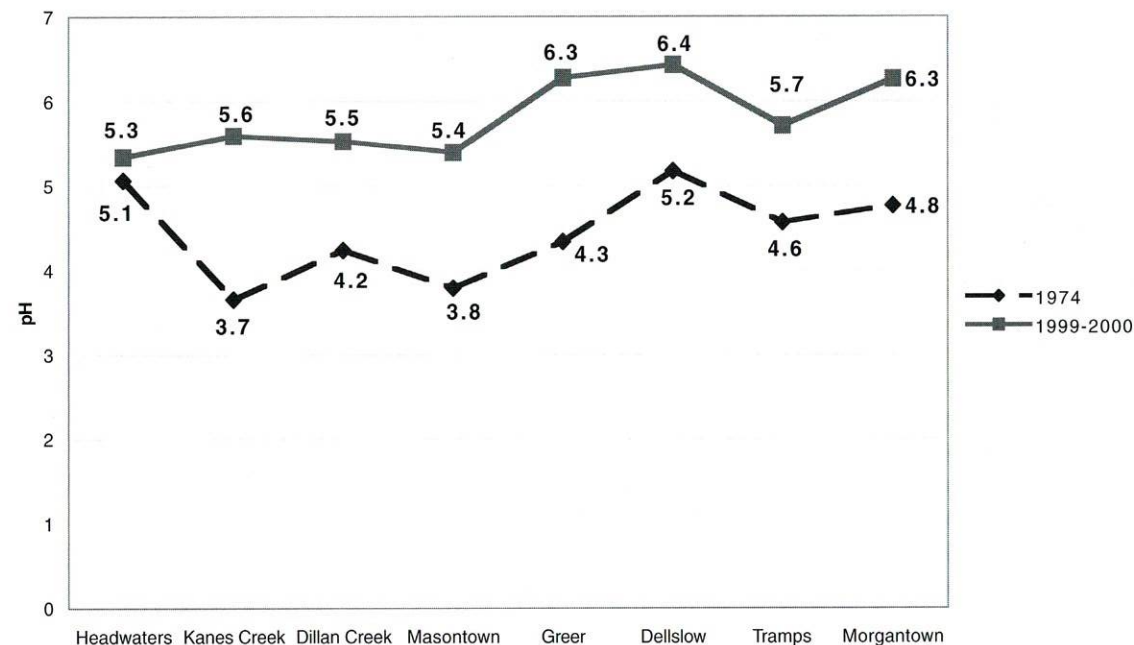
In order to compare stream quality data sets from two different time periods, the flow levels during each sampling phase should be comparable. If flows vary greatly between sampling phases, any observed differences in chemical parameters may be due to localized dilution or concentration effects rather than changes in baseline conditions (Skousen 2000). As no flow data were collected during the 1974 study, we estimated stream flow based on rainfall data and stream flow data from previous years where those data were available (Stewart et al. 2001). The high or low flow conditions as calculated by our estimation technique were then tied to our measured flow conditions in 1999-2000 to coordinate data.

### Microbiological procedures

A separate water sample was collected at a later date each month and tested for the presence of fecal coliform bacteria by the membrane filtration technique. All 29 sites were sampled at least once until it was determined which sites warranted further monitoring. Eight representative sites were chosen and re-sampled monthly beginning in June 1999. The tests were done with 0.7 µm filters instead of 0.45 µm filters, as the larger filter size allows for improved recovery of organisms possibly damaged by acidic conditions in the stream (Bissonnette 1999). The filters were then plated onto membrane-fecal coliform (mfc) media and incubated at 44.5 C for 24 hours. The plates were then counted to determine the number of colony forming units (CFU's) per 100 ml.



Figure 2. Average pH from February-May (high flow conditions) at eight selected sites for 1974 and 1999-2000.



