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FEDERAL AND NON-FEDERAL COAL LEASES:
A COMPARATIVE ECONOMIC EVALUATION

by

Mark A. Borer

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A Thesis submitted to the Faculty and the Board of Trustees of the Colorado School of Mines in partial fulfillment of the requirements for the degree of Master of Science, Mineral Economics.

Signed: Mark A. Borer
Mark A. Borer

Golden, Colorado

Date: April 28, 1978

Approved: Joseph C. Weber
Joseph C. Weber
Thesis Advisor

J. Paul Mather
J. Paul Mather, Chairman
Department of Mineral
Economics

Golden, Colorado

Date: 4/28, 1978

ABSTRACT

The purpose of this study is to determine the comparative economics involved in the leasing, mining, and developing of Federally leased coal as opposed to non-Federally leased coal. The study focuses on the leasing and development processes of Federal and non-Federal coal. The comparative economic analysis of the leasing, mining, and developing of Federal coal as opposed to non-Federal coal is based on the Hayden Gulch mine in Routt County of northwest Colorado.

The Hayden Gulch mine is first economically evaluated as a non-Federal lease, the actual case in this instance. The project is then evaluated as if the lease were a Federal lease, thus requiring the additional Federal approvals relating to the permit process, leasing requirements, and environmental work, along with the additional lead time and development costs.

Results show that the non-Federally leased Hayden Gulch has a distinct economic advantage over the hypothetical Federally leased Hayden Gulch. These results can be attributed to the following factors prevalent in developing

Federally leased coal as opposed to non-Federally leased coal: additional lead time required of Federal projects, significantly higher pre-production costs, uncertainty of government policies and regulations, permit process, and higher production royalties.

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INTRODUCTION

In recent years there has been a considerable amount of literature written about the process of leasing and mining coal. A great deal of this literature had concentrated on the importance of timing in granting permits and the various regulations and laws which have to be followed in the coal leasing processes. However, little has been written on how the permitting and leasing policies affect a mining firm's costs and profits which should be a prime concern to mineral economists.

The purpose of this study was to give a close examination of the actual comparative economics involved in the leasing, mining, and developing of Federal coal as opposed to leasing and mining of non-Federal coal. For purposes of this thesis, state, county, and privately owned coal leases are classified as non-Federal coal leases, while Federal coal is classified as being owned by the United States Government and leased by the Department of Interior.

The thesis quantifies the leasing, permitting, and development costs inherent in the mining of Federal and

non-Federal coal and shows how these policies affect a firm's profit margin. The comparative economic analysis is based on the Hayden Gulch strip mine in Routt County of northwest Colorado. This mine was chosen because of the availability of good and current information on the project which will enable an accurate economic comparison of the two leasing systems.

The study begins with an analysis on the non-Federal coal leasing systems. The analysis concentrates on the various leasing requirements and lease terms found in non-Federal leasing systems. This chapter is followed by an examination of the Federal coal leasing system. The discussion focuses on the evolution of the current leasing system and the important laws and regulations involved in the leasing of Federal coal. The fourth chapter identifies and discusses the major differences in a comparative analysis of the leasing and mining of Federally owned coal as opposed to non-Federally owned coal. The fifth chapter provides a comparative economic analysis of the leasing, developing, and mining of Federal coal as opposed to non-Federal coal. The Hayden Gulch mine is first economically evaluated as a non-Federal lease, the actual case in this instance. The project is then evaluated as if the coal lease were Federal. Finally, a summary, conclusions, and some suggestions are presented pertaining to the results of this study.

NON-FEDERAL COAL LEASING SYSTEMS

This section presents a brief analysis of the non-Federal leasing of coal. The basic terms of any leasing system such as royalties and rentals are explained along with a discussion of the various leasing requirements usually involved in the non-Federal leasing of coal. The discussion centers on private, county, and state leasing systems and is accented by examples from a private lease, a state lease (Colorado), and a Routt County lease (northwest Colorado). For the purposes of this thesis, non-Federal coal leasing involves coal that is not open for leasing through any Federal agency.

Types of Leases and Agreements

There are a multitude of leasing agreements that can be entered into between a firm and the landowners of the non-Federal coal deposits. These agreements commonly known as "option agreements" are generally designed to permit access to the land, allow for exploration work, and if the lands or coal deposit look promising, allows for the exercise of an option to lease or buy the land for coal production purposes.

The option agreement usually comes about when a landowner suspects that there may be coal on his land and wishes to determine feasibility of development and mining. It also may come about when a mining or exploration firm has determined through its own studies that an area would most likely have coal deposits, thus, they enter into some type of option agreement.

