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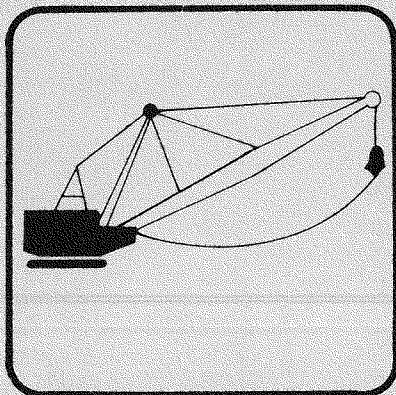
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FINAL REPORT
VOLUME 9

Economics of Large-Scale Surface Coal Mining Using Simulation Modes


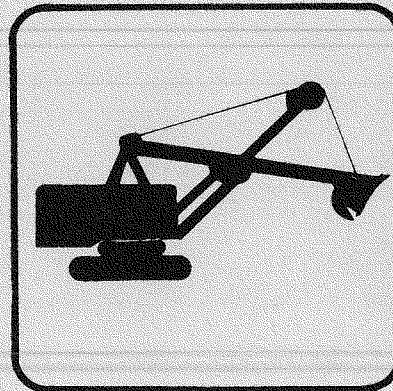
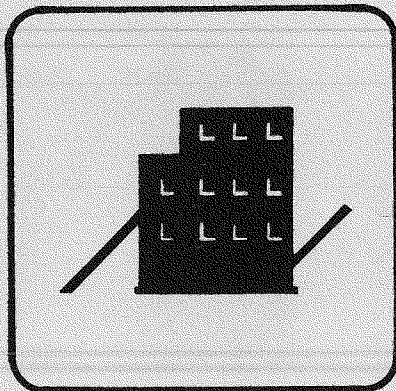
Multiple Dipping Seam Mining
Using Green River Region Test Case

MASTER



ENERGY RESEARCH &
DEVELOPMENT
ADMINISTRATION

OFFICE OF
FOSSIL ENERGY

WORK PERFORMED UNDER
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FLUOR UTAH, INC.
SAN MATEO, CALIF.

BONNER & MOORE
ASSOCIATES, INC.
HOUSTON, TEXAS

MARCH, 1977

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Final Report

Volume 9

ECONOMICS OF LARGE-SCALE SURFACE COAL MINING
USING SIMULATION MODELS

Multiple Dipping Seam Mining
Using Green River Test Case

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Under Contract No. EX-76-C-01-1520

ECONOMIC SYSTEM ANALYSIS OF
COAL PRECONVERSION TECHNOLOGY

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ABSTRACT

Large-scale surface coal mining will play a key role in meeting the future energy needs of the United States, especially in affecting the costs of coal conversion and advanced combustion processes being developed by the U.S. Energy Research and Development Administration (ERDA). Fluor Utah, Inc., with Bonner & Moore Associates, Inc. as subcontractor, was contracted by ERDA to study the costs and problems of large-scale surface coal mining. This project resulted in a series of computer models for use by the industry in mine planning and analysis, and by government in estimating future energy costs.

This report describes the simulation models representative of mountain top removal mining techniques which were developed, documented and tested. The simulation models provide detailed information on mining systems and equipment to assist in mine design and equipment selection.

The Green River Strippable Coal Resource Region was used to test the models. A hypothetical mining situation representative of typical mining problems and conditions encountered in the Green River Region was selected.

The models are part of a series developed for mine planning and economic analysis of surface coal mines. The complete series designed for use by government or private industry, permits examination of large-scale surface coal mining under a variety of terrain conditions and overburden depths. Each major operation in the coal mining process is represented in these models so that the best methods and equipment may be selected and so that the impact of such selection will be reflected in estimates of capital investment, operating costs, and sales price.

1.0 INTRODUCTION

1.1 PURPOSE OF THIS REPORT

The purpose of this report is to describe the development of simulation models for large-scale surface coal mining projects using the multiple dipping seam mining method. A hypothetical test situation in the Green River Region is described, and simulation results for this test situation are presented.

1.2 PROJECT OVERVIEW

Realizing that large-scale surface coal mines would be needed to supply feedstocks for conversion processes currently under development, the U.S. Energy Research and Development Administration sponsored this project to be better able

to determine expected costs for future energy, and

to provide the industry with planning and analysis models to aid in meeting future increased production needs.

The project encompassed 42 months of work at a cost of \$2.5 million involving both the mining and process engineering staff of Fluor Utah, Inc. as prime contractor and the consulting and computer programming staff of Bonner & Moore Associates, Inc. as the major subcontractor.

Successful completion of the project has provided the following immediate benefits:

Scientific planning for coal deposit exploitation by the U.S. coal industry has taken a significant step forward in this project.

Both government and industry, as a result of this project, have a number of powerful tools at their disposal for use in future expansion of surface coal mining.

Information provided by the models will aid in proper planning, equipment selection and exploitation techniques so the coal industry can efficiently scale up to meet the energy needs of the United States.

1.3 PROJECT OBJECTIVES

The first objective of this project is to develop, test and document simulation models representative of current surface mining techniques. The models provide mine designers, policy planners, and engineering managers with the ability to analyze a surface coal mine at two levels of detail. To achieve this goal two types of computer models have been developed:

Detailed Micromodels. These models provide estimates for a detailed part of a large-scale surface mining complex. Individual models allow the user to separately analyze overburden removal, overburden drilling and blasting, coal drilling and blasting, coal loading and hauling, coal preparation and handling, land reclamation, and premining, facilities, and administrative expenses.

Broad Macromodels. These models provide a first order estimate for an entire mining complex. All the detailed operations considered separately by the micromodels are contained as subroutines in the macromodel. In several cases simplified macromodel relationships were derived from detailed micromodel studies. Macromodels have been developed for three mining methods identified by the method of removing overburden: area stripping with draglines, area stripping with shovels and trucks, and contour mining with draglines.

These detailed micromodels and broad macromodels plus supporting information and user manuals, are available to all interested private and public organizations.

The second objective is to use these computer models to estimate mining costs for hypothetical test situations in the eight major United States coal resource regions where coal is likely to be surface mined. The coal resource regions investigated are shown on Figure 1. Results of these analyses, including the sensitivity of coal costs to different mining and financial parameters, are presented in eight separate reports listed in Appendix A.

The objective of Phase I was to delineate the large deposits of surface minable coal in the United States, collect equipment costs and performance data needed to calculate surface coal mining costs, describe major surface mining and coal preparation methods, and investigate the socioeconomic impact of large mining complexes. This information provided a framework for achieving the project objectives. A six-volume Phase I report listed in Appendix B, was issued.

A total of fifteen models have been developed: eleven detailed micromodels, three simplified macromodels, and one economic analysis model. Table 1 shows the mining functions analyzed by each model as well as the types of mining that can be studied.

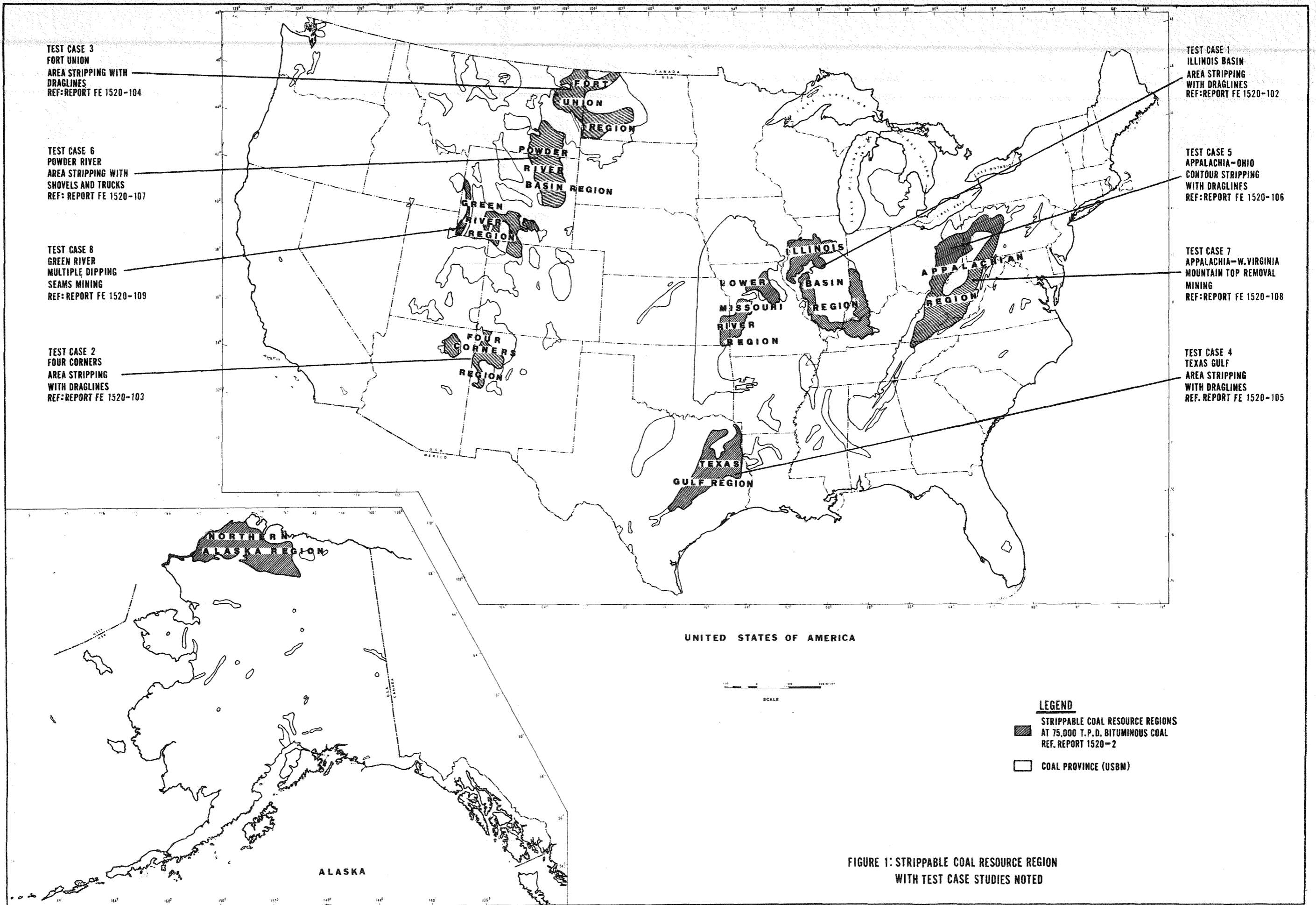
1.4 COMPARISON OF BROAD MACROMODEL AND DETAILED MICROMODELS

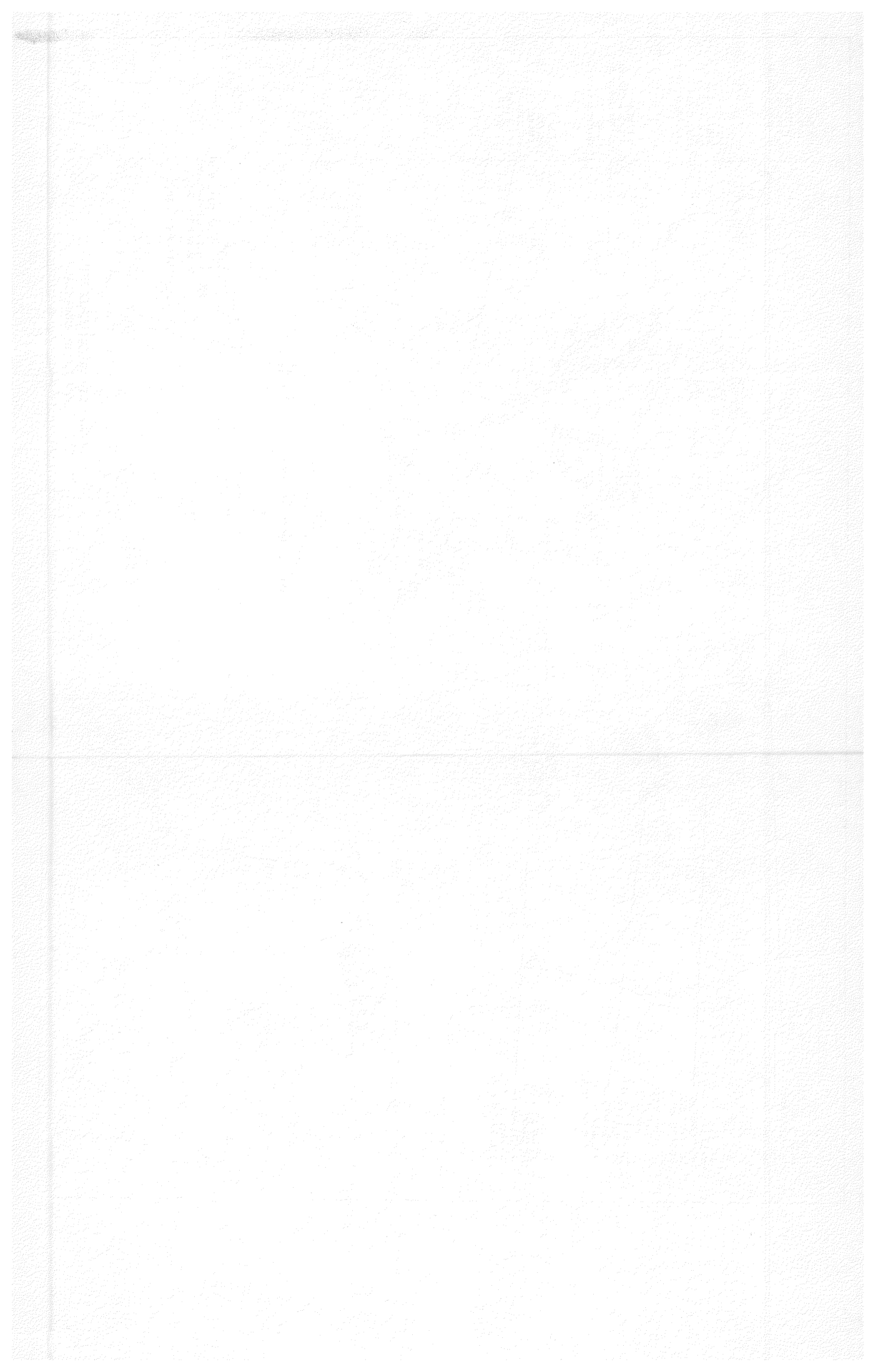
Figure 2 is a flow diagram of the micromodeling and macromodeling systems as applied to the area stripping with draglines mining method. The diagram would have the same form for the other mining methods but would show different models as appropriate to the mining operations. It can be seen that the micromodel system involves using up to seven models, while the macromodel system involves a single model preceding the cash flow analysis. With the micromodel system the user must analyze the model results and prepare the cash flow input, whereas that input is developed directly by the macromodel system.

Both systems begin with a tract description and end with the results of a cash flow analysis. The main difference between the types of models is the number of steps required to reach a solution.

The macromodel system requires only one manual step, i.e., defining case study parameters. The computer programs perform all calculations required to obtain a solution. Thus, first-order estimates can be obtained in a single step. The macromodels are designed to provide answers even for cases where little verified field data are available about the site or region under study. The macromodel user may define all mining and financial parameters; however, each model uses default values, typical of the mining method and region, for all parameters not supplied by the user.

In contrast, the micromodel system requires several manual steps since each mining function is examined separately with the user interpreting the results from each model. This procedure permits interactive use of the computer with decisions being made by the user at each stage of the analysis. The micromodels are designed for use where considerable field data are available. They may be used in less well defined situations since each micromodel also has default values which may be acceptable substitutes for unavailable field data.





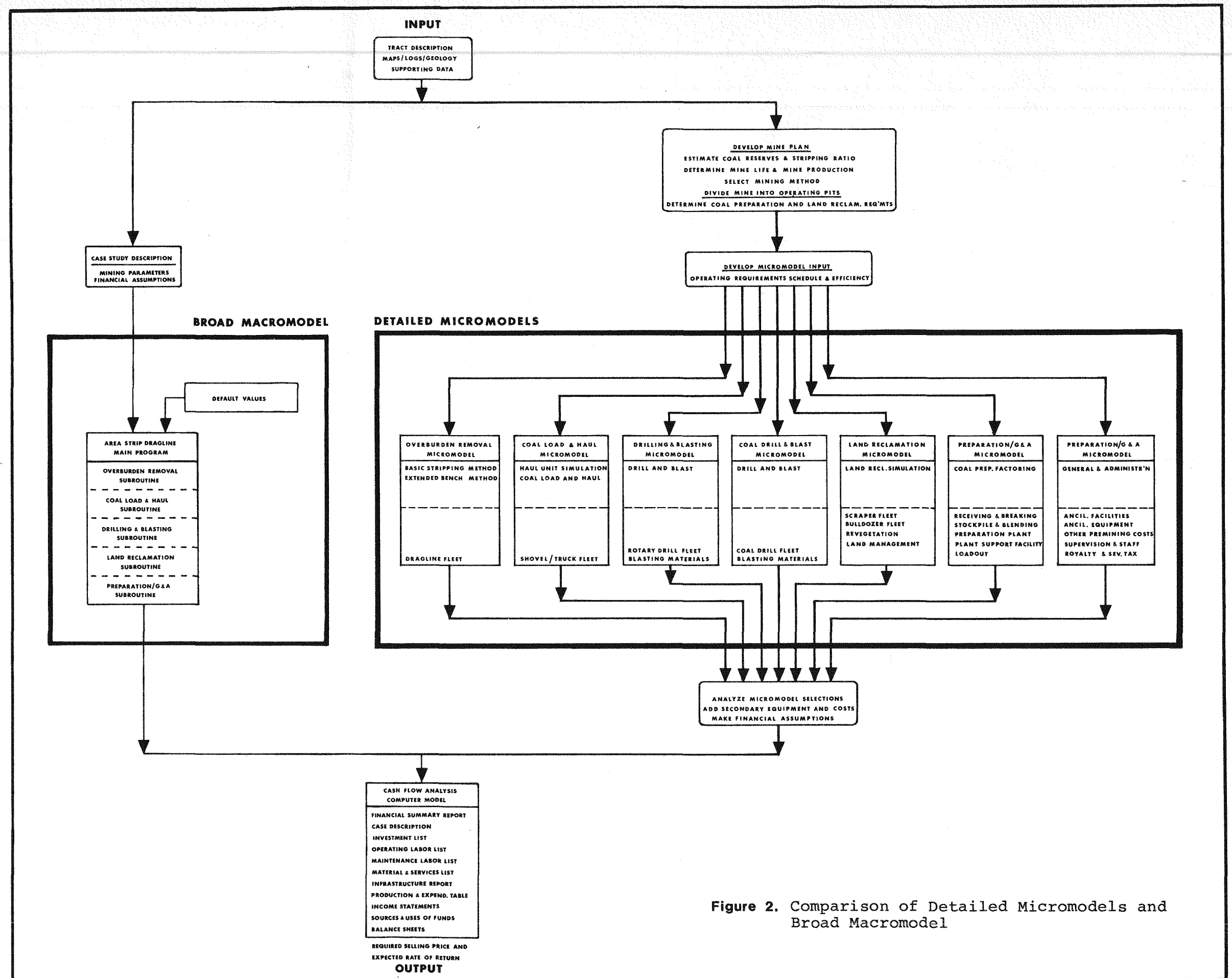


Figure 2. Comparison of Detailed Micromodels and Broad Macromodel

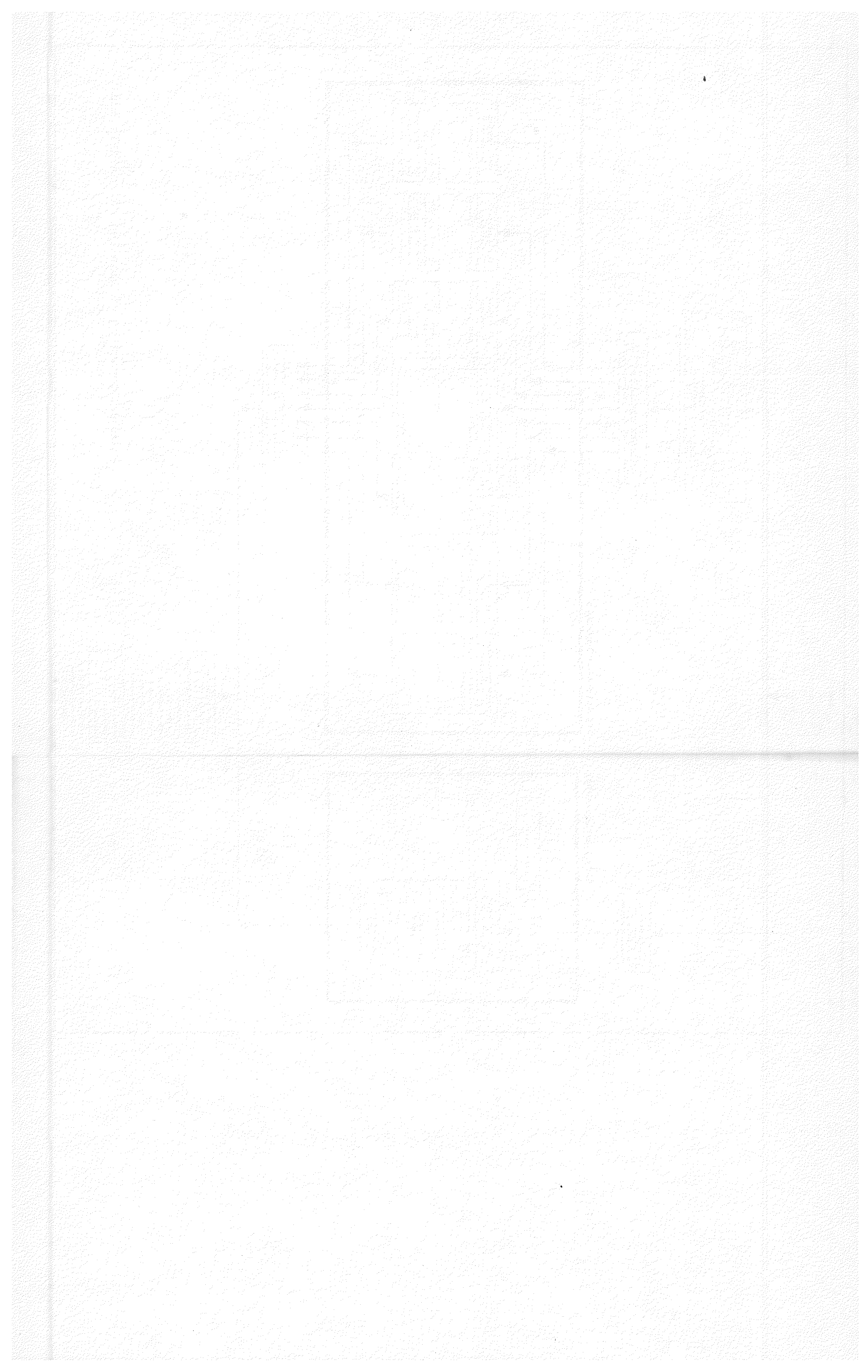


Table 1. Computer Models for Simulation of Surface Coal Mining

	Detailed Micromodels		Broad Macromodels		
	Dragline Mining	Shovel Truck Mining	Area Dragline Mining	Shovel Truck Mining	Contour Dragline Mining
Overburden Removal	Basic Stripping Method (BSM) Extended Bench Method (EBM) Contour Stripping Dragline (CSD) (Ref: Report FE-1520-114)	Shovel Truck Stripping (STS) Multiple Dipping Seams (MDS) Mountain Top Removal (MTR) (Ref: Report FE-1520-115)	Area Dragline Macromodel (ADM) (Ref: Report FE-1520-110)	Area Shovel Truck (AST) (Ref: Report FE-1529-111)	Contour Dragline Macromodel (CDM) (Ref: Report FE-1520-112)
Coal Load and Haul	Haul Unit Simulation (HUS) Coal Load/Haul (CLH) (Ref: Report FE-1520-116)				
Overburden Drilling & Blasting	Drilling And Blasting (DAB) (Ref: Report FE-1520-116)				
Coal Drilling & Blasting	Drilling And Blasting (DAB) (Ref: Report FE-1520-116)				
Land Reclamation	Land Reclamation Simulation (LRS) (Ref: Report FE-1520-116)				
Coal Handling and Preparation	Preparation/General Administrative (PGA) (Ref: Report FE-1520-116)				
Premining, Facilities and Administrative	Preparation/General Administrative (PGA) (Ref: Report FE-1520-116)				
Economic Analysis	Cash Flow Analysis (CFA) (Ref: Report FE-1520-113)		Cash Flow Analysis (CFA) (Ref: Report FE-1520-113)		

Thus, the type of model used depends on the following factors:

1. Availability of field data:
If little, use broad macromodel.
If great, use detailed micromodels.
2. Desired interaction between user and computer:
If little, use broad macromodel.
If great, use detailed micromodels.
3. Desired detail of analysis:
If little, use broad macromodel.
If great, use detailed micromodels.

Once equipment selections have been made the next step is to develop equipment and manpower lists and investment and operating costs. These data are manually compiled when the micromodels are used but developed directly by the macromodel. The final step is the estimation of the coal sales price required to yield a specified return on investment or the return that could be expected from a specified sales price. The Cash Flow Analysis (CFA) model is used for this final step. It develops a complete discounted cash flow analysis of the project and prepares the following reports:

- Financial Summary Report
- Case Description
- Investment List
- Operating Personnel List
- Maintenance Personnel List
- Services and Materials List
- Infrastructure Report
- Production and Cash Expenditure Table
- Financial Statements.

These reports provide the user with a wide range of information useful in evaluating a large-scale surface coal mining project in terms of capital investment, operating costs, and profitability.

1.5 POTENTIAL APPLICATIONS

1.5.1 DETERMINATION OF COAL COSTS FOR COAL CONVERSION AND COMBUSTION

The cost of coal comprises a significant portion of the selling price of synthetic gas, liquid products or electricity produced from coal. Because the competitiveness of these energy options depends so strongly on coal costs, it is important to make reasonably accurate estimates of mining costs. This is particularly true for surface coal mines

which currently supply approximately one-half of U.S. coal production and are expected to supply even more of the U.S. coal demand in the future.*

The macromodels can be used to develop first-order costs for coal conversion process evaluation. The detailed micromodels can be used for more precise cost determination for specific plants.

1.5.2 MINE EVALUATION

Mine evaluation typically progresses through a series of steps from initial order-of-magnitude estimates through final engineering and start-up as follows:

- Order-of-Magnitude Estimate
- Preliminary Estimate
- Basic Engineering
- Detailed Engineering
- Procurement
- Construction
- Start-up.

The broad macromodels can be used to inexpensively obtain order-of-magnitude estimates for initial reserve evaluation.

As more field data is collected, preliminary estimates can be made using: 1) the macromodels for analyzing the overall mining complex, and 2) the detailed micromodels for analyzing critical mining functions.

In the basic engineering stage the computerized models can be used to examine a wide range of alternatives for both mining and processing prior to committing large expenditures for the preparation of detailed engineering drawings, specifications, calculations, and estimates. Using the results of field investigation and testing to further refine model default values with actual realistic data, a great many cases can be run rapidly and inexpensively to examine many alternative mining methods, mining plans, processing methods, equipment types, and equipment sizes.

*REFERENCE: Cyril W. Draffin, Martin R. Adams, Paul O. Hedman and Christian W. Knudsen, "Economic Analysis of Coal Conversion Processes," presented at Third International Conference on Coal Research, Sidney, Australia, October 6-8, 1976. (Available from ERDA Fossil Energy, Washington, D.C. 20545).

The detailed micromodels can be used as an aid in preparing year-by-year mine plans.

The cash flow analysis model can be used to update profitable projections as construction and purchase commitments are made.

1.5.3 EVALUATION OF GOVERNMENT POLICY

Government policies affecting coal mining costs that could be evaluated include: leasing of federal lands, alternative land reclamation requirements, various depreciation methods, increased labor and equipment costs due to safety requirements, state severance taxes, royalty costs, price subsidies, and construction grants.

The models can also be valuable in estimating long term coal price projections. Curves representing the cost of coal as a function of the cumulative amount of coal mined (coal supply curves) could be constructed for coal resource regions.

1.5.4 ENVIRONMENTAL IMPACT ASSESSMENT AND EVALUATION

The infrastructure report printed by the Cash Flow Analysis model presents information in four categories:

- Physical Effects
- Economic Impact
- Utility Requirements
- Manpower Requirements.

This type of information can be used to assess environmental and socioeconomic impact.

1.5.5 PUBLIC ACCESS TO THE SIMULATION MODELS

The simulation models are on line on a Xerox Sigma Seven computer as of the completion of the project. They can be run either in time share (remote terminal) or batch mode. The ultimate method of continued public access to the models has not been decided. Those desiring an up-to-date status of the availability of the models should contact one or more of the following as appropriate:

1. The Fossil Energy Office of the Energy Research and Development Administration in Washington, D.C., which sponsored the project, should be contacted for questions regarding government participation and government agency use.

2. Fluor Utah, Inc., San Mateo, California, which supplied the mining and process engineering expertise for the project, should be contacted for questions regarding the formulation of mining problems, equipment selection logic, and interpretation of simulation results.
3. Bonner & Moore Associates, Inc., Houston, Texas, which supplied the simulation modeling and consulting expertise for the project should be contacted for questions regarding mathematical modeling techniques and details of time share or batch use of the models.

1.6 TEST CASE RESULTS

The first step in analyzing the test case was to develop a baseline solution using the detailed micromodels for a mining complex producing coal with sufficient Btu content to nominally supply a 250 million cubic feet per day gasification plant, a 40,000 barrel per day liquefaction plant, or a 1500 megawatt power plant.

The result was a mining complex with six operating pits and six preparation plants producing approximately 5 million tons of prepared coal per year. Two coal seams, 28 feet and 10 feet thick, with a combined stripping ratio of approximately 7 bank cubic yards of overburden per ton of run-of-mine coal was assumed.

The situation was selected for the test case to describe conditions that would represent practical mining problems typical of the region. The geologic and topographic situation chosen is representative of a typical situation, not a statistical average nor an actual situation.

Regional studies, which are recommended for future study, were not considered as part of the current project. Nevertheless the test case results are of interest because they provide a first-order estimate of the costs and problems of mining in a given region using a specified mining method. With the caution in mind that the values shown represent only hypothetical test situations, it is of interest to compare results in the following key areas:

- Coal Price
- Capital Investment
- Annual Direct Operating Cost
- Requirements for Individual Mining Functions.

