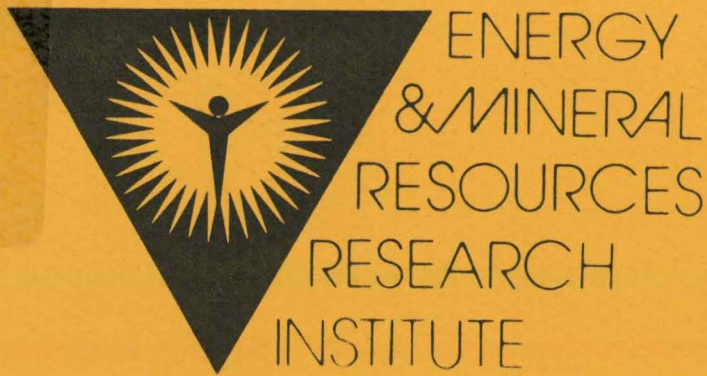
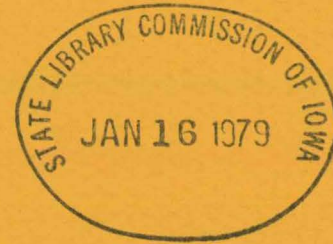


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INCORPORATING ORPHANED MINE SPOIL RECLAMATION
INTO THE MINING PLAN

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June 13, 1978

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Presented at
International Congress for Energy and the Ecosystem
University of North Dakota
Grand Forks, North Dakota
June 13, 1978

ENERGY AND MINERAL RESOURCES
RESEARCH INSTITUTE

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INCORPORATING ORPHANED MINE SPOIL RECLAMATION INTO THE MINING PLAN

by

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INTRODUCTION

The increasing demand for energy in the United States coupled with decreasing supplies of oil and natural gas continues to put pressure on the coal industry to increase coal production and promote maximum utilization of all coal resources. These trends, plus a desire by the State of Iowa to become more energy self-sufficient, stimulated the Iowa Legislature to appropriate \$3,000,000 in 1974 to Iowa State University's Energy and Mineral Resources Research Institute for a three year study of the coal potential of Iowa. The primary goals of this study were to investigate the washability of Iowa coals and to examine coal mining and restoration economics in an agricultural environment. Secondary goals included a multidisciplinary environmental analysis of surface mining covering the physical, biological and social sciences.

In fulfilling these goals two major projects were undertaken. A seventy ton per hour coal preparation plant was designed and built on the Iowa State University campus employing heavy media separation and concentration tables to remove sulfur and ash. Continued coal preparation research is examining fine coal processing and recovery, and chemical coal processing for sulfur removal.

As a part of the coal mining and restoration research, a steeply sloped, forty acre pasture site of low agricultural productivity was chosen for Iowa Coal Project Demonstration Mine No. 1. During mining, 110,000 tons of coal were removed, impact on the surrounding environment was kept at a minimum and the site was restored to a series of level benched terraces suitable for intensive row crop production. Continuing experiments on this site will determine the effectiveness of the restoration with respect to environmental protection and agricultural productivity. As a part of this operation a unique project was initiated to develop a reclamation program for an abandoned surface mine site adjacent to the primary Demonstration Mine experiment.

HISTORY

Surface mining in Iowa parallels the Des Moines River in the south central portion of the state. Strippable coal reserves typically occur in

small 50-200 acre pods the size and nature of which were determined by a combination of depositional history and recent pre-Pleistocene and Pennsylvanian Age erosion. Past surface mining of these deposits followed a pattern of mining from natural drainages, where overburden was thinnest, deeper into hillsides until overburden depth became too great for economic feasibility. These practices have left more than 11,000 acres of orphaned mine spoils in Iowa which are agriculturally unproductive and polluters of watersheds.

As the economics of surface mining change, these abandoned sites are becoming economically attractive for additional mining. Many of the present Iowa mines border abandoned spoils and future mine development can be expected to follow this pattern. It is possible when mining adjacent to old spoils to reclaim these spoils as a part of the mining operation while decreasing the cost of mining. This was the purpose of the reclamation experiment of the Iowa Coal Project conducted in conjunction with the primary experiment of mining and restoration.