Another type of leasing agreement is the lease contract which provides adequate time for exploration and feasibility studies to be conducted. If the deposit can be economically exploited, development of the deposit will begin. However, the lease may be terminated if development for production is not commenced by a certain date or for failure to pay rentals specified in the lease. There are also exploration option agreements under which a firm conducts an exploration program at its own expense and having determined if the deposit is economical, can then exercise an option to lease the land for coal production purposes (Cloues Thesis, 1971).

Lease Terms

Duration

Leases for non-Federal coal deposits are generally issued for a primary term of ten years. There are usually provisions to allow for lease extensions if the need exists.

State of Colorado coal leases are currently for a ten-year period with a preferential right to renew the lease or to receive a new lease provided the mining firm meets the following conditions:

1) Pays all advance minimum royalties until the expiration of the lease.

2) Shows proof of plans for mining during the new lease term.

3) Furnishes adequate geological evidence that the lease acreage is a part of a logical mining unit.

There are also provisions in the state lease for an extension of the lease for production reasons, provisions state that "a lease will continue in effect for so long as coal is produced in paying quantities. Paying quantities means "production sufficient to return royalties to the State equal to the advance minimum royalty but not less than ten dollars per acre per year." (State of Colorado Coal Lease, 1977).

A recent Routt County lease called for "a primary term of ten (10) years...and so long thereafter as operations are conducted on a continuous basis in good faith." (Routt County Lease 2-24-76). In this lease, operations are considered continuous so long as operations do not cease for a period of more than ninety days.

Rentals

Rentals serve as a means of giving the land owner a return on his land even when there is no mining activity being carried on. Basic acreage rentals usually range anywhere from one to five dollars per acre depending on the value of the deposit.

The average rentals for private lands are negotiated by the respective land owners and mining firms. A Routt County lease called for a basic acreage rental of five dollars (\$5.00) the first year and three dollars (\$3.00) for the second year and thereafter. (Routt County Lease, 2-24-76). The current rental for coal mining leases issued by the State of Colorado is one dollar (\$1.00) per acre.

Advance Royalties

Non-Federal coal leases usually include provisions for advance royalties to be incurred if development and mining operations have not commenced on the leased property by a given date. Advance royalties serve as a way for a land owner to realize a return on his resources while another party has control of them. These royalties generally operate as a delay rental and cover the privilege of deferring the commencement of bona fide development or mining operations. The advance royalty can also be designed to enhance the development of the lease area by increasing the amount of

the royalty payments over the years. This is done so that firms do not tie up large amounts of lands for speculative purposes. These royalties are determined without relation to the amount of coal being produced. However, there may be terms in the lease which allow for the advance royalties to be credited against the production royalty once mining operations have commenced. Advanced royalty schedules similar to the State of Colorado's are usually included in most non-Federal leases.

The following table summarizes the advanced royalty schedule for the State of Colorado coal leases:

<u>Lease Year</u>	<u>Advance Royalty/Acre</u>
1	none
2	none
3	none
4	none
5	none
6	\$ 6.00
7	\$ 7.00
8	\$ 8.00
9	\$ 9.00
10	\$10.00

Production Royalties

Production royalties are based upon a given percentage of the value of the coal removed from the mine. The value of the coal used to calculate the royalties is usually the gross value of the coal less certain expenses specified in the lease. Factors such as market value, location, coal quality, and mining method are considered in setting royalty rates. Private and county lease royalty rates are negotiated by the mining firm and the land owner.

The State of Colorado coal lease calls for a production royalty as follows: "For coal removed by strip mining methods, a sum equal to twelve and one-half percent (12 1/2%) of the gross sales price at the first point of sale, for each and every ton of coal mined from the leased premises...(In) no case shall the production royalty to the state be less than 40¢ a ton."(State of Colorado Coal Lease, 1977).

A recent county lease in Colorado called for "as royalty an amount which is equal to five percent (5%) of the gross value of the coal mined from the leased premises at the point of shipment from the leased premises." (Routt County Lease 2-24-76). A private party lease in northwest Colorado called for a basic royalty rate of five percent of gross value at the point of shipment from the mine area. (Proprietary Information, 1977).

Bonus Payments

The bonus payment "in effect constitutes the initial inducement to the land owner to award a mineral lease" (Cloues Thesis, 1971). The bonus payment is an active part of a competitive leasing system. In private lease negotiations, it may serve as the determining factor in the awarding of a lease to a given party. In county lease negotiations, it may determine if the lease will be granted or not. If the bonus bid or payment is not of a sufficient amount, the county commissioners may decide not to grant the lease and demand a larger bonus payment.