## Results and Discussion

Based on estimated and measured flows as previously described, the 1974 and the 1999-2000 monthly data were divided into low flow (June, July, August, September, and October), medium flow (November, December, and January), and high flow (February, March, April, and May) conditions. Only one month of data existed in the low and medium flow classes for the 1974 study. Therefore, the data used in this comparison were from high flow conditions during 1974 and 1999-2000. Data from eight of the 29 sites were selected to represent specific sections of the stream. The Headwater sampling location was the most upstream sampling point and represented an area of limited pollution from households and land disturbances. Two sampling locations were located below the inflow of two major tributaries draining areas heavily surface

mined in the 1970's and 80's (Kanes and Dillan Creek). The Masontown site was just below the town of Masontown where a low-flow acid mine drainage input occurs. Greer is the location of a large limestone aggregate mine. Limestone materials of various sizes are introduced into the stream at this point. At Dellslow, the limestone and water have mixed and several more relatively good quality tributaries have entered the creek. But most important, this site is upstream from a major acid mine drainage input from the Richard underground mine complex. Tramps is immediately downstream from the Richard acid mine drainage input to Deckers Creek, while the Morgantown site is near the mouth just before Deckers Creek enters the Monongahela River.

The high flow averages (February through May data) for these eight representative sites are presented for four parameters: pH, alka-

linity, acidity, and total iron (Figures 2-5). Data from 1999-2000 and 1974 are plotted on the same graph for each parameter to illustrate the change in water quality over time. The graphs indicate that levels of acidity and total iron have significantly decreased ( $P < .0001$  and  $P < .0027$ , respectively) throughout the stream, while alkalinity and pH have significantly increased ( $P < .0001$ ).

Water pH at all sites was higher during the present study than in 1974 (Figure 2). The present pH levels are in most cases 1 to 2 pH units greater than in 1974. In 1974, the average pH in Deckers Creek was never above 5.2 (Teti 1974). Prolonged periods of low pH water in a stream are detrimental for several reasons. When the pH of a sample is below 5.5, aluminum can exist in solution in its highly toxic  $Al^{3+}$  form. Trivalent aluminum and free protons interfere with oxygen absorption in benthic macroinvertebrates and fish. Aluminum also binds phosphorus in less available

forms and interferes with the uptake, transport, and use of nutrients and water by plants. When pH is above 5.5, as during the 1999-2000 sampling period, aluminum will bind with hydroxides and precipitate out of solution, causing less damage to aquatic life.

Alkalinity levels have increased throughout the entire watershed, with the largest average alkalinity levels coming below Greer (Figure 3). Alkalinity is a measure of the ability to neutralize acidity and dissolved metals. A stream with high alkalinity levels will be able to supply adequate amounts of carbonate, bicarbonate, and hydroxide ions in solution to bind up free protons and heavy metals. Several factors are responsible for the increase from 1974 to 1999-2000. In the late 1970's, an active treatment system was constructed on Kanes Creek. This facility intermittently pumps and treats water from a nearby deep mine using ground calcium carbonate. The treated water is passed through a series of

Figure 3. Average alkalinity levels from February-May (high flow conditions) at eight selected sites for 1974 and 1999-2000.