Mining terminated on the Archie Childers property in the spring of 1975 leaving 28 acres of unreclaimed mine spoils and seven acres of unmined land. The topography of the site (Figure 1) was typical of abandoned mine spoils featuring three impoundments, steep spoil banks, gullied slopes and considerable areas with pyritic, acid-producing shales exposed. The mined land was left with no productive value and little vegetative cover to prevent erosion and acid mine drainage runoff. The unmined area was isolated from the farmer's remaining land and littered with abandoned mining equipment making it also relatively useless. Overburden on the unmined acres averaged 20 feet of loess and glacial till, 10 feet of sand and 10 feet of black pyritic shale overlying four feet of coal.

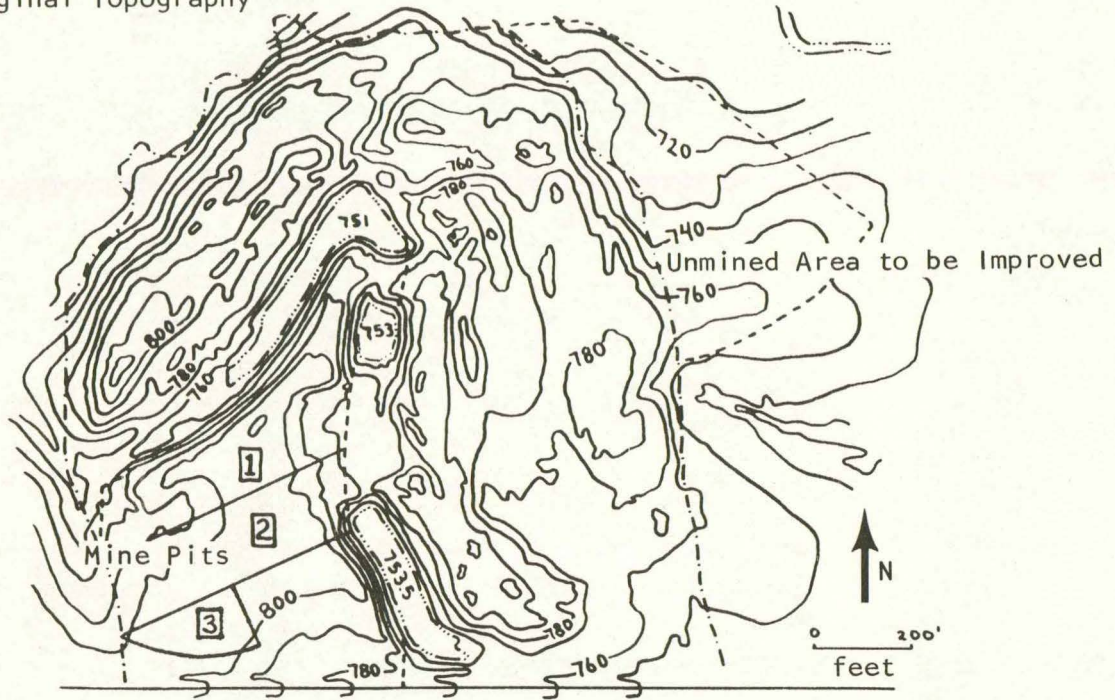
RATIONALE FOR THE ABANDONED MINE LAND RECLAMATION PLAN

In developing the mining plan that included the reclamation of the mine spoils, three interrelated criteria were considered. These were the recovery of a small pocket of coal (31,000 tons) that was probably too small to be economically interesting to a mining firm; the reclamation of 28 acres of abandoned mine spoils, restoring the land to some level of productivity; and accomplishing the operation in an economically acceptable manner. The first two are criteria that relate to the proper utilization of natural resources and the preservation of land productivity and the third, the prospect of economic gain from reclaiming abandoned mine spoils, offers hope that projects of this nature could be incorporated into mining plans that have abandoned mine spoils adjacent to proposed new mining properties.