The State of Colorado leasing system is also based on bonus payments. The competitive lease sale will award a lease to the bidder that offers the highest bonus payment. This bonus as in any leasing system is a function of the value of the lease to the lessee and the competition for the land-use from competing interest. In the most recent State of Colorado coal lease sale (July 13, 1977), the bonus payments ranged from zero to eighteen dollars (\$0-\$18) per acre. The average bonus payment for this lease sale was approximately \$3.75 an acre. The bonus payments for these leases seem to be very depressed, but this can be attributed to the fact that many of the leases were not singularly logical mining units. Many of these leases only had value to mining

firms that owned adjacent lands, for only in conjunction with previous holdings and a state lease would firms be able to develop certain leases as logical mining units.

Leasing Requirements

Bonds

Bonds are usually required before operations are commenced on the leased land. The bonds serve as a deposit in the event that any damages are incurred as a result of the lessee's operation. These bonds are usually returned once all operations, including reclamation, have been satisfactorily completed.

Production and Development Requirements

Non-Federal coal leases have certain production and development requirements which are set out in the lease. These requirements serve to reinforce the use of advance royalties and delay rentals as ways to encourage the lessor to diligently develop the leased property and maintain satisfactory production levels. If the requirements are not met, the lease may be terminated under certain conditions.

The State of Colorado coal lease may be terminated if production is not at a level sufficient to provide for "paying quantities." This termination may only occur when the lease is in operation beyond the primary term of ten

years. State leases may also be terminated if production ceases for a period in excess of 180 consecutive days. Most non-Federal leases will have production and development requirements similar to those found in the state lease.

Mining and Exploration Plans

The non-Federal coal leases have provisions setting up standards for mining and exploration operations. The mine plan is generally one which calls for the use of the mining method which will insure recovery of the greatest possible amounts of coal consistent with the law and prevailing good mining practices.

The State of Colorado coal lease calls for mining methods as follows: "In the underground and open-pit workings, all shafts, inclines and tunnels shall be well timbered (when good mining requires timbering) and all parts of workings shall be kept free from water and waste materials. The underground and open pit workings shall be protected from water and waste materials. The underground and open pit workings shall be protected against fire, floods, creeps, and squeezes. If such events do occur, they are to be checked in a manner which is keeping with good methods of mining." (State of Colorado Lease, 1977). The mine plans for private and county owned leases are generally set up much along the same lines as the state lease.

The exploration plan is usually "nothing more than a plan showing the location and type of work to be conducted, provisions for protection against surface damage, roads, and reclamation procedure to be followed upon completion of such operations." (W.R. Grace, Memo 11-20-77).

In general, the mine and exploration plans negotiated for non-Federal coal deposits call for methods which are consistent with prevailing good practice. These plans should include provisions for maximum economic recovery of the coal, mitigate environmental effects and to reclaim the land using an effective reclamation method. There also may be provisions that the lessee provide copies of geological data, drill hole logs, maps, and reports to the lessor, in the event that the lease is terminated.

Summary

This section has discussed the major requirements which are characteristic of non-Federal coal leases. The requirements, however, will vary from lease to lease depending on the parties involved in the lease negotiations. The requirements of the state lease are set forth in the laws of the state. The leases granted by the various counties and private owners may vary a great deal with the variations limited only by the imagination of involved parties.

The following is a list of requirements and areas which a lease may or may not include: royalty limitations, assessment provisions, report and notice requirements, environmental analysis, coal mine gas mitigation plan, water provisions, rights-of-way, and taxes. The number of these provisions included in the lease will clearly depend on the involved parties and environment in which the deposit exists.

FEDERAL COAL LEASING SYSTEM

This section presents a close examination of the Federal coal leasing system. It has been included to show the evolution of the current leasing system and to highlight the important laws and regulations involved in the leasing of Federal coal. Hopefully, this section will clarify the meaning of these laws and regulations to the reader and enhance his understanding of the leasing of Federal coal.

Evolution of Current Federal Coal Leasing System

In general, the Department of the Interior has the authority to manage the coal resources which lie on the public lands of the United States. Prior to 1970, the coal policy was geared to respond to lease requests on a case-by-case basis without regard to the amount of reserves under lease or to the need of additional leasing. Further, there was no provision for an evaluation of the environmental impacts of leasing.

In 1970, a moratorium on leasing was issued by the Department of Interior. This action was based on a study

by the Bureau of Land Management (BLM) which observed a sharp increase in the leasing of Federal coal and a constant decline in coal production from these Federal lands.

In February 1973, the Secretary of the Interior announced a new coal leasing policy. The long term policy was based on a planning system to determine the size, timing, and location of future coal leases. Further, the long-term policy included the preparation of an Environmental Impact Statement (EIS) to evaluate the entire coal leasing program. The short-term action called for a near total moratorium of new Federal coal leases with leases being issued only to maintain existing mines or to supply reserves for production in the near future.

