

THE POWELL RIVER PROJECT: A LAND-GRANT UNIVERSITY PROGRAM SERVING VIRGINIA'S COAL-PRODUCING REGION¹

by

Carl E. Zipper²

Abstract: The Powell River Project (PRP) is a cooperative effort of Virginia Tech and industry which sponsors research and education programs to benefit Virginia's coal-producing region. Funding is provided by industry, the University, and the state. Many programs develop land reclamation and environmental protection technologies for use by the coal industry and reclaimed land owners. A Board of Directors establishes priorities and allocates funding. A staff solicits proposals to address priorities established by the Board, works with sponsored faculty, and develops education programs to disseminate research results. PRP and cooperating researchers have been successful in developing a wide range of land reclamation and environmental protection technologies, and in using PRP funds to bring other resources to the service region. Challenges include the need to establish a broader funding base, a wider range of community involvement, and more effective approaches to technology transfer.

Introduction

The Powell River Project (PRP) is a cooperative research and education effort developing positive approaches to economic, environmental, and social concerns in southwestern Virginia's coal-producing counties. The PRP operates as a cooperative program of southwest Virginia's industries and Virginia Polytechnic Institute and State University (Virginia Tech). The PRP was founded in 1980 with funding from Penn Virginia Resources Corporation.

The purpose of the PRP is to sponsor research and distribute knowledge so as to benefit people, governments, and industries in its service region. Many PRP programs have addressed land reclamation, environmental protection, and reclaimed land use technologies for use by the coal industry. The PRP is an application of the land grant concept to a non-agricultural clientele.

The purpose of this paper is to describe the PRP program and organization, emphasizing past accomplishments and future challenges.

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2. Associate Director - Programs, Powell River Project, c/o Virginia Center for Coal and Energy Research, Virginia Polytechnic Institute and State University, Blacksburg, Virginia, 24061-0411.

The Southwest Virginia Service Region

Virginia's coal-mining region consists primarily of three counties -- Wise, Dickenson, and Buchanan -- and parts of four others -- Russell, Tazewell, Scott, and Lee. These seven counties constitute the PRP service region. All are located in the southwestern corner of the state, adjacent to eastern Kentucky and southern West Virginia (Figure 1). The terrain is a mountainous remnant of the Appalachian plateau, comprised of flat-lying sedimentary rocks interbedded with coal seams, dissected by rivers and streams. Primary landforms are flat ridgetops, steep sideslopes, and alluvial areas close to waterways. Coal mining is the primary industry.

Although there is some ridgetop development, the most intensive uses of land have occurred adjacent to the rivers and streams where land is flat. However, there are problems with this development pattern. The landscape makes it costly to extend public utilities, and transportation is difficult. Although public resources are being applied to extend water and sewer systems, many communities still lack access. In many locations, streamside development creates crowded conditions that are not conducive to effective on-site residential sewage treatment. Groundwater resources have never been plentiful, and have been affected by underground coal mining in some areas. Some streamside communities are prone to flooding. Terrain has limited non-coal industrial development, and employment opportunities are limited.