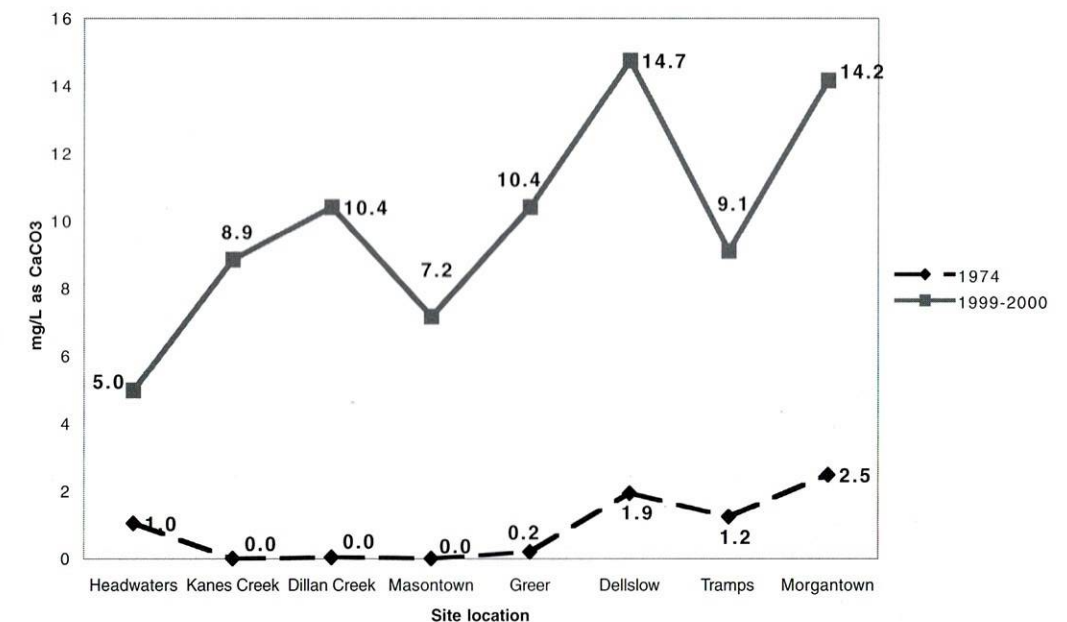
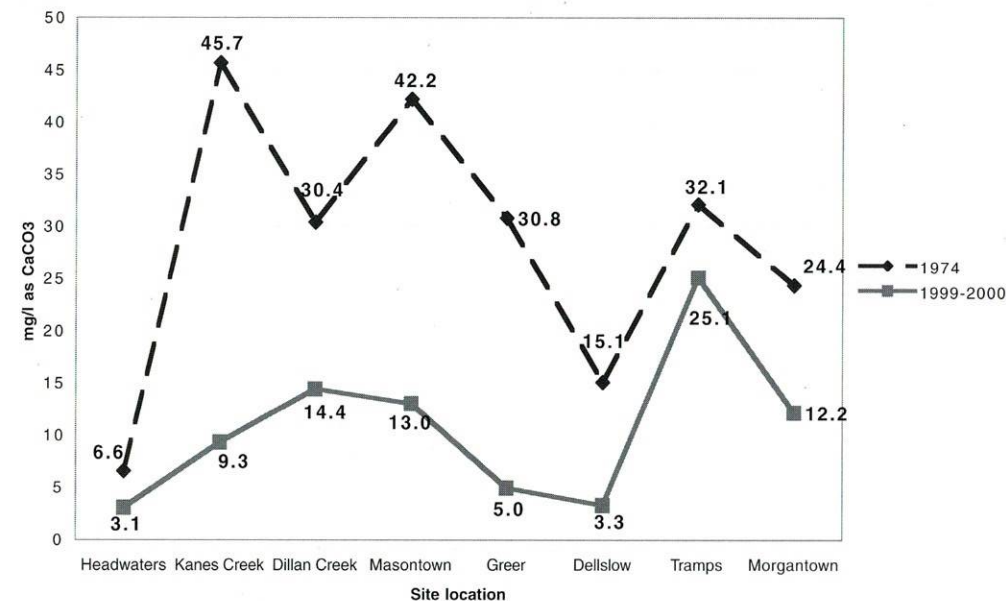




Figure 4. Average acidity levels from February-May (high flow conditions) at eight selected sites for 1974 and 1999-2000.



settling ponds before being discharged into Deckers Creek. When operating, this system adds 1000 to 2000 gallons per minute of high pH, high alkalinity water to the creek. Tables 1 and 2 show the effects of this treatment on both Kanes Creek and the mainstem of Deckers Creek. Levels of iron, aluminum, manganese, and acidity were all reduced, while pH, alkalinity, and calcium were all increased. In Kanes Creek, acidity was reduced by 97%.

Acidity levels have declined, averaging a 62% decrease across all sites, with the smallest decrease occurring below the Richard Mine discharge (21%) (Figure 4). It is interesting that the worst acidity levels are at two different locations for the two sampling periods. Kanes Creek had the highest acidity during the 1974 study, while Tramps had the highest numbers during 1999-2000. This indicates improvements in the upper half of the watershed and continued inputs of mine wa-

ter in the lower part of Deckers Creek. Reducing water acidity has multiple benefits, and is consequentially a main goal of all acid mine drainage remediation measures. Acid water irritates the gills and eyes of fish and insects. Elevated acidity levels also lead to accelerated weathering of clay minerals and pyrite. Clay minerals may break down quicker, releasing metals from their crystal lattices such as aluminum and iron, while the weathering of pyrite has been identified by numerous researchers as the biggest source of acidic mine drainage.

Figure 5 shows the decrease in total iron concentrations over the past 25 years. Total iron levels dropped as much as 87% at Kanes Creek, with an average decrease of 53% across the eight sites (Figure 5). Elevated pH and reduced acidity are both partially responsible for this decrease. During both studies, Tramps had the highest iron levels, due to in-

Table 1. Conditions at the mouth of Kanes Creek during a period of AMD treatment versus a period of no AMD treatment.