This new coal leasing system, entitled Energy Minerals Allocation Recommendation System, was to allow the Interior Department to resume the issuance of Federal coal leases by providing a mechanism for shifting to an environmentally acceptable coal leasing program.

However, this program ran into serious difficulties, for with the release of the departmental Environmental Impact Statement, certain public commentary and hearings were very critical of the program. This along with the criticism of Federal agencies led to the requests for a new draft EIS.

In September 1975, the final programmatic EIS was released. This changed the Energy Minerals Allocation System to an Energy Minerals Activity System. The primary change in this system was the emphasis placed on industry and public nominations for the determination of leasing tracts as opposed to having the Federal agencies identifying the tracts of reserves to be leased. This policy called for the formal lifting of the moratorium which had been in effect since late 1970. The short-term policy was to be retained until the new competitive coal leasing system was fully operational.

This program implemented by the Secretary of Interior in January 1976, has also run into difficulties. The General Accounting Office (GAO) issued a study which concluded that the need for a new Federal coal leasing policy had not been clearly established. The GAO study further concluded that if a leasing system is needed in fact that the Interior Department, under the new system, could not effectively administer the coal leasing program. There have also been various suits filed by groups to enjoin the Department of Interior from implementing the new system.

At the present time, due to a ruling in the Natural Resources Defense Council vs. Royston C. Hughes, the Department of Interior has been enjoined from taking any steps to implement the new coal leasing program. This program also

brought to an end the calling for nominations of tracts for Federal leasing except when it met the following short-term criteria: 1) Maintain an existing mining operation at the present level of production. 2) The mine is necessary to provide reserves to meet existing contracts. 3) The extent of the proposed lease is not greater than is required to meet the previously listed criteria for more than three years in the future.

At the present time this is the only method of obtaining a Federal coal lease. The Department of Interior is in the process of re-evaluating its leasing program and contemplating as to whether or not a new coal leasing program shall be instituted and, if so, what kind it should be.

Authorities

The responsibilities of the government agencies with respect to the leasing of Federal coal are as follows:

1) The BLM exercises, at the bureau level, the Secretary of Interior's authority to determine whether or not mineral leases are to be issued in accordance with existing Federal regulations. Primarily the BLM's function is to issue coal leases and be the office of record in coal lease transactions.

2) The Geological Survey (GS) is responsible for operations conducted within the area of operations by permittees and lessees. The GS determines the action to be taken by the

permittees and lessees from the standpoint of the development, conservation, and the management of the coal resources. Along with these responsibilities, the GS is responsible for all geologic, engineering, and economic value determinations for the coal leasing program. These determinations include: mineral characteristics of lease and permit areas, parceling, royalties, rentals, reserves, development, and production requirements.

3) The BLM, in consultation with the GS, formulates the reclamation requirements to be incorporated into the lease. This is done in accordance with the standards set in the current Federal regulations.

4) The GS reviews and approves exploration and mining plans. They also, in consultation with the BLM and other appropriate surface managing agencies, authorize the abandonment of operations.

5) In regard to land outside the mine operation area, the BLM is responsible for conducting examinations of compliance with the requirements of the lease and to applicable Federal regulations.

6) Any disagreements between the BLM and the GS arising in relation to the issuance of any lease or permit will be referred to and resolved by a high authority within the department.

Energy Minerals Activity Recommendation System (EMARS)

The Department of Interior's coal leasing program is called EMARS and has the following objectives: 1) Orderly and timely development of Federally owned coal. 2) Appropriate use of the resources. 3) Effective environmental protection. 4) A fair market return to the public for the resources sold. The program consists of three principal elements: Nominations, multiple resource land-use planning, and environmental analysis. EMARS relies almost entirely upon industry and public nominations for the ascertainment of reserve tracts for development. The industry and public nominations will provide the BLM with data as to the location and quality of coal to be leased.

Competitive Leasing

The competitive leasing procedure followed for the leasing of Federal coal is as follows:

1) In general, coal lands and deposits are divided into leasing tracts. EMARS is used to determine and identify suitable leasing tracts. Competitive lease sales of Federal coal are determined by BLM motion.

2) The proposed tract to be offered for lease is selected by the BLM and GS. This selection is based on an appropriate land-use plan, from industry nominations, and from competitive

coal lease applications on file. Any short-term sale is also based on these selection criteria. For the selection of any proposed short-term tracts for sale, the BLM first determines if the lease application meets the short-term leasing criteria. No lands can be included in any proposed leasing tract unless the following conditions have been met:

a) the lands have been included in a completed and approved land-use plan;

b) the lands have been included in a known recoverable coal resources area; and

c) the lands have been included in a nomination, or been identified by BLM as a potential leasing tract or included as a part of a short-term lease application.