1.6.1 COAL PRICE

The required coal price can be expressed in two ways: 1) dollars per ton of coal shipped, or 2) dollars per million Btu of heat value of coal shipped. The coal price has a baseline value of approximately \$18.80/ton (no escalation, 10 percent rate of return). In terms of heat value, the baseline selling price is approximately \$.90/million Btu.

The most important financial parameters affecting coal price are return on investment and escalation. The effect of changing return on investment from 10 percent to 15 percent, results in a price increase from approximately \$18.80/ton to approximately \$21.85/ton. To underscore the impact of escalation, an additional set of example sensitivity studies were made to compare baseline results (no escalation) with 5 percent escalation of all investment and operating costs holding price constant, and with 5 percent escalation allowing price to escalate at 5 percent also. The results are shown in the following tabulation:

<u>Estimated Coal Price (Dollars per ton)</u>		
<u>No Escalation</u> <u>Price Constant</u>	<u>5% Cost Escalation</u> <u>Price Constant</u>	<u>5% Cost Escalation</u> <u>5% Price Escalation</u>
all years 18.82	all years 41.03	first year last year 23.49 to 106.61

1.6.2 CAPITAL INVESTMENT

Capital investment includes all equipment, premining, and facilities costs. For the Green River test case the capital investment has a baseline value of approximately \$190 million.

1.6.3 ANNUAL DIRECT OPERATING COST

Operating costs include operating labor, maintenance labor, and material and services. Annual direct operating costs for Green River have a baseline value of approximately \$60 million/year.

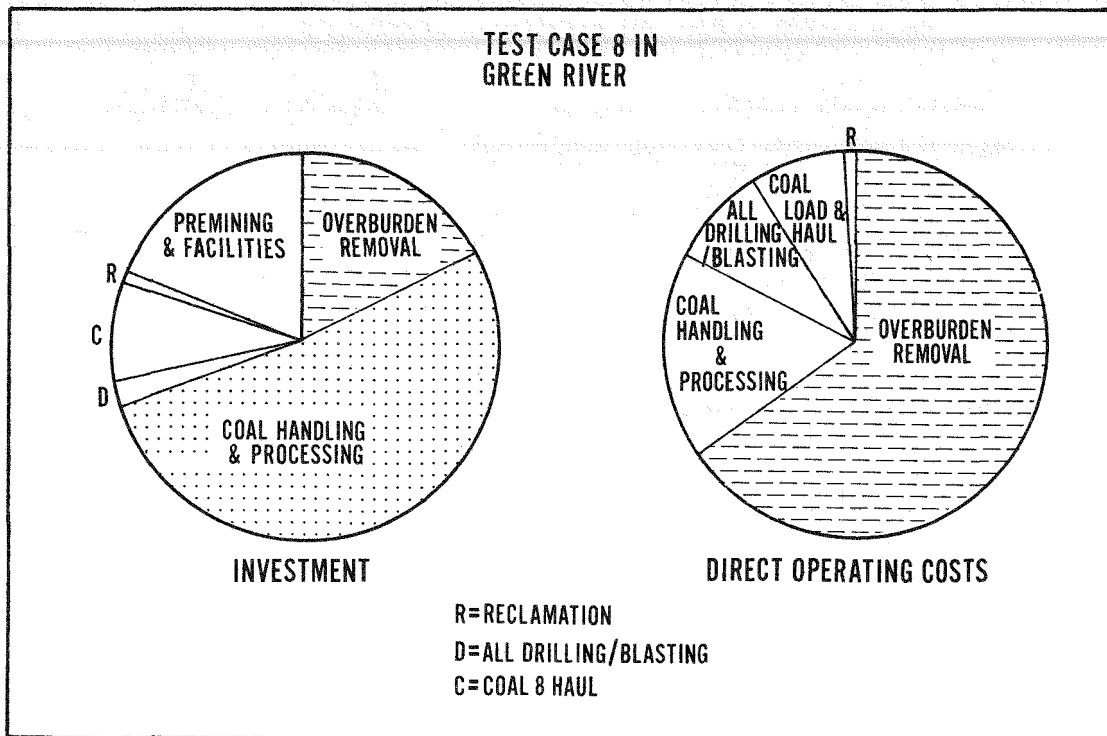


Figure 3. Percent of Capital Investment and Operating Cost by Mining Function

1.6.4 RELATIVE IMPORTANCE OF MINING FUNCTIONS

The percentage of capital investment and operating costs for each mining function is shown in Figure 3. Overburden removal accounts for approximately 17 percent of investment and 66 percent of operating costs. Coal handling and processing account for approximately 53 percent of investment and 17 percent of operating costs.

One reason for the high percentage of capital cost for coal handling and processing is the extensive blending and stockpiling facilities which may be required to provide a uniform, stable feedstock to a coal conversion plant.

This comparison of capital investment and annual operating costs underscores the fact that in large-scale surface coal mining, especially to produce feedstock for a coal conversion plant, it is not the extraction of the coal that has the greatest impact on cost. Rather, it is the removal of the overburden and the processing of the coal to meet feedstock requirements that account for the major costs.

2.0 DESCRIPTION OF THE MINING METHOD - MULTIPLE DIPPING SEAM

2.1 MINING OPERATIONS AT EACH PIT

A mining complex may consist of one or more pits. A pit is the active working area where coal is being uncovered and loaded. When the multiple dipping seam mining method is employed, the following activities are part of the mining operations at each pit:

- Overburden drilling and blasting
- Overburden removal
- Coal drilling and blasting
- Coal loading and hauling
- Land reclamation.

These mining operations, which may take place on several benches, are largely independent activities, but must be coordinated to avoid delays or bottlenecks. All operations must advance at the same annual rate to provide uniform progress through the mine property. The physical relationship of the various operations is shown schematically in Figure 4, the plan view of a hypothetical multiple dipping seam deposit. A detailed discussion of large-scale surface mining methods and equipment can be found in Volume 3 of the Phase I Report (Ref: FE-1520-3).

2.1.1 OVERBURDEN DRILLING AND BLASTING

On each overburden bench a pattern of vertical blast holes is drilled with a rotary drill and the blast holes loaded with the specified amount of blasting agents, primers, and detonating cord. The blasting agent and primer fills only a portion of the blast hole; fine drill cuttings or other suitable material (termed stemming) fills the remainder of the blast hole. Blast holes are detonated according to a planned sequence or series designed to obtain efficient fragmentation of the overburden. A typical self-propelled rotary drill used for drilling overburden blast holes is shown in Figure 5.

Drilling and blasting is performed following land clearing and topsoil removal and prior to overburden removal.

2.1.2 OVERBURDEN REMOVAL

Overburden is excavated by front-end loaders working on a series of benches and loaded into haul trucks which carry the overburden to waste dump areas. A typical front end loader is shown in Figure 6. A typical overburden haul truck is shown in Figure 7.

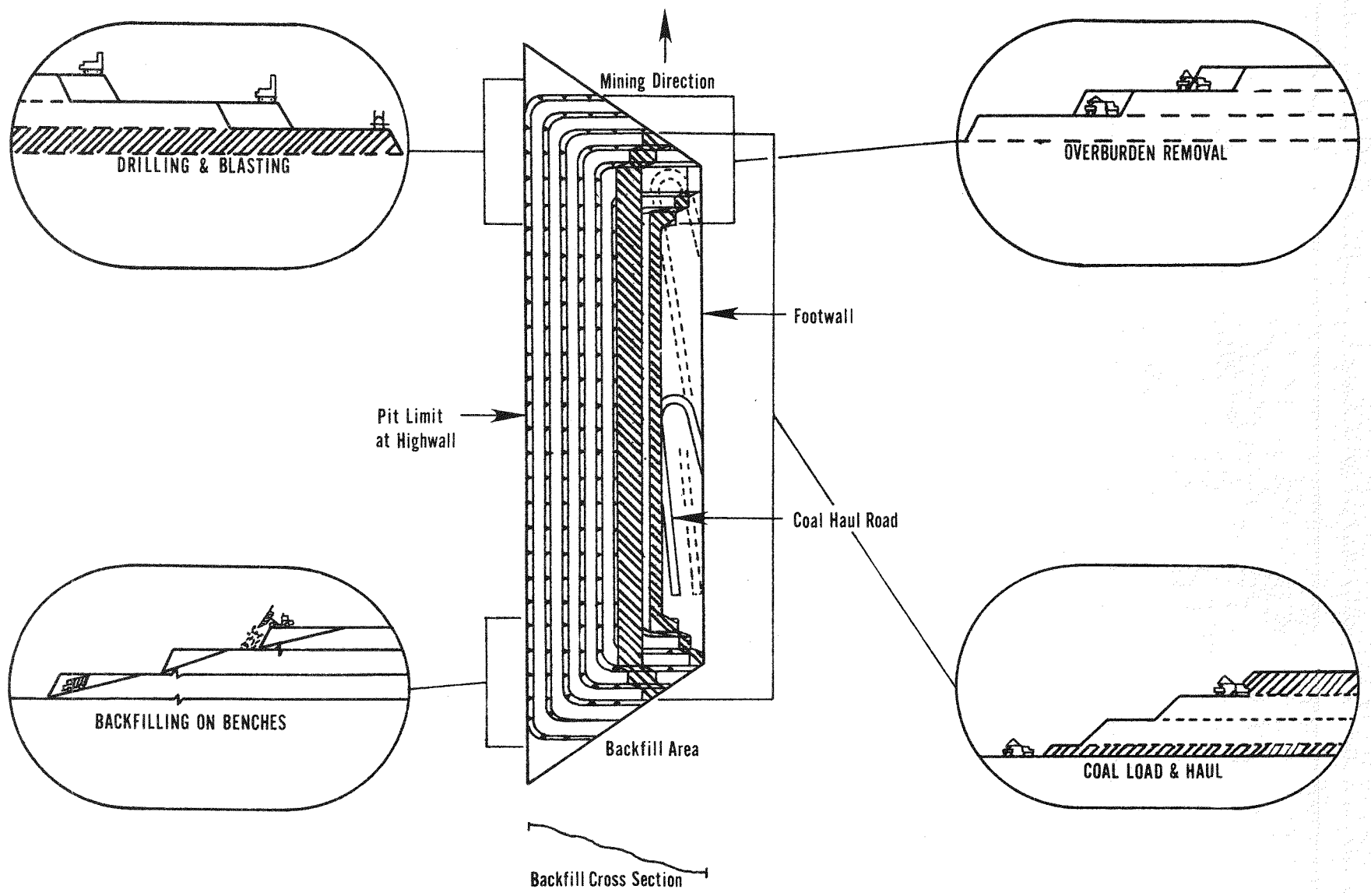


Figure 4. Multiple Dipping Seam Mining - Hypothetical Pit

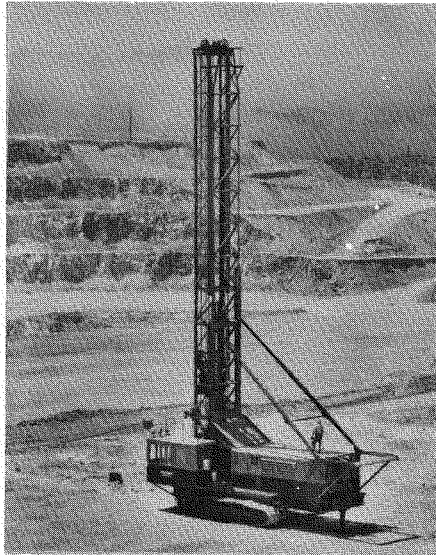


Figure 5. Rotary Drill for Overburden Drilling

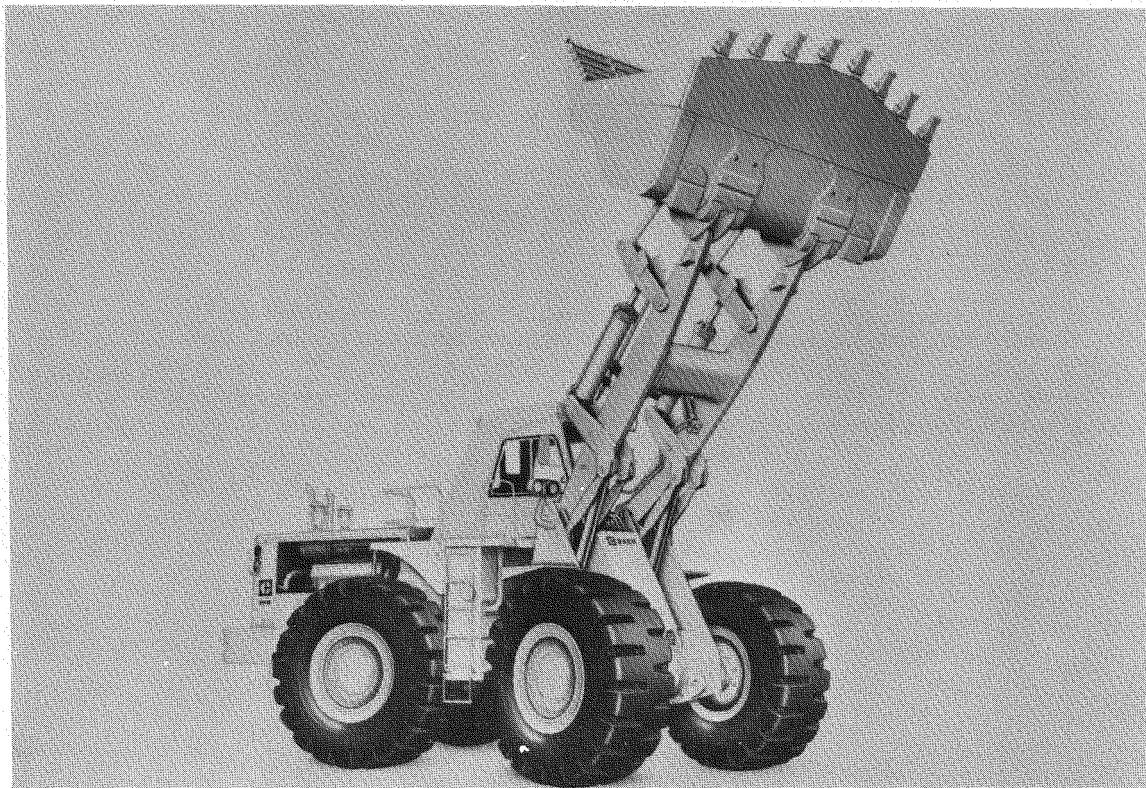


Figure 6. Front End Loader for Loading Overburden and Coal

With the removal of the overburden, the coal seam is ready for drilling and blasting.

2.1.3 COAL DRILLING AND BLASTING

Prior to drilling and blasting coal, the top of the coal seam is cleaned by a front-end loader or, possibly, a motor grader.

Coal is easily drilled and generally requires much less blasting agent to achieve the desired fragmentation. Blast holes in coal are drilled with an auger type drill. The blast hole pattern, while similar to overburden blast patterns, is generally designed to reduce the production of fine coal to a minimum.

Blast holes are stemmed with coal fines to avoid extraneous contamination, and detonated in a manner to obtain the desired fragmentation.

Figure 8 shows a typical self-propelled auger coal drill.



Figure 7. Overburden Haul Truck

2.1.4 COAL LOADING AND HAULING

Coal is loaded from one or more seams by a front-end loader and hauled by a fleet of rear dump trucks which shuttle between the pit and the receiving station at the preparation plant. The loader loads the coal from the exposed seam into waiting trucks adjacent to the point of excavation. The trucks will travel via ramps and a haul road network to the receiving station. A typical rear dump coal truck is shown in Figure 9.

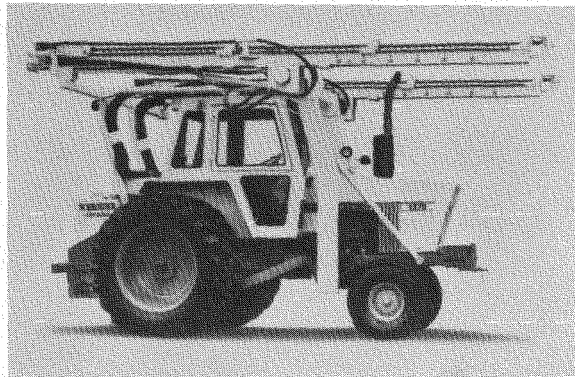


Figure 8. Auger Drill For Coal Drilling



Figure 9. Rear Dump Coal Hauling Truck

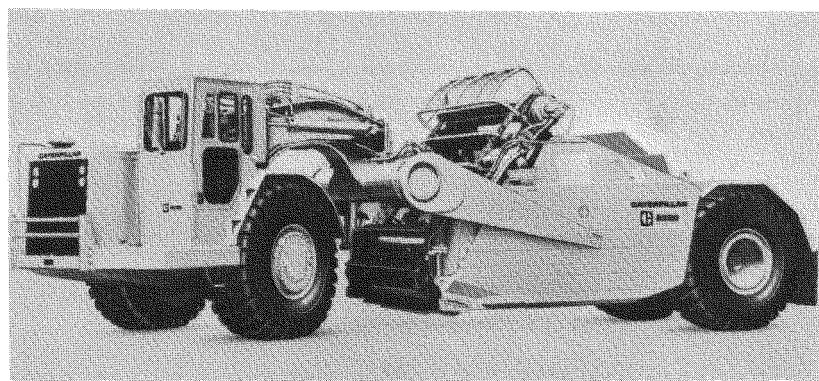


Figure 10. Self-Loading Scraper for Removal and Redistribution of Topsoil

2.1.5 LAND RECLAMATION

Land reclamation includes the following operations:

- Topsoil removal
- Topsoil spreading
- Spoil regrading
- General dozing
- Revegetation
- Land management.

Topsoil removal, if required, is accomplished by a fleet of self-loading elevating scrapers. The scraper fleet hauls the topsoil from the cleared area, ahead of drilling and blasting, to a stockpile or to regraded spoil in backfilled areas of the mine. The scraper spreads the topsoil prior to revegetation. A typical self-loading scraper is shown in Figure 10.

Spoil areas are regraded by a fleet of bulldozers. Bulldozers are also required for general reclamation activities, including recontouring, drainage control, erosion control, ditching, and dam work. A typical track-type tractor with bulldozer is shown in Figure 11.

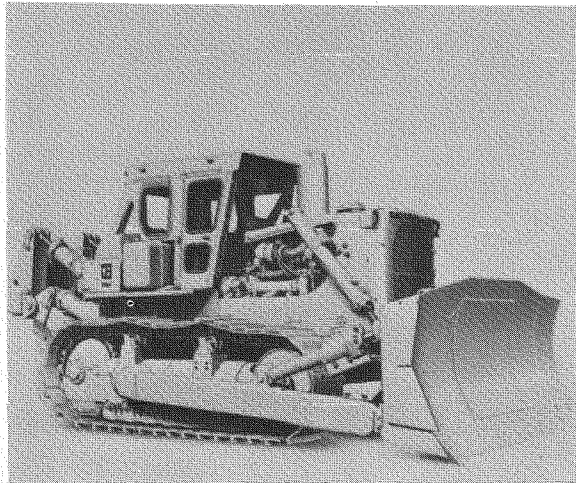


Figure 11. Track-Type Tractor with Bulldozer for Regrading Spoil and General Reclamation

Revegetation includes preparation of the soil prior to planting, the addition of required soil amendments, and reseeding.

Land management costs include follow-up activities to ensure long-term revegetation (including reseeding of areas remaining barren following initial revegetation effort), plus interest on posted land reclamation bonds.

2.1.6 SUPPORT EQUIPMENT FOR MINING OPERATIONS AT EACH PIT

Several types of support equipment are required for the primary operations at each pit:

Overburden drilling and blasting:

- Bulldozer to prepare bench for drill
- Wheeled loader to push cuttings into holes
- Prill truck to deliver blasting agents and supplies.

Overburden removal:

- Bulldozer to maintain uniform and level dump areas for the overburden haul trucks
- Grader to maintain haul roads
- Water truck to maintain haul roads

Coal loading and hauling:

- Loader to clean the top of coal
- Grader to maintain the haul road
- Water truck to maintain the haul road
- Pumps to remove water from pit
- The grader and water truck allocated to overburden removal will be utilized part-time in coal loading and hauling operations.

It is assumed that no major road-building equipment is required.

2.2 CENTRAL OPERATIONS FOR THE MINE COMPLEX

A mine complex consists of several pits, each providing coal to a central preparation and loadout facility. The central operations serving the entire complex provide two basic functions: coal handling and preparation, and general and administrative activities. If the pits are far apart, the central facilities may be divided with each location servicing a group of pits.

2.2.1 COAL HANDLING AND PREPARATION

Coal preparation is a process for treating run-of-mine or raw coal to meet market specifications. Commonly, this is accomplished by mechanical sorting of particles in a medium

of water. (Chemical processes are currently under investigation.) Prepared coal normally has defined physical property specifications, higher calorific value, and lower moisture, sulfur and ash contents than raw coal. It is a premium quality coal which has advantages in the conversion process.

Coals, as they occur in the ground, are extremely heterogeneous with characteristics that vary widely from seam to seam and within an individual seam. They tend to be adulterated with "deleterious dirt" which results in ash or sulfur products upon conversion. Complicating the inherent complexity and heterogeneity of coals is the mining process which introduces additional adulterants, including waste rock, mineral partings within the seam, and tramp materials. Therefore, run-of-mine coal usually requires preparation.

Three Levels of Preparation Difficulty

Through the use of developed flowsheets, equipment lists and arrangement drawings, capital costs have been determined for three different coal preparation plants. The plants represent levels of preparation difficulty which provide three cost alternatives for study, as shown in Table 2.

TABLE 2. THREE TYPES OF PREPARATION PLANTS

DIFFICULTY OF PREPARATION	THEORETICAL WASHABILITY DATA REQUIRED	PLANT DESIGN (FLOWSHEET)
Slight	Size consist	Crushing and screening plant
Moderate	Size consist Sink/float Washability curves	Baum jig plant
Great	Size consist Sink/float Washability curves	Heavy media plant

Coal conversion processes may not require the degree of preparation described in this volume; however, the benefits of coal preparation are likely to be recognized as more becomes known about the conversion process.

In an actual situation, the coal preparation plant is designed based on detailed knowledge of the properties of the run-of-mine coal (plant input) and the feedstock specifications of the prepared coal (plant output). For the generalized or hypothetical situation, neither coal properties nor the feedstock specifications are known.

Therefore, to provide three alternatives which would indicate the relative cost of hypothetical coal preparation approaches that might be considered in the future, the following plants have been examined:

Crushing and screening plant
Baum jig plant
Heavy media plant.

These plants have been designed based on assumed properties for the incoming coal. A coal that requires slight preparation effort was chosen as the basis for a crushing and screening plant; a coal that requires a moderate preparation effort was chosen as the basis for a Baum jig plant; and a coal that requires a great preparation effort was chosen as the basis for design of a plant requiring two-stage heavy media separation and flotation.

For each of the three hypothetical plants being studied, the following general specifications and costs have been estimated for a plant with a baseline rated capacity of 75,000 tons per day (TPD) of run-of-mine coal:

1. Capital cost
2. Yield factor $\frac{(\text{tons output of prepared coal})}{(\text{tons input of run-of-mine coal})}$
3. Rated capacity.

Cost extrapolation factors have been developed to establish preparation plant costs as shown in the following formula:

$$\text{Cost for plant of specified capacity} = \text{Cost for plant of baseline capacity} \times \left\{ \frac{\text{Rated Production Specified Plant}}{\text{Rated Production Baseline Plant}} \right\}^Y$$

Where: Y = plant cost scaling factor.

Other facilities may be required in addition to the preparation plant:

- Raw coal receiving and breaking
- Blending and stockpiling
- Prepared coal loadout
- Support facilities.

Capital costs have been estimated for hypothetical designs of each of the additional facilities.

A hypothetical overall plot plan for the coal handling and preparation facility is shown in Figure 12.

The estimated costs are hypothetical and would vary widely in actual situations. Many alternate process steps, such as grinding, briquetting, thermal drying, etc., that may be required to feed a specific conversion process with a particular coal are not included in the general hypothetical plant designs.

Any one of the hypothetical plants can be combined with one or more of the required additional support facilities to form a complete preparation unit to provide coal for conversion into synthetic fuels. In order to adjust for different production rates, factoring formulas are available for each of the three plants or four facilities. However, due to the different assumptions used in the development of the plants and facilities, the probability of an actual situation matching a theoretical combination is very low; therefore, any final results should be used with great caution.

A detailed discussion of large-scale coal processing for coal conversion can be found in Volume 4 of the Phase I Report (Ref: FE-1520-4).

2.2.2 GENERAL AND ADMINISTRATIVE FUNCTIONS

The centralized general and administrative functions serving the entire mining complex have been divided into five categories:

- Ancillary facilities
- Ancillary equipment
- Other premining costs
- Supervisory and support staff
- Miscellaneous overhead costs.

Ancillary facilities include roads and site work, buildings (shops, warehouses, offices, laboratories, and other facilities), electric power system, water system, and communications system.

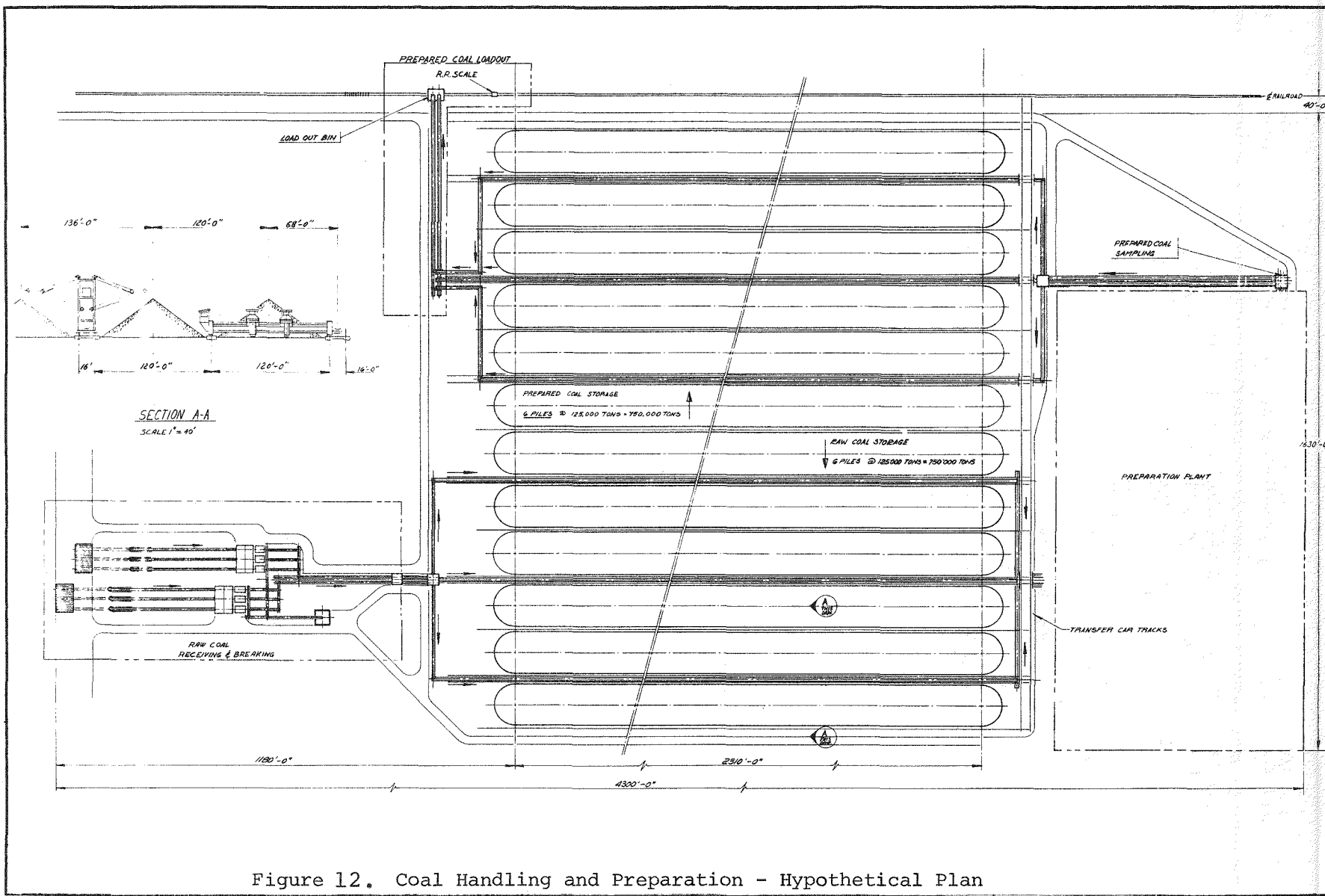


Figure 12. Coal Handling and Preparation - Hypothetical Plan

Ancillary equipment includes mobile equipment such as utility trucks and cranes, as well as shop equipment for maintenance operations, such as machine tools and overhead cranes.

Other premining costs include initial payments for land rights, exploration drilling costs, contract engineering costs (feasibility study plus final design), and environmental impact statement costs.

The supervisory and support staff consists of mine management, supervision, technical staff, safety, administration, and purchasing.

Miscellaneous overhead costs include a cash reserve, home office expenses, royalty and severance taxes, insurance and property taxes, and inventories of spare parts, supplies, and stockpiled coal.

3.0 HYPOTHETICAL TEST CASE - GREEN RIVER

3.1 MINING SITUATION DESCRIPTION

In order to develop a micromodel for multiple dipping seam mining, a representative test situation was selected for detailed analysis. The Green River (Wyoming) Strippable Coal Resource Region, described in detail in Volume 2 of the Phase I Report (Ref: FE-1520-2) was selected for the test case, and a hypothetical situation was constructed. While this hypothetical situation does not represent an actual site, every effort has been made to describe a situation which would present itself to practical mining problems typical of the Green River region.