Parameter	With Treatment (August 2000)	Without Treatment (September 2000)
pH	6.2	3.8
Acidity	4.0	143.3
Alkalinity	11.1	0.0
Total iron	.1	27.4
Aluminum	.2	3.7
Calcium	211.4	107.7
Manganese	.7	2.0

Table 2. Conditions in Deckers Creek 1500 m downstream after Kanes Creek has entered the mainstem during a period of AMD treatment versus a period of no AMD treatment.

Parameter	With Treatment (August 2000)	Without Treatment (September 2000)
pH	6.4	5.8
Acidity	5.3	30.2
Alkalinity	28.6	21.0
Total iron	.1	5.8
Aluminum	.2	.4
Calcium	142.3	78.1
Manganese	.5	1.2



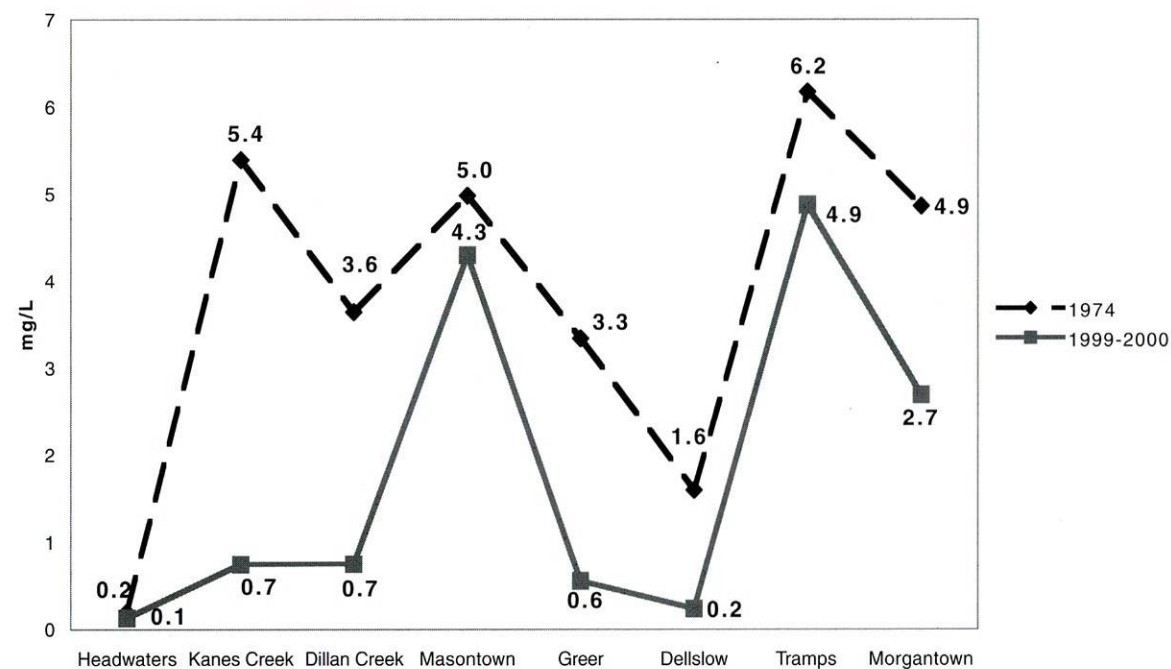
puts of untreated mine drainage at Richard. Iron is less toxic than aluminum, but will readily combine with hydroxide ions to form stream bottom-coating precipitates.

Decreased mining activity, higher additions of alkaline materials to the creek, and reclamation of abandoned mines in the Dillan and Kanes Creek areas have led to improved chemical quality of Deckers Creek. Possibly the most important factor behind the water quality improvements in Deckers Creek is natural healing that comes with time. Wood et al. (1999) indicates that minewater pollution is most severe in the first few decades after a discharge begins and that water, even from large mining complexes, improves in quality after 40 years. As oxidizable pyrite supplies diminish, the overall quality of mine drainage improves, contributing to improvements in receiving streams. With less mining activity in the watershed and improved reclamation on

the few remaining active mining sites, water quality has improved. Natural reclamation and reclamation projects conducted by the state on abandoned sites, and better treatment and control of water on active sites also enhances this improvement.