3) Tract selection factors for Federal coal leases include the following: depth, quality, thickness of coal seams, water resources; socio-economic impacts; aesthetic values such as scenic, cultural, wildlife, and vegetative values; and rehabilitation potential.

4) The procedures of competitive leasing must comply with the National Environmental Policy Act (NEPA) as follows: If there are several proposed leasing units having many of the same characteristics, they may be covered by the same regional environmental impact statement as opposed to filing an EIS for every proposed leasing unit.

5) A technical examination is completed on each leasing unit after the final EIS has been completed. This is included to determine the specific reclamation and bonding requirements and to propose stipulations which will minimize environmental effects. The technical examinations also include an evaluation of the lease which balances the value of the coal to be mined against the cost of mining and the environmental costs. The BLM receives from the GS a comparative study of the different possible mining methods and determines the method or methods which provide for the maximum economic recovery of the coal in the proposed leasing tract.

6) At this point the BLM and GS are ready for the recommendation of tentative coal lease tracts. This recommendation occurs only after the preceding requirements in this section have been met, after consultation with the state government and appropriate surface management agency, and after a public hearing in the area which may be affected by the coal lease sale. The State Director then determines a proposed coal lease sale schedule which is submitted to the Secretary of Interior for final approval.

The Director's recommendation and the Secretary's final approval are required to include an evaluation which includes:

a) the effects of the different available mining methods upon the maximum economic recovery of the coal deposit, and

b) the effects which mining the proposed lease have upon the community and environment in that area.

7) After the proposed coal lease sale schedule has been approved a notice of this schedule is published in the Federal Register and in area newspapers.

8) A pre-sale evaluation of the proposed coal lease tract is then conducted.

9) After the sale of the coal lease, a post-sale evaluation of the bids is conducted by the GS and BLM.

Leasing Requirements

The following sections will deal with the various leasing requirements as set forth in the Federal Register.

Lease Terms

Coal leases were previously granted for periods of twenty years and as long thereafter as coal was produced annually in commercial quantities from that lease. At the end of the twenty-year period the leases were subject to revision.

The coal leases were subject to cancellation if various performance requirements were not met. These performance requirements will be discussed later.

At the present time, April 1977, due to a ruling in Natural Resources Defense Council vs. Royston C. Hughes, the only way to obtain a coal lease is under short-term criteria.

Thus the duration of any lease at this time is for a period of three years subject to revision, renewal, or cancellation at the end of that period.

No person, association, or corporation may hold at any one time leases or permits which exceed 46,080 acres in any state. A permit may also not exceed 5,120 acres. However, there is no statute limiting the acreage that may be included in any one leasing tract. This is determined by the GS after taking into consideration the data and area requirements involved with each leasing tract. The acreage of leases under the current short-term criteria is only in an amount which provides adequate reserves to meet these criteria for a period of three years.

Logical Mining Unit and Reserves

A logical Mining Unit (LMU) is an area of coal land that can be developed and mined in an efficient and economical manner given the resources and technology. A LMU may consist of one or more Federal leaseholds and may include intervening of adjacent non-Federal lands. However, all lands must be contiguous, under the effective control of a single operator, and capable of being developed and operated as a unified mine. The complete extraction of LMU reserves must occur within forty years from the first approval of a

mining plan for that LMU. No LMU approved after August 4, 1976, may exceed 25,000 acres, including both Federal and non-Federal coal deposits.

LMU reserves are defined as being equal to the sum of (1) estimated recoverable reserves under the federal lease in the LMU, and (2) estimated non-Federal recoverable reserves in the LMU.

Diligent Development

As a result of the BLM coal lease study which discovered a sharp increase in the total Federal acreage under lease and a consistent decline in coal production, regulations have been passed which encourage production from new and existing coal leases. The lease holders to avoid cancellation must meet diligent development requirements.

Diligent development of any Federal coal lease issued after August 4, 1976, means the preparation and the initiation of production of at least one percent of the LMU reserves by the end of the tenth year from the effective date of the lease. Diligent development of any coal lease issued before August 4, 1976 means that there must be the production of one-fortieth (2 1/2%) of the LMU reserves before June 1, 1986.

Continuous Operations

This leasing requirement means that there must be the production of coal in the amount of one percent of the LMU

reserves for each of the first two years following the achievement of production and an annual average amount of one percent of the associated LMU reserves thereafter. The annual average amount is computed on a three-year period. The period for which the average is computed consists of the year in question and the two preceding years.

