

Variations from "Approximate Original Contour" Requirements in Central Appalachia: History and Prospects¹

by
Carl E. Zipper²

Abstract. The Surface Mining Control and Reclamation Act (SMCRA) requires mining firms to restore mined land to "approximate original contour" (AOC) unless a variance is obtained. In central Appalachian mining regions, AOC variance applications are not common, in spite of the region's needs for flat lands. In adding the AOC variance language to legislation which became SMCRA, it was the intent of Congress to allow surface mining firms to produce flat lands to meet the needs of Appalachian communities. There are many reasons why mining firms do not choose to take advantage of the AOC variance option in more widespread fashion. Community and economic development leaders must take the initiative if AOC variance reclamation is to have an impact on central Appalachia's needs for developable lands. Legal and regulatory changes could lower barriers to AOC variance reclamation. Additional research is needed to develop technologies which will aid development of mined lands.

Additional key words: Surface Mining Control and Reclamation Act.

Introduction

Since enactment in 1977, the Surface Mining Control and Reclamation Act (SMCRA) has had profound effects on the coal industry and the environment. These effects been strongly felt in the mountains of central Appalachia, the area of the United States that has been most intensively affected by mining.

One result of SMCRA has been the widespread restoration of mined land to "approximate original contour" (AOC). SMCRA Section 515(b)3 requires mining operators to "restore the approximate original contour of the land, with all highwalls, spoil piles, and depressions eliminated." Implementation of AOC, and associated SMCRA environmental protection performance standards, have reduced the environmental effects of surface coal mining.

However, SMCRA's AOC requirements also constrain mining firms from producing level lands to serve the needs of central Appalachian communities. Non-flood prone flat lands are at a premium in this mountainous region, and housing, commercial, and industrial sites are in short supply. This constraint occurs in spite of the "AOC variance" provisions of SMCRA which allow waiver of the AOC requirements in situations where the reconstructed landform will serve an "equal or better economic of public use" than that which preceded mining [Sec.515(c), 515(d)]. This constraint is perceived as a problem because of the high rates of unemployment and poverty, poor housing conditions, and

other quality of life problems which affect central Appalachia. These problems result in part from shortages of developable land.

The purpose of this paper is to present current and historical information regarding the AOC and AOC variance requirements of SMCRA. The paper will place the development of these requirements in an historical context, so as to clearly identify congressional intent. It will also define reasons for mining operators' failure to take more widespread advantage of AOC variance opportunities, and suggest actions that will enhance the ability of mining firms to produce developable lands in central Appalachia.

The Historical Context

Prior to the 1970's, "shoot and shove" mining was creating exposed highwalls and unstable outcrops throughout Appalachia. The environmental effects of these mining practices received the attention of Congress and the nation, leading to increasingly stringent state laws in the 1970s. These effects also brought about the development of federal legislation providing national environmental protection standards for the surface mining industry. These efforts led to PL 95-87, the Surface Mining Control and Reclamation Act of 1977.

The effort to forge the law that became SMCRA was protracted. The first federal surface mining bill was introduced by Everett Dirksen in 1940 (Dunlap 1975); the legislative effort which culminated in SMCRA began in 1971 (Waters 1979). Over the next six years, the establishment of federal controls over surface mining was a major agenda item in both houses of Congress. Activities included 183 days of hearings, 18 days of House action, three House-Senate conferences, 11 House Committee Reports, two Presidential vetoes (Udall 1979), and additional activity in the Senate.

¹ Paper presented at the 1990 Mining and Reclamation Conference and Exhibition, Charleston, West Virginia, April 23-26, 1990. Publication in this proceedings does not preclude authors from publishing their manuscripts, whole or in part, in other publication outlets.

² Carl E. Zipper is Associate Director, Powell River Project, and Associate Director, Virginia Center for Coal and Energy Research, Virginia Polytechnic Institute and State University, Blacksburg, Virginia 24061.

Approximate Original Contour - Sec.515(b)3

The AOC concept was advanced in the initial attempt to establish federal jurisdiction over surface mining, the legislative proposal by Everett Dirksen in 1940. This bill required mining operators to perform reclamation operations "as may be necessary to make the contour of the land approximately the same as before the mining operation was begun" (Dunlap 1975).