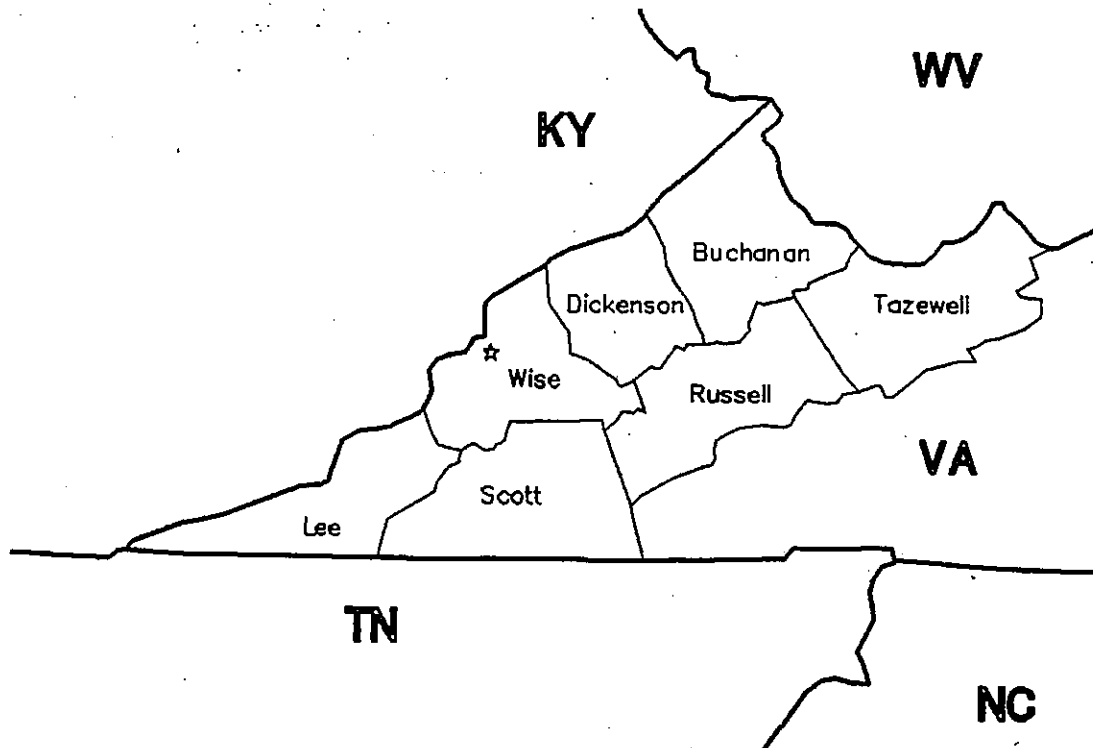


Figure 1. The seven county Powell River Project service region in southwestern Virginia, and the location of the PRP Education Center in Wise County.

Conditions in southwestern Virginia are similar to those in eastern Kentucky, southern West Virginia, and northeastern Tennessee. The central Appalachian coal mining region supports a population of over one million people within a land area that exceeds that of many states.

Mission and Program Areas

The Powell River Project's mission is to sponsor research and education programs to benefit its service region. The mission statement defines five major program areas: mined land reclamation and reclaimed land use; environmental protection technologies for use by the coal industry; other coal industry concerns; economic development; and quality of life.

The majority of the PRP's funding has been applied to the mined land reclamation and use, and environmental protection program areas, in part because the coal industry is PRP's primary sponsor. However, the University recognizes that the Virginia coal industry's ability to compete successfully in the national and international marketplace is essential to the region's economy. The industry's ability to comply with environmental laws and regulations cost effectively affects its ability to compete, while its land reclamation and environmental protection practices

influence the quality of life experienced by area citizens.

The Powell River Project also sponsors programs which address concerns having no direct relation to coal mining or reclaimed mined land, but such efforts are not discussed in this paper.

Funding and Administration

Funds gathered from public and private sources are utilized to sponsor programs and to support staff. Funds are provided by industry, Virginia Tech, and the state.

Program priorities are established by a Board of Directors composed of University personnel and representatives of various service region interests, including the coal industry. This Board oversees all funding decisions. An Advisory Council provides input to the Board.

Program proposals are solicited from Virginia Tech faculty and other qualified parties. When necessary, staff members approach researchers with expertise required to address priorities established by the Board. Proposals are reviewed by a committee which includes University faculty and non-University interests. This group makes funding recommendations to

the Board, based on the Board's priorities, the quality of proposals received, and availability of funds.

The Powell River Project's chief administrative position is the Chairman of the Board of Directors. Currently, this position is held by Ernie Stout, Acting Vice Provost for Research and Graduate Studies at Virginia Tech. On-campus personnel include John Gerken, Associate Director for Administration (a 15% position), whose duties include fund management and communications with the Board of Directors and other administrative bodies. An Associate Director for Programs (a 40% position) is also supported by Powell River Project, with the assistance of Cooperative Extension. The duties of this position are to solicit proposals, develop programs, provide assistance to program leaders as needed to achieve PRP objectives, and work with researchers to develop education programs for dissemination of research results.

Off-campus administrative personnel include an Associate Director for Corporate Relations, C.B. Slemp, whose primary responsibilities are fund raising and establishment of corporate partnerships and involvement.

Programs

Concern with the effects of coal mining on southwest Virginia's land use constraints caused Penn Virginia Resources Corporation to seek involvement by Virginia Tech in 1980. The first suite of programs addressed use of reclaimed mined lands for livestock, timber, and horticultural production. As time went on, researchers recognized that the reclamation conducted during mining endowed the land with characteristics that could not be altered without major expense. Thus, the emphasis shifted to developing land reclamation technologies that could be implemented cost-effectively by industry to produce lands suitable for improved use. In the mid-1980s, PRP began developing programs to address the environmental protection needs of the deep-mining industry.