Exploration and Mining Plans

Before conducting any type of operation on a leased land the operator needs to submit to the proper authorities a comprehensive exploration plan and if the situation dictates, a mine plan.

The exploration plan is a detailed plan submitted to the GS for approval before exploration operations begin. This plan shows the location and type of exploration work to be conducted, environmental protection procedures, roads, and reclamation procedures to be followed upon completion of such operations.

The mining plan is a detailed plan for development of the coal resource submitted to the GS for approval prior to the commencement of any operation. This plan includes the proposed location, method, and extent of mining and all related activities associated to such operations. The plan also includes action to be taken to reclaim disturbed areas, diminish adverse impacts, and, in general, meet the performance

standards set forth by the lease. The mining plan covers all operations to be conducted on a lease either for a three year short-term lease or a period of at least five years or of a logical mining unit.

In general, the exploration and mining plans should be consistent with the requirements of the lease. The plans should include provisions for maximum recovery of the coal, protection of the environment, and sufficient information to substantiate the effectiveness of the proposed reclamation method.

Performance Requirements

The BLM has a set of standards and obligations which are followed in surface mining operations. These regulations provide for maximum recovery of the coal resource consistent with technology and the existing economic environment.

Operators should "take action to minimize, control, or prevent damage to the recreational, cultural, scientific, historical, and known or suspected archeological and paleontological values of the land." (43 CFR 3041).

The performance requirements for surface mine reclamation call for the lands to be reclaimed equally or better for uses which the lands were capable of supporting before the exploration or mining operations took place.

Acreage Rental

The Mineral Leasing Act Amendments of 1975 called for the Secretary of Interior to set annual advance rentals on leases. Advance rental provisions call for an annual rental per acre for coal leases not to be less than 25¢ for the first year, not less than 50¢ for the second through fifth years, and not less than \$1.00 for each and every year thereafter. On all leases issued before August 4, 1976, the rental paid for any year can be credited against the royalties for that year. For leases issued after August 4, 1976, the rental payments may not be credited against the royalties.

Royalties

Federal coal leasing requires a royalty payment of not less than twelve and one-half percent of the value of the coal from a surface mine. In an underground mine the minimum royalty rate cannot be less than eight percent of the value of the coal removed.

The value basis of the coal for royalty purposes is the gross value at the point of sale where only crushing and loading are performed prior to the point of sale. If additional processing is required to remove impurities they may be deducted from the gross value in calculating the royalties. The gross value of the coal is calculated by taking the sales

price times the number of units sold provided that the value of the coal is the only factor under consideration in determining the sales price.

MAJOR DIFFERENCES IN A COMPARATIVE ANALYSIS OF
FEDERAL AND NON-FEDERAL COAL PROJECTS

The purpose of this chapter is to disclose the major differences in a comparative analysis of Federal and non-Federal coal projects. The major differences are the lease acquisition process, permit process, leasing requirements, production royalties, and lead time or development schedule.

Lease Acquisition Process

The lease to the prospective coal reserve must be obtained from the Federal government, state, county, or private owner. For purposes of this thesis, state, county, and privately owned coal leases are classified as non-Federal leases. This section will discuss the Federal lease acquisition process along with some of the associated problems of this process. This will be followed by a discussion of the non-Federal lease acquisition process which will highlight the major differences in the two lease acquisition processes.

Federal Lease Acquisition

The acquisition of Federal leases from the Department of Interior has become an increasingly uncertain, complex,

and costly process (see Federal Leasing Systems). This is due largely to the numerous investigative requirements, environmental studies, public hearings, and the large number of leasing requirements. The process is further complicated because the only way of obtaining a Federal coal lease is by meeting the government's short-term leasing criteria.

The exact timetable for Federal lease acquisition is unknown. The specific amount of time required to acquire a Federal coal lease must be evaluated for each situation. There is no "rule of thumb." The following description of Federal lease acquisition has been developed from papers discussing the development of Federal coal mines, contacts with coal industry people, and from the author's personal experience.

The prospective mining firm must allow time, capital, and resources to work on the following procedure for Federal lease acquisition.

1) Exploration Program: Before any Federal coal reserve is even considered for leasing, it must be identified as being in an area of known coal reserves. (43 CFR 3041). Although a requirement for leasing, this classification by the GS is useless to the prospective mining firm from a commercial and development standpoint. To determine commercial reserves, an exploration program must be initiated. This exploration program requires an exploration license which the mining firm must obtain from the BLM.

The exploration license allows the mining firm to begin a drilling and exploration program on the lease area. By law, this drilling and exploration program must include at least four data points per square mile which are either drill holes or coal outcrops. The purpose of the exploration program is to obtain information on the physical and geological characteristics of the coal reserve along with the quality of the coal. The results of the exploration program must be analyzed and a determination made if there are adequate reserves which can be commercially mined or developed.