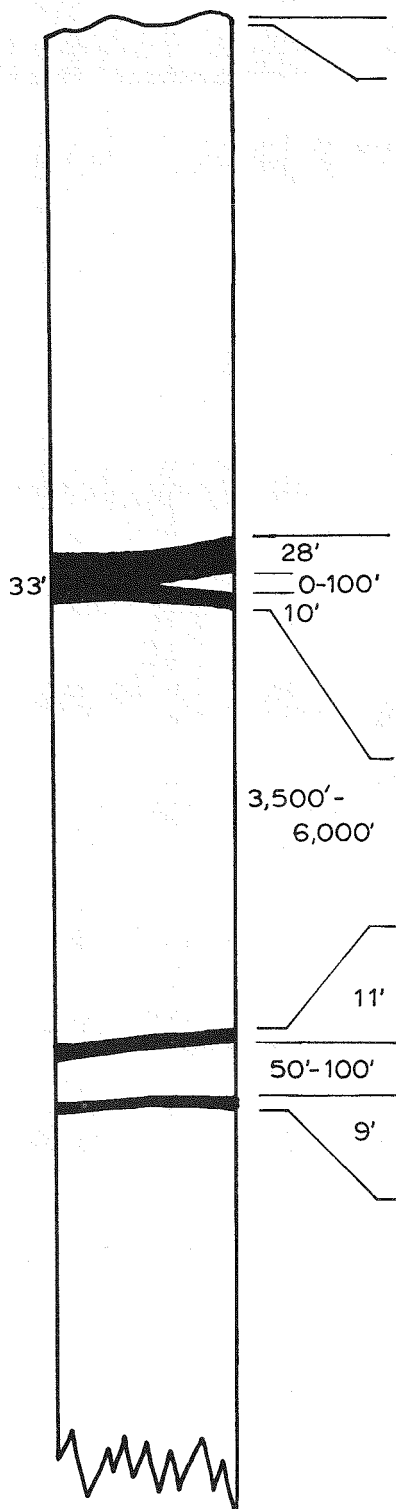
In order to fully document the underlying problems and assumptions related to the test case, the following paragraphs describe in detail the test case geology, mining complex requirements, and individual pit requirements.

3.1.1 GEOLOGY FOR TEST CASE

The geologic and topographic situation chosen for the Green River test case is representative of a majority of the conditions encountered in the region. It is not a statistical average nor an actual condition, but only a typical situation. The topography chosen for the test case was taken from U.S. Geological Survey 1:24,000 scale topographic maps of the region.

The coal seams for the test case geology are patterned after two adjacent coal seams of the Adaville coals. Overburden thickness and characteristics, and coal seam thickness and quality are composites of data taken from the geology data base described in Volume 2 of the Phase I Report (Ref: FE-1520-2), and information obtained during field visits. The geologic situation chosen is summarized in a stratigraphic column (Figure 13), which was used in compiling a hypothetical geology map of the area.

The key geologic parameters are summarized in Table 3. The overburden density was determined by taking a weighted average of the density of the materials shown in the stratigraphic column. The overburden thickness is measured by the average perpendicular distance between coal seams. The swell factors, highwall angle, spoil angle and topsoil thickness are based on data gathered during field visits.



SOIL: Stony desert soil poorly developed and less than 3 inches thick.

ROCK INTERVAL: Alternating poorly consolidated thick beds of sandstone and shale.

No. 1, 1A, AND 1B COAL: Subbituminous coal. Main seam (No. 1) divides into upper split (No. 1A) and lower split (No. 1B). Typical composit analysis shows Btu/lb 10,250, sulfur 2.7%, moisture 23%, and ash 14%.

ROCK INTERVAL: Alternating sandstone and shale.

No. 2 COAL: Subbituminous coal. Typical analysis shows Btu/lb 10,980, sulfur 5.4%, moisture 23%, and ash 15%.

ROCK INTERVAL: Alternating sandstone and shale.

No. 3 COAL: Subbituminous coal. Typical analysis shows Btu/lb 11,300, sulfur 2.1%, moisture 15%, and ash 10%.

ROCK INTERVAL: Alternating sandstone and shale.

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ERDA										
	TITLE	STRATIGRAPHY				Figure 13				
		Case Study - Dipping Seam								
		Open Pit Mining with								
		Shovels or Loaders and Trucks								

Table 3.

GEOLOGY FOR GREEN RIVER TEST CASE

Coal Height 1	ft	28
2	ft	10
Coal Heat Value	Btu/lb	10,250
Coal Density	lb/bank yd ³	2,130
Coal Swell Factor		.35
Coal Face Angle	degrees	76
Dip of Coal Seams	degrees	20
Burden Height Avg	ft	70
Between Seams		
Burden Density	lb/bank yd ³	4,290
Burden Swell Factor		.35
Burden Highwall Angle	degrees	63.43
Surface Slope Angle	degrees	9
Burden Spoil Angle		33.69
Topsoil Thickness Saved	ft	0

3.1.2 MINING COMPLEX REQUIREMENTS FOR TEST CASE

The prime factor in determining the overall size of a mining complex is the annual amount of energy in the form of prepared coal that must be shipped from the complex. For the test case, an energy demand of 130 trillion Btu's per year was selected. This energy demand is roughly equivalent to the annual feedstock requirement for either a 250-million standard cubic feet per day coal gasification plant, a 40,000 barrel per day coal liquefaction plant, or a 1500 megawatt power plant.

Assuming a 30-year life for the project and assuming that the combination of feedstock specifications and coal characteristics allow a low degree of coal preparation as represented by a crushing and screening plant, the overall production requirements for the mining complex can be determined as shown in Table 4.

3.1.3 INDIVIDUAL PIT REQUIREMENTS FOR TEST CASE

The mining complex has been divided into eighteen identical mining pits. Six pits are operated simultaneously which feed run-of-mine coal into six crushing and screening plants. The pits each contain sufficient coal to provide 10 years of production. Three sets of six pits are mined in successive 10-year periods to provide the necessary annual production for a 30-year total mine life. In an actual practical situation the size of each pit would vary depending on the geologic variations and land ownership patterns.

Each individual pit in the hypothetical mining complex contains approximately 11.6 million tons of coal in place. The detailed individual pit requirements for a 10-year pit life are shown in Table 5.

Table 4.

MINING COMPLEX REQUIREMENTS FOR GREEN RIVER TEST CASE

Energy Demand	Btu/yr	1.3x10 ¹⁴
Coal Delivered	Prep tons/yr	6,318,455
Preparation Plant Type		Crushing & Screening
Preparation Plant Recovery		
	Prep tons/ROM tons	.99
Coal Demand	ROM tons/yr	6,382,278
Expected Coal Recovery in Mine		.92
Production Life	Years	30
Total Coal in Place	Tons	208,118,087
Stripping Ratio		
	Burden bank yd ³ /coal ton in place	7.0
Burden Demand	Bank yd ³ /yr	44,658,273
Total Pits in Complex		18
Years in Each Pit		10
No. of Active Pits		6
Total Preparation Plants		
in Complex		6
Rated Capacity of Preparation		
Plant (Combined Total)	ROM tons/day	25,530

Table 5.

INDIVIDUAL PIT OPERATING REQUIREMENTS
FOR GREEN RIVER TEST CASE

Overburden Drilling & Blasting	Bank yd ³ /yr	7,443,044
Overburden Removal	Bank yd ³ /yr	7,443,044
Coal Drilling & Blasting	Bank yd ³ /yr	1,085,643
Coal Loading & Hauling	ROM tons/yr	1,063,713
Coal Handling & Preparation (Each Plant)	ROM tons/day (250 days/yr)	4,255
Land Reclamation	Acres recl./yr	61

3.2 MINE OPERATION SCHEDULE AND EFFICIENCY

Once annual operating requirements for each pit have been established, the operating schedules and efficiency for each function are determined. In Table 5, the following six factors are defined for each mining operation:

SHY = Scheduled Hours per Year

Total number of hours in a year

(365 days x 24 hours per day = 8760 hours
less days, shifts, or hours not worked due
to the following:

- a. Holidays
- b. Weekends
- c. Strikes
- d. Vacation shutdown
- e. Severe weather seasonal shutdown
- f. Preventative maintenance shifts during week
- g. Idle shifts during day
- h. Less than 8-hour shift (work rules).

AEF = Annual Efficiency Factor

Discount factor used to account for lost scheduled
hours during a year due to the following:

- a. Unscheduled minor repair
- b. Unscheduled major repair
- c. Scheduled overhaul.

PHY = Productive Hours per Year

Scheduled hours per year times annual efficiency
factor

ESO = Efficiency of Simulated Operation

Discount factor (sometimes expressed as minutes per
hour) used to account for lost production due to:

- a. Shift startup and shutdown
- b. On-shift routine preventative maintenance
- c. Fueling
- d. Breaks
- e. Operator skill
- f. Job conditions
- g. Weather
- h. Mobility
- i. Difficulty of material
- j. Job supervision
- k. Interfaces with other operations
- l. Short moves to reposition within work area.

PTF = Propel Time Factor

Discount factor used to account for lost production
due to:

- a. Moving to a working position on a new panel
- b. Moving to a working position on a new bench
- c. Moving to a working position in a new mine.

FF = Fill Factor

Discount factor used to account for lost or extra production due to:

- a. Inability of machine to carry 100% of its rated capacity
- b. Ability of machine to carry in excess of 100% of its rated capacity.

The schedules and efficiencies shown in Table 6 are used to compute machine annual production capabilities which are compared with pit annual production requirements. A user could vary these values to match his own field experience and production needs.

Table 6.

MINE OPERATION SCHEDULE AND EFFICIENCY

	Overburden & Coal Drill	Stripping Loader	Truck	Coal Loader	Coal Truck	Regrading Bulldozer
Scheduled Hours						
Per Year	3625	8183	8183	3625	3625	1630
Annual Efficiency						
Factor	.90	.90	.90	.90	.90	.90
Productive Hours						
Per Year	3262.5	7365	7365	3262.5	3262.5	1465
Efficiency of Simulated Oper.	1.00*	.833	.833	.833	.833	.75
Propel Time Factor	1.00*	.90	N/A	.90	N/A	N/A
Fill Factor	N/A	.90	1.10**	.90	1.10**	N/A

*Drilling rate specified accounts for efficiency and propel time.

**Indicates 10% overload is allowable.

3.3 BASELINE SOLUTION USING MICROMODELS

During Phase I of the project, a series of computerized micromodels was developed to analyze separately the various required mining operations. These micromodels require detailed input to define a problem, and are intended for use by a user who desires a high degree of interaction with the models.

The following micromodels are pertinent to the Green River test case:

Multiple Dipping Seam Mining with Loaders (MDL)
Drilling and Blasting Overburden (DAB)
Drilling and Blasting Coal (DBC)
Land Reclamation Simulation (LRS)
Preparation/General Administrative (PGA)
Cash Flow Analysis (CFA).

In brief, each model uses input based on the mining situation, schedule and efficiency, and the user's judgment to select a combination of equipment with the least ownership and operating cost for each function. The selections are reviewed by the user, and with the addition of suitable support equipment, a cash flow analysis is used to estimate a required price for the coal in the deposit. The use of the micromodels to solve a mining problem is shown schematically in Figure 14. A solution to a mining problem using the micromodels is developed in six steps:

1. Tract Description (user)
2. Develop Mine Plan (user)
3. Develop Micromodel Input (user)
4. Run Micromodel Solutions (computer)
5. Analyze Micromodel Selections, Add Secondary Equipment, and Make Financial Assumptions (user)
6. Cash Flow Analysis (computer).

A baseline reference point has been established by running a detailed micromodel solution for the hypothetical situation in Green River as defined by the test case mining situation description. The test case mine operation schedules and efficiencies were also used. The results of the test case baseline solution using micromodels are described in the following paragraphs.

3.3.1 MULTIPLE DIPPING SEAMS WITH LOADERS

The Multiple Dipping Seam with Loaders (MDL) computer micromodel simulates overburden removal and coal loading and hauling with loaders and trucks. The model determines the travel distances and production requirements for one or more overburden benches and coal seams based on input for the multiple dipping seam configuration and required coal production (Appendix B.1).

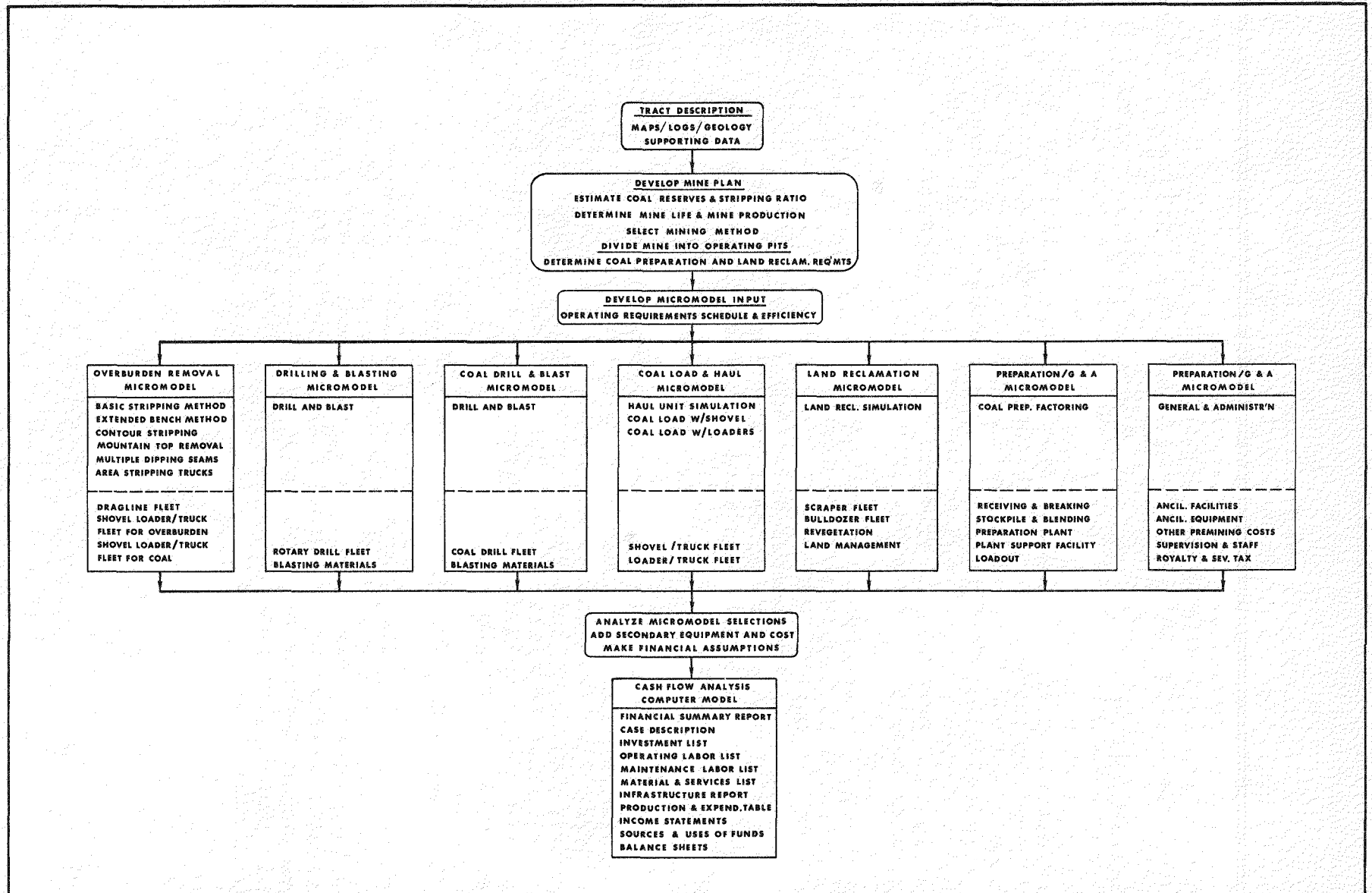


Figure 14. The Micromodeling System

The MDL micromodel calculates the pit dimensions required for a specified stripping ratio (bank cubic yards of overburden per ROM ton of recovered coal) and for a specified coal demand. An alternative selection is available whereby the model uses the down-dip mining limit instead of the stripping ratio. In either case, the model calculates the dimensions of the idealized section that fits the geometric input. Figure 15 illustrates the idealized cross section of the baseline case, and identifies dimensions that are shown as model output in Appendix B.2.

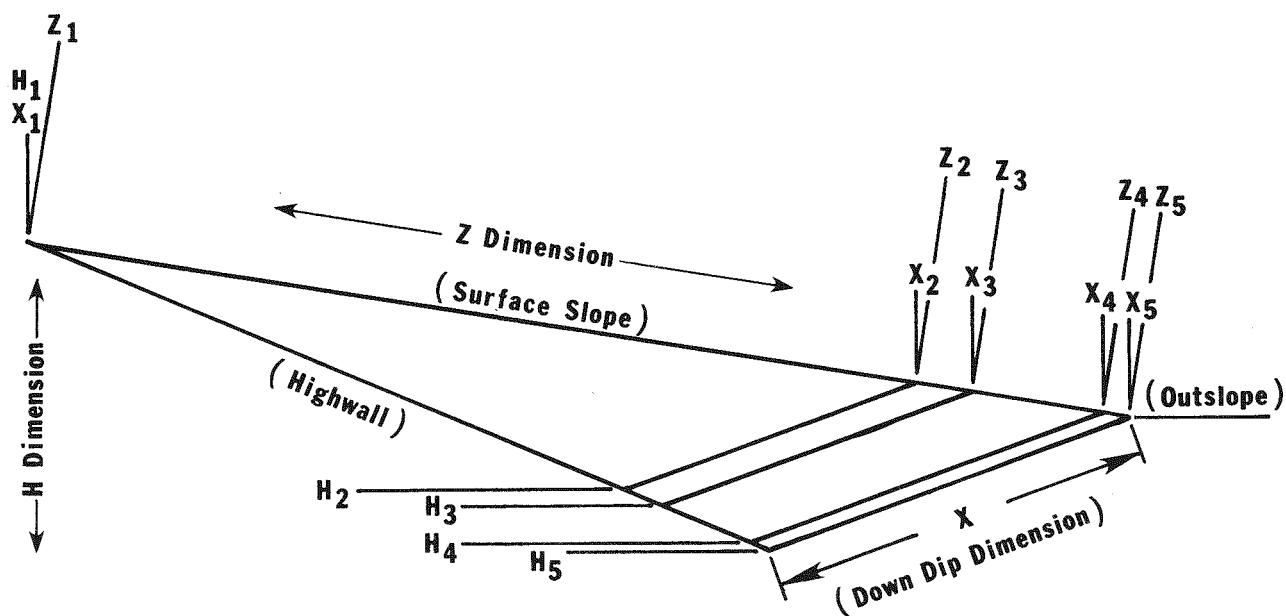


Figure 15. Idealized Cross Section

The MDL micromodel divides the property into mining benches using the contact of the bottom coal seam with the ground surface (outslope) as a zero reference baseline. Benches established on, or above, the baseline are classified as positive benches (at, or above, the elevation of the outslope). Benches below the baseline are classified as negative benches (below the elevation of the outslope). In this manner, the model is capable of distributing excavated overburden to mined-out portions of the pit as follows:

- 1) Overburden from all benches is backfilled into the same bench from which it was excavated.
- 2) Surplus overburden from positive benches is used on the same bench to gently terrace the reclaimed slope.
- 3) Surplus overburden from negative benches is deposited along the outslope for disposal.

Next, the MDL micromodel calculates the volumes of overburden and coal that must be removed during the transition period prior to the steady state condition when overburden can be dumped directly into mined-out areas of the pit (Appendix B.3). The transition overburden volume is stockpiled along the highwall at the end of the mining property where it will be readily accessible to be returned to the pit when mining terminates.

On completion of the transition period mining proceeds along the strike (direction of outcrop), and the model calculates the steady state bench volumes and haul distances for overburden and coal (Appendix B.4). Bench volumes and weighted average haul distances are used by the model to select a fleet of loaders and trucks for each bench and for the total operation. Two methods can be used for fleet sizing. In the first method, the least cost combination is selected for each bench independently without requiring a standard size loader or truck. In the second method, all benches use the same standard size loader and truck. By comparing the two methods the user can:

- 1) Size each bench operation independently, or
- 2) Standardize the equipment selection and assess the increased costs of standardization.

The results of the second method, shown in Appendix B.5, indicate a fleet of three 10-cubic yard loaders and fifteen 50-ton rear dump rock trucks would be required for overburden removal for a least cost solution of \$9.39/ton, and a fleet of two 10-cubic yard loaders and ten 50-ton rear dump coal trucks would be required for coal production for a least cost solution of \$1.02/ton of recoverable coal. All costs are in January 1975 dollars (no escalation).

3.3.2 DRILLING AND BLASTING

The Drilling and Blasting (DAB) computer micromodel simulates the drilling of vertical blast holes on one or more benches and determines the required amounts of blasting materials for overburden drilling and blasting.

Three types of cases can be run:

1. Spacing, burden, and drill diameter not specified
2. Drill diameter specified
3. Spacing, burden, and drill diameter specified.

In addition, a variety of blasting materials can be chosen.

The program determines the number of holes that must be drilled per year. This is used to determine the required quantity of machines and blasting materials. Costs are determined and a least cost solution is selected.

Up to 26 input parameters must be defined in order to run the Drilling and Blasting micromodel. These parameters are listed with definitions and baseline values in Appendix B.6.

The Drilling and Blasting output indicates that 0.94 (or 1.0) No. 9 rotary drills would provide the least cost solution of \$0.57 per ton of recoverable coal (i.e., $\frac{\$611,020}{1,063,713 \text{ tons}}$).

An abbreviated listing of the computer output is shown in Appendix B.7. All costs are in January 1975 dollars (no escalation).

3.3.3 DRILLING AND BLASTING COAL

The DAB computer model can also be used to simulate the drilling of vertical blast holes in coal and determine the required amounts of blasting materials related to coal drilling and blasting. When the DAB model is used for analysis of coal drilling and blasting, it has been given the code DBC to differentiate from overburden drilling and blasting.

The DBC model must be run as Case 3, in which spacing, burden and drill diameter are specified. There are two choices of drill hole size using an auger-type drill: 3 inches and 6 inches. Specifying one or the other drill hole diameter causes the model to automatically select the appropriate size auger drill for analysis.

The program determines the number of holes that must be drilled per year, the quantity of machinery required, and the quantity of blasting materials required. Costs are determined based on the selected drill size.

Input parameters for the Drilling and Blasting Coal micromodel with definitions and baseline values are listed in Appendix B.8.

The DBC output indicates that 0.234 (or 1 rounded off to the next highest integer) Drill No. 24, a 6-inch auger-type drill, would provide the required number of drill holes for blasting the coal. Drilling and Blasting Coal costs amount to \$0.040 per ton of recoverable coal (i.e., $\frac{\$46,760}{1,063,713 \text{ tons}}$). An abbreviated listing of the computer output is shown in Appendix B.9. All costs are in January 1975 dollars (no escalation).

3.3.4 LAND RECLAMATION

The Land Reclamation Simulation (LRS) micromodel analyzes four separate operations: required scraper fleet for top-soil removal and redistribution; required bulldozer fleet for general dozer work and for spoil grading; costs of revegetation; and land management.

Input to the LRS program requires both a definition of the geometry and desired production and a definition of the performance specifications of the equipment to be used. The input parameters and baseline values are shown in Appendix B.10.

The LRS output indicates that a fleet of 0.35 bulldozers (or 1.0) would be required for spoil grading and general dozing. Combining bulldozer fleet costs with revegetation and land management yields a cost of \$.05/recoverable ton of coal. Abbreviated listings of the computer input and output are shown in Appendix B.10. All costs are in January 1975 dollars (no escalation).

3.3.5 COAL PREPARATION FACTORING

The Preparation/General Administrative (PGA) micromodel determines the coal handling and processing costs by means of extrapolation from a standard size facility. In addition, it allows plant selection based on three levels of difficulty of preparation effort: crushing and screening, Baum jig, and heavy media. The micromodel separates ownership and operating costs into five categories:

- Receiving and Breaking
- Blending and Stockpiling
- Coal Loadout
- Preparation Plant
- Preparation Plant Support.

The input parameters for the PGA model are used to define the costs of the standard size facility and the extrapolation factors for determining the costs of a new size facility. The key input parameters are energy demand and plant

type which are used to determine the daily rated capacity of the new plant in run-of-mine tons of coal. Coal washability curves are not directly considered.

Abbreviated listings of the input and output of the PGA model when used for coal preparation factoring are shown in Appendices B.11, B.12 and B.13. The output indicates that the cost of coal handling and preparation in six facilities each rated at 4,255 TPD run-of-mine coal would be \$2.79/ton of recoverable coal. All costs are in January 1975 dollars (no escalation).

3.3.6 GENERAL AND ADMINISTRATIVE

The Preparation/General Administrative (PGA) micromodel determines the central facilities, staff, and premining costs by means of extrapolation from a standard size facility. The micromodel separates ownership and operating costs into thirteen categories:

- Roads and Site Work
- Buildings
- Electric Power System
- Water System
- Communications System
- Mobile Support Equipment
- Shop Equipment
- Land Rights
- Exploration Drilling
- Contract Engineering
- Environmental Impact Statement
- Supervisory and Support Personnel
- Royalty and Severance Tax.

The input parameters for the PGA model are used to define the general and administrative costs for the standard size mine and to define the extrapolation factors. The key input parameters are energy demand and stripping ratio which are used to determine the size of premining costs, facilities, and administration for the new mine. An abbreviated list of input variables is shown in Appendices B.14 and B.15.

The output of the PGA model indicates that a General and Administrative cost of \$1.94/ton of recoverable coal would be required. An abbreviated listing of the computer output is shown in Appendix B.16. All costs are in January 1975 dollars (no escalation).

3.3.7 CASH FLOW ANALYSIS

The Cash Flow Analysis (CFA) computer model is used to determine the required selling price of coal for a required return on investment. The CFA model takes into account the time value of money, as well as such financial parameters as interest rates, tax rates, and escalation rates. All expenditures and revenues are compiled each year for the project. In addition, initial investment, deferred investment, and replacement investment requirements are determined.

Three types of input data are required to run the CFA model:

- Mining operation data
- Personnel data
- Case description parameters, financial assumptions, and default values.

The mining operation data defines the performance and cost of all items required for the mining complex. For each item in a mine operation approximately 40 parameters must be input to provide sufficient data for the cash flow analysis. Data from micromodel results are transferred to cash flow input, using the form shown in Appendix C.1.

The personnel data defines the classifications, salary grades, schedules, effective hours per year, and dollars per effective hour for all types of manpower required for the mine complex. The baseline input classifications and work schedules are shown in Appendix C.2.

The financial assumptions and default values define the economic conditions and accounting provisions for the project. More than 30 financial assumptions must be input to provide sufficient data for the cash flow analysis as shown in Appendix C.3.

The output generated by the CFA model is contained in eight reports:

1. Financial Summary Report and Case Description
2. Investment List
3. Operating Personnel List
4. Maintenance Personnel List
5. Services and Materials List
6. Infrastructure Report
7. Production and Cash Expenditure Table
8. Financial Statements.

These reports are discussed in detail in Section 4.0.

4.0 MICROMODEL TEST CASE

4.1 TEST CASE SOLUTION

The baseline solution for a hypothetical mine complex in the Green River Region, producing 6,318,290 tons per year of prepared coal from six pits and processed in six coal preparation plants, is shown in detail in the eight reports contained in Appendix D:

1. Financial Summary Report and Case Description
2. Investment List
3. Operating Personnel List
4. Maintenance Personnel List
5. Services and Materials List
6. Infrastructure Report
7. Production and Cash Expenditure Table
8. Financial Statements.

The Financial Summary Report lists key financial information and the Case Description records the basic mining parameters and financial assumptions as shown in Appendix E.1 and summarized as follows:

FINANCIAL SUMMARY REPORT

Sales price in base dollars	: \$/prepared ton	18.82
	: \$/million Btu	.91
Return on investment	: Percent	10.00*
Return on paid-in capital	: Percent	10.87**
Cummulative investment to steady state:	M\$	189851.
Cummulative investment total project	: M\$	507648.
Annual operating cost at steady state	: M\$	60204.

Base year is	1975
Project begins	1976
First coal production in	1982
Steady state begins in	1985
Steady state ends in	2011
Last coal production in	2013
Project ends in	2015

*Discounted cash flow internal rate of return assuming project is financed completely by internal capital.

**Discounted cash flow internal rate of return assuming project is financed by user-set combination of internal capital and external debt.

CASE DESCRIPTION

Mining Parameters

Index to Plant Type***	1
Coal Demand ROM Tons/Year (Complex)	6,382,278
Stripping Ratio (Bank Yards/Recovered Ton)	7.0
Height of Topsoil in Feet	.00
Height of Coal in Feet (combined)	38.0
Prepared Coal Tons/Year	6,318,455
Energy Demand for Complex Trillion Btu/Year	130
ROM Coal Heat Value Btu/lb	10250
Reclamation - Other Costs - \$/Acre	900

FINANCIAL ASSUMPTIONS

Capital/Debt Ratio	2
GAA-Mineral Rights (\$/Acre)	50.00
GAA-Royalty Amount (\$/Ton)	.25
GAA-Surface Rights (\$/Acre)	250.00
GAA-Severance Tax (\$/Ton)	0
Rate - Cash Flow Discount	.10
Rate - Federal Income Tax	.48
Rate - Long Term Interest	.08
Rate - Short Term Interest	.10
Value - Req. Price of Coal - \$/Ton	0

***Preparation Plant Types:

- 1 = Crushing and Screening
- 2 = Baum Jig
- 3 = Heavy Media

The coal price for the baseline solution may be considerably different from current prices for Green River coals for several reasons:

1. Costs of equipment have increased drastically over the last decade.
2. Operating costs have increased drastically over the last decade.
3. Some long-term contracts had low profit margins and little or no escalation.
4. The market price for coals varies widely (for example: steam coal versus metallurgical coal).
5. Higher stripping ratios are being encountered (i.e., the thickest seams with the least overburden were mined first).
6. Some coals are sold with little or no blending, stockpiling, or preparation.

In addition, a wide range of coal price estimates results from the range of mining parameters and financial assumptions used.

To underscore the impact of financial assumptions on required coal price, a set of alternative studies were run to compare with baseline results.

Baseline -----	\$18.82/ton
(No escalation, 10% Rate of Return, price constant for all project years)	
Alternate 1 -----	\$21.85/ton
(No escalation, 15% Rate of Return, price constant for all project years)	
Alternate 2 -----	\$41.03/ton
(5% Cost Escalation, 10% Rate of Return, price constant for all project years)	
Alternate 3 -----	first year \$23.49/ton; last year \$106.61/ton
(5% Cost Escalation, 10% Rate of Return, Price Escalates at 5%)	

The Investment List shows all required equipment, facilities, and premining costs. The total investment is divided into initial investment (required to reach steady state production), deferred investment (required additions as mining proceeds), and replacement capital (required to replace worn out equipment) as shown in Appendix D.2.

The initial capital investment requirements for the baseline solution are shown in detail in Table 7. Note that overburden removal plus coal handling and preparation together account for approximately 70 percent of the initial investment while general and administrative items (including premining costs) account for nearly 20 percent of the initial investment.

The Operating Personnel List shows all equipment/plant operating crews plus the general and administrative staff. As shown in Appendix D.3, the baseline solution indicates that an initial operating staff of 1332 people would be required with an annual payroll of \$28,901,000 (January 1975 dollars with no escalation).