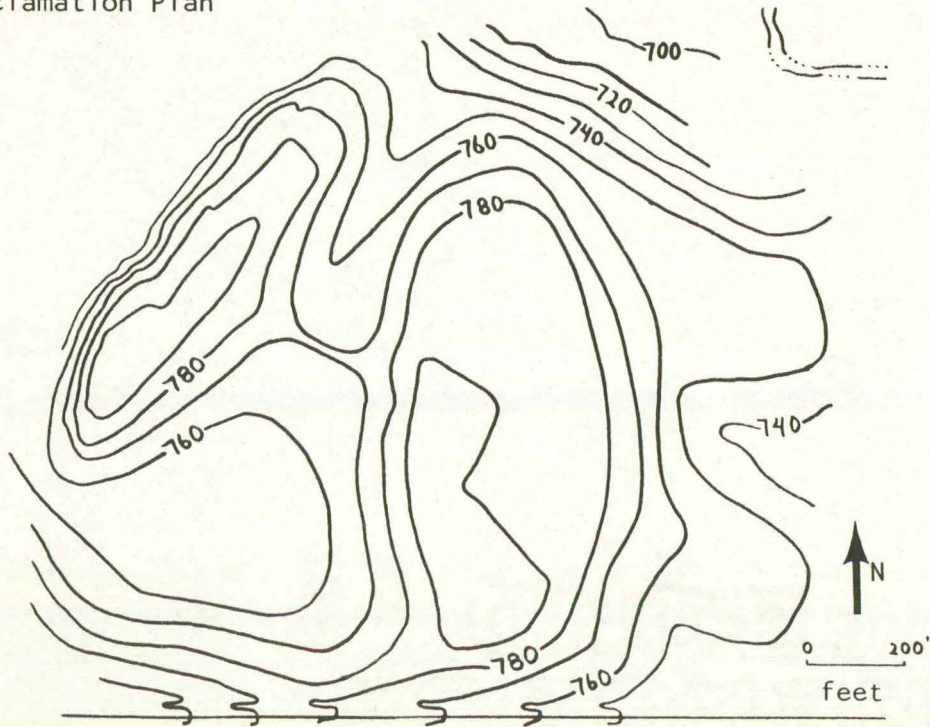
To be economical, the reclamation plan for the project was designed to require a minimum of rehandling of overburden materials. This was accomplished by a final reclamation plan that featured the filling of all impoundments and surrounding gullies and leaving a depression where the coal would be removed during mining (Figure 1). Premining exploratory drilling also determined that there were sufficient volumes of topsoil and clay over

Figure 1. Original Topography and Reclamation Plan

Original Topography



Reclamation Plan



the remaining seven unmined acres to cover the entire site with at least two feet of non-toxic materials, and the reclamation plan called for maximum slopes of 4:1 to prevent excessive runoff and erosion from the reclaimed surface.

The final topographic configuration and topsoiling provisions of this proposed plan were not consistent with the existing state requirements or the present federal surface mining law with respect to the acres to be mined. However, because the post-mining topography was not inconsistent with the surrounding area and because the expected site productivity greatly exceeded the pre-mining productivity, the state mine inspector waived the state's topsoiling and topographic requirements in favor of the proposed reclamation plan.

MINING AND RECLAMATION

Prior to mining, bulldozers leveled the spoil piles on the property to be reclaimed preparing it to be topsoiled. When mining began, 85,000 cu. yds. of clay and topsoil from pit 1 were spread by scrapers over the eastern portion of the site to a minimum depth of two feet. The sand and shale from pit 1 were spoiled in five unmined acres in the northeast corner of the site to improve the utility of the land for the farmer and to eliminate the need to double-haul this material as mining progressed.

During coal removal from pit 1, the topsoil and clay from pit 2 were spread over the northern portion of the site and the improved area in the northeast corner. The sand of pit 2 was layered and mixed with clay as an experiment to determine whether the permeability of the reclaimed soil could be improved. Shale from pit 2 was spoiled in pit 1.

Topsoil and clay from pit 3 were spread over pit 1 and the northwest portion of the site and the sand and shale were spoiled in pit 2. Reclamation was completed by dozing down the highwalls around pit 3 and the southern impoundment. Nearly 31,000 tons of coal had been mined and the site was covered with at least two feet of clay or topsoil.

Work at the site terminated November 17, 1977, and the site was frost seeded in the spring of 1978 with a mixture of crown vetch, bromegrass, birdsfoot trefoil and red clover.