The forerunner of the modern day AOC legislation was introduced by Congressman Wayne Hays of Ohio (Simpson 1985). House bill H.R. 6482 required operators to "backfill the operations so that the approximate original contour of the land is restored ..." [Sec. 18; Cong. Rec. 118:35035. 11 October 1972]. However, this proposed legislation also allowed for liberal exemptions from the AOC requirement. Where restoration of the original terrain might result in negative environmental effects due to the steepness of reconstructed slopes, the mining operator would be able to "backfill and grade according to a plan of terracing and drainage that will eliminate ..." hazards such as soil erosion, slides, or acid drainage. H.R. 6482 also allowed the Secretary of the Interior to "approve an alternative plan" of reclamation that does not violate the purpose of the section, which was "to restore the area of land affected to the same or an equally useful purpose as before any mining." Such an open-ended variance concept was not repeated in any subsequent legislative packages which received the serious consideration of the Congress.

The 93rd Congress brought considerable discussion of the AOC question to both the House and Senate floors. Substantial reworking of the legislation in both chambers of Congress (Senate Bill S. 425 and House Bill H.R. 11500) led to AOC language closely resembling that of SMCRA Sec. 515(b)3, with the open-ended variance provisions of H.R. 4682 (92nd Congress) eliminated. This language remained in place through subsequent debate, receiving only minor changes. The result is that, today, surface mining operators from throughout the U.S. are required to "restore the approximate original contour of the land, with all highwalls, spoil piles, and depressions eliminated" [Sec. 515(b)3] unless a variance from the AOC requirement is obtained through the permitting process.

A reading of the Congressional Record and various committee hearing documents shows that, without a doubt, the will of Congress was behind the AOC requirements. Numerous attempts to weaken those requirements were defeated. In response to one such attempt, Senator Nelson called the AOC provisions "the very guts of the most important part of the bill, the most significant provision, or one of the two or three most significant provisions, in the measure." [Cong. Rec. 121:33326. 9 October 1975].

The primary rationale of Congress for establishing the AOC requirements was undoubtedly a desire to protect the environment from the effects of minimally-regulated surface mining. Major points of discussion included the following:

1. Major environmental problems were resulting from "pre-law" non-AOC mining, especially in the central Appalachian area. For example, a report by Mathematica, Inc. (1973) documented landslides, mud flows, and rock slides resulting from unstable spoil out-slopes. The results of a 1964 aerial survey indicated that an estimated 12% of the total surface mined area in eastern Kentucky was in slides. By 1972, in spite of considerable tightening of Kentucky's regulatory standards, the annual eastern Kentucky slide area had increased to 400 hectares.

When properly implemented, AOC results in placement of spoils in the most stable place in the mined landscape: the level bench produced by the mining disturbance.

2. Pre-law mining was resulting in "aesthetic disturbances" including exposed highwalls ("scars in the mountainsides") and poorly revegetated out-slopes (Mathematica 1973; CEQ 1974). These visible symptoms of pre-law mining were the targets of comments by numerous witnesses at congressional hearings, and they came to symbolize the abuses of uncontrolled Appalachian surface mining (Simpson 1985). AOC reclamation results in coverage of the highwall and elimination of out-slope spoils.
3. The "haulback" mining method was being widely cited as the most cost-effective method for achieving AOC in steep-slope terrain. An additional virtue of haulback mining, from an environmental standpoint, is that it allows contemporaneous reclamation. That is, spoil is removed from a current mining area directly to the mined-out pits. Other common surface mining methods of that time required reclamation to be performed as a separate operation (i.e. spoil must be rehandled after mining to achieve reclamation). Thus, adoption of an AOC reclamation standard stimulated mining operators to adopt haulback methods, thus reducing opportunities to abandon surface mining operations after removing coal but prior to initiating reclamation.
4. Congress was under the impression that economic impacts of environmental protection achieved through widespread adoption of AOC would be minimal. The incremental costs of AOC were estimated at \$2.00 to \$3.00 per ton, on average, although those costs were acknowledged to be greater in steep-slope mining areas such as Virginia, eastern Kentucky and southern West Virginia (ICF 1977). In 1971, the outset of the legislative process which led to SMCRA, average F.O.B. mine prices for coal were approximately \$7.00 per ton (US DOE 1980). By 1975, average F.O.B. mine prices had risen to approximately \$19.00 per ton. Under these pricing conditions, it appeared that the marginal reclamation costs imposed by AOC would have minimal effects.