The Maintenance Personnel List shows all personnel required to maintain the equipment fleet and the plant. As shown in Appendix D.4, the baseline solution indicates that an initial maintenance staff of 473 people would be required with an annual payroll of \$9,354,000 (January 1975 dollars with no escalation).

Table 7. INITIAL CAPITAL INVESTMENT FOR HYPOTHETICAL TEST CASE IN GREEN RIVER**

MINING STEP	BASELINE INVESTMENT*	PERCENT
Drilling & Blasting	3,329,000	1.9
Overburden Removal	28,726,000	16.7
Coal Drilling & Blasting	424,000	.2
Coal Load & Haul	17,020,000	9.9
Coal Handle & Prep	90,949,000	52.8
Land Reclamation	812,000	.4
Premining and Facilities	31,164,000	18.1
TOTAL	\$172,423,000	100.0

*Baseline investment from Investment List (Appendix D). All costs are in January 1975 dollars (no escalation).

Table 8. ANNUAL DIRECT OPERATING COST FOR HYPOTHETICAL TEST CASE IN GREEN RIVER**

MINING STEP	BASELINE ANNUAL* OPERATING COST	PERCENT
Drilling & Blasting	4,423,000	7.4
Overburden Removal	39,611,000	65.7
Coal Drilling & Blasting	439,000	0.7
Coal Load & Haul	5,033,000	8.4
Coal Handle & Prep	10,244,000	17.0
Land Reclamation	455,000	.8
TOTAL	\$60,205,000	100.0

*Baseline annual operating cost from operating personnel table, maintenance personnel table, and materials and services table (Appendix D). General and administrative not included. All costs are in January 1975 dollars (no escalation).

**Mine complex with 3 pits and 1 preparation plant produces nominal coal feed required for:

- 250 million cu.ft./day gasification plant, or
- 40,000 BBL/day liquefaction plant, or
- 1500 megawatt power plant

The Services and Materials List shows all required contract services, spare parts, and consumable items. Power, water, and fuel quantities are compiled. As shown in Appendix D.5, the baseline solution indicates an annual services and materials cost \$39,930,000 (January 1975 dollars with no escalation).

The annual direct operating costs (labor plus materials and services) are shown in detail in Table 8. Overburden removal accounts for over 65 percent of the total operating costs while overburden drilling and blasting accounts for approximately 7 percent and coal handling and preparation approximately 17 percent of the total operating costs.

Note that the total initial investment and the total annual operating costs shown in Tables 7 and 8 are derived from the investment list, operating manpower list, maintenance manpower list, and materials and services list, while the steady state values in the financial summary are derived from the pro forma financial statements for the first year of rated production. Therefore, the values found in Tables 7 and 8 will be approximately, but not exactly, the same as the values found in the financial summary.

The Infrastructure Report (Appendix D.6) contains items of interest with regard to environmental impact statements and socioeconomic studies under the following headings:

- Physical Effects
- Economic Impact
- Utility Requirements
- Manpower Requirements

The environmental and socioeconomic impact of the mine complex can be summarized as follows:

Acres Disturbed:	367 acres/yr
Payrolls, Purchases and Taxes:	\$76,125,000/yr
Water Requirements:	1411-acre-ft/yr
Electric Power:	47,362 megawatt hrs/yr
Manpower - Operating:	1332
- Maintenance:	473

The Production and Cash Expenditure Table (Appendix D.7) shows the year by year production for each mining operation as well as the cash expenditure for equipment, manpower, and services and materials.

The Financial Statements show yearly pro forma income statements, sources and uses of funds, and balance sheets for the life of the project (Appendix D.8).



APPENDICES

- A. List of Final Reports and Phase I Reports
- B. Micromodel Test Case Analysis Input and Results
- C. Cash Flow Analysis Input
- D. Curve Fitting Analysis
- E. Macromodel Baseline Solution
- F. Macromodel Sensitivity Analysis

APPENDIX A

- A.1 Final Report List (Phase II Report)
- A.2 Phase I Report List

The Final Report consists of sixteen volumes which include a one volume executive summary; eight volumes, documenting example applications of the simulation models for hypothetical test situations; and seven volumes giving user documentation on how each model operates.

The Phase I Report consists of six volumes documenting data gathering activities and modeling efforts completed during the first 24 months of the project.

Appendix A.1 Final Report List (Phase II Report)

Economics of Large-Scale Surface Coal Mining
Using Simulation Models

SUMMARY

Volume 1: Executive Summary (ref: FE-1520-101).

REGIONAL TEST CASES

- Volume 2: Area Stripping with Draglines Using Illinois Basin Region Test Case (ref: FE-1520-102).
Volume 3: Area Stripping with Draglines Using Four Corners Region Test Case (ref: FE-1520-103).
Volume 4: Area Stripping with Draglines Using Fort Union Region Test Case (ref: FE-1520-104).
Volume 5: Area Stripping with Draglines Using Texas Gulf Region Test Case (ref: FE-1520-105).
Volume 6: Contour Stripping with Draglines Using Appalachia-Ohio Region Test Case (ref: FE-1520-106).
Volume 7: Area Stripping with Shovels and Trucks Using Powder River Region Test Case (ref: FE-1520-107).
Volume 8: Mountain Top Removal Mining Using Appalachia-West Virginia Region Test Case (ref: FE-1520-108).
Volume 9: Multiple Dipping Seam Mining Using Green River Region Test Case (ref: FE-1520-109).

USER'S MANUALS FOR COMPUTER MODELS

- Volume 10: User's Manual for Area Dragline Macromodel (ref: FE-1520-110).
Volume 11: User's Manual for Area Shovel Truck Macromodel (ref: FE-1520-111).
Volume 12: User's Manual for Contour Stripping with Draglines Macromodel (ref: FE-1520-112).
Volume 13: User's Manual for Cash Flow Analysis Model (ref: FE-1520-113).
Volume 14: User's Manual for Dragline Stripping Micro-models (ref: FE-1520-114).
Volume 15: User's Manual for Shovel Truck Mining Micro-models (ref: FE-1520-115).
Volume 16: User's Manual for Nonstripping Mining Function Micromodels (ref: FE-1520-116).

All volumes available from:

National Technical Information Service
U.S. Department of Commerce
Springfield, Virginia 22161

Appendix A.2 Phase I Report List

Volume 1: Introduction, Summary, Conclusions, and Recommendations for Research.

Summary of Phase I results (31 pages, ref: FE-1520-1).

Volume 2: Characterization of Coal Deposits for Large-Scale Surface Mining.

Delineates strippable coal resource regions of the U.S. and describes their physiography, surficial deposits, soils, structural geology, general stratigraphy, and coal stratigraphy (346 pages, ref: FE-1520-2).

Volume 3: Surface Coal Mining Methods and Equipment.

Describes mining methods and equipment used in large scale surface coal mining (109 pages, ref: FE-1520-3).

Volume 4: Large-Scale Coal Processing for Coal Conversion.

Discusses coal preparation plant design related to producing feedstocks for coal conversion and describes hypothetical plants for three types of coal preparation (80 pages, ref: FE-1520-4).

Volume 5: Survey of Socioeconomics, Financial Statistics, and Legal Aspects.

Provides an overview of the socioeconomic, financial, and legal factors which affect surface coal mining (121 pages, ref: FE-1520-5).

Volume 6: Computer Systems to Support Mine Planning.

Describes the status of the simulation models and supporting data files at the end of Phase I (307 pages, ref: FE-1520-6).

Available from the National Technical Information Service,
U.S. Department of Commerce,
Springfield, Virginia 22161.

Further information not contained in these volumes can be obtained from Fluor Utah, Inc., in San Mateo, California or the Fossil Energy Office of the Energy Research and Development Administration in Washington, D.C.

APPENDIX B

Micromodel Base Case Analysis Input and Results

- B.1 Multiple Dipping Seams Mining with Loaders (MDL) Input
- B.2 Multiple Dipping Seams Mining with Loaders (MDL) Output (Single Line Variables)
- B.3 Multiple Dipping Seams Mining with Loaders (MDL) Output (Transition Period)
- B.4 Multiple Dipping Seams Mining with Loaders (MDL) Output (Haul Road Distances)
- B.5 Multiple Dipping Seams Mining with Loaders (MDL) Output (Equipment Optimization)
- B.6 Drilling and Blasting (DAB) Input
- B.7 Drilling and Blasting (DAB) Output
- B.8 Drilling/Blasting Coal (DBC) Input
- B.9 Drilling/Blasting Coal (DBC) Output
- B.10 Land Reclamation (LRS) Input and Output
- B.11 Preparation/General Administrative (PGA) Input (Coal Preparation Factoring)
- B.12 Preparation/General Administrative (PGA) Default Values (Coal Preparation Factoring)
- B.13 Preparation/General Administrative (PGA) Output (Coal Preparation Factoring)
- B.14 Preparation/General Administrative (PGA) Input (Premining, Facilities, and Administration)
- B.15 Preparation/General Administrative (PGA) Default Values (Premining, Facilities, and Administration)
- B.16 Preparation/General Administrative (PGA) Output (Premining, Facilities, and Administration)
- B.17 Preparation/General Administration (PGA) Output (Premining, Facilities, and Administration Summary)

Appendix B.1 thru B.5 Multiple Dipping Seams Mining with
Loaders - Input and Output

The Multiple Dipping Seams Mining with Loaders (MDL) computer model simulates overburden removal and coal loading and hauling with a fleet of loaders and trucks. The model determines the geometry for each bench and selects the least cost fleet required to meet specified production from a set of loader and truck combinations.

Computer input and output for the hypothetical baseline situation for the Green River test case are shown on the following 7 pages.

B.2 Continued

SALF	22731.15	TOTAL STRIKE LENGTH AT BOTTOM OF PIT
SBLF	27364.77	TOTAL STRIKE LENGTH AT HIGHWALL
SCLF	24763.20	TOTAL STRIKE LENGTH AT OUTSLOPE
CRYFA	2862.021	CU.YARDS OB RECOVERED PER FOOT ADVANCE
CRTEA	465.0781	TCNS OF COAL RECOVERED PER FOOT ADVANCE
CRAFY	672.9192	CCAL RECOVERED ACRE/FEET PER YEAR
CRTML	9733134.	TOTAL TONS OF COAL RECOVERED DURING MINE LIFE
VCSYY	695011.2	COAL VOLUME - ROM CU.YDS/YEAR FOR EACH LAYER
	303780.5	
VCSTY	740186.7	COAL VOLUME - ROM TONS/YEAR FOR EACH LAYER
	323526.1	
VCBR	158.6399	VERTICAL DISTANCE FROM TOP OF TRIANGLE TO EACH BENCH
	108.6399	
	58.63989	
	8.639893	
VBKP	4043279.	TOTAL VOLUME OF BACKFILL FOR POSITIVE BENCHES
VBKN	2696334.	TOTAL VOLUME OF BACKFILL FOR NEGATIVE BENCHES
HCBE	1001.61	DISTANCE FROM OUTCROP TO TOP OF HIGHWALL
GATAD	599.3108	TOTAL ACRES DISTURBED FOR G & A
HCD	329.1794	HORIZONTAL DISTANCE FROM CENTER OF GRAVITY OF COAL SEAM TO SURFACE SLOPE
	175.6761	
CHDF	23572.20	HORIZONTAL DISTANCE FROM CENTER OF GRAVITY OF COAL SEAM TO ADVANCE SLOPE AT END OF YEAR
	23421.70	
CRDF	24678.27	TOTAL HORIZONTAL DISTANCE FROM CENTER OF GRAV. OF COAL SEAM TO OUTSLOPE
	25562.61	
X	.0000000	X SIDE OF TRIANGLES
	282.7056	
	303.3386	
	354.9216	
	362.2908	
H	.0000000	HEIGHT OF TRIANGLES
	137.0586	
	147.0617	
	172.3697	
	175.6423	
Z	.0000000	Z SIDE OF TRIANGLES
	791.3281	
	849.0825	
	993.4697	
	1014.097	
TRIA	.0000000	AREA OF TRIANGLES
	54229.15	
	62423.75	
	85473.00	
	89059.12	
ACFY	2486.054	ADVANCE OF COAL IN FEET/YEAR
FCBD	.1462265	FRACTION OVERBURDEN TO OUTSIDE DUMP

B.3 Multiple Dipping Seams Mining with Loaders (MDL) Output (Transition Period)

TRANSITION PERIOD					
	TR.PER. IN DAYS	HAUL DIST IN FEET	VOLUME TONS/TR.PER	VOLUME CU.Y/TR.PER	CUBIC YARDS CAP.REQUIRED
OVERBURDEN	377.2	20847.	28363360.	13223021.	1689.
COAL	377.2	22000.	1605170.	1638265.	612.

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TRANSITION PERIOD													
	VOLUME TONS/TR.PER.	TCNS/ PAYLD	HORSE POWER	CYCLE TIME	TRUCK DATA			OWNERSHIP COST \$/TR.P.	OPERATING COST \$/TR.P.	DIPPER CAPAC.	LOADER DATA		
					NO. OF TRUCKS	SPARE-- TRUCKS					NO. OF LOADERS	OWNERSHIP COST \$/TR.P.	OPERATING COST \$/TR.P.
OB	28363360.	50.	700.	36.65	58.07	.00	6147763.	16060423.	10.00	5.11	946156.	2636716.	
TOTAL	28363360.				58.07	.00	6147763.	16060423.		5.11	946156.	2636716.	
SUM OF INTEGER UNITS FOR INVEST.					59					6			
TOTAL O & O \$/ROM TON								.222082E 08 2.281			.358267E 07 .368		
COAL	1605170.	50.	700.	31.04	8.91	.00	323398.	775352.	10.00	1.69	84217.	230564.	
TOTAL	1605170.				8.91	.00	323398.	775352.		1.69	84217.	230564.	
SUM OF INTEGER UNITS FOR INVEST.					9					2			
TOTAL O & O \$/ROM TON								.109875E 07 .113			314780.	.032	

B.4 Multiple Dipping Seams Mining with Loaders (MDL) Output (Haul Road Distances)

MDS MODEL RUN DATE 12:42 NOV 17,'76 PAGE NO. 4.06
 0504 (MDSG0504) HYPOTHETICAL MINE STUDY - BASELINE SOLUTIONS
 4 GREEN RIVER - PRESET LOADER/TRUCK COMBINATION

HAUL ROAD ON POSITIVE BENCH

BENCH NO.	BACKHAUL DISTANCE (FEET)			FORWARD DISTANCE (FEET)			VOLUME CU.YD/YEAR	CU. YARDS CAPACITY REQUIRED
	ALONG STRIKE	BENCH LOOP	TOTAL	8% SLOPE	HORIZONTAL	TOTAL		
1	4276.	2820.	7095.	0.	0.	0.	2147066.	292.
2	5096.	2621.	7717.	0.	0.	0.	1343761.	182.
3	5916.	2422.	8338.	0.	0.	0.	540461.	73.
4	6736.	2223.	8959.	0.	0.	0.	11993.	2.
WT. AVERAGE				WT. AVERAGE			TOTAL	TOTAL
4775.				0.			4043279.	549.

HAUL ROAD ON NEGATIVE BENCH

1	4276.	630.	4906.	471.	1558.	2029.	2034493.	276.
2	3456.	376.	3832.	1306.	1431.	2737.	1006046.	137.
3	2636.	122.	2758.	2141.	1304.	3445.	117599.	16.
WT. AVERAGE				WT. AVERAGE			TOTAL	TOTAL
3954.				799.			3158137.	429.

AVE. COAL HAUL ROAD IN EACH LAYER

COAL LAYER	DISTANCE IN FEET			TONS/YEAR	CU. YARDS CAP. REQD
	HORIZONTAL	8% SLOPE	TOTAL		
1	23572.	1306.	24878.	740187.	426.
2	23422.	2141.	25563.	323526.	186.
AVER.	23526.	1560.			

B.5 Continued

COAL LOAD AND HAUL

NO.	VOLUME TONS/YEAR	TRUCK DATA					OWNERSHIP		OPERATING		LOADER DATA		OWNERSHIP		OPERATING	
		TONS/ PAYLD	HORSE POWER	CYCLE TIME	NO. OF TRUCKS	SPARE- TRUCKS	COST \$/YEAR	COST \$/YEAR	DIPPER CAPAC.	NO. OF LOADERS	COST \$/YEAR	COST \$/YEAR				
1	740187.	50.	700.	33.32	6.66	.00	166685.	383769.	10.00	1.18	55809.	106319.				
2	323526.	50.	700.	33.86	2.96	.00	71436.	170467.	10.00	.51	27904.	46471.				
TOTAL	1363712.				9.62	.00	238121.	554237.		1.69	83713.	152789.				
SUM OF INTEGER UNITS FOR INVEST.					10					3						
TOTAL O & O							792358.				236503.					
\$/ROM TON								.671				.200				

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TOTAL MINE COSTS

	TRUCKS		LOADERS		COMBINED	
	TOTAL \$	\$/ROM TON	TOTAL \$	\$/ROM TON	TOTAL \$	\$/ROM TON
O.B.	.688320E 08	7.068	.225749E 08	2.318	.914069E 08	9.386
COAL	.762847E 07	.783	.226377E 07	.232	.989223E 07	1.016
TOTAL	.764605E 08	7.852	.248386E 08	2.551	.101299E 09	10.402

Appendix B.6 & B.7 Drilling and Blasting Input and Output

The Drilling and Blasting (DAB) computer model simulates the drilling of vertical blast holes and determines the required amounts of blasting materials related to overburden drilling and blasting.

Computer input and output for the hypothetical baseline situation for the Green River test case are shown on the following 3 pages.

B.6 Drilling and Blasting (DAB) Input

0504 (GDAH0504) GREEN RIVER
DRILLING AND BLASTING OVERBURDEN

	LAYER 1	LAYER 2	LAYER 3	LAYER 4	LAYER 5	LAYER 6	LAYER 7
KMED	MEDIUM FOR DRILLING, 0=COAL 1=O.B.	1.	1.	1.	1.	1.	1.
ICASE	ICASE = 1, NO S,B,SDDI SPECIFIED	2.	2.	2.	2.	2.	2.
	ICASE = 2, SDDI SPECIFIED						
	ICASE = 3, S,B, AND SDDI SPECIFIED						
OSRHY	SCHEDULED OPERATING HOURS PER YEAR	3625.00	3625.00	3625.00	3625.00	3625.00	3625.00
OPRHY	PRODUCTIVE OPERATING HOURS PER YEAR	3262.50	3262.50	3262.50	3262.50	3262.50	3262.50
EDD	EFFICIENCY OF DRILLING OPERATIONS - FRACTION	1.000	1.000	1.000	1.000	1.000	1.000
PTF	PROPEL TIME FACTOR - FRACTION	1.00	1.00	1.00	1.00	1.00	1.00
P	PANEL WIDTH - FEET	390.00	390.00	390.00	390.00	390.00	390.00
HRMF	HOLE BOTTCM MARGIN - FEET	.00	.00	.00	.00	.00	.00
DPGCC	DENSITY OF PRIMER - GRAM / CC	.00	.00	.00	.00	.00	.00
DAGCC	DENSITY OF ANFO - GRAM / CC	.80	.80	.80	.80	.80	.80
DSGCC	DENSITY OF SLURRY - GRAM / CC	1.50	1.50	1.50	1.50	1.50	1.50
PRPY	POWDER RATIO - LBS. / YARD	.50	.50	.50	.50	.50	.50
PDH	PERCENTAGE DRY HOLES	.90	.90	.90	.90	.90	.90
PWH	PERCENTAGE WET HOLES	.10	.10	.10	.10	.10	.10
HPF	HEIGHT OF PRIMER - FEET	.00	.00	.00	.00	.00	.00
PEBC	% EX. BLASTING CAPS/CAST BOOSTERS	.05	.05	.05	.05	.05	.05
CBCCC	COST OF BLASTING CAPS/CAST BOOSTERS - \$/100	125.00	125.00	125.00	125.00	125.00	125.00
CDCUMF	COST OF DETONATING CORD - \$ / M FT	45.00	45.00	45.00	45.00	45.00	45.00
CPDP	COST OF PRIMER - \$ / LB.	.00	.00	.00	.00	.00	.00
CADP	COST OF ANFO - \$ / LB.	.08	.08	.08	.08	.08	.08
CSDP	COST OF SLURRY - \$ / LB.	.32	.32	.32	.32	.32	.32
PLY	PROJECT LIFE - YEARS	10.00	10.00	10.00	10.00	10.00	10.00
DRSMFH	DRILLING RATE IN SOFT MAT'L - FT./HR.	100.	100.	100.	100.	100.	100.
B03YY	BURDEN DEMAND - BANK YDS/YR	.1258E C5	.5373E C6	.1329E C7	.2122E C7	.2011E C7	.9964E C6
H3	HEIGHT OF BURDEN - FEET	8.64	50.00	50.00	50.00	50.00	50.00
SDDI	SPECIFIED DRILL DIAMETER - INCHES	9.875	9.875	9.875	9.875	9.875	9.875

B.7 Drilling and Blasting (DAB) Output

0504 (00AB0504) GREEN RIVER
DRILLING AND BLASTING OVERBURDEN

		LAYER 1	LAYER 2	LAYER 3	LAYER 4	LAYER 5	LAYER 6	LAYER 7
S	SPACING - FT.	25.00	25.00	25.00	25.00	25.00	25.00	25.00
B	BURDEN - FT.	25.00	25.00	25.00	25.00	25.00	25.00	25.00
BAF	BURDEN ACRE FEET	9.02	66.60	164.81	263.02	249.26	123.52	22.94
ABBY	AREA BURDEN - BANK YDS	.12576E 06	.53727E 07	.13295E 08	.21217E 08	.20107E 08	.99642E 07	.11802E 07
RLADFF	RATE OF LINEAR ADVANCE - FT. / YR.	100.77	743.51	1840.81	2937.72	2784.01	1376.67	256.46
RHLF	REQUIRED HOLE LENGTH - FT.	8.64	50.00	50.00	50.00	50.00	50.00	50.00
VCIFY4	VOLUME EFFECTED - CU. YD. / FOOT OF HOLE	23.15	23.15	23.15	23.15	23.15	23.15	23.15
PEH	POUNDS OF EXPLOSIVE PER HOLE	100.00	579.00	579.00	579.00	579.00	579.00	369.00
VECYH	VOLUME EFFECTED - CU. YD. / HOLE	200.00	1157.41	1157.41	1157.41	1157.41	1157.41	737.50
N4Y	NUMBER OF HOLES PER YEAR	62.00	464.00	1148.00	1833.00	1737.00	860.00	120.00
WAPFH	WEIGHT OF ANFO - LBS. / FT. OF HOLE	26.56	26.56	26.56	26.56	26.56	26.56	26.56
WSPFH	WEIGHT OF SLURRY - LBS. / FT. OF HOLE	49.81	49.81	49.81	49.81	49.81	49.81	49.81
WPPFH	WEIGHT OF PRIMER - LBS. / FT. OF HOLE	.00	.00	.00	.00	.00	.00	.00
MAF	HEIGHT OF ANFO IN HOLE - FT.	3.76	21.80	21.80	21.80	21.80	21.80	13.89
MSF	HEIGHT OF SLURRY IN HOLE - FT.	2.01	11.62	11.62	11.62	11.62	11.62	7.41
SHDF	STEMMING HEIGHT FOR DRY HOLES - FT.	4.88	28.20	28.20	28.20	28.20	28.20	17.97
SHWF	STEMMING HEIGHT FOR WET HOLES - FT.	6.63	38.38	38.38	38.38	38.38	38.38	24.45
RLDC=Y	REQUIRED LENGTH OF DETONATING CORD - FT / YR	2398.53	40019.98	99014.94	158056.19	149818.19	74174.94	10462.23
CDCOY	COST OF DETONATING CORD - \$ / YR.	107.93	1800.90	4455.67	7114.32	6741.73	3337.87	470.80
MSCY	NO. OF BLASTING CAPS/CAST BOOSTERS / YEAR	65.00	487.00	1205.00	1924.00	1825.00	902.00	167.00
CBCOY	COST OF BLASTING CAPS/CAST BOOSTERS - \$/YR	81.25	608.75	1506.25	2405.00	2276.75	1127.50	206.75
WPPY	WEIGHT OF PRIMER - LBS. / YR.	.00	.00	.00	.00	.00	.00	.00
CCOY	COST OF PRIMER - \$ / YR.	.00	.00	.00	.00	.00	.00	.00
WAPY	WEIGHT OF ANFO - LBS. / YR.	5580.00	241790.37	598222.75	955176.25	905150.62	448145.94	53136.00
CADY	COST OF ANFO - \$ / YR.	446.40	19343.22	47657.81	74414.06	72412.00	35851.66	4250.87
WSPY	WEIGHT OF SLURRY - LBS. / YR.	620.00	26846.61	66469.19	106130.69	100572.31	49794.01	5904.00
CSDY	COST OF SLURRY - \$ / YR.	198.40	8596.99	21270.14	33961.82	32183.14	15934.08	1889.28
APRPY	ACTUAL POWDER RATIO - LBS. / CU. YD.	.49	.50	.50	.50	.50	.50	.50
CEBY	COST OF EXPLOSIVES - \$ / YR.	833.98	30349.86	75089.81	119895.12	113615.50	56251.11	6819.70
CEFY	COST OF EXPLOSIVES - \$ / FT. OF HOLE	1.56	1.31	1.31	1.31	1.31	1.31	1.34
CEJ3	COST OF EXPLOSIVES - \$ / UNIT BLASTED	.07	.06	.06	.06	.06	.06	.06

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	A	B	C	D	E	F	G	H	I	J	K	L	M	N
		NDR	MSCWN	MSUPN	MSDAO	\$/FT	\$/UNIT	M\$/YR	\$/FT	\$/UNIT	CMS/YR	C\$/FT	C\$/UNIT	C\$/AFT
9 B 45R ER8	.002	.13	.23	.37	.69	.029	.83	1.56	.066	1.20	2.24	.096	1331.57	
9 B 45R ER8	.071	5.75	9.94	15.69	.68	.029	30.35	1.31	.056	40.04	1.98	.086	6913.24	
9 B 45R ER8	.176	14.24	24.60	38.84	.68	.029	75.09	1.31	.056	113.93	1.98	.086	6912.54	
9 B 45R ER8	.281	22.72	39.26	61.98	.68	.029	119.90	1.31	.057	181.87	1.98	.086	6914.84	
9 B 45R ER8	.266	21.53	37.20	58.74	.68	.029	113.62	1.31	.057	172.35	1.98	.086	6914.59	
9 B 45R ER8	.132	10.67	18.44	29.11	.68	.029	58.25	1.31	.056	80.50	1.98	.086	6910.30	
9 B 45R ER8	.016	1.26	2.18	3.45	.68	.029	6.82	1.34	.058	10.27	2.01	.087	4471.57	
	.944	76.30	131.85	208.18	4.77	.203	402.86	9.45	.400	611.02	14.16	.613	40368.64	

(See next page for definitions of Columns A thru N)

B.7 Drilling and Blasting (DAB) Output - Definitions

Column A Rotary drill data base identification number
B Number of drills required
C Annual ownership cost for drills (thousands of dollars)
D Annual operating cost for drills (thousands of dollars)
E Annual ownership and operating cost for drills (thousands of dollars)
F Drilling cost (\$/foot of hole drilled)
G Drilling cost (\$/cubic yard of overburden drilled and blasted)
H Annual operating cost for explosives (thousands of dollars)
I Explosives cost (\$/foot of hole drilled)
J Explosives cost (\$/cubic yard of overburden drilled and blasted)
K Combined annual ownership and operating costs for drilling and explosives
(thousands of dollars)
L Combined cost (\$/foot of hole drilled)
M Combined cost (\$/cubic yard of overburden drilled and blasted)
N Combined cost (\$/acre of coal uncovered)

Appendix B.8 and B.9 Drilling/Blasting Coal
Input and Output

The Drilling and Blasting Coal (DBC) computer model simulates the drilling of blast holes with an auger-type drill and determines the required amounts of blasting materials related to coal drilling and blasting.

Computer input and output for the hypothetical baseline situation for the Green River test case are shown on the following 3 pages.