MINING ECONOMICS

The economics of this mining and reclamation experiment were very important because the project was only subsidized by the \$10,000 reclamation bond of the original miner held by the mine inspector of the State of Iowa. It was necessary for the sale of coal to offset the cost of reclamation. The economic summary of the experiment is shown in Table 1.

Nearly 31,000 tons of raw coal were mined and transported to the coal preparation plant at Iowa State University for cleaning and consumption in

Table I

SUMMARY OF ICP RECLAMATION PROJECT ECONOMICS

	<u>Costs</u>	<u>Income</u>
Coal Sales		\$ 636,628.62
30,960.755 raw tons		
\$1.16/MMBTU		
11,305 BTU/lb. (cleaned)		
78.4% recovery (cleaned)		
Reclamation Bond		<u>10,000.00</u>
Total Income		\$ 646,628.62
Earthmoving	\$ 328,029.71	
labor, equipment and maintenance		
Coal Removal @ \$2.85/ton	88,238.15	
Transportation @ \$5.10/ton	157,899.85	
Royalty @ \$0.50/ton	15,480.40	
Coal Preparation @ \$1.63/clean ton	39,565.37	
OSM Reclamation Tax @ \$0.35/ton on 4126 tons	<u>1,444.10</u>	
Total Costs	\$ 630,657.58	
Net Income to Iowa Coal Project		\$ 15,971.04

the university's physical plant. Costs of coal removal, transportation and royalty were paid on a 'raw ton' basis. During cleaning, 78.4% of the coal was recovered and the heating value was increased to an average of 11,305 BTU/lb. The cost of cleaning was \$1.63/clean ton (operational cost; capital cost not included) and the cleaned coal was sold for \$1.16/MMBTU netting \$636,628.62. Following October 1, 1977, 4,126 tons of coal were mined and \$1,444.10 (35¢/ton) was paid as required for the Coal Production and Reclamation Fee of the Office of Surface Mining.

Earthmoving accounted for more than 50% of the mining and reclamation costs and can be broken down approximately as follows: 61% equipment rental, 10% contractor overhead, 8% fuel and lubricants, 7% maintenance, insurance, taxes and miscellaneous expenses.

The economic benefit to the project that was gained by reclaiming the surrounding acres can be shown by examining the volume of overburden that was spoiled in the five acres of improved land and the volume of topsoil and clay that covered the 28 reclaimed acres. More than 230,000 cu. yds. of material were disposed of in this manner eliminating the necessity of hauling it back to the mined acres to rebuild the original contour. At \$0.55/cu. yd. (approximate cost to transport unconsolidated material by scraper over the course of ICP mining operations), the savings to the project exceeded \$125,000.00. The project would have failed economically if it would have had to rebuild the mined acres to satisfy PL 95-87 requirements.

DISCUSSION

The Iowa Coal Project mine spoil reclamation experiment has shown that it is possible to incorporate orphaned mine spoil reclamation into the mining operation. In this operation 28 acres of orphaned mine spoils were reclaimed potentially to pastureland productivity, 5 acres of unmined land were improved and 5 of 7 unmined acres were mined and reclaimed recovering nearly 31,000 tons of coal. Considering all of these benefits to the land owner, the miner was also able to operate profitably.

It is important, however, to realize the fragile nature of the site and the need for proper management to maintain it. With only two feet of topsoil covering acid producing shales, permanent vegetation will be necessary to prevent erosion and the generation of acid 'hot spots'.

Reclaiming orphaned mine spoils as a part of a mining operation is also contingent upon common ownership of the land to be mined and reclaimed, and the availability of the necessary volume of non-toxic overburden to topsoil leveled mine spoils.

Mining and reclamation plans of this nature have become potentially more feasible following the passage of the federal Surface Mining Control and Reclamation Act. The Office of Surface Mining Abandoned Mine Lands Reclamation Fund provides financial support for the reclamation of orphaned mine spoils, and when the economics of this type of operation are not completely positive, application by the land owner for partial federal funding may provide the necessary money to make the operation feasible. Mining plans that include orphaned mine spoil reclamation can in this manner stretch the value of federal reclamation funds by reclaiming more acreage than otherwise possible.

SOURCES

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