AOC Variance for Mountaintop Removal - Sec. 515(c)

The proposal to grant variances for mountaintop removal mining was introduced in the 93rd Congress, in Senate Bill S. 425, Section 213(c) [Cong. Rec. 120:33338. 9 October 1974]. The proposed requirements in that legislation were similar in most respects to SMCRA Section 515(c), which governs mountaintop removal variances. However, the one major difference was that no specific post-mining land use requirements were imposed.

In the House of Representatives during the 93rd Congress, the primary surface mining bill (H.R. 11500) also contained an AOC variance provision [Sec. 211(d)]. This was a more general provision, not restricted to mountaintop removal mining. This clause allowed the "regulatory authority to grant appropriate exceptions to the requirements" for restoring the land to AOC, in cases where "an industrial, commercial, residential, agricultural, or public facility development is proposed" for the affected lands, provided the proposed use is deemed to constitute an "equal or better economic or public use" and this use "can only be obtained" through variance from AOC [Cong. Rec. 120:25280. 25 July 1974].

The House-Senate Conference produced a bill [S. 425] which contained language essentially the same as that of today's 515(c), and in essence contained a more restrictive AOC variance provision than either of the two bills advanced by the House and Senate.

In order to receive a variance from the AOC requirements of SMCRA on a mining operation that would "remove an entire coal seam or seams running through the upper

fraction of a mountain, ridge, or hill", a mining operator would have to conform to these general standards:

1. The planned reclamation practices must prepare the land for an industrial, commercial, agricultural, residential, or public post-mining land use that is "deemed to constitute and equal or better economic or public use ... as compared with the premining use." [515(c)3].
2. The planned land use must be compatible with adjacent land uses, and "appropriate assurances" must be presented to show that the planned land use is practical and attainable. Required assurances include documentation of planned investment in public facilities that might be required to support the proposed land use, expected need and market for the products or services to be provided by the planned land use, "commitments by public agencies, where appropriate", and compatibility with adjacent land uses [515(c)3].
3. The reclaimed area will be designed by a professional engineer, will remain stable, and "no damage will be done to the natural water courses" [515(c)4].

AOC Variance for Steep-Slope Mining - Sec.515(e)

Senate Bill S. 425 (SMCRA of 1974) was passed by majority votes in both houses during the closing days of the 93rd Congress, but was pocket vetoed by President Ford. In a letter to Congress, the President expressed one of his dissatisfactions as being the lack of allowance of "limited variances -- with strict environmental safeguards -- to achieve specific post-mining land uses" [Cong. Rec. 121:5852. 10 March 1975]. In spite of the President's plea, the 94th Congress included no additional AOC variance procedures to the bills which were to become the basis for H.R. 2 and S. 7.

The forerunner of SMCRA's steep-slope mining AOC variance requirement [Sec. 515(e)] was proposed by Senator Ford of Kentucky during the first session of the 95th Congress [Cong. Rec. 123:15705. 20 May 1977]. This proposed amendment to the legislation contained wording nearly identical to SMCRA Section 515(e), with two major exceptions:

1. The proposed amendment would have allowed the variance to be applied to agricultural land uses, as well as commercial, industrial, residential, and public uses.
2. The proposed amendment would have made variances available on all mining; the variance applied to forerunners of two SMCRA clauses: 515(b)3, the general AOC clause, and 515(d)2, which requires AOC in "steep-slope" mining situations. Today's 515(e) grants variances only to Section 515(d)2.

In all other respects, Senator Ford's proposal was identical to today's 515(e). The House bill contained no similar AOC variance provision. The result of the House-Senate Conference was a bill containing the modified version of Senator Ford's amendment that became Section 515(e). Once again, the House-Senate Conference tightened the proposed AOC variance clause.

Under 515(e), a "steep-slope" mining operation (i.e. an operation in an area where the average slope is in excess of 20 degrees, "or such lesser slope as might be defined by the regulatory authority" [515(d)4]) may receive an AOC variance for an approved (industrial, commercial, residential, or public) land use by meeting the following requirements:

1. The planned operations will "render the land, after reclamation, suitable for" the proposed use, which will be an "equal or better use" than that which preceded mining.

2. The post-mining landform is designed by a professional engineer, and will remain stable.
3. The watershed of the affected area will be improved.
4. No more spoil will be placed off the mine bench than is necessary to achieve the proposed use.

It is notable that Section 515(e) does not require detailed "appropriate assurances" be provided, as in the mountaintop removal variance permitting requirements.