B.8 Drilling/Blasting Coal (DBC) Input

DRILLING AND BLASTING SIMULATION
INPUT PARAMETERS

0504 (G08C0504) GREEN RIVER
DRILLING AND BLASTING COAL

		LAYER 1	LAYER 2
KMED	MEDIUM FOR DRILLING, 0=COAL 1=O.B.	0.	0.
ICASE	ICASE = 1, NO S,B,SDDI SPECIFIED	3.	3.
	ICASE = 2, SDDI SPECIFIED		
	ICASE = 3, S,B, AND SDDI SPECIFIED		
OSRHY	SCHEDULED OPERATING HOURS PER YEAR	1813.00	1813.00
OPRHY	PRODUCTIVE OPERATING HOURS PER YEAR	1631.00	1631.00
E00	EFFICIENCY OF DRILLING OPERATIONS - FRACTION	1.000	1.000
PTF	PROPEL TIME FACTOR - FRACTION	1.00	1.00
P	PANEL WIDTH - FEET	360.00	360.00
HBMF	HOLE BOTTOM MARGIN - FEET	.00	.00
DPGCC	DENSITY OF PRIMER - GRAM / CC	.00	.00
DAGCC	DENSITY OF ANFO - GRAM / CC	.80	.80
DSGCC	DENSITY OF SLURRY - GRAM / CC	1.50	1.50
PRPY	POWDER RATIO - LBS. / YARD	.25	.25
P0H	PERCENTAGE DRY HOLES	.90	.90
PWH	PERCENTAGE WET HOLES	.10	.10
HPF	HEIGHT OF PRIMER - FEET	.00	.00
PEBC	% EX. BLASTING CAPS/CAST BOOSTERS	.05	.05
CRCOC	COST OF BLASTING CAPS/CAST BOOSTERS - \$/100	125.00	125.00
CDCCMF	COST OF DETONATING CORD - \$ / M FT	45.00	45.00
CPDP	COST OF PRIMER - \$ / LB.	.00	.00
CA0P	COST OF ANFO - \$ / LB.	.08	.08
CSDP	COST OF SLURRY - \$ / LB.	.32	.32
PLY	PROJECT LIFE - YEARS	10.00	10.00
DRSMFH	DRILLING RATE IN SOFT MAT'L - FT./HR.	360.	360.
CDRTY	COAL DEMAND - TONS/YEAR	1063715.	1063715.
COBYY	COAL DEMAND - BANK YDS/YR	.6951E C6	.3037E C6
HC	HEIGHT OF COAL - FEET	20.00	10.00
SDDI	SPECIFIED DRILL DIAMETER - INCHES	6.000	6.000
S	SPACING - FEET	20.00	20.00
B	BURDEN - FEET	20.00	20.00

B.9 Drilling/Blasting Coal (DBC) Output

DRILLING AND BLASTING SIMULATION
INTERMEDIATE VARIABLES

0504 (GDRC0504) GREEN RIVER
DRILLING AND BLASTING COAL

		LAYER 1	LAYER 2
CAF	COAL ACRE FEET	153.87	188.25
ACBY	AREA COAL - BANK YDS	.69509E 07	.30370E 07
RL4JFY	RATE OF LINEAR ADVANCE - FT. / YR.	1861.85	2277.76
RHLF	REQUIRED HOLE LENGTH - FT.	28.00	10.00
VCFY4	VOLUME EFFECTED - CU. YD. / FOOT OF HOLE	14.81	14.81
PEH	POUNDS OF EXPLOSIVE PER HOLE	104.00	37.00
VECYH	VOLUME EFFECTED - CU. YD. / HOLE	414.81	148.15
N4Y	NUMBER OF HOLES PER YEAR	1675.00	2049.00
WAPFH	WEIGHT OF ANFO - LBS. / FT. OF HOLE	9.81	9.81
WSPFH	WEIGHT OF SLURRY - LBS. / FT. OF HOLE	18.39	18.39
WPPF4	WEIGHT OF PRIMER - LBS. / FT. OF HOLE	.00	.00
HAF	HEIGHT OF ANFO IN HOLE - FT.	10.61	3.77
HSP	HEIGHT OF SLURRY IN HOLE - FT.	5.66	2.01
SHDF	STEMMING HEIGHT FOR DRY HOLES - FT.	17.39	6.23
SHWF	STEMMING HEIGHT FOR WET HOLES - FT.	22.34	7.99
RLDCLY	REQUIRED LENGTH OF DETONATING CORD - FT / YR	92459.94	70690.44
CDCCY	COST OF DETONATING CORD - \$ / YR.	4160.70	3181.07
NBCY	NO. OF BLASTING CAPS/CAST BOOSTERS / YEAR	1758.00	2151.00
CBCCY	COST OF BLASTING CAPS/CAST BOOSTERS - \$/YR	2197.50	2688.75
WPPY	WEIGHT OF PRIMER - LBS. / YR.	.00	.00
CPDY	CCST OF PRIMER - \$ / YR.	.00	.00
WAPY	WEIGHT OF ANFO - LBS. / YR.	156779.94	68231.69
CADY	CCST OF ANFO - \$ / YR.	12542.39	5458.53
WSPY	WEIGHT OF SLURRY - LBS. / YR.	17420.00	7581.30
CSDY	COST OF SLURRY - \$ / YR.	5574.40	2426.02
APRPY	ACTUAL POWDER RATIO - LBS. / CU. YD.	.25	.25
CEDY	CCST OF EXPLOSIVES - \$ / YR.	24474.98	13754.36
CEFH	CCST OF EXPLOSIVES - \$ / FT. OF HOLE	.52	.67
CEJ3	COST OF EXPLOSIVES - \$ / UNIT BLASTED	.02	.01

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A	B	C	D	E	F	G	H	I	J	K	L	M	N
	NDR	M\$GWN	M\$OPN	M\$OAO	\$/FT	\$/UNIT	M\$/YR	\$/FT	\$/UNIT	CM\$/YR	C\$/FT	C\$/UNIT	C\$/AFT
24 CD 6-35	.080	.81	2.54	3.35	.07	.003	24.47	.52	.023	27.83	.59	.026	1808.58
24 CD 6-35	.035	.36	1.11	1.47	.07	.001	13.75	.67	.013	15.22	.74	.014	808.51
	.115	1.17	3.65	4.82	.14	.004	38.22	1.19	.036	43.05	1.33	.040	2617.09

(See next page for definitions of Columns A thru N)

B.9 Drilling/Blasting Coal (DBC) Output - Definitions

Column A	Rotary drill data base identification number
B	Number of drills required
C	Annual ownership cost for drills (thousands of dollars)
D	Annual operating cost for drills (thousands of dollars)
E	Annual ownership and operating cost for drills (thousands of dollars)
F	Drilling cost (\$/foot of hole drilled)
G	Drilling cost (\$/cubic yard of overburden drilled and blasted)
H	Annual operating cost for explosives (thousands of dollars)
I	Explosives cost (\$/foot of hole drilled)
J	Explosives cost (\$/cubic yard of overburden drilled and blasted)
K	Combined annual ownership and operating costs for drilling and explosives (thousands of dollars)
L	Combined cost (\$/foot of hole drilled)
M	Combined cost (\$/cubic yard of overburden drilled and blasted)
N	Combined cost (\$/acre of coal uncovered)

Appendix B.10 Land Reclamation Simulation
Input and Output

The Land Reclamation Simulation (LRS) micromodel analyzes four separate operations: required scraper fleet for top-soil removal and redistribution; required bulldozer fleet for spoil pile regrading and for general dozer work; costs of revegetation; and land management.

Computer input and output for the hypothetical baseline situation for the Green River test case are shown on the following 2 pages.

B.10 Land Reclamation (LRS) Input and Output

0504 (GLRS0504) GREEN RIVER BASIN
 1 LAND RECLAMATION SIMULATION

I KAC	4	METHOD OF INPUT - 1, 2, 3, OR 4
I KSR	0	SPOIL REGRADE - 1=YES, 0=NO
I LOGPA	1	PRINT INPUT VARIABLES IF = 1
* ACRES	614.000	ACRES ON PROPERTY
* ACRT	.115467E 08	AREA COAL IN RECOVERABLE TONS
I CDRTY	.106371E 07	COAL DEMAND - RECOVERED TONS / YEAR
I CGD	600.000	COST FOR GENERAL DOZING - \$/ACRE
I CLM	100.000	COST FOR LAND MANAGEMENT - \$/ACRE
I CRV	200.000	COST FOR REVEGETATION - \$/ACRE
C EMH	49.9800	EFFECTIVE MINUTES PER HOUR
I FRD	.833000	EFFICIENCY OF LAND RECLAMATION - FRACTION
I HQT	.000000	HEIGHT OF TOPSOIL - FEET
I PRHY	1465.00	PRODUCTIVE LAND RECLAMATION - HRS / YR
* PWF	100.000	PANEL WIDTH - FEET
C RAY	56.5634	RECLAMATION ACRES PER YEAR
C TANT	.000000	TANGENT OF ANGLE OF SPOILS
C TMY	10.8551	TOTAL MINING YEARS

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I = Input
 C = Calculated
 * = Calculated if not input

0504 (GLRS0504) GREEN RIVER BASIN
 1 LAND RECLAMATION SIMULATION

	<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>	<u>E</u>	<u>F</u>	<u>G</u>	<u>H</u>	<u>I</u>	<u>J</u>	<u>K</u>	<u>L</u>
	L-MPH	E-MPH	CTM	TPH	MCYY	#	I-M\$/YR	O-M\$/YR	IOM\$/YR	\$/CY	\$/A	\$/TON
GENERAL DOZING						.35			33.94		600.000	.032
						.35					600.000	.032
REVEGETATION									11.31		200.000	.011
LAND MANAGEMENT									5.66		100.000	.005
TOTAL LAND RECLAMATION									50.91		900.000	.048

Note: Since no topsoil was saved in Base Case example, columns A thru E, G, H, and J are blank.

(See next page for definitions of Columns A thru L)

B.10 Land Reclamation Simulation (LRS) Output - Definitions

Column A Scraper average speed loaded (miles/hr)
B Scraper average speed empty (miles/hr)
C Scraper cycle time (minutes)
D Scraper production (tons/hr)
E Scraper production (thousands cubic yards/year)
F Number of scrapers required
Number of dozers required
G Annual ownership costs (thousands of dollars)
H Annual operating costs (thousands of dollars)
I Annual ownership and operating costs (thousands of dollars)
J Cost (\$/cubic yard of topsoil)
K Cost (\$/acre)
L Cost (\$/ton of coal recovered)

Appendix B.11, B.12 & B.13 Coal Preparation Factoring
Input and Output

The Preparation/General Administrative (PGA) micromodel determines the coal handling and processing costs by means of extrapolation from a standard size facility. In addition, it allows plant selection based on three levels of difficulty of preparation effort: crushing and screening, Baum jig, and heavy media. The micromodel separates ownership and operating costs into five categories:

- Receiving and Breaking
- Blending and Stockpiling
- Coal Loadout
- Preparation Plant
- Preparation Plant Support.

Computer input and output for the hypothetical baseline situation for the Green River test case are shown on the following 4 pages.

B.11 Preparation/General Administrative (PGA) Input (Coal Preparation Factoring)

PGA MODEL ECONOMIC SUMMARY

RUN DATE 11:24 NOV 05,'76 PAGE NO. 1.1

CASE NO. 504 TITLE (PGA0504) HYPOTHETICAL MINE STUDY - BASELINE SOLUTION

ALT. NO. 504 TITLE GREEN RIVER

1975 DOLLARS

I IMQA	0	INCLUDE GENERAL & ADMINISTRATIVE
I IMQP	1	INCLUDE PREP PLANT
I IPPT	1	PP - INDEX TO PLANT TYPE
I LGCF	1	WRITES CFA CONTROL FILE IF 1
I LOGOV	1	PRINTS DEFAULT VARIABLES IF 1
I LOGEC	1	WRITES CFA EQUIPMENT FILE IF 1
I LOGPA	1	PRINTS PARAMETERS IF 1
I LGRD	1	PRINTS REGRESS. DATA FILE IF 1
I LSSD	1	WRITES SPECIFICATION DATA IF 1
I LSSM	1	WRITES ECONOMIC SUMMARY IF ONE
I NY	3	NO. OF YEARS TO STARTUP
I PPED	.409500E 15	PP - BASE ENERGY BTU/YEAR
I PP3T	75000.0	PP - BASE TONS/DAY
I PPVED	.130000E 15	PP - COMPLEX ENERGY DEMAND BTU/YEAR
I PPNHV	10250.0	PP - COAL HEAT VALUE BTU/LB
I PPDY	250.000	PP - OPERATING DAYS/YEAR
I SF3	.350000	SWELL FACTOR FOR BURDEN
I SFC	.350000	SWELL FACTOR FOR COAL
I SRYT	7.00000	STRIPPING RATIO YARDS/ROM TONS
I TMY	30.0000	TOTAL MINING YEARS

B.12 Preparation/General Administrative (PGA) Default Values (Coal Preparation Factoring)

PGA MODEL ECONOMIC SUMMARY

RUN DATE 11:24 NOV 05,'76 PAGE NO. 1.3

CASE NO. 504 TITLE (PGA0504) HYPOTHETICAL MINE STUDY - BASELINE SOLUTION

ALT. NO. 504 TITLE GREEN RIVER

1975 DOLLARS

	10990.	12760.	13084.							
PPBHV	BASE HEAT VALUES	10990.	12760.	13084.						
PPBSF	BASE SIZE FACTORS	.9900	.8250	.7870						
PPRHF	BASE HEAT FACTORS	1.0036	1.0373	1.0600						
PPCCF	CAP. COST FACTORS	17700.	67400.	3600.	9500.	8100.	52100.	8100.	70200.	8100.
PPCCX	CAP. COST EXP.	.80	.80	1.00	.80	.50	.75	.50	.70	.50
PPPSF	OPER. PER. FRACTIONS	2.00	8.50	2.00	2.00	9.60	6.00	9.60	6.00	9.60
		2.00	2.00	2.00	2.00	4.80	2.00	7.20	6.00	9.60
		3.00	.00	1.00	3.00	.00	3.00	.00	3.00	.00
		.00	.00	.00	1.00	.00	3.00	.00	5.00	.00
		.00	.00	.00	.00	.00	2.00	.00	2.00	.00
		.00	.00	.00	.00	.00	.00	.00	2.00	.00
		.00	.00	.00	.00	.00	.00	.00	.00	.00
		.00	.00	.00	.00	.00	.00	.00	.00	.00
PPPSX	OPER. PER. EXP.	.35	.35	.35	.35	.35	.35	.35	.35	.35
PPDS	OPER. SCHED. CODES	5.	9.	12.	9.	5.	9.	5.	9.	5.
PPDC	OPER. CLASS CODES	13.	13.	13.	13.	11.	13.	11.	13.	11.
		18.	23.	18.	18.	22.	17.	22.	17.	22.
		23.	0.	23.	22.	0.	22.	0.	22.	0.
		0.	0.	0.	23.	0.	23.	0.	5.	0.
		0.	0.	0.	0.	0.	10.	0.	23.	0.
		0.	0.	0.	0.	0.	0.	0.	10.	0.
		0.	0.	0.	0.	0.	0.	0.	0.	0.
		0.	0.	0.	0.	0.	0.	0.	0.	0.
PPMLF	MAINT. LABOR COST F.	71.52	81.09	30.56	54.31	174.02	184.13	215.38	249.38	232.32
PPMLX	MAINT. LABOR EXP.	.35	.35	.35	.35	.35	.35	.35	.35	.35
PPMYF	MAINT. MATL. COST F.	122.07	309.86	10.33	43.67	101.25	287.42	101.25	516.37	101.25
PPMYX	MAINT. MATL. EXP.	.80	.80	.80	.80	.50	.75	.50	.70	.50
PPFCF	FUEL COST FACTORS	.00	.00	.00	12.41	.00	15.45	.00	17.93	.00
PPFCX	FUEL COST EXP.	.00	.00	.00	.80	.00	.75	.00	.70	.00
PPWCF	WATER COST FACTORS	.00	.00	.00	.00	.00	2.40	.00	4.20	.00
PPWCX	WATER COST EXP.	.00	.00	.00	.00	.00	1.00	.00	1.00	.00
PPECF	ELEC. COST FACTORS	45.35	99.87	22.12	19.08	128.12	185.00	128.12	314.65	128.12
PPECX	ELEC. COST EXP.	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

PGA MODEL ECONOMIC SUMMARY

RUN DATE 11:24 NOV 05, '76 PAGE NO. 1-4

CASE NO. 504 TITLE (PGA0504) HYPOTHETICAL MINE STUDY - BASELINE SOLUTION
 ALT. NO. 504 TITLE GREEN RIVER

1975 DOLLARS

PPLCF	LABOR COST FACTORS	68.78	105.53	55.83	79.24	143.62	161.06	166.80	220.21	189.99
PPLCX	LABOR COST EXP.	.35	.35	.35	.35	.35	.35	.35	.35	.35
PPWCF	OWN, COST FACTORS	3625.	5438.	8712.	5438.	2000.	5438.	2000.	5438.	2000.
PPDTF	OPER. HOURS/DAY	14.50	21.75	38.45	21.75	8.00	21.75	8.00	21.75	8.00
PPEQTY	UNIT QUANTITIES	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
PPMS	MAINT. SCHED. CODES	5.	5.	5.	5.	5.	5.	5.	5.	5.
PPMC	MAINT. CLASS CODES	4.	4.	4.	4.	4.	4.	4.	4.	4.
		5.	5.	5.	5.	5.	5.	5.	5.	5.
		6.	6.	6.	6.	6.	6.	6.	6.	6.
		14.	14.	14.	14.	12.	14.	12.	14.	12.
		12.	12.	12.	12.	13.	12.	13.	12.	13.
		18.	18.	18.	18.	22.	18.	22.	18.	22.
		23.	23.	23.	23.	0.	23.	0.	23.	0.
		3.	0.	0.	0.	0.	0.	0.	0.	0.
PPMF	MAINT. FRACTIONS	.074	.087	.069	.131	.097	.096	.118	.113	.146
		.074	.044	.069	.064	.195	.096	.157	.099	.146
		.296	.261	.278	.259	.292	.288	.315	.311	.328
		.071	.042	.066	.061	.233	.092	.226	.068	.210
		.212	.125	.199	.187	.093	.128	.075	.122	.070
		.205	.401	.256	.239	.090	.248	.109	.248	.100
		.068	.040	.063	.059	.000	.052	.000	.039	.000
		.000	.000	.000	.000	.000	.000	.000	.000	.000
PPCRSY	START YEAR	7.								
PPCRNY	NO. YEAR STARTUP	3.								
PPCRSE	STARTUP EFF.	1.								
PPCRPL	PURCHASE LEAD TIME	3.								
PPCRLO	LIFE OF OPERN.	30.								
PPD2SF	SALVAGE FRACTION	.00								
PPD2DM	DEPREC. METHOD	0.								
PPD2PC	PURCHASE CODE	5.								
PPD2RA	REGIONAL ADJ.	1.00								
PPD2EF	ESCAL. FACTOR	.00								
PPD2CO	CONSTRUCTION CODE	1.								

B.13 Preparation/General Administrative (PGA) Output (Coal Preparation Factoring)

PGA MODEL ECONOMIC SUMMARY RUN DATE 11:24 NOV 05, '76 PAGE NO. 1.2

CASE NO. 504 TITLE (PGA0504) HYPOTHETICAL MINE STUDY - BASELINE SOLUTION
 ALT. NO. 504 TITLE GREEN RIVER

1975 DOLLARS

PREPARATION PLANT STATISTICS

TYPE	SIZE	- - - DELIVERED COAL - - -			
	TONS/DAY	BTU/LB	TONS/YEAR	BTU/YEAR	
1	25528.5	10286.9	.631829E 07	.130000E 15	

		UNIT	LABOR OWNERSHIP OPERATING			O&D
		INVESTMENT	- - - - - \$/HOUR - - - - -			\$/TON
REC & BREAK	PREP. PLANT	.106948E 08	151.16	311.75	397.44	.403
BLEND-STOCK	PREP. PLANT	.407249E 08	231.93	791.33	631.37	1.212
COAL LOADOUT	PREP. PLANT	.122537E 07	122.70	14.86	203.64	.329
CRUSH-SCREEN	PREP. PLANT	.574016E 07	174.15	111.54	333.89	.380
CS SUPPORT	PREP. PLANT	.115756E 08	315.65	611.57	886.41	.469
		.699609E 08				2.793

C PPFTY	.631829E 07	PP - FINISHED COAL TONS/YEAR
C PPHF	1.00360	PP - HEAT VALUE FACTOR FOR IPPT
C PPHV	10990.0	PP - BASE HEAT VALUE FOR IPPT
C PPNS	25528.5	PP - COMPLEX SIZE TONS/DAY
C PPSF	.990000	PP - SIZE FACTOR FOR IPPT

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Appendix B.14, B.15, & B.16 Premining, Facilities, and
Administration Input and Output

The Preparation/General Administrative (PGA) micromodel determines the central facilities, staff, and premining costs by means of extrapolation from a standard size facility. The micromodel separates ownership and operating costs into thirteen categories:

- Roads and Site Work
- Buildings
- Electric Power System
- Water System
- Communications System
- Mobile Support Equipment
- Shop Equipment
- Land Rights
- Exploration Drilling
- Contract Engineering
- Environmental Impact Statement
- Supervisory and Support Personnel
- Royalty and Severance Tax.

Computer input and output for the hypothetical baseline situation for the Green River test case are shown on the following 4 pages.

B.14 Preparation/General Administrative (PGA) Input (Premining, Facilities and Administration)

PGA MODEL ECONOMIC SUMMARY

RUN DATE 11:24 NOV 05,'76 PAGE NO. 1.1

CASE NO. 504 TITLE (PGA0504) HYPOTHETICAL MINE STUDY - BASELINE SOLUTION
 ALT. NO. 504 TITLE GREEN RIVER

1975 DOLLARS

I IMOGA	1	INCLUDE GENERAL & ADMINISTRATIVE
I IMOPP	1	INCLUDE PREP PLANT
I IPPT	1	PP - INDEX TO PLANT TYPE
I LRGCF	1	WRITES CFA CONTRL FILE IF 1
I LOGDV	1	PRINTS DEFAULT VARIABLES IF 1
I LOGEC	1	WRITES CFA EQUIPMENT FILE IF 1
I LOGPA	1	PRINTS PARAMETERS IF 1
I LOGRD	1	PRINTS REGRESS. DATA FILE IF 1
I LOGSD	1	WRITES SPECIFICATION DATA IF 1
I LOGSM	1	WRITES ECONOMIC SUMMARY IF ONE
I NY	3	NO. OF YEARS TO STARTUP
I DBBPY	4290.00	DENSITY OF OVERBURDEN BANK LBS/YARD
I FCR	.920000	EXPECTED COAL RECOVERY FACTOR
I GAMR	50.0000	GAA - MINERAL RIGHTS (\$/ACRE)
I GARA	.250000	GAA - ROYALTY AMOUNT (\$/TON)
I GASR	250.000	GAA - SURFACE RIGHTS (\$/ACRE)
I GAST	.000000	GAA - SEVERANCE TAX (\$/TON)
I GATAO	10082.0	TOTAL ACRES DISTURBED IN COMPLEX
I GATYB	102.210	GAA - TONS/YEAR - BASELINE
I GAUP	.110000	GAA - UNION PAYMENT (\$/TON)
I SFB	.350000	SWELL FACTOR FOR BURDEN
I SFC	.350000	SWELL FACTOR FOR COAL
I SRYT	7.00000	STRIPPING RATIO YARDS/ROM TONS
I TMY	30.0000	TOTAL MINING YEARS

B.15 Preparation/General Administrative (PGA) Default Values (Premining, Facilities and Administration)

PGA MODEL ECONOMIC SUMMARY

RUN DATE 11:24 NOV 05,'76 PAGE NO. 1.6

CASE NO. 504 TITLE (PGA0504) HYPOTHETICAL MINE STUDY - BASELINE SOLUTION
ALT. NO. 504 TITLE GREEN RIVER

1975 DOLLARS

G1CCF	SITE WORK, \$	.150000E	07																	
G2SQF	BUILDINGS, SQ. FT.	155000.																		
G2DSQF	BUILDING COST, \$/SQFT	36.2500																		
G2MSFF	ANNUAL FUEL COST, \$	80000.0																		
G2MSFW	ANNUAL WATER COST, \$	900.000																		
G3CCF	POWER SYSTEM COST, \$	.890000E	07																	
G4ACCF	H2O SYS. COST, C-S, \$	200000.																		
G4BCCF	H2O SYS. COST, B-J, \$	450000.																		
G4CCCF	H2O SYS. COST, H-M, \$	550000.																		
G5CCF	COMMUNICATION SYS., \$	250000.																		
G6CCF	MOBIL EQUIPMENT, \$	.120000E	07																	
G7CCF	SHOP EQUIPMENT, \$	.100000E	07																	
G8PERC	LAND, DOWN PYMT FRACTION	.100000																		
GASR	LAND, SURFACE RIGHTS, \$/ACRE	250.000																		
GAMR	LAND, MINERAL RIGHTS, \$/ACRE	50.0000																		
TMV	LIFE OF OPERATION, YEARS	30.0000																		
G9CCF	EXPLORN. DRILLING, \$/HOLE	1000.00																		
G9AHOL	EXPLORN. DRILLING, ACRES/HOLE	40.0000																		
G10CCD	ENGINEERING, \$	.600000E	07																	
G11CCF	ENVIRONMENTAL IMPACT STAT., \$	.100000E	07																	
G13PRC	STAFF PERS., PERCENT OF UNION	.160000																		
G13MPW	TOTAL UNION MANPOWER ESTIMATE	2058.00																		
G13FCT	SUPPLIES, \$/YEAR/STAFF PER.	2000.00																		
G13OCL	WORK CLASS - STAFF	24.0000																		
G13OSC	WORK SCHEDULE - STAFF	3.00000																		
G13AWR	AVERAGE STAFF WAGE, \$/YEAR	17900.0																		
GARA	ROYALTY ON COAL, \$/TON	.250000																		
GAST	SEVERANCE TAX, \$/TON	.000000																		
GAUP	UNION PENSION FUND, \$/TON	.110000																		
G1EXP	SITE CAP. COST EXP.	.35																		
G2EXP1	BLDG FUEL EXP.	.85																		
G2EXP2	BLDG FUEL M&S EXP.	.90																		
G2EXP3	BLDG WATER EXP.	.75																		
G3EXP	POWER SYS. EXP.	.70																		
G4EXP	WATER SYS. EXP.	.45																		
G5EXP	COMM. SYS. EXP.	.40																		
G6EXP	MOBILE SUP. EXP.	.85																		
G7EXP	SHOP EXP.	.45																		
G1JEXP	CONT. ENG. EXP.	.55																		
G1IEXP	E.I.S. EXP.	.25																		
G1JEXP	STAFF EXP.	.90																		
GACRLO	LIFE OF OPERATION	32.	32.	32.	32.	32.	32.	32.	32.	32.	32.	32.	32.	32.	32.	32.	32.	32.	32.	32.
GACRNY	NO. YEARS STARTUP	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
GACROH	OPERATING HOURS/YEAR	2000.	2000.	2000.	2000.	2000.	2000.	2000.	2000.	2000.	2000.	2000.	2000.	2000.	2000.	2000.	2000.	2000.	2000.	2000.
GACRPL	PURCHASE LEAD TIME	3.	3.	3.	3.	3.	2.	2.	5.	5.	6.	4.	0.	0.						
GACRQT	QUANTITY	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
GACRSY	STARTUP YEAR	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.	7.
GAD2BY	BASE YEAR	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GAD2CD	CONSTRUCTION CODE	1.	1.	1.	1.	1.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
GAD2DM	DEPRECIATION METHOD	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
GAD2EF	STARTUP EFF. FACTOR	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
GAD2PC	PURCHASE CODE	5.	5.	5.	5.	5.	5.	5.	5.	1.	1.	5.	1.							

B.15 (Continued)

GAD2RA REGIONAL ADJUSTMENT FACTOR	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
GAD2SF SALVAGE FRACTION	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

B.16 Preparation/General Administrative (PGA) Output
 Premining, Facilities and Administration)

PGA MODEL ECONOMIC SUMMARY

RUN DATE 11:24 NOV 05.'76 PAGE NO. 1.5

CASE NO. 504 TITLE (PGA0504) HYPOTHETICAL MINE STUDY - BASELINE SOLUTION
 ALT. NO. 504 TITLE GREEN RIVER

1975 DOLLARS

GENERAL & ADMINISTRATIVE COSTS

	UNIT INVESTMENT	OWNERSHIP \$/HOUR	OPERATING \$/HOUR	O&O \$/TON
ROADS & SITE ANC. FAC.	.150000E 07	77.58	.00	.026
BUILDINGS ANC. FAC.	.561875E 07	293.59	40.45	.111
ELECT. SYS. ANC. FAC.	.890000E 07	460.30	.00	.154
WATER SYS. ANC. FAC.	200000.	10.34	.00	.003
COMMUN. SYS. ANC. FAC.	250000.	12.93	.00	.004
MOBILE SUP. ANC. FAC.	.120000E 07	62.06	.00	.021
EQUIP. SHOP ANC. FAC.	.100000E 07	51.72	.00	.017
LAND RIGHTS PREMINE	302460.	15.64	45.37	.020
EXPL. DRILL. PREMINE	252050.	13.04	.00	.004
CONT. ENG. PREMINE	.600000E 07	310.31	.00	.104
E. I. S. PREMINE	.100000E 07	51.72	.00	.017
SUPERV. PER.	.000000	.00	3273.83	1.094
ROY-SEV. TAX	.000000	.00	1076.98	.360
	.262232E 08	1356.23	4436.63	1.936

TOTAL MM TONS/YEAR 102.210
 TOTAL ACRES DISTURBED 10082.0

C CDRTYX .638211E 07 COMPLEX COAL DEMAND ROM TONS/YEAR
 C PPFHV 10286.9 PP - FINAL HEAT VALUE
 C VBBY .134024E 10 VOL. OVERBURDEN BANK YARDS
 C VCRT .191463E 09 VOL. COAL ROM TONS

APPENDIX C

Cash Flow Analysis Input

- C.1 Definition of Equipment and Facilities Requirements for the Project.
- C.2 Definition of Personnel Data.
- C.3 Definition of Case Description Parameters, Financial Assumptions, and Default Values.

A User's Manual for the Cash Flow Analysis Model is contained in Volume 13 of the Final Report (ref: FE-1520-113). The following examples of manually prepared input data are for the hypothetical baseline situation for the Green River test case.

The equipment data (Appendix C.1) is prepared manually by the user based on the results of the micromodel analysis shown in Appendix B.

The personnel data (Appendix C.2) establishes wage categories and work schedules for all employees.

The case description, financial parameters, and default values (Appendix C.3) record the values used for the major mining and economic variables.

Appendix C.1 Definition of Equipment and Facilities

Each item of equipment, facilities, or premining costs must be defined on a series of input cards as follows:

- 1) ECRG Card: Defines the mining operation code; the equipment identification number from the equipment data base; the initial quantity required; the quantity of fleet spares; the operating hours per year; the steady state annual production in 1000's; the start year (first year of production); the number of years to complete startup (time from first production to reach steady state production); the startup efficiency (discounts production in early years); the purchase lead time in years; deferred purchase; life of operation in years; and scheduled hours per year.
- 2) EDI Card; Defines equipment type and size.
- 3) ED2 Card: Defines equipment investment cost; depreciation (replacement) life; salvage fraction; depreciation method; purchase code for progress payment schedule; investment base year; investment regional adjustment; investment escalation; construction and tax credit treatment.
- 4) ED3 Card: Defines the equipment operating costs for maintenance labor, maintenance material, fuel, tires, electric power, water, and other.
- 5) ED01 Card: Defines the personnel wage classification, personnel work schedule basis, and quantity of operating personnel required for the equipment.
- 6) EPM1 Card: Defines the personnel wage classification for personnel work schedule basis and fractional proportion of maintenance expenditure for that classification required for the equipment.
- 7) EMSU Card: Defines the usage adjustment, if any, to the operating costs shown on the ED3 card to account for any variation from the assumed conditions used in the equipment data file.

A worksheet is used to code the equipment and facilities information for entry into a computerized data file for the cash flow program.

Appendix C.2 Definition of Personnel Data

All operating and maintenance personnel must be identified by two codes:

- 1) PWC: Personnel Wage Classification which identifies the person's union pay grade and work description.
- 2) PSB: Personnel Schedule Basis which identifies the possible work schedules (shifts per day, hours per shift, and shifts per week).

Two additional parameters are defined for each combination of wage classification and schedule basis:

- 1) EHPY: Effective Hours Per Year which is an estimate of the annual number of hours the person is expected to be on the job ready to work (accounts for overtime, holidays, etc.).
- 2) PDPH: Personnel Dollars Per Hour which is an estimate of the total wages plus overtime, pre-mining and payroll added costs per hour. This personnel data is organized into a computerized file for the cash flow program.

The personnel wage classifications schedules used for the hypothetical baseline situation for the Green River test case are shown on the following 3 pages.