Research

Research is sponsored by the PRP for the purpose of solving real-world problems. Most of the land reclamation and environmental protection research sponsored by PRP takes place on the ground, in the Virginia coalfields, with direct involvement by mining firms and landowners.

The majority of the following programs were co-sponsored by other organizations. In all

cases, PRP resources were essential to initiation of the project. In most cases, PRP funds served as seed money, and co-sponsors joined the effort after the project had been initiated. One recent publication for each program has been cited.

Land Reclamation:

The nature of surface soils on sideslopes are a major impediment to use of conventional land reclamation practices in the Virginia coalfields. These soils are often thin, infertile, and difficult to isolate. Lee Daniels and Dan Amos (Department of Crop and Soil Environmental Sciences) addressed this problem, beginning in 1981, through a program entitled *The Effect of Controlled Overburden Placement on Minesoil Genesis and Plant Growth*, which investigated use of blasted overburden as "topsoil substitutes" (Haering et al., 1993). A series of successful funding applications to U.S. Office of Surface Mining Reclamation and Enforcement (U.S. OSMRE) allowed the program to continue until 1989. The project found that, when "topsoil substitutes" are properly selected, handled, and managed, the resulting minesoils can support vigorous vegetation and achieve performance bond release. In fact, favorable overburden materials can be more productive than many native topsoils, especially if organic amendments (such as sewage sludge) are applied.

Today, topsoil substitutes are commonly used by Virginia mining operations, but organic amendments are not. With these facts in mind, Lee Daniels developed a program entitled *Development and Demonstration of New Technologies for the Utilization of Municipal Sewage Sludge on Surface Mined Lands* in 1989, with funding from Enviro-Gro Technologies and the Virginia Center for Innovative Technology (CIT) (Haering and Daniels, 1992). The project established a 150-acre demonstration of composted sewage sludge utilization on reclaimed mined lands, with the cooperation of Red River Coal Company. The project included monitoring of surface water, groundwater, and vegetation. Guidelines for use of sewage sludge on mined lands were developed and submitted to regulatory agencies for review.

The potential for the coal industry to produce non-flood-prone flat lands was addressed by an experimental practice mining operation conducted between 1984 and 1988 by Amos Ridge Coal Company. The PRP monitored the operation, with funding assistance from U.S. OSMRE (Zipper et al., 1989). The company produced a broad, near-level bench, approximately 12 acres in size, out of the roughly 70-acre disturbance in steep-slope terrain, by stripping a series of finger

points and building three hollow fills. All highwalls were backfilled, and all SMCRA performance standards not covered by the variance were met. The *Amos Ridge Experimental Practice* demonstrated that a number of environmental and economic benefits can be achieved while creating flat lands in Appalachian terrain. The experimental mining method reduced the costs of mining and reclamation, while producing a piece of property with improved land-use potential. The new landform is less erosive, more stable, and more productive than the land that would have been produced by standard mining.

Reclaimed Land Use:

A project entitled *Beef Production from Forages Grown on Reclaimed Mined Lands* has been conducted by John Gerken (Animal Science Department) since 1980 (Gerken and Baker, 1990). A cattle herd has been maintained on reclaimed mine areas at the PRP Education Center. The herd's performance has been monitored and documented as superior to state averages in all respects. Throughout the period, calving percentages and weaning weights remained high. Research activities included determining the nutritional value of various forages and documenting the herd's economic performance. Because of this program, cattle production has become more prevalent on reclaimed mines in Virginia.

A program entitled *On-Site Waste Disposal on Reclaimed Mines and Other Filled Lands: Feasibility Study of Alternative Technologies* is being led by Ray Reneau and Charles Hagedorn of the Department of Crop and Soil Environmental Sciences (Reneau et al., 1992). A lack of adequate building sites hinders economic development in the coalfield region. The use of reclaimed mined lands as building sites in many areas is prevented by the limited extent of public sewers. The research objective is to examine on-site wastewater disposal technologies (alternatives to septic drainfields) for potential application to reclaimed mined lands. This project is being conducted in partnership with the Virginia Department of Health, which must approve regulatory change if new technologies research are to come into common use. Virginia CIT and Virginia Water Resources Research Center also co-sponsor the project.