OSMRE Regulations Governing AOC Variance

The statutes of SMCRA are augmented by the United States Office of Surface Mining Reclamation and Enforcement regulatory program. These regulations contain more detailed requirements for AOC variances authorized by Sections 515(c) [30CFR 785.14 and 30CFR 824] and 515(e) [30CFR 785.15 and 785.16] of SMCRA. Variances obtained under either of these two sets of requirements must comply with the OSMRE regulation pertaining to alternative post-mining land use [30CFR 816.133(c)], which requires that there be a "reasonable likelihood for achievement" of the planned post-mining land use, and that the use will not be "impractical or unreasonable" nor will it "involve unreasonable delay in implementation."

The regulations in 30CFR 785.15 give definition to the "watershed improvement" requirement of 515(e). This clause states that the watershed will be deemed to be "improved" if "compared with the condition of the waters before mining or with its condition if the approximate original contour were to be restored".

1. Total suspended solids or other pollutants will be reduced, or
2. Flood hazards within the affected watershed will be reduced,

and flows will not vary in a manner adversely affecting local ecology or water use.

Congressional Intent

This review indicates that without a doubt, Congress intended to allow mining and associated reclamation activities to provide sites suitable for industrial, commercial, industrial, and public land uses which would meet the needs of Appalachian communities. However, Congress wished the variance provisions to be restrictive, not open ended. Reduction of the environmental impacts of mining was maintained as a first priority.

There is ample evidence of Congressional intention to maintain strict controls over AOC variance reclamation. In both the 93rd and the 95th Congress, the House-Senate Conference Committee developed compromise legislation by tightening language defining AOC variance proposals. In 1973, Senator Allen of Alabama proposed amended language to the AOC requirements which called for land to be restored to the approximate original contour unless "another surface configuration is equally effective in controlling erosion, siltation, and rainwater runoff ..." [Cong. Rec. 119:33326. 9 October 1973]. This proposed amendment was soundly defeated, indicating that the Congress was not content to allow variance from AOC on purely environmental grounds. In 1975, in response to President Ford's call for additional variances to achieve specific post-mining land uses, the Conference Report rejected this proposal with the statement, "The Committee believes that unlimited variances would greatly weaken the bill by possibly becoming the rule rather than the exception" [Cong. Rec. 121:5852. 10 March 1975]. In 1977, as Senator Ford proposed the pre-

cursor to SMCRA Section 515(e), his remarks included, "I share your concern on the subject of control. We must guard against a flexible provision that would allow abuses. Obviously, we do not wish to encourage a situation that would allow variances to become the rule" [Cong. Rec. 123:15706, 20 May 1977]. In 1977, the House-Senate Conference Report on House Bill H.R. 2 and Senate Bill S. 7, regarding changes imposed to produce SMCRA Section 515(e), stated: "The variance however is only for developed land uses such as industrial, residential or commercial sites. Agricultural, open space, and similar types of land uses do not qualify" [H.R. Report 95-493, 95th Congress, first session].

There are examples of AOC variance mining procedures being used to prepare lands for improved land use in central Appalachia. For example, near Norton and Wise, Virginia, commercial areas have been prepared on recently-reclaimed mine areas. Near Hazard, Kentucky, commercial development has also occurred on reclaimed mine areas. However, application of AOC variance has not been widespread, although a great need for developable land exists in central Appalachia. When AOC variance reclamation is used to prepare lands for improved uses, such activities generally occur in locales where real estate is highly valued, such as potential commercial areas located next to major highways. There has been very little activity in the remotely-located areas of Appalachia, off the major highways and away from larger towns, where the need for flat land tends to be greatest.

Reasons for Lack of AOC Variance Activity

Difficulties in meeting the AOC variance requirements have to do with three major areas: planning and permitting, mining operations, and technical constraints. From the standpoint of the mining industry, there are major difficulties inherent in the necessity of submitting plans for implementing an improved (i.e. industrial, commercial, residential, or public) land use with the mining permit application. Especially in cases where the variance is sought under the mountaintop removal variance clause [515(c)], the amount of detail that must be provided can impose substantial costs on the permitting process. Data on markets for a proposed service or product (as required by 515(c)3B) will be particularly difficult to obtain years in advance of land use implementation. This market assessment problem also has implications relative to the fact that a land developer must be able to expect profit from development activities. Again, it will be difficult to gauge the profitability of a proposed investment far in advance. These constraints are most operative in situations where flat land suitable for development is needed most: the land deep in the hills, away from highways, population centers, and sources of employment. In Appalachia, many areas are "off the beaten track" primarily due to transportation and other difficulties caused by terrain.