C.2 Definition of Personnel Data

<u>Personnel</u> <u>Wage</u> <u>Classification</u>	<u>Grade and Work Description</u>	<u>Personnel</u> <u>Schedule</u> <u>Basis</u>	<u>Shifts</u> <u>Per</u> <u>Day</u>	<u>Hours</u> <u>Per</u> <u>Shift</u>	<u>Days</u> <u>Per</u> <u>Week</u>
PWC 1	5 Coal Loading Operator	PSB 1	1	7.25	5
PWC 2	5 Strip Mach Operator	PSB 2	1	7.25	6
PWC 3	5 Master Electrician	PSB 3	1	8.00	5
PWC 4	4 Electrician	PSB 4	1	8.00	6
PWC 5	4 Machinist	PSB 5	2	7.25	5
PWC 6	4 Mechanic	PSB 6	2	7.25	6
PWC 7	4 Welder 1st Class	PSB 7	2	8.00	5
PWC 8	4 Oiler	PSB 8	2	8.00	6
PWC 9	4 Groundman	PSB 9	3	7.25	5
PWC 10	4 Central Control	PSB 10	3	7.25	6
PWC 11	3 Mobile Equip Operator	PSB 11	3	8.00	5
PWC 12	3 Repairman	PSB 12	3	8.00	6
PWC 13	3 Stat Equip Operator				
PWC 14	3 Welder				
PWC 15	3 Driller & Shooter				
PWC 16	3 Car Loader				
PWC 17	2 Tipple Attendant				
PWC 18	2 Helper				
PWC 19	1 Car Operation				
PWC 20	1 Sampler				
PWC 21	1 Svc Vehicle Driver				
PWC 22	1 Utility Man				
PWC 23	1 Laborer				
PWC 24	S Gen & Adm Staff				

Personnel Effective Hours Per Year

Personnel

Wage

Personnel Schedule Basis

<u>Classification Grade</u>		<u>PSB 1</u>	<u>PSB 3</u>	<u>PSB 5</u>	<u>PSB 6</u>	<u>PSB 9</u>	<u>PSB 10</u>	<u>PSB 12</u>
PWC 1	5	1618		1618	1942	1618	1942	2269
PWC 2	5	1618		1618	1942	1618	1942	2269
PWC 3	5	1618		1618	1942	1618	1942	2269
PWC 4	4	1618		1618	1942	1618	1942	2269
PWC 5	4	1618		1618	1942	1618	1942	2269
PWC 6	4	1618		1618	1942	1618	1942	2269
PWC 7	4	1618		1618	1942	1618	1942	2269
PWC 8	4	1618		1618	1942	1618	1942	2269
PWC 9	4	1618		1618	1942	1618	1942	2269
PWC 10	4	1618		1618	1942	1618	1942	2269
PWC 11	3	1618		1618	1942	1618	1942	2269
PWS 12	3	1618		1618	1942	1618	1942	2269
PWC 13	3	1618		1618	1942	1618	1942	2269
PWC 14	3	1618		1618	1942	1618	1942	2269
PWC 15	3	1618		1618	1942	1618	1942	2269
PWC 16	3	1618		1618	1942	1618	1942	2269
PWC 17	2	1618		1618	1942	1618	1942	2269
PWC 18	2	1618		1618	1942	1618	1942	2269
PWC 19	1	1618		1618	1942	1618	1942	2269
PWC 20	1	1618		1618	1942	1618	1942	2269
PWC 21	1	1618		1618	1942	1618	1942	2269
PWC 22	1	1618		1618	1942	1618	1942	2269
PWC 23	1	1618		1618	1942	1618	1942	2269
PWC 24	S		2000					

Personnel Dollars Per Hour

Personnel

Wage

Personnel Schedule Basis

<u>Classification Grade</u>		<u>PSB 1</u>	<u>PSB 3</u>	<u>PSB 5</u>	<u>PSB 6</u>	<u>PSB 9</u>	<u>PSB 10</u>	<u>PSB 12</u>
PWC 1	5	11.32		11.42	12.37	11.52	12.48	12.90
PWC 2	5	11.32		11.42	12.37	11.52	12.48	12.90
PWC 3	5	11.32		11.42	12.37	11.52	12.48	12.90
PWC 4	4	10.49		10.59	11.47	10.69	11.58	12.10
PWC 5	4	10.49		10.59	11.47	10.69	11.58	12.10
PWC 6	4	10.49		10.59	11.47	10.69	11.58	12.10
PWC 7	4	10.49		10.59	11.47	10.69	11.58	12.10
PWC 8	4	10.49		10.59	11.47	10.69	11.58	12.10
PWC 9	4	10.49		10.59	11.47	10.69	11.58	12.10
PWC 10	4	10.49		10.59	11.47	10.69	11.58	12.10
PWC 11	3	10.03		10.13	10.97	10.23	11.08	11.46
PWS 12	3	10.03		10.13	10.97	10.23	11.08	11.46
PWC 13	3	10.03		10.13	10.97	10.23	11.08	11.46
PWC 14	3	10.03		10.13	10.97	10.23	11.08	11.46
PWC 15	3	10.03		10.13	10.97	10.23	11.08	11.46
PWC 16	3	10.03		10.13	10.97	10.23	11.08	11.46
PWC 17	2	9.67		9.77	10.58	9.87	10.69	11.07
PWC 18	2	9.67		9.77	10.58	9.87	10.69	11.07
PWC 19	1	9.56		9.66	10.46	9.76	10.57	10.77
PWC 20	1	9.56		9.66	10.46	9.76	10.57	10.77
PWC 21	1	9.56		9.66	10.46	9.76	10.57	10.77
PWC 22	1	9.56		9.66	10.46	9.76	10.57	10.77
PWC 23	1	9.56		9.66	10.46	9.76	10.57	10.77
PWC 24	S		10.28					

Appendix C.3 Definition of Case Description Parameters, Financial Assumptions, and Default Values

The parameters to be defined are in three categories as follows:

- 1) Mining Parameters which provide identifying information for the case description report but which do not directly affect the cash flow calculations.
- 2) Financial Assumptions and Control Parameters which define the major items that determine the method and cost of financing the project and that determine the revenue and profitability. Depreciation method, escalation rate, and purchase method are also defined.
- 3) Default Values which define the major items needed to create yearly pro-forma financial statements for the project. Regional adjustment factors are also defined.

The mining parameters, financial assumptions, and default values for the hypothetical baseline situation for the Green River test case are shown on the following 2 pages.

C.3 Definition of Case Description Parameters, Financial Assumptions and Default Values

CFA MODEL:

504 (CDC0504) HYPOTHETICAL MINE STUDY - BASELINE SOLUTION
 1 GREEN RIVER - 2 SEAMS (28 & 10 FEET)

DATE: 15:44 NOV 17, '76 PAGE NO. 1.02

CASE DESCRIPTION

MINING PARAMETERS

IPPTS	1	INDEX TO PLANT TYPE
CDRTY\$	.638211E 07	COAL DEMAND ROM TONS/YEAR (COMPLEX)
SKYTS	7.00000	STRIPPING RATIO YARDS/ROM TONS
HBT\$	.033000	HEIGHT OF TOPSOIL - FEET
HC\$	38.0000	HEIGHT OF COAL IN FEET
PPFTY\$	.631829E 07	PREPARED COAL TONS/YEAR
PPNED\$	.130000E 15	ENERGY DEMAND FOR COMPLEX BTU/YEAR
PPNHV\$	10250.0	ROM COAL HEAT VALUE BTU/LB
RCC\$	900.000	RECLAMATION - OTHER COSTS - \$/ACRE
VCBP	10286.9	VALUE - COAL BTU/POUND

FINANCIAL ASSUMPTIONS

CDR	2.00000	CAPITAL/DEBT RATIO
GAMK\$	50.0000	GAA - MINERAL RIGHTS (\$/ACRE)
GARA\$	.250000	GAA - ROYALTY AMOUNT (\$/TON)
GASR\$	250.000	GAA - SURFACE RIGHTS (\$/ACRE)
GAST\$	.000000	GAA - SEVERANCE TAX (\$/TON)
RCFD	.100000	RATE - CASH FLOW DISCOUNT
RFIT	.480000	RATE - FEDERAL INCOME TAX
RLTI	.800000E-01	RATE - LONG TERM INTEREST
RSTI	.100000	RATE - SHORT TERM INTEREST
VSPC	.000000	VALUE - REQ. PRICE OF COAL - \$/TON

FINANCIAL CONTROL PARAMETERS

DM1	.000000	RESET DEP. METHOD 1 TO NONZERO VALUE
DM2	.000000	RESET DEP. METHOD 2 TO NONZERO VALUE
DM3	.000000	RESET DEP. METHOD 3 TO NONZERO VALUE
ERAE1	.000000	ESCAL. RATE - ALL EQUIP. INVEST.
EREL	.000000	ESCAL. RATE - ELECTRICITY
ERFU	.000000	ESCAL. RATE - FUELS
ERML	.000000	ESCAL. RATE - MAINTENANCE LABOR
ERMM	.000000	ESCAL. RATE - MAINTENANCE MATERIALS
EROL	.000000	ESCAL. RATE - OPERATING LABOR
EROT	.000000	ESCAL. RATE - OTHER COSTS
ERSPC	.000000	ESCAL. RATE - SELLING PRICE OF COAL
ERTI	.000000	ESCAL. RATE - TIRES
ERWA	.000000	ESCAL. RATE - WATER
ESPC	.000000	ESC. COAL PRICE PER COST ESC. IF 1
PC1	.000000	RESETS PUR. CODE 1 TO NONZERO VALUE
PC2	.000000	RESETS PUR. CODE 2 TO NONZERO VALUE
PC3	.000000	RESETS PUR. CODE 3 TO NONZERO VALUE
PC4	.000000	RESETS PUR. CODE 4 TO NONZERO VALUE
PC5	.000000	RESETS PUR. CODE 5 TO NONZERO VALUE
PC6	.000000	RESETS PUR. CODE 6 TO NONZERO VALUE
PC7	.000000	RESETS PUR. CODE 7 TO NONZERO VALUE

\$ IN NAME INDICATES A MEMO ITEM FOR CFA

C.3 Continued

CFA MODEL:

504 (GDC0504) HYPOTHETICAL MINE STUDY - BASELINE SOLUTION
 1 GREEN RIVER - 2 SEAMS (28 & 10 FEET)

DATE: 15:44 NOV 17, '76 PAGE NO. 01

PARAMETER LIST

LCFCO	0	BUILDS CORRELATION DATA FILE IF 1
LCFDB	0	LOGS DEBUG ARRAYS IF 1
LCFFP	1	PRINTS THE FINANCIAL PARAMETERS IF 1
LCFFSR	1	PRINTS FINANCIAL SUMMARY REPORT IF 1
LCFIL	1	PRINTS INVESTMENT LIST IF 1
LCFIR	1	PRINTS INFRASTRUCTURE REPORT IF 1
LCFMPL	1	PRINTS MAINTENANCE MANPOWER LIST IF 1
LCFOPL	1	PRINTS OPERATING MANPOWER LIST IF 1
LCFPCE	1	PRINTS PRODN. & CASH EXP. REPORT IF 1
LCFPFS	1	PRINTS PRO-FORMA STATEMENTS IF 1
LCFSML	1	PRINTS SERVICE & MATERIALS LIST IF 1
LCFXY	1	BUILDS X,Y PLOT FILE IF 1
NEDNC	0	NEW EQUIP. DATA FOR NEXT CASE IF 1
CEOMW	10.0000	CCST OF ELECTRICITY - \$/MEGAWATT HOUR
CFDMG	300.000	COST OF FUEL - \$/M GALS.
CWDMG	.500000E-01	COST OF WATER - \$/M GALS
DAPG	.100000	DEPLETION ALLOWANCE - PERCENT OF GROSS
DAPN	.500000	DEPLETION ALLOWANCE - PERCENT OF NET
DEC	.000000	DEBT/EQUITY RATIO CONTROL
DER	1.00000	DEBT/EQUITY RATIO
DERT	.100000	DEBT/EQUITY RATIO TOLERANCE
EYAEI	.000000	ESCAL. YEAR - ALL EQUIP. INVEST.
EYMC	.000000	ESCAL. YEAR - HOURLY COSTS
EYML	.000000	ESCAL. YEAR - MAINTENANCE LABOR
EYOL	.000000	ESCAL. YEAR - OPERATING LABOR
EYSPC	.000000	ESCAL. YEAR - SELLING PRICE OF COAL
FALC	1.20000	FACTOR - ANNUAL LEASE COSTS
FCR	.250000	FACTOR - CASH REQUIREMENTS
FHOC	.200000E-01	FACTOR - HOME OFFICE COSTS
FIPT	.500000E-01	FACTOR - INSURANCE & PROPERTY TAX
FSI	.100000	FACTOR - SUPPLIES INVENTORY
FWI	.625000E-01	FACTOR - WAREHOUSE INVENTORY
RAAEI	1.00000	REGIONAL ADJ. - ALL EQUIP. INVEST.
RAEL	1.00000	REGIONAL ADJ. - ELECTRICITY
RAFU	1.00000	REGIONAL ADJ. - FUELS
RAML	1.00000	REGIONAL ADJ. - MAINTENANCE LABOR
RAMM	1.00000	REGIONAL ADJ. - MAINTENANCE MATERIALS
RAOL	1.00000	REGIONAL ADJ. - OPERATING LABOR
RAOT	1.00000	REGIONAL ADJ. - OTHER COSTS
RATI	1.00000	REGIONAL ADJ. - TIRES
RAWA	1.00000	REGIONAL ADJ. - WATER
RCD	.000000	RATE - CASH DIVIDENDS
RCI	.120000	RATE - CONSTRUCTION INTEREST
RITC	.700000E-01	RATE - INVESTMENT TAX CREDIT
RLTOR	10.0000	RATE - L-T DEBT REPAYMENT (YEARS)
VCOY	365.000	VALUE - CALENDAR DAYS/YEAR
VQAP	20.0000	VALUE - DAYS ACCOUNTS PAYABLE
VQAR	45.0000	VALUE - DAYS ACCOUNTS RECEIVABLE
VDCI	10.0000	VALUE - DAYS OF COAL INVENTORY
VFCY	1976.00	VALUE - FIRST CALENDAR YEAR
VDDY	250.000	VALUE - OPERATING DAYS/YEAR
VSC	.000000	VALUE - STARTING CASH
VUPDH	.000000	VALUE - UNION PENSION \$/HOUR

APPENDIX D

Micromodel Baseline Solution

- D.1 Report 1 Financial Summary Report - provides economic highlights such as required investment, selling price, and rate of return.
- Case Description - identifies the case being analyzed, including mining parameters and financial assumptions.
- D.2 Report 2 Investment List - identifies all equipment facilities, and other premining costs; shows total investment and replacement capital.
- D.3 Report 3 Operating Personnel List - identifies all operating personnel, including supervision and staff; shows total manpower needs and payroll.
- D.4 Report 4 Maintenance Personnel List - identifies all maintenance personnel; shows total manpower needs and payroll.
- D.5 Report 5 Services and Materials List - identifies all services and materials; shows annual cost; shows annual quantity of electric power, water, and fuel.
- D.6 Report 6 Infrastructure Report - summarizes physical effects, economic impact, utility requirements, and manpower requirements.
- D.7 Report 7 Production and Cash Expenditure Table - for each year of the project shows production and cash expenditure.
- D.8 Report 8 Financial Statements - for each year of the project compiles an income statement, sources and uses of funds statement, and a balance sheet.

All costs are in January 1975 dollars (no escalation).

Appendix D.1 Financial Summary Report
and Case Description

The Financial Summary report provides economic highlights including required investment, selling price, and rate of return.

The Case Description identifies the case being analyzed, including mining parameters and financial assumptions.

CFA MODEL :

504 (CDC0504) HYPOTHETICAL MINE STUDY - BASELINE SOLUTION
 1 GREEN RIVER - 2 SEAMS (28 & 10 FEET)

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FINANCIAL SUMMARY REPORT

SALES PRICE IN BASE DOLLARS	: \$/PREPARED TON	18.82
	: \$/MILLION BTU	.91
RETURN ON INVESTMENT	: PERCENT	10.00
RETURN ON PAID-IN-CAPITAL	: PERCENT	10.87
CUMMULATIVE INVESTMENT TO STEADY STATE	: M\$	189851.
CUMMULATIVE INVESTMENT TOTAL PROJECT	: M\$	507648.
ANNUAL OPERATING COST AT STEADY STATE	: M\$	60204.
BASE YEAR IS	1975	
STEADY STATE YEAR IS	1985	

PRO-FORMA STATEMENT HIGHLIGHTS

		MIN VALUE		MAX VALUE	
		UNIT	YEAR	UNIT	YEAR
LONG-TERM DEBT	: M\$	257.	1976	45934.	1984
PAID-CAPITAL	: M\$	571.	1976	338432.	2013
RETAINED EARNINGS	: M\$	-52013.	1983	509316.	2013
DEBT/EQUITY	: RATIO	-.65	1976	1.69	1982
CASH	: M\$	0.	1976	7873.	1985
SURPLUS CASH	: M\$	0.	1976	857717.	2014
INVENTORY	: M\$	7.	2015	10415.	1984
SHORT-TERM BORROW	: M\$	0.	1986	56187.	1983
CUR. ASSETS/CUR. LIAB.	: RATIO	.01	1981	272.09	2015
SALES PRICE	: \$/TON	18.82	1982	18.82	1982
NET EARNINGS	: M\$/YR	-19559.	1982	22998.	1988
CASH FLOW	: M\$/YR	-12118.	1982	47451.	2011

CASE DESCRIPTION

MINING PARAMETERS

I IPPT\$	1	INDEX TO PLANT TYPE
C CDRTY\$	.638211E 07	COAL DEMAND ROM TONS/YEAR (COMPLEX)
I SRYT\$	7.00000	STRIPPING RATIO YARDS/ROM TONS
I HRT\$	.000000	HEIGHT OF TOPSOIL - FEET
I HCS	38.0000	HEIGHT OF COAL IN FEET
C PPFTY\$	.631829E 07	PREPARED COAL TONS/YEAR
I PPNED\$	.130000E 15	ENERGY DEMAND FOR COMPLEX BTU/YEAR
I PPNHV\$	10250.0	ROM COAL HEAT VALUE BTU/LB
I ROC\$	900.000	RECLAMATION - OTHER COSTS - \$/ACRE
D VCBP	13286.9	VALUE - COAL BTU/POUND

FINANCIAL ASSUMPTIONS

I COR	2.00000	CAPITAL/DEBT RATIO
I GAMR\$	50.0000	GAA - MINERAL RIGHTS (\$/ACRE)
I GARAS	.250000	GAA - ROYALTY AMOUNT (\$/TON)
I GASR\$	250.000	GAA - SURFACE RIGHTS (\$/ACRE)
I GAST\$	.000000	GAA - SEVERANCE TAX (\$/TON)
I RCFD	.100000	RATE - CASH FLOW DISCOUNT
I RFIT	.480000	RATE - FEDERAL INCOME TAX
I RLTI	.800000E-01	RATE - LONG TERM INTEREST
I RSTI	.100000	RATE - SHORT TERM INTEREST
I VSPC	.000000	VALUE - REQ. PRICE OF COAL - \$/TON

FINANCIAL CONTROL PARAMETERS

I DM1	.000000	RESET DEP. METHOD 1 TO NONZERO VALUE
I DM2	.000000	RESET DEP. METHOD 2 TO NONZERO VALUE
I DM3	.000000	RESET DEP. METHOD 3 TO NONZERO VALUE
I EPAEI	.000000	ESCAL. RATE - ALL EQUIP. INVEST.
I EREL	.000000	ESCAL. RATE - ELECTRICITY
I ERFU	.000000	ESCAL. RATE - FUELS
I ERML	.000000	ESCAL. RATE - MAINTENANCE LABOR
I ERMM	.000000	ESCAL. RATE - MAINTENANCE MATERIALS
I EROL	.000000	ESCAL. RATE - OPERATING LABOR
I EROT	.000000	ESCAL. RATE - OTHER COSTS
I ERSPC	.000000	ESCAL. RATE - SELLING PRICE OF COAL
I ERTI	.000000	ESCAL. RATE - TIRES
I ERWA	.000000	ESCAL. RATE - WATER
I ESPC	.000000	ESC. COAL PRICE PER COST ESC. IF 1
I PC1	.000000	RESETS PUR. CODE 1 TO NONZERO VALUE
I PC2	.000000	RESETS PUR. CODE 2 TO NONZERO VALUE
I PC3	.000000	RESETS PUR. CODE 3 TO NONZERO VALUE
I PC4	.000000	RESETS PUR. CODE 4 TO NONZERO VALUE
I PC5	.000000	RESETS PUR. CODE 5 TO NONZERO VALUE
I PC6	.000000	RESETS PUR. CODE 6 TO NONZERO VALUE
I PC7	.000000	RESETS PUR. CODE 7 TO NONZERO VALUE

\$ IN NAME INDICATES A MEMO ITEM FOR CFA

Appendix D.2 Investment List

The investment list identifies all equipment facilities, and other premining costs; shows total investment and replacement capital. Columns A through R of the investment list are defined as follows:

- Column A: For each mining operation the steady state annual production requirement is given followed by a list of equipment or facilities giving the equipment file number, type, and size. Note that the general and administrative operation includes ancillary facilities, ancillary equipment (including mobile equipment, such as pick-ups, service vehicles, and maintenance vehicles), and premining costs.
- Column B: Original quantity of equipment required to reach steady state production.
- Column C: Fleet Spares.
- Column D: Total quantity equals original quantity plus fleet spares.
- Column E: Unit investment is the regionally adjusted base year required investment per item.
- Column F: Total investment equals total quantity times unit investment. Note that items with an asterisk are deferred purchases which are additional equipment required as the mine development becomes further away from the central plant.
- Column G: Productive hours per year for the equipment.
- Column H: Depreciation life in hours.
- Column I: Replacement years equals depreciation life divided by productive hours per year.
- Column J: Replacement quantity is the number of new machines that must be purchased at intervals later in the project to replace worn out machines.
- Column K: Replacement capital equals replacement quantity times unit investment.

- Column L: Salvage fraction is the portion of the purchase price which can be recovered when the equipment is replaced.
- Column M: Depreciation method
1 = straight line
2 = declining balance
3 = double declining balance.
- Column N: Purchase year is the project year in which a commitment must be made to purchase equipment (takes into account purchase lead time).
Purchase plan is the method of progress payments for the equipment.
1 = Lump sum with order
2 = Lump sum at delivery
3 = 25% with order, 75% at delivery
4 = 50% with order, 50% at delivery
5 = Equal payments each year
6 = Lease
- Column O: Base year for escalation of unit investment determined by subtracting the calendar year of the cost file from the calendar year of the start of the project.
- Column P: Escalation rate as an annual fraction.
- Column Q: Regional adjustment as a multiplier for base costs.
- Column R: Beginning and ending operating year of the machines.

CFA MODEL:

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 1 GREEN RIVER - 2 SEAMS (28 & 10 FEET)

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A		B	C	D	E	INVESTMENT LIST					L	M	N	O	P	Q	R		
MINING		: ORIG SPR TOT			UNIT	TOTAL	PROD	DEPREC	REPL	REPL	REPL	SAL	DP	PUR	BAS	INFL	REF	OPR YRS	
OPERATION		: QTY QTY QTY			INVEST	INVEST	HRS	HOURS	YRS	QTY	CAPITAL	FRC	MD	YR	PL	YR	RATE	ADJ	1ST-LAST
					(M\$)	(M\$)	(H/YR)				(M\$)								
OVER. DRILL & BLAST (THOUSAND CU YDS)		42720																	
RD9	ROTARY DRILL 8 45 R ER8	6	0	6	330.7	1984.	3263	20000	6.1	24	7937.	.00	1	6	2	0	.00	1.00	7-38
CD10	TR TRACTOR ST BLADE-RIPPER	6	0	6	151.7	910.	1632	24000	14.7	12	1820.	.00	1	6	2	0	.00	1.00	7-38
LD1	WHEEL LCADER 1.5 CUBIC YARD	6	0	6	36.4	218.	1632	12000	7.4	24	874.	.00	1	6	2	0	.00	1.00	7-38
TDX1	PRILL TRUCK 6 TON CAPACITY	6	0	6	36.0	216.	1632	20000	12.3	12	432.	.00	1	6	2	0	.00	1.00	7-38
TOTAL (LESS DEFERRED)						3329.					11063.								
OVERBURDEN REMOVAL (THOUSAND CU YDS)		43241																	
LD19	WHEEL LOADER 10 CUBIC YARD	18	5	23	240.1	5522.	7365	12000	1.6	324	77792.	.15	1	6	2	0	.00	1.00	7-38
TD26	HAUL TRUCK W050 D050RM	90	15	105	182.6	19173.	7365	20000	2.7	990	180774.	.00	1	6	2	0	.00	1.00	7-38
CD3	TR TRACTOR STRAIGHT BLADE	9	3	12	135.3	1624.	7365	24000	3.3	81	10959.	.00	1	6	2	0	.00	1.00	7-38
CD10	TR TRACTOR ST BLADE-RIPPER	6	0	6	151.7	910.	7365	24000	3.3	54	8192.	.00	1	6	2	0	.00	1.00	7-38
GD6	MOTORGRADER 16 FT BLADE	6	0	6	124.9	749.	7365	30000	4.1	42	5246.	.00	1	6	2	0	.00	1.00	7-38
TDX2	WATER TRUCK 6000 GALLON	6	0	6	124.6	748.	7365	40000	5.4	30	3738.	.00	1	6	2	0	.00	1.00	7-38
TOTAL (LESS DEFERRED)						28726.					286701.								
COAL DRILL & BLAST (THOUSAND CU YDS)		6382																	
RD24	AUGER DRILL 6 INCH	6	0	6	70.6	424.	1632	20000	12.3	12	847.	.00	1	6	2	0	.00	1.00	7-38
TOTAL (LESS DEFERRED)						424.					847.								
COAL LOAD & HAUL (THOUSAND RCM TONS)		6382																	
L19C	WH LOADER 10 CUBIC YARD	12	3	15	240.1	3601.	1631	12000	7.4	48	11525.	.00	1	6	2	0	.00	1.00	7-36
T26C	HAUL TRUCK 50 TON	60	9	69	182.6	12599.	1631	20000	12.3	120	21912.	.00	1	6	2	0	.00	1.00	7-36
GD6A	MOTORGRADER 16 FT BLADE	6	0	6	124.9	749.	1631	15000	9.2	18	2248.	.00	1	6	2	0	.00	1.00	7-36
PUMP	8 INCH PUMP 125000 GPH	6	1	7	10.0	70.	1631	21600	13.2	12	120.	.00	1	6	2	0	.00	1.00	7-36
TOTAL (LESS DEFERRED)						17020.					35805.								
COAL HANDLE & PREP (THOUSAND CLEAN TONS)		6318																	
CONSTRUCTION INTEREST						20988.													
PRRB	REC & BREAK PREP. PLANT	6	0	6	1782.5	10695.	3625	108750	30.0	0	0.	.00	1	4	5	0	.00	1.00	7-38
PRBS	BL ENC-STOCK PREP. PLANT	6	0	6	6787.5	40725.	5438	163140	30.0	0	0.	.00	1	4	5	0	.00	1.00	7-38
PRCL	COAL LOADCUT PREP. PLANT	6	0	6	204.2	1225.	8712	261360	30.0	0	0.	.00	1	4	5	0	.00	1.00	7-38
PRCS	CRUSH-SCREEN PREP. PLANT	6	0	6	956.7	5740.	5438	163140	30.0	0	0.	.00	1	4	5	0	.00	1.00	7-38
PRSI	CS SUPPORT PREP. PLANT	6	0	6	1929.3	11576.	2000	60000	30.0	0	0.	.00	1	4	5	0	.00	1.00	7-38
TOTAL (LESS DEFERRED)						90949.					0.								

99

100

A LAND RECLAMATION (ACRES)			B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R		
			368																		
CD3	TR	TRACTOR STRAIGHT BLADE	6	0	6	135.3	812.	1465	24000	16.4	6	812.	.00	1	6	2	0	.00	1.00	7-38	
TOTAL (LESS DEFERRED)							812.													812.	
GENERAL & ADMINISTRATION																					
CONSTRUCTION INTEREST							4941.														
SITE	ROADS & SITE	ANC. FAC.	1	0	1	1500.0	1500.	2000	64000	32.0	0	0.	.00	1	4	5	0	.00	1.00	7-38	
BLDG	BUILDINGS	ANC. FAC.	1	0	1	5618.8	5619.	2000	64000	32.0	0	0.	.00	1	4	5	0	.00	1.00	7-38	
PWR	ELECT. SYS.	ANC. FAC.	1	0	1	8900.0	8900.	2000	64000	32.0	0	0.	.00	1	4	5	0	.00	1.00	7-38	
H2O	WATER SYS.	ANC. FAC.	1	0	1	200.0	200.	2000	64000	32.0	0	0.	.00	1	4	5	0	.00	1.00	7-38	
COM	COMMUN. SYS.	ANC. FAC.	1	0	1	250.0	250.	2000	64000	32.0	0	0.	.00	1	4	5	0	.00	1.00	7-38	
MBEQ	MOBILE SUP.	ANC. FAC.	1	0	1	1200.0	1200.	2000	64000	32.0	0	0.	.00	1	5	5	0	.00	1.00	7-38	
SHEQ	EQUIP. SHOP	ANC. FAC.	1	0	1	1000.0	1000.	2000	64000	32.0	0	0.	.00	1	5	5	0	.00	1.00	7-38	
LAND	LAND RIGHTS	PREMINE	1	0	1	302.5	303.	2000	64000	32.0	0	0.	.00	1	2	1	0	.00	1.00	7-38	
XDRL	EXPL. DRILL.	PREMINE	1	0	1	252.0	252.	2000	64000	32.0	0	0.	.00	1	2	1	0	.00	1.00	7-38	
ENG	CONT. ENG.	PREMINE	1	0	1	6000.0	6000.	2000	64000	32.0	0	0.	.00	1	1	5	0	.00	1.00	7-38	
EIS	E. I. S.	PREMINE	1	0	1	1000.0	1000.	2000	64000	32.0	0	0.	.00	1	3	1	0	.00	1.00	7-38	
TOTAL (LESS DEFERRED)							31164.													0.	
TOTALS							172423.													335227.	