Environmental Protection:

A program entitled *Location of Aquifers and Determination of Aquifer Characteristics in the Coalfields of Southwestern Virginia* was conducted by Gary LeCain and George Harlow, of the U.S. Geological Survey (USGS), between 1984

and 1989 (Harlow and LeCain, 1991). Co-sponsorship funding was provided by Virginia Department of Mines, Minerals and Energy, and the USGS. This study was the first systematic assessment of the region's groundwater resources. As well as developing improved understanding, the study has influenced the groundwater monitoring conducted by deep mining operations. The study confirmed that coal seams are the primary geologic strata acting as confined aquifers in the Virginia coalfield.

A program entitled *New Technologies for the Stabilization and Reclamation of Coal Refuse Materials* was conducted by Lee Daniels between 1984 and 1991 (Stewart and Daniels, 1992). The objective was to develop cost-effective, environmentally sound procedures for revegetating coal refuse disposal areas. Over twenty active and abandoned coal refuse sites were sampled and characterized in the laboratory, while direct seeding and topsoil cover experiments were conducted at four active disposal sites. Refuse revegetation guidelines, which define refuse characteristics suitable for revegetation using lime applications, reduced topsoil cover, and/or direct seeding, have been submitted to regulatory review. As a follow up to this program, Dr. Daniels is investigating the feasibility of using alkaline fly ash to prevent acid mine drainage from coal refuse disposal areas (Stewart et al., 1992). Both programs were co-sponsored by Virginia CIT and industry.

A program entitled *Development and Monitoring of Wetlands for Treatment of Water Associated with Coal Mining Activities* is led by Albert Hendricks (Biology Department) (Duddleston and Hendricks, 1992). This project is developing passive systems for treating acidic discharges from coal mining operations. The research emphasis is development of a subsurface-drainage wetland design which maximizes sulfate-reducing bacterial activity. The design has the potential to reduce wetland area requirements, a major concern in Virginia's mountainous coalfields. Laboratory studies are being conducted to evaluate the influence of water chemistry and substrate type on bacterial waste-treatment effectiveness, an operational-scale prototype is in use at a Westmoreland Coal Company site, and pilot studies are being conducted at a United Coal Company site. The project is co-sponsored by Virginia CIT and the two cooperating coal companies.

Education Programs

A major purpose for PRP's education programs is to disseminate knowledge gained through research to people living and working in

the service region. Most of these programs are led by Jonathon Rockett, who serves as Extension Agent - Mined Land Development, a Virginia Cooperative Extension position supported by PRP.

The PRP maintains an Education Center in Wise County, Virginia (Figure 1). The 1700-acre site is located at the headwaters of the Powell River. Most of the research begun in 1980 took place in this area, which provided the Powell River Project with its name.

The Education Center site has been dedicated to research and education use by its owner, Penn Virginia Resources Corporation, in cooperation with the University. A variety of education resources are available, including demonstrations of reclaimed land use technologies, a wide variety of land reclamation research plots, and active mining. A variety of reclaimed lands are present, including highwall-bench-outslope terrain produced by "shoot and shove" mining in the 1960s and 1970s; standard "approximate original contour" reclamation conducted in the 1980s; and experimental reclamation conducted on large acreages in cooperation with PRP research. During the past four years, over 10,000 people have visited the Education Center.

PRP education programs are oriented towards a variety of audiences, but the primary audience is mining industry and regulatory agency personnel. Technical workshops are one means of reaching this audience. All major research projects are followed by workshops, for the purpose of bringing the results to personnel working in the field. The PRP also holds a Symposium each year, where researchers report plans, progress, and results to an audience of mining industry and regulatory agency personnel, public leaders, and private citizens.

Two publication series, designed to disseminate the results of completed research, are published by PRP and distributed by Virginia Cooperative Extension. These are *Reclamation Guidelines*, aimed at an audience of mining, reclamation, and regulatory professionals; and *Information for the Virginia Coalfields*, written for a more general audience.

School children of all ages constitute another audience. Programs are held for primary and secondary school children at the Education Center, in cooperation with the schools. An annual Field Day for high school earth science classes is held at the Education Center. Grants are provided to two local community colleges for the purpose of sponsoring field-oriented educational activities for Environmental Science students. Mountain Empire Community College uses these funds to establish experimental

hardwood reforestation field trials, while Southwest Virginia Community College has established a surface water quality monitoring network. Both activities are maintained by students, as part of their educational program.

Research and Education - A Combined Approach

Our goal is to develop research and education programs which complement one another, research to solve problems and education to communicate the results. This approach is exemplified by a program entitled *Reforestation and Forest Land Uses of Surface-Mined Lands*, led by Jim Burger and John Torbert (Department of Forestry). The research was begun in 1980. From the beginning, the goal has been to develop reclaimed land reforestation practices capable of being implemented cost-effectively, assuring performance bond release, and establishing a productive forest that will provide future value to the landowner. A series of experiments and demonstrations were established at the Education Center and at other sites. Based on these activities, the investigators developed reforestation guidelines for use in mined land reclamation, which specify soil reconstruction, species selection, companion vegetation, fertilization, and seedling handling practices.