Other problems result from the fact that the owners of many coal-bearing lands in Appalachia are corporations specializing in mineral and timber development. Some of these corporate interests lack experience in developing land for improved uses, and such activities may not be their primary business objective. The existence of unmined coal below the level of the proposed surface mining operation will constrain surface development, from the landowner standpoint, as modern full-seam coal extraction technologies often cause surface subsidence.

Performance bonding costs can also be increased by an AOC variance application. In many cases, altering the landform so as to increase available level area will also increase the area disturbed by mining by increasing the amount of excess spoil to be disposed in locations other than the mining bench. In such cases, if the performance bond amount is calculated on a per-acre basis, the bonding cost will be increased. More significantly, a "landform al-

teration" mining regime will, in many cases, entail a longer-term commitment by the mining operator. This can mean a substantial increase in the hypothetical "worst case" reclamation cost used to calculate the performance bond amount.

Although there are situations where a mining operation is rendered more cost effective by an AOC variance mining regime (Zipper et al. 1989), an AOC variance mining operation can also impose operational difficulties. Hollow fills can be costly to implement, as hollow fill construction is closely regulated. [30CFR 816.71-74]. Also, the long-term commitment required can impact the mining operator's ability to respond to negative price impacts by shutting down, or sharply curtailing production, at short notice.

There are also technical difficulties with implementing improved land uses on reclaimed surface mines. In remote areas, especially, waste disposal can be a problem, as septic drainfields are generally not permitted for placement on reclaimed surface mine fills. Also, young fills are prone to settlement, which can damage homes and other buildings if not constructed using methods that protect against structural distortion from differential settlement.

In general, environmental considerations are not a major hindrance to application of AOC variance mining procedures. AOC mining in central Appalachia has some inherent environmental liabilities, especially in steeply-sloping areas (Bell et al. 1989). When properly implemented, AOC variance mining activities can meet the regulatory requirements defining improvement of the natural watershed, by reducing the amount of steeply-sloping mined areas, and by reducing flooding potentials in mountainous watersheds (Zipper et al. 1989). Flat, level areas covered by deep, loose minesoils will, in general, absorb greater rainfall than steep, reclaimed slopes

Implications

First, community and economic development leaders in the coalfield counties must recognize that the coal industry has little incentive to seek AOC variance for surface mining operations, so as to produce flat lands suitable for community development. AOC variance application can add to permitting time and cost. It can also add to the problems associated with obtaining performance bond while detracting from the operators ability to respond to unanticipated coal price changes and other marketing difficulties.

If AOC variance reclamation is to solve land use problems for Appalachian communities, community leaders and local governments must take the initiative. Where opportunities are recognized to produce flat lands that will aid community development, these opportunities need to be called to the attention of mining operators and landowners. Local governments can offer to help lower the barriers to obtaining an AOC variance by taking the initiative to provide documentation necessary to support AOC variance application, as defined by the relevant federal and state regulatory programs.

Legal and regulatory changes could also lower the barriers to AOC variance without producing "open ended" situations where variances from AOC become the rule rather than the exception. Specifically, SMCRA requires that the reclaimed land be rendered "suitable" for an approved "equal or better economic or public use" [515(c)3 and 515(e)2]. The ability of mining firms to produce lands that would be an aid to community development would be enhanced if criteria were developed for selectively waiving the requirement that the proposed land use actually be implemented at the immediate conclusion of mining. These criteria might include a demonstrated community need for the proposed land use, as certified by an independent third party. Given that a genuine need exists, the "reasonable

likelihood" that the land use for which the site is prepared would actually be implemented is very real. Thus, in communities where housing sites are in short supply, for example, the mining firm could be granted a variance to produce a site that is physically suited for housing (i.e. has access to public roads, potential access to water and waste disposal, and is located on stable ground) without accepting the obligation to arrange financing and to physically produce housing on that site. This change would remove a major impediment to mining firms' willingness to produce beneficial landforms.