The exploration program requires the prospective mining firm to sink a substantial amount of money into a lease area with little or no assurance that the firm will acquire the lease for the reserve. In the past, a prospecting permit could be obtained from the government which could lead to a preference right lease if coal was found. Presently there are no option type agreements which will give a company preferential rights to acquire the coal lease once the exploration program has been completed. The lease will be granted in a competitive bidding and lease sale procedure open to all prospective mining firms. Thus, at the end of the exploration program, which may take up to two years to complete, the possibility exists that the lease could be granted to another party.

2) Surface Acquisition: Since the surface ownership is often different from that of the underlying coal, negotiations for surface acquisition usually need to be conducted prior to the exploration program. Current government exploration licenses give the mining firm no right to enter the surface of the lease area; this often forces the mining firm to obtain surface rights prior to exploration. The surface agreement usually contains an option to purchase if the project is determined feasible and the lease is granted.

3) Environmental Studies: This phase of Federal lease acquisition includes such studies as environmental baseline studies, socio-economic studies, archeological studies, and environmental analysis. The environmental studies begin very early in the Federal lease acquisition process and continue at a low level of activity throughout the life of the mine. The environmental studies and reports must be submitted with many of the permit applications.

Along with the basic environmental studies, the leasing of Federal coal requires that the BLM perform an EIS for the lease area. The EIS procedure, required by the National Environmental Policy Act (NEPA), basically requires government agencies to place environmental concerns high on the list of factors being considered during policy decisions and agency approvals. The EIS is required for any activities

which "have a major significant effect upon the quality of the human environment." The EIS process is described in Appendix A.

In summary, prior to Federal lease acquisition, the prospective mining firm must have allowed time, resources, and capital for the following:

- Completion of the initial exploration and determination of the preliminary project feasibility.
- Completion of option agreements for surface acquisition and mining rights.
- Completion of the basic environmental studies.
- Concurrent performance of the EIS procedure and NEPA process; this will be terminated by the GS approval of mining and reclamation plans.

Current industry estimates for completing these initial steps in the Federal lease acquisition process call for a period of approximately two years under optimum conditions. This estimate is based on the assumption that the exploration license and surface rights are obtained with a minimum amount of delay.

Assuming the preceding requirements have been met, the Federal coal reserve is ready to lease. The bureaucratic process of the sale of the Federal coal lease will, at a minimum, take up a period of six months assuming the lease is sold at the initial lease sale. Many times the coal lease will not be issued at the initial lease sale because

the bonus bid by the mining firm does not meet the minimum bonus bid set by the government.

It can be suggested that the government drilling information used for determining the minimum bonus bid may be unreliable. The government drilling information is based on a GS drilling program and on the drilling information provided by the mining firm from its exploration program. The GS drilling program drills on existing roads only, makes no attempt to drill on hard to prepare sites, and thus drills only on otherwise level and clear sites. A drilling program of this type is inadequate because it ignores the geologic deposition of the coal and follows no set drilling pattern. According to common engineering practice, the initial drilling in an exploration program should be on a grid pattern. Drilling the lease area on a grid pattern will generally give a more accurate representation of the physical and geological characteristics of the coal reserve.

In addition to the inadequacies of the GS drilling program, there is a great deal of ambiguity of how the government arrives at the minimum bonus bid. The government minimum bonus bid is a function of many factors which include the following: interpretation of drilling data (reserve estimates), estimated mining costs, and assumptions concerning production rates, capital equipment utilization, and rate-of-return. Clearly if the government's interpretation of

these factors is different than that of the mining firms, the resulting bonus bid by the mining firm may differ greatly from the minimum bonus bid set by the government. In some cases, this phenomena may cause the minimum bonus bid set by the government to be much higher than a mining firm's bonus bid. Thus, the lease sale process could take 2-3 six month periods before a mining firm has resubmitted and met the minimum bonus bid set by the government.

Once the minimum bonus bid is met, the coal lease sale is finalized and the prospective lease is granted to the mining firm. The mining firm is now ready to move forward in the mine development process.

Non-Federal Lease Acquisition

The acquisition of leases for non-Federal coal reserves is usually much simpler, less time consuming, and requires less capital than Federal lease acquisition. This is basically due to the nature of the ownership and the multitude of leasing agreements that can be entered into by the mining firm and lessee of the coal reserve.