Appendix D.3 Operating Personnel List

The operating personnel list identifies all operating personnel, including supervision and staff; shows total manpower needs and payroll. Columns A through M of the operating personnel list are defined as follows:

- Column A: For each mining operation the equipment file number and type is given as well as the operator's wage classification description.
- Column B: Union pay grade.
- Column C: Personnel schedule basis (shifts per day - hours per shift - days per week).
- Column D: Quantity of operators required per machine shift.
- Column E: Quantity of machines requiring operators.
- Column F: Scheduled machine hours per year.
- Column G: Total scheduled hours equals quantity of machines times scheduled machine hours.
- Column H: Effective hours per year (hours on the job per man) for the personnel schedule basis.
- Column I: Manpower needs represent the total number of men that must be hired to have men on the job for every scheduled hour for the machine.
- Column J: Base year dollars per hour per man based on wage table plus regional adjustment and additional union pension.
- Column K: Annual payroll in base year dollars for steady state production.
- Column L: Manpower required to operate the deferred equipment.
- Column M: Annual payroll for operators of deferred equipment.

CFA MODEL:

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A M I N I N G O P E R A T I O N		B : GD	C PERSONNEL SCHEDULE	D QTY	E EQP QTY	F SCHED HR/YR	G TOTAL SCHED HR	H EFF HR/YR	I MANPOWER NEEDS	J PAYRL RATE	K INITIAL PAYROLL (M\$/YR)	L DEFR MANP (MAX)	M DEFR PAYROLL (M\$/YR)
OVER. DRILL & BLAST													
RD9	RTARY DRILL	DRILLER & SHOOTER	3	2-7.25-5	1.00	6	3625	21750	1618	13.4	10.13	220.3	
		HELPER	2	2-7.25-5	1.00	6	3625	21750	1618	13.4	9.77	212.5	
CD10	TR TRACTOR	MOBILE EQUIP OPERAT	3	1-7.25-5	1.00	6	1813	10878	1618	6.7	10.03	109.1	
		STRIP MACH OPERATOR	5	3-8.00-6	1.00	6	1813	10878	2269	4.8	12.90	140.3	
LD1	WHEEL LOADER	MOBILE EQUIP OPERAT	3	1-7.25-5	1.00	6	1813	10878	1618	6.7	10.03	109.1	
BLST	BLAST CREW A	DRILLER & SHOOTER	3	1-7.25-5	1.00	6	1813	10878	1618	6.7	10.03	109.1	
		HELPER	2	1-7.25-5	4.00	6	1813	10878	1618	26.9	9.67	420.8	
TDX1	PRILL TRUCK	MOBILE EQUIP OPERAT	3	1-7.25-5	1.00	6	1813	10878	1618	6.7	10.03	109.1	
OVERBURDEN REMOVAL													
LD19	WHEEL LOADER	STRIP MACH OPERATOR	5	3-8.00-6	1.00	18	8183	147294	2269	64.9	12.90	1900.1	
TDX2	HAUL TRUCK	MOBILE EQUIP OPERAT	3	3-8.00-6	1.00	90	8183	736470	2269	324.6	11.46	8439.9	
CD3	TR TRACTOR	MOBILE EQUIP OPERAT	3	2-7.25-6	1.00	9	8183	73647	1942	37.9	10.97	807.9	
		STRIP MACH OPERATOR	5	3-8.00-6	1.00	9	8183	73647	2269	32.5	12.90	950.0	
CD10	TR TRACTOR	MOBILE EQUIP OPERAT	3	1-7.25-5	1.00	6	8183	49098	1618	30.3	10.03	492.5	
		STRIP MACH OPERATOR	5	3-8.00-6	1.00	6	8183	49098	2269	21.6	12.90	633.4	
GD6	MOTORGRADER	MOBILE EQUIP OPERAT	3	3-8.00-6	1.00	6	8183	49098	2269	21.6	11.46	562.7	
TDX2	WATER TRUCK	MOBILE EQUIP OPERAT	3	3-8.00-6	1.00	6	8183	49098	2269	21.6	11.46	562.7	
COAL GRILL & BLAST													
RD24	AUGER DRILL	DRILLER & SHOOTER	3	1-7.25-5	1.00	6	1813	10878	1618	6.7	10.03	109.1	
COAL LOAD & HAUL													
LI9C	WM LOADER	COAL LOADING OPERAT	5	1-7.25-5	1.00	12	1813	21756	1618	13.4	11.32	246.3	
T26C	HAUL TRUCK	MOBILE EQUIP OPERAT	3	1-7.25-5	1.00	60	1813	108780	1618	67.2	10.03	1091.1	
GD6A	MOTORGRADER	MOBILE EQUIP OPERAT	3	1-7.25-5	1.00	6	1813	10878	1618	6.7	10.03	109.1	
PUMP	8 INCH PUMP	UTILITY MAN	1	1-7.25-5	1.00	6	1813	10878	1618	6.7	9.56	104.0	
COAL HANDLE & PREP													
PRR8	REC & BREAK	STAT EQUIP OPERATOR	3	2-7.25-5	.73	6	3625	21750	1618	9.8	10.13	160.8	
		HELPER	2	2-7.25-5	.73	6	3625	21750	1618	9.8	9.77	155.1	
		LABORER	1	2-7.25-5	1.10	6	3625	21750	1618	14.8	9.66	231.1	
PRB5	BLEND-STOCK	STAT EQUIP OPERATOR	3	3-7.25-5	3.11	6	5438	32628	1618	62.7	10.23	1038.1	
		LABORER	1	3-7.25-5	.73	6	5438	32628	1618	14.7	9.76	232.5	
PRCL	COAL LOADOUT	STAT EQUIP OPERATOR	3	3-8.00-6	.73	6	8712	52272	2269	16.8	11.46	437.3	
		HELPER	2	3-8.00-6	.73	6	8712	52272	2269	16.8	11.07	422.4	
		LABORER	1	3-8.00-6	.37	6	8712	52272	2269	8.5	10.77	208.3	
PRCS	CRUSH-SCREEN	STAT EQUIP OPERATOR	3	3-7.25-5	.73	6	5438	32628	1618	14.7	10.23	243.7	
		HELPER	2	3-7.25-5	.73	6	5438	32628	1618	14.7	9.87	235.1	
		UTILITY MAN	1	3-7.25-5	1.10	6	5438	32628	1618	22.2	9.76	350.3	
		LABORER	1	3-7.25-5	.37	6	5438	32628	1618	7.5	9.76	117.8	
PR51	CS SUPPORT	MOBILE EQUIP OPERAT	3	2-7.25-5	3.52	6	2000	12000	1618	26.1	10.13	427.9	
		UTILITY MAN	1	2-7.25-5	1.76	6	2000	12000	1618	13.1	9.66	204.0	
LAND RECLAMATION													
CD3	TR TRACTOR	MOBILE EQUIP OPERAT	3	2-7.25-6	1.00	6	1630	9780	1942	5.0	10.97	107.3	
		STRIP MACH OPERATOR	5	3-8.00-6	1.00	6	1630	9780	2269	4.3	12.90	126.2	
GENERAL & ADMINISTRATION													

A	B	C	D	E	F	G	H	I	J	K	L	M
STF SUPERV. PER. GEN & ADM STAFF	S	1-8.00-5	329.00	1	2000	2000	2000	329.0	10.28	6764.2		

TOTALS

1332.0

28901.0

.0*

.0

INFLATION ESCALATION RATE = .00
 REGIONAL ADJUSTMENT FACTOR = 1.00

Appendix D.4 Maintenance Personnel List

The maintenance personnel list identifies all maintenance personnel; shows total manpower needs and payroll. Columns A through M of the maintenance personnel list are defined as follows:

- Column A: For each mining operation the equipment file number and type is given as well as the maintenance wage classification description.
- Column B: Union pay grade.
- Column C: Personnel schedule basis (shifts per day-hours per shift-days per week).
- Column D: Fraction of maintenance labor hourly cost to be allocated to a particular maintenance wage classification type.
- Column E: Base year maintenance hourly cost including regional adjustment.
- Column F: Total productive hours equals the number of machines times productive machine hours.
- Column G: Effective hours per year (hours on the job per man) for the personnel schedule basis.
- Column H: Manpower needs represents the total number of men that must be hired to have men on the job for every maintenance labor hour required for the machine.
- Column I: Base year dollars per hour per man based on wage table plus regional adjustment and additional union pension.
- Column J: Required maintenance labor hours equals the hourly cost times total productive hours divided by payroll rate.
- Column L: Manpower required to maintain the deferred equipment.
- Column M: Annual payroll for maintenance of deferred equipment.

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A MINING OPERATION	B : GD	C PERSONNEL SCHEDULE	D FRAC	E HOURLY COST	F TOTAL PROD HRS	G EFF HR/YR	H MANPOWER NEEDS	I PAYR PATE	J REQD HOURS	K INITIAL PAYROLL (M\$/YR)	L DEFR MANP (MAX)	M DEFR PAYROLL (M\$/YR)
OVER. DRILL & BLAST												
RD9 ROTARY DRILL MECHANIC	4	3-7.25-6	1.00	7.61	19578	1942	6.6	11.58	12866	149.0		
CD10 TR TRACTOR MECHANIC	4	3-7.25-6	1.00	4.42	9792	1942	1.9	11.58	3737	43.3		
LD1 WHEEL LOADER MECHANIC	4	3-7.25-6	1.00	1.06	9792	1942	.5	11.58	896	10.4		
TDX1 DRILL TRUCK MECHANIC	4	3-7.25-6	1.00	.95	9792	1942	.4	11.58	803	9.3		
OVERBURDEN REMOVAL												
LD19 WHEEL LOADER MECHANIC	4	3-7.25-6	1.00	7.21	132570	1942	42.5	11.58	82541	955.8		
TD26 HAUL TRUCK MECHANIC	4	3-7.25-6	1.00	4.66	662850	1942	137.4	11.58	266742	3088.9		
CD3 TR TRACTOR MECHANIC	4	3-7.25-6	1.00	3.96	66285	1942	11.7	11.58	22667	262.5		
CD10 TR TRACTOR MECHANIC	4	3-7.25-6	1.00	4.42	44190	1942	8.7	11.58	16866	195.3		
GD6 MOTORGRADER MECHANIC	4	3-7.25-6	1.00	2.50	44190	1942	4.9	11.58	9540	110.5		
TDX2 WATER TRUCK MECHANIC	4	3-7.25-6	1.00	6.35	44190	1942	12.5	11.58	24231	280.6		
COAL DRILL & BLAST												
RD24 AUGER DRILL MECHANIC	4	3-7.25-6	1.00	1.95	9792	1942	.8	11.58	1648	19.1		
COAL LOAD & HAUL												
L19C WH LOADER MECHANIC	4	3-7.25-6	1.00	7.21	19572	1942	6.3	11.58	12186	141.1		
T26C HAUL TRUCK MECHANIC	4	3-7.25-6	1.00	4.66	97860	1942	20.3	11.58	39380	456.0		
GD6A MOTORGRADER MECHANIC	4	3-7.25-6	1.00	2.50	9786	1942	1.1	11.58	2112	24.5		
PUMP 8 INCH PUMP MECHANIC	4	3-7.25-6	1.00	3.65	9786	1942	1.6	11.58	3084	35.7		
COAL HANDLE & PREP												
PRRB REC & BREAK ELECTRICIAN	4	2-7.25-5	.07	26.20	21750	1618	2.5	10.59	3991	42.2		
MACHINIST	4	2-7.25-5	.07	26.20	21750	1618	2.5	10.59	3981	42.2		
MECHANIC	4	2-7.25-5	.30	26.20	21750	1618	9.8	10.59	15927	168.7		
WELDER	3	2-7.25-5	.07	26.20	21750	1618	2.5	10.13	3994	40.5		
REPAIRMAN	3	2-7.25-5	.21	26.20	21750	1618	7.4	10.13	11925	120.8		
HELPER	2	2-7.25-5	.20	26.20	21750	1618	7.4	9.77	11956	116.8		
LABORER	1	2-7.25-5	.07	26.20	21750	1618	2.5	9.66	4011	38.7		
PRBS BLEND-STOCK ELECTRICIAN	4	2-7.25-5	.09	29.70	32628	1618	4.9	10.59	7961	84.3		
MACHINIST	4	2-7.25-5	.04	29.70	32628	1618	2.5	10.59	4026	42.6		
MECHANIC	4	2-7.25-5	.26	29.70	32628	1618	14.8	10.59	23883	252.9		
WELDER	3	2-7.25-5	.04	29.70	32628	1618	2.5	10.13	4017	40.7		
REPAIRMAN	3	2-7.25-5	.12	29.70	32628	1618	7.4	10.13	11957	121.1		
HELPER	2	2-7.25-5	.40	29.70	32628	1618	24.6	9.77	39773	388.6		
LABORER	1	2-7.25-5	.04	29.70	32628	1618	2.5	9.66	4012	38.8		
PRCL COAL LOADOUT ELECTRICIAN	4	2-7.25-5	.07	11.19	52272	1618	2.4	10.59	3811	40.4		
MACHINIST	4	2-7.25-5	.07	11.19	52272	1618	2.4	10.59	3811	40.4		
MECHANIC	4	2-7.25-5	.28	11.19	52272	1618	9.5	10.59	15354	162.6		
WELDER	3	2-7.25-5	.07	11.19	52272	1618	2.4	10.13	3810	38.6		
REPAIRMAN	3	2-7.25-5	.20	11.19	52272	1618	7.1	10.13	11490	116.4		
HELPER	2	2-7.25-5	.26	11.19	52272	1618	9.5	9.77	15326	149.7		
LABORER	1	2-7.25-5	.06	11.19	52272	1618	2.4	9.66	3814	36.9		
PRCS CRUSH-SCREEN ELECTRICIAN	4	2-7.25-5	.13	19.89	32628	1618	5.0	10.59	8027	85.0		
MACHINIST	4	2-7.25-5	.06	19.89	32628	1618	2.4	10.59	3922	41.5		
MECHANIC	4	2-7.25-5	.26	19.89	32628	1618	9.8	10.59	15871	168.1		
WELDER	3	2-7.25-5	.06	19.89	32628	1618	2.4	10.13	3907	39.6		
REPAIRMAN	3	2-7.25-5	.19	19.89	32628	1618	7.4	10.13	11980	121.4		

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A	B	C	D	E	F	G	H	I	J	K	L	M	
	HELPER	2	2-7.25-5	.24	19.89	12628	1618	9.8	9.77	15875	155.1		
	LABORER	1	2-7.25-5	.06	19.89	32628	1618	2.4	9.66	3963	38.3		
PRSI CS SUPPCRT	ELECTRICIAN	4	2-7.25-5	.10	63.74	12000	1618	4.3	10.59	7005	74.2		
	MACHINIST	4	2-7.25-5	.19	63.74	12000	1618	8.7	10.59	14084	149.2		
	MECHANIC	4	2-7.25-5	.29	63.74	12000	1618	13.0	10.59	21090	223.3		
	REPAIRMAN	3	2-7.25-5	.23	63.74	12000	1618	10.9	10.13	17592	178.2		
	STAT EQUIP OPERATOR	3	2-7.25-5	.09	63.74	12000	1618	4.3	10.13	7022	71.1		
	UTILITY MAN	1	2-7.25-5	.09	63.74	12000	1618	4.4	9.66	7126	68.8		
LAND RECLAMATION													
CD3 TR TRACTOR	MECHANIC	4	3-7.25-6	1.00	3.96	8790	1942	1.5	11.58	3005	34.8		
GENERAL & ADMINISTRATION													
TOTALS								672.7			9354.4	.0*	.0
INFLATION ESCALATION RATE = .00													
REGIONAL ADJUSTMENT FACTOR = 1.00													

Appendix D.5 Services and Materials List

The services and materials list identifies all services and materials; shows annual cost; shows annual quantity of electric power, water, and fuel. Columns A through K of the services and materials list are defined as follows:

- Column A: For each mining operation the equipment file number and type is given as well as a listing of the types of hourly services and materials costs associated with the equipment.
- Column B: Total productive hours equals the number of machines times productive machine hours.
- Column C: Base year materials and services hourly cost including regional adjustment.
- Column D: Usage adjustment to account for any variation from the assumed conditions used in the equipment data file.
- Column E: Annual cost equals total productive hours times hourly cost times use factor.
- Column F: Annual steady state electric power requirements.
- Column G: Annual steady state water requirements.
- Column H: Annual steady state fuel requirements.
- Column I: Electric power for deferred equipment.
- Column J: Water for deferred equipment.
- Column K: Fuel for deferred equipment.

A		B	SERVICES AND MATERIALS LIST			F	G	H	I	J	K
MINING	:	TOTAL	C	D	E	F	G	H	I	J	K
OPERATION	:	PROD	HOURLY	USE	ANNUAL	ANNUAL	QUANTITY		DEFR.	ANNUAL	QUANTITY
		(HR/YR)	COST	FACTR	COST	10.00	.05	300.00	10.00	.05	300.00
			(ADJ)	(M\$)	E-MWH	W-MGAL	F-MGAL	E-MWH	W-MGAL	F-MGAL	
OVER. DRILL & BLAST											
RD9	ROTARY DRILL B 45 R ER8										
	MATERIAL	19578	5.07	1.000	99.3	0	0	0	0	0	0
	ELECTRIC	19578	1.76	1.000	34.5	3445	0	0	0	0	0
	OTHER	19578	5.88	1.000	115.1	0	0	0	0	0	0
CD10	TR TRACTOR ST BLADE-RIPPER										
	MATERIAL	9792	10.10	1.000	98.9	0	0	0	0	0	0
	FUELS	9792	3.71	1.000	36.3	0	0	121	0	0	0
LD1	WHEEL LCADER 1.5 CUBIC YARD										
	MATERIAL	9792	4.73	1.000	46.3	0	0	0	0	0	0
	FUELS	9792	1.07	1.000	10.5	0	0	34	0	0	0
	TIRES	9792	.32	1.000	3.1	0	0	0	0	0	0
BLST	BLAST CREW AND EXPLOSIVES										
	OTHER	9792	236.08	1.000	2311.7	0	0	0	0	0	0
TDX1	PRILL TRUCK 6 TCN CAPACITY										
	MATERIAL	9792	1.31	1.000	12.8	0	0	0	0	0	0
	FUELS	9792	.66	1.000	6.5	0	0	21	0	0	0
	TIRES	9792	.57	1.000	5.6	0	0	0	0	0	0
TOTALS (LESS DEFERRED)					2780.6						
OVERBURDEN REMOVAL											
LD19	WHEEL LOADER 10 CUBIC YARD										
	MATERIAL	132570	37.26	1.000	4939.6	0	0	0	0	0	0
	FUELS	132570	6.28	1.000	832.5	0	0	2775	0	0	0
	TIRES	132570	3.81	1.000	505.1	0	0	0	0	0	0
TD26	HAUL TRUCK W050 D050RM										
	MATERIAL	662850	7.00	1.000	4639.9	0	0	0	0	0	0
	FUELS	662850	5.94	1.000	3937.3	0	0	13124	0	0	0
	TIRES	662850	4.11	1.000	2724.3	0	0	0	0	0	0
CD3	TR TRACTOR STRAIGHT BLADE										
	MATERIAL	66285	7.00	1.000	464.0	0	0	0	0	0	0
	FUELS	66285	3.71	1.000	245.9	0	0	819	0	0	0
CD10	TR TRACTOR ST BLADE-RIPPER										
	MATERIAL	44190	10.10	1.000	446.3	0	0	0	0	0	0
	FUELS	44190	3.71	1.000	163.9	0	0	546	0	0	0
GD6	MOTORGRADER 16 FT BLADE										
	MATERIAL	44190	16.31	1.000	720.7	0	0	0	0	0	0
	FUELS	44190	2.82	1.000	124.6	0	0	415	0	0	0
	TIRES	44190	1.76	1.000	77.8	0	0	0	0	0	0
TDX2	WATER TRUCK 6000 GALLON										
	MATERIAL	44190	5.70	1.000	251.9	0	0	0	0	0	0
	FUELS	44190	5.65	1.000	249.7	0	0	832	0	0	0
	TIRES	44190	.50	1.000	22.1	0	0	0	0	0	0
	WATER	44190	.50	1.000	22.1	0	441899	0	0	0	0
TOTALS (LESS DEFERRED)					20367.8						
COAL DRILL & BLAST											
RD24	AUGER DRILL 6 INCH										

	A	B	C	D	E	F	G	H	I	J	K
FUELS		2000	40.00	1.000	80.0	0	0	200	0	0	0
WATER		2000	.45	1.000	.9	0	17999	0	0	0	0
PWR ELECT. SYS. ANC. FAC.											
H2C WATER SYS. ANC. FAC.											
COM COMMUN. SYS. ANC. FAC.											
MBEQ MOBILE SUP. ANC. FAC.											
SHEQ EQUIP. SHOP ANC. FAC.											
LAND LAND RIGHTS PREMINE		2000	45.37	1.000	90.7	0	0	0	0	0	0
OTHER											
XDRL EXPL. DRILL. PREMINE											
ENG CONT. ENG. PREMINE											
EIS E. I. S. PREMINE											
STF SUPERV. PER. MATERIAL		2000	329.28	1.000	658.6	0	0	0	0	0	0
RLTX ROY-SEV. TAX OTHER		2000	1076.98	1.000	2154.0	0	0	0	0	0	0
INSURANCE & PROP. TAX					6669.2						
HOME OFFICE COSTS					1563.7						
TOTALS (LESS DEFERRED)					11217.1						
TOTALS (LESS DEFERRED)					39930.0	47362	459899	21686	0	0	0
TOTAL DEFERRED					.0*						

		REGIONAL	INFLATION								
		ADJUSTMENT	ESCALATION								
		FACTOR	RATE								
MATERIAL :		1.00	.00								
FUELS :		1.00	.00								
TIRES :		1.00	.00								
ELECTRIC :		1.00	.00								
WATER :		1.00	.00								
OTHER :		1.00	.00								

Appendix D.6 Infrastructure Report

The infrastructure report summarizes the physical effects, economic impact, utility requirements, and manpower requirements as follows:

- 1) Physical Effects: Gives the steady state annual amount and the total for the project life for acreage disturbed, preparation plant reject material, prepared coal production, and overburden handled.
- 2) Economic Impact: Gives the steady state annual amount and the maximum annual amount for the payroll (operating and maintenance personnel), fuel purchases, tire purchases, other materials and services purchases, insurance and property tax and royalty and severance tax.
- 3) Utility Requirements: Gives the steady state annual water and electric power requirements.
- 4) Manpower Requirements: Gives the steady state annual manpower requirements and the maximum annual manpower requirements for both operating and maintenance personnel.

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INFRASTRUCTURE REPORT

ALL FIGURES IN BASE DOLLARS

PHYSICAL EFFECTS :	UNITS	ANNUAL	PROJECT TOTAL
ACREAGE DISTURBED	ACRES	367	10966
PREP PLANT REJECT	MTONS	64	1907
COAL PRODUCTION	MTONS	6318	188284
OVERBURDEN HANDLED	MCYDS	43240	1288575

ECONOMIC IMPACT :	UNITS	ANNUAL	+ DEF
PAYROLL	M\$	38256.	38256.
FUEL PURCHASES	M\$	6506.	6506.
TIRE PURCHASES	M\$	3832.	3832.
MATL & OTHER SERVICES	M\$	18709.	18709.
INS. & PROP. TAXES	M\$	6669.	6669.
ROYALTY & SEVR. TAXES	M\$	2154.	2154.
TOTAL		76125.	76125.

UTILITY REQUIREMENTS :	UNITS	ANNUAL
WATER	ACRE-FEET	1411.
ELECTRICITY	MEGA WH	47362.

GRADE	OPERATING		MAINTENANCE	
	ANNUAL	+ DEF	ANNUAL	+ DEF
S	329.0	329.0	.0	.0
1	87.5	87.5	14.2	14.2
5	141.6	141.6	.0	.0
2	81.7	81.7	51.3	51.3
4	.0	.0	353.1	353.1
3	692.3	692.3	54.2	54.2
TOTAL	1332.0	1332.0	472.7	472.7

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Appendix D.7 Production and Cash Expenditure Table

The production and cash expenditure table shows for each year of the project the production and cash expenditure as follows:

- 1) **Production:** For each mining operation the total production is shown for each year and summarized for the total project. The total energy content of the prepared coal is also shown for each year.
- 2) **Expenditures:** For each mining operation the expenditures are shown for three categories. The equipment expenditures include all progress payments and final payments for the original quantity, fleet spares, replacements, and deferred purchases. The manpower expenditures include the payroll for both operating and maintenance personnel. The services and materials expenditures include the costs of maintenance materials, fuel, tires, electric power, water, and other services and materials.

PRODUCTION AND CASH EXPENDITURE TABLE (\$M)

	1976	1977	1978	1979	1980	1981	1982	1983
	*****	*****	*****	*****	*****	*****	*****	*****
OVER. DRILLING & BLASTING (MILLION CU YDS)	0	0	0	0	0	0	11	26
EQUIPMENT	0	0	0	0	0	0	1110	1110
MANPOWER	0	0	0	0	0	0	547	1095
SERVICES & MATERIALS	0	0	0	0	0	0	927	1854
OVERBURDEN REMOVAL (MILLION CU YDS)	0	0	0	0	0	0	12	26
EQUIPMENT	0	0	0	0	0	0	9575	11016
MANPOWER	0	0	0	0	0	0	6414	12828
SERVICES & MATERIALS	0	0	0	0	0	0	6789	13579
COAL DRILLING & BLASTING (MILLION CU YDS)	0	0	0	0	0	0	2	4
EQUIPMENT	0	0	0	0	0	0	141	141
MANPOWER	0	0	0	0	0	0	43	85
SERVICES & MATERIALS	0	0	0	0	0	0	104	207
COAL LOADING & HAULING (THOUSAND ROM TONS)	0	0	0	0	0	0	5106	6382
EQUIPMENT	0	0	0	0	0	0	17020	0
MANPOWER	0	0	0	0	0	0	2208	2208
SERVICES & MATERIALS	0	0	0	0	0	0	2825	2825
COAL HANDLING & PREP. (THOUSAND CLEAN TONS)	0	0	0	0	0	0	1685	3791
EQUIPMENT	0	0	0	0	0	0	30316	30316
MANPOWER	0	0	0	0	0	0	2667	5335
SERVICES & MATERIALS	0	0	0	0	0	0	747	1495
LAND RECLAMATION (ACRES)	0	0	0	0	0	0	98	220
EQUIPMENT	0	0	0	0	0	0	271	271
MANPOWER	0	0	0	0	0	0	89	179
SERVICES & MATERIALS	0	0	0	0	0	0	62	125
GENERAL & ADMINISTRATIVE								
EQUIPMENT	857	1412	1857	857	1590	1590	23000	0
MANPOWER	752	1503	2255	3006	3758	4509	5261	6013
SERVICES & MATERIALS	73	146	220	293	366	439	684	757
MISCELLANEOUS	17	34	50	67	84	101	6989	8920
TOTAL EXPENDITURE	1699	3095	4382	4223	5798	6639	117789	100359
BILLION BTU PRODUCED	0	0	0	0	0	0	0	0

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PRODUCTION AND CASH EXPENDITURE TABLE (\$M)

	1984	1985	1986	1987	1988	1989	1990	1991
	-----	-----	-----	-----	-----	-----	-----	-----
OVER. DRILLING & BLASTING (MILLION CU YDS)	40	43	43	43	43	43	43	43
EQUIPMENT	1110	0	0	0	661	734	734	73
MANPOWER	1642	1642	1642	1642	1642	1642	1642	1642
SERVICES & MATERIALS	2781	2781	2781	2781	2781	2781	2781	2781
OVERBURDEN REMOVAL (MILLION CU YDS)	40	43	43	43	43	43	43	43
EQUIPMENT	16494	9068	9318	9567	9567	7877	9318	9318
MANPOWER	19243	19243	19243	19243	19243	19243	19243	19243
SERVICES & MATERIALS	20368	20368	20368	20368	20368	20368	20368	20368
COAL DRILLING & BLASTING (MILLION CU YDS)	6	6	6	6	6	6	6	6
EQUIPMENT	141	0	0	0	0	0	0	0
MANPOWER	128	128	128	128	128	128	128	128
SERVICES & MATERIALS	311	311	311	311	311	311	311	311
COAL LOADING & HAULING (THOUSAND ROM TONS)	6382	6382	6382	6382	6382	6382	6382	6382
EQUIPMENT	0	0	0	0	0	2881	0	749
MANPOWER	2208	2208	2208	2208	2208	2208	2208	2208
SERVICES & MATERIALS	2825	2825	2825	2825	2825	2825	2825	2825
COAL HANDLING & PREP. (THOUSAND CLEAN TONS)	5897	6318	6318	6318	6318	6318	6318	6318
EQUIPMENT	30316	0	0	0	0	0	0	0
MANPOWER	8002	8002	8002	8002	8002	8002	8002	8002
SERVICES & MATERIALS	2242	2242	2242	2242	2242	2242	2242	2242
LAND RECLAMATION (ACRES)	343	367	367	367	367	367	367	367
EQUIPMENT	271	0	0	0	0	0	0	0
MANPOWER	268	268	268	268	268	268	268	268
SERVICES & MATERIALS	187	187	187	187	187	187	187	187
GENERAL & ADMINISTRATIVE								
EQUIPMENT	0	0	0	0	0	0	0	0
MANPOWER	6764	6764	6764	6764	6764	6764	6764	6764
SERVICES & MATERIALS	830	830	830	830	830	830	830	830
MISCELLANEOUS	10838	10387	10004	9721	9471	9320	9092	8843
TOTAL EXPENDITURE	126969	87254	87121	87087	87498	88611	86943	86782
BILLION BTU PRODUCED	121325	129991	129991	129991	129991	129991	129991	129991

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PRODUCTION AND CASH EXPENDITURE TABLE (\$M)