Third, additional research is necessary to develop technologies that will aid development of mined lands. Hollow fills are a necessary component of most AOC variance mining plans in steeply sloping Appalachian terrain. Hollow fill construction is tightly regulated, due to the negative, and quite dramatic, environmental impact that would result from fill failure. Mining operators find the tight regulations associated with hollow fill construction, in many cases, to be a reason for avoiding hollow fill construction. Additional research aimed at finding more cost-effective, but environmentally sound, hollow fill construction techniques would aid the ability of mining firms to produce this level land. Regulators cannot liberalize hollow fill construction standards without assurances that such actions will not compromise the environmental integrity of the resultant structures.

There are also technical difficulties associated with constructing buildings on reclaimed mine sites. Recently reclaimed mines are, essentially, soil and rock fills, subject to settlement with time and changes in moisture status (Krebs and Zipper 1989). Conventional construction techniques, designed for stable ground, would be inappropriate for mined lands of recent origin without costly modifications that detract from the economic flexibility of a mined land development venture. Research to develop cost-effective techniques for construction of buildings that can withstand the effects of settlement will aid mined land development potentials.

Waste disposal can also be a problem for developing mined lands in remote areas, where public sewers are not available. In mountainous Appalachian terrain, natural soils suitable for conventional septic drainfields are scarce, especially in the highlands. Reclaimed mine spoil is generally considered to be unsuitable for on-site waste disposal systems, due to the presence of multiple channels and voids that occurs when earth materials are placed in non-controlled fashion. The development of cost-effective waste disposal technologies for application on fill materials, possibly including controlled placement of soil and/or spoil materials during construction of specific areas designed to host septic drainfield waste disposal systems, would greatly aid mined land development prospects.

Literature Cited

- Bell, James C., W. Lee Daniels, and Carl E. Zipper. 1989. The practice of "approximate original contour" in the central Appalachians: I. Slope stability and erosion potential. *Landscape and Urban Planning*. (In press).
- Council on Environmental Quality (CEQ). 1973. *Coal Surface Mining and Reclamation - An Environmental and Economic Assessment of Alternatives*. Prepared for U.S. Senate Committee on Insular Affairs. Serial No. 93-8 (92-43). U.S. Government Printing Office, Washington, DC. 143 p.
- Dunlap, Louise C. 1976. An analysis of the legislative history of the Surface Mining Control and Reclamation Act of 1975. *Rocky Mountain Mineral Law Institute* 21:11-58.
- ICF, Inc. 1977. *Energy and Economic Impacts of H.R. 13950 (Surface Mining Control and Reclamation Act of 1986)*. ICF, Inc. Washington, DC. National Technical Information Service PB-274 632.
- Imhoff, Edgar A., T.O. Fritz, and J.R. LaFavers. 1976. *A Guide to State Programs for the Reclamation of Surface Mined Areas*. Circular 731. U.S. Geological Survey, Arlington, VA. 29 p.
- Krebs, R.D., and C.E. Zipper. 1989. *Foundations for Housing on Reclaimed Mined Lands*. Virginia Cooperative Extension Service Publication 460-115. Blacksburg, Virginia. 12 p.
- Mathematica, Inc. 1974. *Design of Surface Mining Systems in Eastern Kentucky*. Volume 1. Prepared for Appalachian Regional Commission and Kentucky Department of Natural Resources. National Technical Information Service PB 242 651. 82 p.
- National Research Council (NRC). 1984. *Highwall Elimination and Return to Approximate Original Contour as Required in the Surface Mining Control and Reclamation Act of 1977*. Committee on Highwalls and Approximate Original Contour, Board on Minerals and Energy Resources, Commission on Natural Resources. National Academy Press. Washington, DC. ISBN 0-309-03448-5.
- Simpson, John W. 1985. The emotional landscape and Public Law 95-87. *Landscape Architecture* 75(3):60-63+.
- Udall, Morris K. 1979. The enactment of the Surface Mining Control and Reclamation Act in Retrospect. *West Virginia Law Review*. 81:553-557.
- U.S. Department of Energy (US DOE). 1980. *Coal Data: A Reference*. Energy Information Administration. DOE-EIA-0064(80). UC-90.
- Waters, Robert A. 1979. A summary of the legislative history of the Surface Mining Control and Reclamation Act of 1977 and the relevant periodical literature. *West Virginia Law Review*. 81:775-783.
- Zipper, C.E., W.L. Daniels and J.C. Bell. 1989. Approximate original contour reclamation: An alternative in steep-slope terrains. *Journal of Soil and Water Conservation* 44(4):279-283.