Recent activities have focused on dissemination of results. Workshops have been held for this purpose. Demonstrations have been established at the Education Center. The researchers are in the process of establishing field-scale demonstrations of recommended practices on lands owned by Pocahontas Land Corporation in West Virginia and Martiki Coal Company in Kentucky, with support provided by those companies, and on Penn Virginia property.

Additional efforts to disseminate results include a *Reclamation Guidelines* publication "Restoring Forests on Surface Mined Lands", and a videotape entitled "Improved Reclamation with Trees." Both items contain practical, how-to information based on research, for the purpose of stimulating improved reclamation practice.

Other Powell River Project Initiatives

Improved Cooperation with Other States

During the 1989, Powell River Project personnel, with support from Virginia Tech administration, initiated an effort to establish improved working relationships with other land grant Universities serving central Appalachia: University of Kentucky, West Virginia University, and University of Tennessee. It is our goal to forge closer ties with these Universities, for the purpose of

enhancing combined abilities to deliver programs which meet the needs of clientele in central Appalachian areas. This goal is being advanced through deliberate efforts to improve communication, and through coordinated pursuit of complementary objectives.

Reclamation of AML through Re-mining

Abandoned mined lands (AML) are areas which were mined prior to implementation of the Surface Mining Control and Reclamation Act (SMCRA), have not been adequately reclaimed, and are adversely affecting public health and safety and/or the environment. There are large acreages of AML throughout eastern coal-mining areas, but there is no active, national program with the primary goal of reclaiming AML whose adverse impacts are environmental.

Many persons recognize that there is the potential to achieve reclamation of these areas through re-mining. However, it is widely acknowledged that current laws and regulations tend to discourage reclamation of AML by re-mining operations. Generally speaking, those disincentives are greatest where pre-existing environmental problems are most severe. The result is often "remnant recovery" re-mining operations, which remove coal from previously mined sites while excluding environmental problems from permitted areas. (Zipper et al., 1992).

The PRP is attempting to address this issue. A survey of knowledgeable mining industry, regulatory agency, and environmental and citizens interests revealed general agreement that a problem exists, but little consensus of opinion regarding what should be done about it (Santopietro and Zipper, 1993). Currently, a working group of industry and regulatory personnel is meeting on a regular basis to address pertinent issues.

An Assessment

Successes

The Powell River Project has been fortunate to achieve success in developing programs to address the needs of the Virginia coal-mining industry. One key has been open communication between researchers, industry personnel, and the agencies.

Another major factor in PRP's record has been the sustained financial support provided by Penn Virginia Resources Corporation, Norfolk Southern Foundation, and the Commonwealth of Virginia. This long-term support has allowed program leaders and staff to look beyond the

one- and two- year funding cycles which normally drive academic research, to formulate long-term goals and develop programs to address those goals.

The ability of PRP to conduct programs has been extended by program leaders' success in obtaining funding from outside sources. This activity is necessary because of the limited extent of the direct funding available to PRP. The annual PRP budget is on the order of \$250,000, including administrative expenses. In recent years, matching and parallel funds brought in by program leaders have totaled between \$300,000 and \$400,000 annually, and the annual value of program effort (including in-kind contributions, faculty time contributions, and waived indirect costs) has exceeded \$1,000,000.

Challenges

Financial Support:

As with most research ventures, financial support is a major concern. Since 1980, Penn Virginia Resources Corporation has been PRP's primary sponsor. The Norfolk Southern Foundation has also provided sustained support since the mid-1980s. Other companies have also contributed. Because of this corporate support, we have been fortunate to receive funding from the state.

Our goal remains to develop a broad base of corporate support, but we have not been successful in doing so. Reasons may include the facts that the early funding was provided solely by Penn Virginia, leading some to consider the program as the "Penn Virginia Project"; the PRP name refers only to a small geographic area within a larger service area; and some PRP programs deal solely with reclaimed mined lands while the majority of Virginia coal is produced by deep mining. Another major factor is undoubtedly the financial condition of the industry, as evidenced by the long-term trends of declining coal prices (Table 1).