	1992	1993	1994	1995	1996	1997	1998	1999
	*****	*****	*****	*****	*****	*****	*****	*****
OVER. DRILLING & BLASTING (MILLION CU YDS)	43	43	43	43	43	43	43	43
EQUIPMENT	0	0	733	733	1110	376	376	0
MANPOWER	1642	1642	1642	1642	1642	1642	1642	1642
SERVICES & MATERIALS	2781	2781	2781	2781	2781	2781	2781	2781
OVERBURDEN REMOVAL (MILLION CU YDS)	43	43	43	43	43	43	43	43
EQUIPMENT	15045	9318	7418	9318	9318	9068	9567	9567
MANPOWER	19243	19243	19243	19243	19243	19243	19243	19243
SERVICES & MATERIALS	20368	20368	20368	20368	20368	20368	20368	20368
COAL DRILLING & BLASTING (MILLION CU YDS)	6	6	6	6	6	6	6	6
EQUIPMENT	0	0	141	141	141	0	0	0
MANPOWER	128	128	128	128	128	128	128	128
SERVICES & MATERIALS	311	311	311	311	311	311	311	311
COAL LOADING & HAULING (THOUSAND RCM TONS)	6382	6382	6382	6382	6382	6382	6382	6382
EQUIPMENT	0	0	10956	60	2881	0	0	0
MANPOWER	2208	2208	2208	2208	2208	2208	2208	2208
SERVICES & MATERIALS	2825	2825	2825	2825	2825	2825	2825	2825
COAL HANDLING & PREP. (THOUSAND CLEAN TONS)	6318	6318	6318	6318	6318	6318	6318	6318
EQUIPMENT	0	0	0	0	0	0	0	0
MANPOWER	8002	8002	8002	8002	8002	8002	8002	8002
SERVICES & MATERIALS	2242	2242	2242	2242	2242	2242	2242	2242
LAND RECLAMATION (ACRES)	367	367	367	367	367	367	367	367
EQUIPMENT	0	0	0	0	0	0	271	271
MANPOWER	268	268	268	268	268	268	268	268
SERVICES & MATERIALS	187	187	187	187	187	187	187	187
GENERAL & ADMINISTRATIVE								
EQUIPMENT	0	0	0	0	0	0	0	0
MANPOWER	6764	6764	6764	6764	6764	6764	6764	6764
SERVICES & MATERIALS	830	830	830	830	830	830	830	830
MISCELLANEOUS	8742	8349	8533	8332	8263	7990	7753	7498
TOTAL EXPENDITURE	91586	85466	95580	86383	89512	85233	85766	85135
BILLION BTU PRODUCED	129991	129991	129991	129991	129991	129991	129991	129991

CFA MODEL:

504 (CDC0504) HYPOTHETICAL MINE STUDY - BASELINE SOLUTION
1 GREEN RIVER - 2 SEAMS (28 & 10 FEET)

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PRODUCTION AND CASH EXPENDITURE TABLE (\$M)

	2000	2001	2002	2003	2004	2005	2006	2007
	=====	=====	=====	=====	=====	=====	=====	=====
OVER. DRILLING & BLASTING (MILLION CU YDS)	43	43	43	43	43	43	43	43
EQUIPMENT	661	661	661	0	73	73	806	733
MANPOWER	1642	1642	1642	1642	1642	1642	1642	1642
SERVICES & MATERIALS	2781	2781	2781	2781	2781	2781	2781	2781
OVERBURDEN REMOVAL (MILLION CU YDS)	43	43	43	43	43	43	43	43
EQUIPMENT	9567	9068	7878	15045	9567	9318	9318	7168
MANPOWER	19243	19243	19243	19243	19243	19243	19243	19243
SERVICES & MATERIALS	20368	20368	20368	20368	20368	20368	20368	20368
COAL DRILLING & BLASTING (MILLION CU YDS)	6	6	6	6	6	6	6	6
EQUIPMENT	0	0	0	0	0	0	141	141
MANPOWER	128	128	128	128	128	128	128	128
SERVICES & MATERIALS	311	311	311	311	311	311	311	311
COAL LOADING & HAULING (THOUSAND RCM TONS)	6382	6382	6382	6382	6382	6382	6382	6382
EQUIPMENT	749	0	0	0	2881	0	10956	0
MANPOWER	2208	2208	2208	2208	2208	2208	2208	2208
SERVICES & MATERIALS	2825	2825	2825	2825	2825	2825	2825	2825
COAL HANDLING & PREP. (THOUSAND CLEAN TONS)	6318	6318	6318	6318	6318	6318	6318	6318
EQUIPMENT	0	0	0	0	0	0	0	0
MANPOWER	8002	8002	8002	8002	8002	8002	8002	8002
SERVICES & MATERIALS	2242	2242	2242	2242	2242	2242	2242	2242
LAND RECLAMATION (ACRES)	367	367	367	367	367	367	367	367
EQUIPMENT	271	0	0	0	0	0	0	0
MANPOWER	268	268	268	268	268	268	268	268
SERVICES & MATERIALS	187	187	187	187	187	187	187	187
GENERAL & ADMINISTRATIVE								
EQUIPMENT	0	0	0	0	0	0	0	0
MANPOWER	6764	6764	6764	6764	6764	6764	6764	6764
SERVICES & MATERIALS	830	830	830	830	830	830	830	830
MISCELLANEOUS	7312	7050	6766	6709	6486	6133	6445	6146
TOTAL EXPENDITURE	86359	84578	83104	89553	86806	83323	95465	81987
BILLION BTU PRODUCED	129991	129991	129991	129991	129991	129991	129991	129991

CFA MODEL:

504 (CDC0504) HYPOTHETICAL MINE STUDY - BASELINE SOLUTION
 1 GREEN RIVER - 2 SEAMS (28 & 10 FEET)

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PRODUCTION AND CASH EXPENDITURE TABLE (\$M)

	2008	2009	2010	2011	2012	2013	2014	2015
	-----	-----	-----	-----	-----	-----	-----	-----
OVER. DRILLING & BLASTING (MILLION CU YDS)	43	43	43	43	28	14	0	0
EQUIPMENT	733	0	0	376	376	376	0	0
MANPOWER	1642	1642	1642	1642	1095	547	0	0
SERVICES & MATERIALS	2781	2781	2781	2781	1854	927	0	0
OVERBURDEN REMOVAL (MILLION CU YDS)	43	43	43	43	29	14	0	0
EQUIPMENT	9318	9318	9567	15045	7878	7628	0	0
MANPOWER	19243	19243	19243	19243	12828	6414	0	0
SERVICES & MATERIALS	20368	20368	20368	20368	13579	6789	0	0
COAL DRILLING & BLASTING (MILLION CU YDS)	6	6	6	6	4	2	0	0
EQUIPMENT	141	0	0	0	0	0	0	0
MANPOWER	128	128	128	128	85	43	0	0
SERVICES & MATERIALS	311	311	311	311	207	104	0	0
COAL LOADING & HAULING (THOUSAND ROM TONS)	6382	6382	6382	6382	0	0	0	0
EQUIPMENT	60	749	0	2881	0	0	0	0
MANPOWER	2208	2208	2208	2208	0	0	0	0
SERVICES & MATERIALS	2825	2825	2825	2825	0	0	0	0
COAL HANDLING & PREP. (THOUSAND CLEAN TONS)	6318	6318	6318	6318	4212	2106	0	0
EQUIPMENT	0	0	0	0	0	0	0	0
MANPOWER	8002	8002	8002	8002	5335	2667	0	0
SERVICES & MATERIALS	2242	2242	2242	2242	1495	747	0	0
LAND RECLAMATION (ACRES)	367	367	367	367	245	122	0	0
EQUIPMENT	0	0	0	0	0	0	0	0
MANPOWER	268	268	268	268	179	89	0	0
SERVICES & MATERIALS	187	187	187	187	125	62	0	0
GENERAL & ADMINISTRATIVE								
EQUIPMENT	0	0	0	0	0	0	0	0
MANPOWER	6013	5261	4509	3758	3006	2255	1503	752
SERVICES & MATERIALS	757	684	611	538	464	391	146	73
MISCELLANEOUS	5930	5680	5398	5447	4678	4108	1412	1395
TOTAL EXPENDITURE	83157	81897	80290	88250	53184	33147	3061	2220
BILLION BTU PRODUCED	129991	129991	129991	129991	86661	43330	0	0

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504 (CDC0504) HYPOTHETICAL MINE STUDY - BASELINE SOLUTION
1 GREEN RIVER - 2 SEAMS (28 & 10 FEET)

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PRODUCTION AND CASH EXPENDITURE TABLE (\$M)

	TOTALS

OVER. DRILLING & BLASTING	
(MILLION CU YDS)	1273
EQUIPMENT	14392
MANPOWER	49268
SERVICES & MATERIALS	83416

	147076
OVERBURDEN REMOVAL	
(MILLION CU YDS)	1289
EQUIPMENT	315427
MANPOWER	577278
SERVICES & MATERIALS	611031

	1503735
COAL DRILLING & BLASTING	
(MILLION CU YDS)	190
EQUIPMENT	1271
MANPOWER	3846
SERVICES & MATERIALS	9318

	14435
COAL LOADING & HAULING	
(THOUSAND RCH TONS)	190192
EQUIPMENT	52825
MANPOWER	66233
SERVICES & MATERIALS	84750

	203808
COAL HANDLING & PREP.	
(THOUSAND CLEAN TONS)	188285
EQUIPMENT	90949
MANPOWER	240062
SERVICES & MATERIALS	67258

	398269
LAND RECLAMATION	
(ACRES)	10966
EQUIPMENT	1624
MANPOWER	8048
SERVICES & MATERIALS	5610

	15281
GENERAL & ADMINISTRATIVE	
EQUIPMENT	31164
MANPOWER	216455
SERVICES & MATERIALS	26566
MISCELLANECUS	246492

	520678

TOTAL EXPENDITURE	2803283

BILLION BTU PRODUCED

3873731

Appendix D.8 Financial Statements

Pro-forma financial statements are prepared for each year of the project as follows:

- 1) **Income Statement:** Shows selling price and resulting revenue, costs, net income, federal (accounts for depletion and investment tax credit), and net earnings.
- 2) **Sources and Uses of Funds:** Shows from where funds are derived balanced against how they are utilized.
- 3) **Balance Sheet:** Shows year end financial status balancing assets against liabilities and net worth.

CFA MODEL :

504 (CDC0504) HYPOTHETICAL MINE STUDY - BASELINE SOLUTION
1 GREEN RIVER - 2 SEAMS (28 & 10 FEET)

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ALL FIGURES IN THOUSANDS OF DOLLARS

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
INCOME STATEMENT										
SALES PRICE \$/TON	.00	.00	.00	.00	.00	.00	18.82	18.82	18.82	18.82
REVENUES (NET)	0	0	0	0	0	0	31714	71356	110999	118927
COSTS										
MANPOWER	0	0	0	0	0	0	11969	21730	31491	31491
SERVICES & MATERIALS	0	0	0	0	0	0	11454	20084	28713	28713
LEASING COSTS	0	0	0	0	0	0	0	0	0	0
G & A	842	1683	2525	3366	4208	5050	12934	15689	18432	17981
INTEREST	125	373	755	1234	1895	2718	7475	8834	8760	5413
DEPRECIATION	0	0	0	0	0	0	7441	12699	18423	17903
TOTAL COSTS	967	2056	3280	4601	6103	7768	51273	79037	105819	101502
NET INCOME	-966	-2055	-3279	-4600	-6102	-7767	-19558	-7679	5180	17425
TAXES	0	0	0	0	0	0	0	0	0	0
NET EARNINGS	-966	-2055	-3279	-4600	-6102	-7767	-19558	-7679	5180	17425
MEMO : FOR THIS PROBLEM, PERCENTAGE DEPLETION IS										
	0	0	0	0	0	0	0	0	2590	8713
SOURCE AND USE OF FLNDS										
SOURCE										
NET EARNINGS	-966	-2055	-3279	-4600	-6102	-7767	-19558	-7679	5180	17425
DEPRECIATION	0	0	0	0	0	0	7441	12699	18423	17903
SALE OF ASSETS	0	0	0	0	0	0	0	276	492	492
INCREASE IN DEBT	286	471	619	286	530	530	27144	14285	16111	3023
INCREASE IN CAPITAL	571	941	1238	571	1060	1060	54289	28569	32221	6046
TOTAL SOURCE	-109	-643	-1421	-3743	-4512	-6176	69315	48149	72426	44889
USE										
SURPLUS CASH	0	0	0	0	0	0	0	0	0	0
SHORT TERM BORROW&REP	1024	2123	3386	4679	6318	7990	26080	4587	-10030	-30953
A/R, INV, A/P, CASH CHAN	28	-8	-30	-87	-3	-49	10975	5467	8038	-1461
INC OR DEC(-) IN WORK C	-994	-2131	-3416	-4766	-6321	-8039	-15104	880	18069	29493
FIXED ASSET PURCHASE	857	1412	1857	857	1590	1590	81433	42854	48332	9068
REDUCTION IN DEBT	29	76	138	166	219	272	2987	4415	6026	6328
PAYMENT OF DIVIDEND	0	0	0	0	0	0	0	0	0	0
TOTAL USE	-109	-643	-1421	-3743	-4512	-6176	69315	48149	72426	44889

CFA MODEL:

504 (CDC0504) HYPOTHETICAL MINE STUDY - BASELINE SOLUTION
1 GREEN RIVER - 2 SEAMS (28 & 10 FEET)

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ALL FIGURES IN THOUSANDS OF DOLLARS

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
BALANCE SHEET										
CURRENT ASSETS										
CASH	0	0	0	0	0	0	2992	5433	7873	7873
SURPLUS CASH	0	0	0	0	0	0	0	0	0	0
ACCOUNTS RECEIVABLE	0	0	0	0	0	0	3910	8797	13685	14662
INVENTORY	61	103	138	83	136	143	7572	7617	10415	8278
TOTAL CURRENT ASSETS	61	103	138	83	136	143	14474	21847	31973	30813
FIXED ASSETS										
DEPRECIABLE ASSETS	0	0	0	0	0	0	89597	132175	180014	188590
LESS DEPRECIATION	0	0	0	0	0	0	7441	20140	38563	54666
NET DEPRECIABLE ASSET	0	0	0	0	0	0	82156	112035	141451	132124
NON-DEPRECIABLE ASSET	0	0	0	0	0	0	0	0	0	0
FIXED ASSET PRDG. PAY	857	2269	4126	4983	6574	8164	0	0	0	0
TOTAL FIXED ASSETS	857	2269	4126	4983	6574	8164	82156	112035	141451	132124
TOTAL ASSETS	918	2372	4264	5066	6710	8307	96631	133881	173424	162937
CURRENT LIABILITIES										
ACCOUNTS PAYABLE	4	8	12	16	20	24	665	1142	1619	1619
SHORT TERM BORROW	1024	3146	6533	11212	17530	25520	51600	56187	46156	15202
CURRENT PORTION OF DEBT	29	76	138	166	219	272	2987	4415	6026	6328
TOTAL CURRENT LIAB.	1056	3230	6682	11394	17769	25817	55252	61744	53801	23149
LONG TERM DEBT	257	652	1134	1253	1564	1822	25980	35850	45934	42629
TOTAL LIABILITIES	1313	3882	7816	12647	19333	27639	81232	97594	99735	65778
NET WORTH										
PAID-IN CAPITAL	571	1513	2751	3322	4382	5443	59731	88300	120522	126567
RETAINED EARNINGS	-966	-3022	-6301	-10902	-17005	-24773	-44332	-52012	-46832	-29407
TOTAL NET WORTH	-394	-1509	-3551	-7580	-12623	-19331	15399	36288	73689	97160
TOTAL LIAB + NET	918	2372	4264	5066	6709	8307	96631	133881	173424	162937

ALL FIGURES IN THOUSANDS OF DOLLARS

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
INCOME STATEMENT										
SALES PRICE \$/TON	18.82	18.82	18.82	18.82	18.82	18.82	18.82	18.82	18.82	18.82
REVENUES (NET)	118927	118927	118927	118927	118927	118927	118927	118927	118927	118927
COSTS										
MANPOWER	31491	31491	31491	31491	31491	31491	31491	31491	31491	31491
SERVICES & MATERIALS	28713	28713	28713	28713	28713	28713	28713	28713	28713	28713
LEASING COSTS	0	0	0	0	0	0	0	0	0	0
G & A	17598	17315	17065	16915	16696	16437	16336	15943	16127	15927
INTEREST	3659	3385	3107	2841	2508	2154	1909	1688	1821	1792
DEPRECIATION	16825	15119	15122	14447	14535	15010	17028	17023	15639	14185
TOTAL COSTS	98286	96024	95499	94407	93933	93806	95477	94858	93791	92107
NET INCOME	20641	22904	23428	24521	24994	25121	23450	24069	25136	26820
TAXES	0	0	430	5765	6246	6270	5575	5708	6310	7112
NET EARNINGS	20641	22904	22998	18756	18748	18851	17875	18361	18827	19708
MEMO : FOR THIS PROBLEM, PERCENTAGE DEPLETION IS										
	10321	11452	11714	11893	11893	11893	11725	11893	11893	11893
SOURCE AND USE OF FUNDS										
SOURCE										
NET EARNINGS	20641	22904	22998	18756	18748	18851	17875	18361	18827	19708
DEPRECIATION	16825	15119	15122	14447	14535	15010	17028	17023	15639	14185
SALE OF ASSETS	432	432	432	432	216	432	432	432	432	216
INCREASE IN DEBT	3106	3189	3410	3831	3351	3380	5015	3106	6416	3418
INCREASE IN CAPITAL	6212	6378	6819	7662	6702	6760	10030	6212	12832	6835
TOTAL SOURCE	47217	48023	48782	45127	43552	44434	50381	45134	54146	44362
USE										
SURPLUS CASH	16352	31829	31629	26395	26074	25490	26946	30305	29525	30889
SHORT TERM BORROWING	-15201	0	0	0	0	0	0	0	0	0
A/R, INV, A/P, CASH CHAN	-265	-255	-237	-275	-371	-279	2519	760	1590	-601
INC OR DEC(-) IN WORK C	31288	31573	31391	26119	25702	26210	29465	31065	31115	30287
FIXED ASSET PURCHASE	9318	9567	10229	11492	10052	10140	15045	9318	19248	10253
REDUCTION IN DEBT	6610	6882	7161	7516	7798	8083	5870	4752	3783	3822
PAYMENT OF DIVIDEND	0	0	0	0	0	0	0	0	0	0
TOTAL USE	47217	48023	48782	45127	43552	44434	50381	45134	54146	44362

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1 GREEN RIVER - 2 SEAMS (28 & 10 FEET)

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ALL FIGURES IN THOUSANDS OF DOLLARS

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
BALANCE SHEET										
CURRENT ASSETS										
CASH	7873	7873	7873	7873	7873	7873	7873	7873	7873	7873
SURPLUS CASH	16352	48182	79811	106205	132279	158769	185715	215020	245544	276433
ACCOUNTS RECEIVABLE	14662	14662	14662	14662	14662	14662	14662	14662	14662	14662
INVENTORY	8294	8309	8351	8430	8340	8345	8652	8294	8914	8352
TOTAL CURRENT ASSETS	47181	79026	110697	137170	163154	189650	216902	246849	276994	307321
FIXED ASSETS										
DEPRECIABLE ASSETS	197476	206612	216408	227469	237305	247013	261627	270512	289328	299365
LESS DEPRECIATION	73291	88410	103533	117980	132515	147526	164553	181577	197216	211401
NET DEPRECIABLE ASSET	124185	118201	112876	109489	104790	99488	97073	88935	92112	87964
NON-DEPRECIABLE ASSET	0	0	0	0	0	0	0	0	0	0
FIXED ASSET PROG. PAY	0	0	0	0	0	0	0	0	0	0
TOTAL FIXED ASSETS	124185	118201	112876	109489	104790	99488	97073	88935	92112	87964
TOTAL ASSETS	171367	197228	223572	246659	267944	289137	313975	335784	369106	395284
CURRENT LIABILITIES										
ACCOUNTS PAYABLE	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619
SHORT TERM BORROW	0	0	0	0	0	0	0	0	0	0
CURRENT PORTION OF DEBT	6610	6882	7161	7516	7798	8083	5870	4752	3783	3822
TOTAL CURRENT LIAB.	8229	8501	8780	9135	9417	9702	7489	6371	5401	5441
LONG TERM DEBT	39124	35431	31679	27994	23547	18845	17990	16344	18977	18572
TOTAL LIABILITIES	47353	43932	40460	37129	32964	28546	25479	22714	24378	24013
NET WORTH										
PAID-IN CAPITAL	132779	139158	145977	153639	160340	167101	177131	183343	196175	203010
RETAINED EARNINGS	-8765	14138	37136	55892	74640	93491	111366	129727	148554	168262
TOTAL NET WORTH	124013	153295	183113	209530	234980	260592	288497	313070	344729	371272
TOTAL LIAB + NET	171367	197228	223573	246659	267944	289138	313975	335784	369107	395285

ALL FIGURES IN THOUSANDS OF DOLLARS

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
INCOME STATEMENT										
SALES PRICE \$/TON	18.82	18.82	18.82	18.82	18.82	18.82	18.82	18.82	18.82	18.82
REVENUES (NET)	118927	118927	118927	118927	118927	118927	118927	118927	118927	118927
COSTS										
MANPOWER	31491	31491	31491	31491	31491	31491	31491	31491	31491	31491
SERVICES & MATERIALS	28713	28713	28713	28713	28713	28713	28713	28713	28713	28713
LEASING COSTS	0	0	0	0	0	0	0	0	0	0
G & A	15857	15585	15348	15093	14907	14645	14360	14303	14081	13728
INTEREST	1844	1780	1735	1681	1569	1614	1527	1632	1654	1610
DEPRECIATION	14815	14787	14854	14836	14892	14866	14118	16162	16887	16308
TOTAL COSTS	92721	92355	92142	91815	91673	91328	90210	92301	92825	91850
NET INCOME	26207	26572	26786	27113	27255	27599	28718	26626	26103	27078
TAXES	6837	6805	7115	6726	7327	7475	8036	7050	6815	7289
NET EARNINGS	19370	19767	19670	20387	19928	20125	20681	19577	19288	19789
MEMO : FOR THIS PROBLEM, PERCENTAGE DEPLETION IS	11893	11893	11893	11893	11893	11893	11893	11893	11893	11893
SOURCE AND USE OF FUNDS										
SOURCE										
NET EARNINGS	19370	19767	19670	20387	19928	20125	20681	19577	19288	19789
DEPRECIATION	14815	14787	14854	14836	14892	14866	14118	16162	16887	16308
SALE OF ASSETS	432	432	432	432	432	432	432	216	432	432
INCREASE IN DEBT	4483	3148	3405	3279	3750	3243	2846	5015	4174	3130
INCREASE IN CAPITAL	8967	6296	6810	6559	7499	6487	5693	10030	8348	6260
TOTAL SOURCE	48067	44431	45171	45494	46501	45152	43771	51000	49128	45920
USE										
SURPLUS CASH	30595	31277	30953	31724	31264	31577	31380	31838	32864	33049
SHORT TERM BORROWING	0	0	0	0	0	0	0	0	0	0
A/R, INV, A/P, CASH CHAN	62	-245	49	32	48	-80	142	216	66	-166
INC OR DEC (-) IN WORK C	30657	31031	31002	31755	31312	31496	31523	32054	32930	32882
FIXED ASSET PURCHASE	13450	9445	10214	9838	11249	9730	8539	15045	12521	9390
REDUCTION IN DEBT	3960	3956	3955	3900	3940	3926	3709	3900	3676	3647
PAYMENT OF DIVIDEND	0	0	0	0	0	0	0	0	0	0
TOTAL USE	48068	44431	45171	45493	46501	45152	43771	51000	49128	45920

CFA MODEL:

504 (CDC0504) HYPOTHETICAL MINE STUDY - BASELINE SOLUTION
1 GREEN RIVER - 2 SEAMS (28 & 10 FEET)

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ALL FIGURES IN THOUSANDS OF DOLLARS

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
BALANCE SHEET										
CURRENT ASSETS										
CASH	7873	7873	7873	7873	7873	7873	7873	7873	7873	7873
SURPLUS CASH	307029	338306	369259	400982	432246	463823	495203	527041	559905	592954
ACCOUNTS RECEIVABLE	14662	14662	14662	14662	14662	14562	14662	14662	14662	14662
INVENTORY	8552	8302	8350	8326	8414	8320	8245	8652	8494	8298
TOTAL CURRENT ASSETS	338116	369143	400144	431844	463195	494678	525983	558228	590934	623787
FIXED ASSETS										
DEPRECIABLE ASSETS	312383	321395	331177	340583	351400	360697	368804	383633	395722	404681
LESS DEPRECIATION	226216	241003	255857	270693	285585	300451	314569	330731	347618	363926
NET DEPRECIABLE ASSET	86167	80392	75320	69890	65815	60247	54235	52902	48105	40755
NON-DEPRECIABLE ASSET	0	0	0	0	0	0	0	0	0	0
FIXED ASSET PROG. PAY	0	0	0	0	0	1	1	1	1	1
TOTAL FIXED ASSETS	86167	80392	75320	69890	65815	60247	54235	52903	48105	40755
TOTAL ASSETS	424283	449535	475464	501734	529010	554925	580219	611131	639039	664542
CURRENT LIABILITIES										
ACCOUNTS PAYABLE	1619	1619	1619	1619	1619	1619	1619	1619	1619	1619
SHORT TERM BORROW	0	0	0	0	0	0	0	0	0	0
CURRENT PORTION OF DEBT	3960	3956	3955	3900	3940	3926	3709	3900	3676	3647
TOTAL CURRENT LIAB.	5579	5575	5574	5519	5559	5545	5328	5519	5295	5266
LONG TERM DEBT	19096	18288	17738	17117	16927	16244	15381	16495	16993	16476
TOTAL LIABILITIES	24675	23863	23312	22636	22486	21789	20709	22014	22288	21742
NET WORTH										
PAID-IN CAPITAL	211977	218273	225083	231642	239141	245627	251320	261350	269698	275958
RETAINED EARNINGS	187632	207399	227069	247456	267384	287509	308190	327766	347054	366843
TOTAL NET WORTH	399609	425672	452152	479098	506525	533136	559510	589117	616752	642801
TOTAL LIAB + NET	424283	449535	475464	501734	529010	554925	580219	611131	639040	664543

ALL FIGURES IN THOUSANDS OF DOLLARS

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
INCOME STATEMENT										
SALES PRICE \$/TON	18.82	18.82	18.82	18.82	18.82	18.82	18.82	18.82	.00	.00
REVENUES (NET)	118927	118927	118927	118927	118927	118927	79285	39642	0	0
COSTS										
MANPOWER	31491	31491	31491	31491	31491	31491	19522	9761	0	0
SERVICES & MATERIALS	28713	28713	28713	28713	28713	28713	17259	8629	0	0
LEASING COSTS	0	0	0	0	0	0	0	0	0	0
G & A	14039	13740	12699	11625	10519	9743	8148	6754	3061	2220
INTEREST	1884	1786	1751	1710	1656	1839	1731	1617	1309	1034
DEPRECIATION	15109	13905	14159	14624	14768	17011	13644	11480	2017	0
TOTAL COSTS	91236	89636	88813	88163	87146	88797	60304	38242	6387	3254
NET INCOME	27691	29292	30115	30764	31782	30131	18981	1401	-6386	-3253
TAXES	7583	8952	8746	9058	9547	8754	5305	336	0	0
NET EARNINGS	20108	20940	21368	21706	22235	21377	13676	1064	-6386	-3253
MEMO : FOR THIS PROBLEM, PERCENTAGE DEPLETION IS										
	11893	11893	11893	11893	11893	11893	7928	700	0	0
SOURCE AND USE OF FUNDS										
SOURCE										
NET EARNINGS	20108	20940	21368	21706	22235	21377	13676	1064	-6386	-3253
DEPRECIATION	15109	13905	14159	14624	14768	17011	13644	11480	2017	0
SALE OF ASSETS	432	432	216	432	432	9064	432	5094	216	0
INCREASE IN DEBT	7074	2681	3418	3356	3189	6101	2751	2668	0	0
INCREASE IN CAPITAL	14148	5362	6835	6711	6378	12202	5502	5336	0	0
TOTAL SOURCE	56870	43321	45996	46829	47002	65754	36005	26643	-4153	-3253
USE										
SURPLUS CASH	31262	32195	31748	32916	33600	43096	34268	23872	1806	-6686
SHORT TERM BORROW&REP	0	0	0	0	0	0	0	0	0	0
A/R, INV, A/P, CASH CHAN	480	-776	133	-22	22	257	-10604	-9087	-9396	310
INC OR DEC(-) IN WORK C	31743	31418	31882	32893	33622	43353	23663	14784	-7590	-6377
FIXED ASSET PURCHASE	21222	8043	10253	10067	9567	18303	8254	8004	0	0
REDUCTION IN DEBT	3906	3860	3861	3869	3813	4098	4089	3854	3437	3124
PAYMENT OF DIVIDEND	0	0	0	0	0	0	0	0	0	0
TOTAL USE	56871	43320	45996	46829	47002	65754	36005	26643	-4153	-3253

ALL FIGURES IN THOUSANDS OF DOLLARS

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
BALANCE SHEET										
CURRENT ASSETS										
CASH	7873	7873	7873	7873	7873	7873	4881	2440	0	0
SURPLUS CASH	624216	656410	688159	721074	754675	797771	832038	855910	857717	851030
ACCOUNTS RECEIVABLE	14662	14662	14662	14662	14662	14662	9775	4887	0	0
INVENTORY	9038	8214	8345	8326	8287	8826	5460	2988	15	7
TOTAL CURRENT ASSETS	655789	687160	719038	751935	785497	829132	852153	866226	857731	851037
FIXED ASSETS										
DEPRECIABLE ASSETS	425470	433081	443117	452752	461887	471126	478948	480857	480641	480641
LESS DEPRECIATION	379035	392940	407099	421722	436490	453500	467144	478624	480641	480641
NET DEPRECIABLE ASSET	46435	40141	36019	31030	25398	17626	11804	2234	1	1
NON-DEPRECIABLE ASSET	0	0	0	0	0	0	0	0	0	0
FIXED ASSET PROG. PAY	1	1	1	1	1	0	0	0	0	0
TOTAL FIXED ASSETS	46436	40141	36019	31030	25398	17626	11804	2234	1	1
TOTAL ASSETS	702224	727301	755058	782966	810895	846758	863.58	868460	857732	851037
CURRENT LIABILITIES										
ACCOUNTS PAYABLE	1619	1619	1615	1611	1607	1603	971	494	8	4
SHORT TERM BORROW	0	0	0	0	0	0	0	0	0	0
CURRENT PORTION OF DEBT	3906	3860	3861	3869	3813	4098	4089	3854	3437	3124
TOTAL CURRENT LIAB.	5525	5479	5476	5479	5419	5701	5060	4348	3445	3128
LONG TERM DEBT	19643	18464	18021	17508	16885	18887	17550	16363	12927	9803
TOTAL LIABILITIES	25168	23943	23497	22987	22304	24588	22610	20712	16371	12931
NET WORTH										
PAID-IN CAPITAL	290106	295468	302303	309014	315393	327594	333097	338433	338433	338433
RETAINED EARNINGS	386950	407890	429258	450964	473199	494576	508251	509316	502928	499675
TOTAL NET WORTH	677056	703358	731561	759978	788592	822170	841348	847748	841361	838107
TOTAL LIAB + NET	702224	727301	755058	782966	810895	846758	863958	868460	857732	851038