In contrast to improved water quality for the above conditions, a new water pollution problem is becoming apparent. Fecal coliform bacteria populations are very high in some parts of the watershed due to inadequate sewage treatment. Figure 6 shows the average fecal coliform counts for the Spring of 1999. No data are available from the 1974 study, but it is hypothesized that the harsh conditions in the creek during 1974 would have masked any bacterial problems. Of the eight sites shown, five had average fecal coliform counts higher than the West Virginia standard for secondary use waters of 200 colony forming units per 100 ml sample (Figure 6, dashed line).

Figure 5. Average total iron levels from February-May (high flow conditions) at eight selected sites for 1974 and 1999-2000.



Masontown was by far the most heavily impacted site in the watershed. During the summer months of 1999, low stream flow, sustained sewage flow, and elevated temperatures led to fecal coliform levels as high as  $9.0 \times 10^6$ . Coyne et al. (1994) made similar observations, noting that warm, shallow streams, high in organic carbon, permit fecal coliform regrowth.

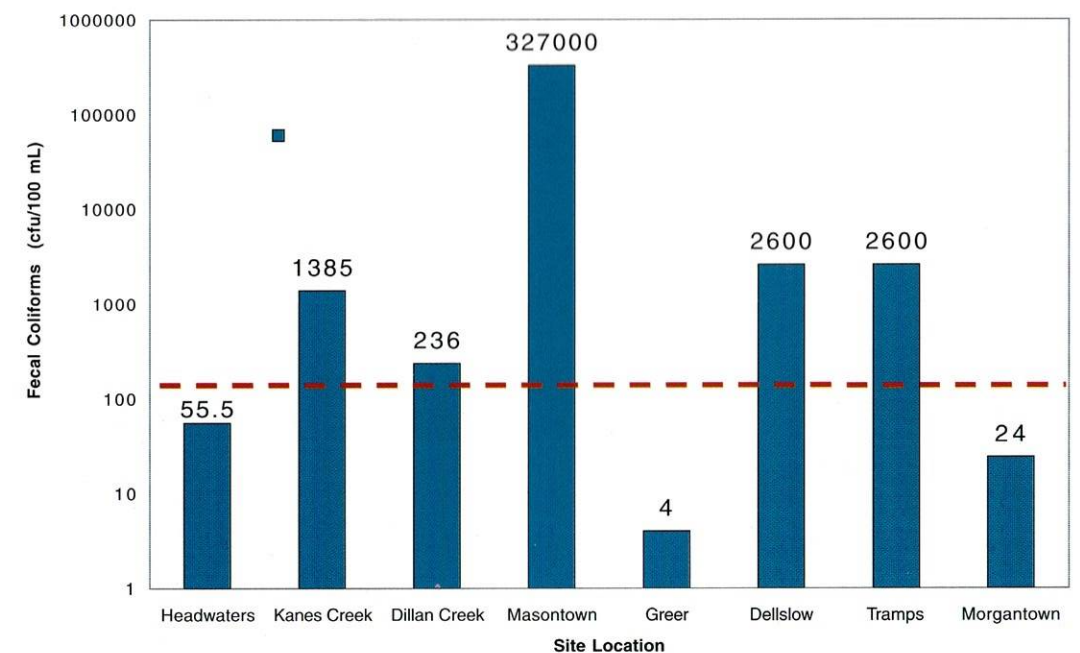
The present data help highlight some environmental laws and regulations enacted and enforced in the state which have led to the improvement of water quality in Deckers Creek. In 1977, the Surface Mining Control and Reclamation Act (SMCRA) was passed by the federal government. This law enhanced already existing efforts to make coal operators reclaim mine sites and to control the quality of the drainage coming from active mining sites. Operators are required to treat their wastewater if necessary before discharging it into receiving streams. Reclamation is mandatory, and more effective methods of backfill handling and placement are now required, thereby reducing the potential for acid mine

drainage discharge. This legislation has had the effect of protecting existing environments and ensures that mine sites will not degrade the environment for future generations. The present study illustrates the long-term benefits that have been realized by requiring compliance with these laws. This study also shows that as the chemistry of Deckers Creek returns to pre-mining ranges, sewage input will become an increasingly noticeable problem.