Technology Transfer:

We face a continuing challenge in our efforts to affect change in reclamation practice based on the results of completed research. For example: soil compaction during reclamation continues to impede reclaimed land productivity, in spite of workshops and publications which point out the negative effects of soil compaction.

Stimulating change in human behavior is a challenge, in any field. We are able to identify two sources of problems in this area. One is the reg-

Table 1. Average Virginia mine prices for coal (current and 1980 dollars), total and surface-mined coal production, and coal mining employment, 1975-1991.

Year	Avg. Mine Price		Production			Employment
	(Curr.\$)	(1980 \$)	Total (Million Tons)	Surface	Surface (%)	
1975	\$30.46	\$44.01	35.5	12.4	34.8	14,231
1976	24.12	32.75	40.0	14.1	35.3	15,124
1977	29.65	37.75	37.5	13.6	36.2	15,742
1978	30.50	36.20	31.9	10.4	32.7	13,415
1979	35.99	39.24	37.0	8.5	22.9	14,777
1980	34.58	34.58	41.0	8.7	21.1	14,399
1981	34.96	31.87	42.0	8.5	20.2	14,238
1982	34.57	29.63	40.5	8.3	20.6	14,008
1983	31.86	26.45	35.5	7.6	21.3	10,414
1984	31.17	24.81	41.4	7.3	17.6	13,689
1985	30.16	23.18	42.4	7.1	16.8	12,621
1986	28.13	21.23	41.8	7.1	17.0	12,525
1987	27.42	19.96	45.5	7.4	16.3	11,766
1988	26.49	18.52	46.4	7.9	17.1	11,096
1989	27.64	18.43	43.9	6.9	15.8	9,909
1990	28.05	17.75	46.5	7.6	16.4	10,265
1991	27.45	16.78	42.3	8.1	19.1	9,755

Sources: Average Mine Price from U.S. DOE, adjusted for inflation using consumer price index. Other data from VDMME.

ulatory context. Generally speaking, reclamation personnel are going to act in a way which they believe will satisfy the inspector. Therefore, it is essential to include the inspectors in education programs whenever possible.

Another problem has to do with our ability to reach the right people. While reclamation specialists often attend educational programs, it has proven far more difficult to reach the mine foremen and equipment operators. Unless the rationale for change is effectively communicated to these individuals, alterations of reclamation practice are unlikely to occur.

Legal and Regulatory Change:

Because mined land reclamation practice is heavily influenced by regulations, concern with legal and regulatory change is constant. As a program of an academic institution, PRP is constrained in its ability to advocate specific legal and regulatory changes.

Because PRP goals include creating change that will benefit our service region, we cannot hide from legal and regulatory issues. We believe that the need for change can be evaluated most effectively when reliable, unbiased infor-

mation is available. Many PRP research programs have been conducted to generate technical information that is relevant to legal and regulatory issues. However, there is a fine line between reporting research results and implications, and taking on an advocacy role. It is essential for PRP to address pertinent issues while walking that line, because our ability to maintain status as a respected and objective source of information depends upon it.

Our activity in the re-mining area is causing us to explore additional mechanisms for dealing constructively with legal and regulatory issues. Re-mining is different from most of the issues we have dealt with previously, because lack of technical information is not the problem. Problems in this area have much more to do with differences in values and perspective among competing interests than with technology.

The fact that a broad spectrum of interests agree that a problem exists provides a basis for PRP involvement. We see our role as bringing people representing various interests together, for the purpose of advancing mutual understanding. We also see PRP playing a positive role by disseminating information about this issue to the general public.

Community Involvement:

Until recently, the primary groups involved in PRP have been mining industry, regulatory agencies, and higher education. However, we will be evaluating opportunities to involve a wider spectrum of community interests in the PRP

Two issues which we have been dealing with recently point to the need for greater community involvement. One was sewage sludge. An effort to expand the sewage sludge application program met with a level of community opposition for which we were unprepared. A wider spectrum of community involvement could have helped us to foresee the intensity of opposition.

Re-mining is another area where PRP can benefit from community involvement. Environmental and citizens interests, as well as mining and regulatory personnel, have an interest in developing positive solutions to the re-mining/AML reclamation problem.

Conclusion

The Powell River Project has applied the land grant university model to land reclamation and environmental protection concerns of the Virginia coal region. The PRP conducts research to develop knowledge and solve problems, and education to place relevant knowledge into the hands of people who can use it.

The PRP faces challenges in its effort to survive and grow. The PRP hopes to address these challenges by expanding partnerships with other land grant universities, and a wider range of industry and citizen interests.

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