### Conclusions

Based on high flow averages for 1974 and 1999-2000 data, water quality improved in Deckers Creek during the past 27 years. The four chemical parameters measured indicate that conditions have become more favorable for aquatic life in Deckers Creek, with the greatest recovery occurring in the upper half of the watershed. Below the town of Richard, less improvement has been seen due to the massive inflow of untreated mine drainage. Sewage inputs will become a more noticeable problem as the acid inputs into Deckers Creek continue to decline.

Figure 6. Spring average Fecal Coliform counts at indicated locations (1999).





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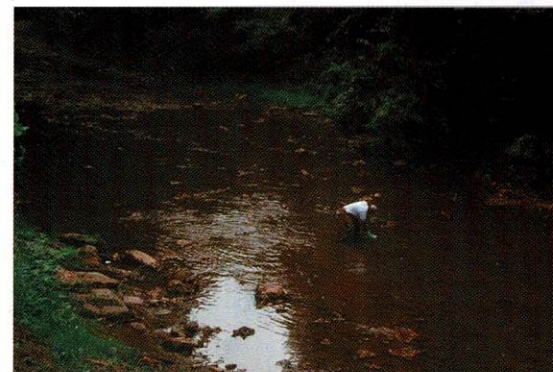
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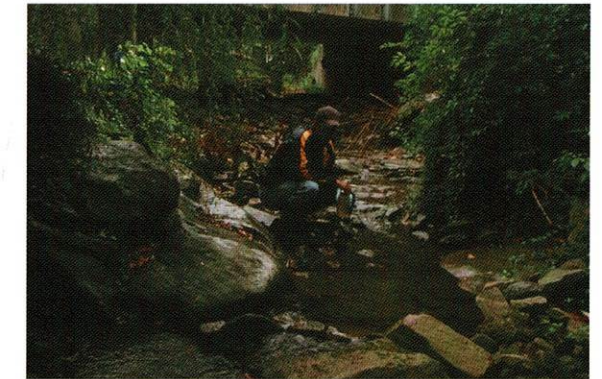
The unpolluted headwaters of Deckers Creek.



A high volume of acid mine drainage enters Deckers Creek at the Richard Underground Mine discharge.



The effects of the Richard Mine discharge on Deckers Creek are still obvious at the mouth of Deckers Creek, where it flows into the Monongahela River at Morgantown.

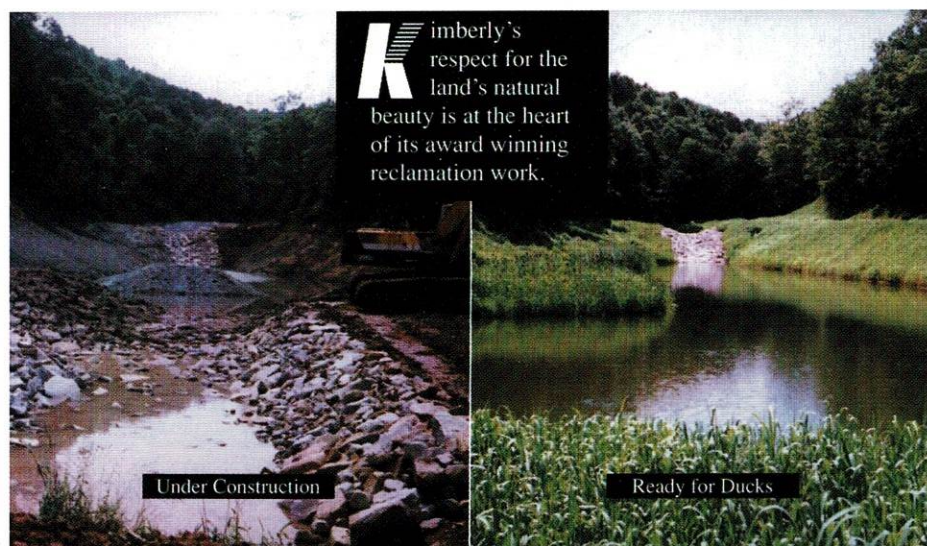


Several clean tributaries enter Deckers Creek in the upper half of the watershed.



Iron hydroxide coats the streambed in Deckers Creek immediately below the Richard Mine discharge.





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