The State of Colorado lease acquisition process is representative of most non-Federal lease acquisitions in respect to the amount of time and capital involved. The state lease acquisition process requires that the mining firms nominate the state held leases which they would like to see offered

for sale. The mining firm must nominate these leases at least thirty days before a scheduled lease sale. State lease sales are scheduled approximately every three months. The leases are issued to the mining firm which bids the highest bonus payment per acre. The minimum acceptable bonus bid is one dollar (\$1.00) per acre which is equal to the first year's rental payment.

Once the lease is granted, the lessee must obtain a state exploration license so that an exploration program can be initiated. An exploration license for state leases can be obtained in approximately two to four weeks under normal conditions. The mining firm will conduct an exploration program to determine the physical and geological characteristics of the coal reserve. They will use this data to determine if the lease can be developed commercially.

The results from the exploration program may determine that the project is unfeasible. The mining firm would then have the option to drop the state lease at the end of the first year. The sunk cost in the lease at this point would be the bonus bid payment and the cost of the exploration program. The bonus bid payment per acre for state leases will usually range from \$5-\$20 while bonus bid for Federal leases may run from \$500-\$1,000 and even higher in some cases. The

mining firm's loss in dropping a state lease is a fraction of the loss in dropping a Federal lease. This is due to the great differential in bonus bid payments. The smaller bonus bid payments of state leases enable mining firms to look at a larger number of state leases. The smaller amount of sunk costs allows the mining firms to risk less financial capital in determining preliminary project feasibility. The risking of a smaller amount of capital enables small mining firms to compete effectively in the lease acquisition process.

The remainder of this section will discuss the typical procedures followed in the non-Federal lease acquisition process. The mining firm must deal with the following procedures in any non-Federal lease acquisition.

1) Exploration Program: The mining firm and the lessee of the coal reserve will usually set up option agreements which allow for the lease acquisition and the exploration program. The option agreement allows the mining firm to carry out a drilling and exploration program on the lease area to determine the physical and geological characteristics of the coal deposit. This agreement allows the mining firm to exercise an option to lease if the exploration program determines adequate reserves. This is in contrast to Federal lease acquisition where there are no option type agreements. An exploration license on a Federal lease does not give the

mining firm an option to lease. The license only permits the mining firm to drill and explore the lease area.

2) Surface Acquisition: Negotiations for surface acquisition should be conducted concurrently with the negotiations for the option agreements and the lease contracts. The surface acquisition will usually contain an option, much like the lease agreement, which can be exercised to obtain the surface if the project is determined feasible. The agreement may call for the outright purchase of the land or it may be in the form of a lease contract for the life of the mine. Just as in the lease agreement, there is considerable flexibility in the type of agreement which can be used for surface acquisition.

3) Environmental Studies: Although various environmental studies are required throughout the mine development process, the mining firm does not need to have these studies initiated or completed to acquire most non-Federal leases.

The mining firm will usually make a preliminary investigation of environmental data which is available. This investigation along with general physical observations of the area enable the mining firm to determine the major areas of environmental concern. The mining firm is essentially looking for the serious environmental problems which may inhibit the development of a mining project. The mining firm will base much of its decision to acquire the lease on this early

investigative information. The ability of a company to handle and judge this information effectively may save them from sinking considerable time and capital into a project which has the potential for serious environmental problems.

The NEPA process will have a limited effect on non-Federal projects. The number of permits and approvals required from Federal agencies is limited significantly due to the non-Federal status of the project (see Permit Process). The limited effect of the NEPA process upon non-Federal projects enables the mine development process to be shortened significantly. This will enable the mining firm to have a smaller amount of manpower, time, and capital tied up in the development process. The limited effect of the NEPA process will also reduce the amount of risk and uncertainty inherent in any mine development schedule.

Permit Process

The permit process for Federal and non-Federal projects has become an increasingly complex problem for the mining firm. To begin any mining operation, permits and approvals of various kinds are required from Federal, state, and local agencies. In past years the amount of information required for a permit was minimal and permits were usually granted within a few weeks or months. Presently, the amount of information required with

the permit application has multiplied many fold. This has increased the time required to both assemble the information and evaluate the same for approval.

"The number of permits involved, whether they are Federal, state, or county will vary with each mining site. There is no general rule that applies." (J.R. Jones, 1977). This phenomenon requires that each coal project be evaluated on a site specific basis. The required permits as well as the proper timing for their application must be evaluated early in the mine development process. The failure to include one permit or approval at the beginning of the process can result in costly time delays. The mine cannot usually commence operations without having all the permits and approvals.

When the coal is Federally owned as opposed to non-Federal poses yet another problem. In general, Federal mining projects require all the Federal, state, county, and local approvals of non-Federal projects plus the additional permits and approvals required of Federal projects. The fact that a project is Federal tends to only lengthen and complicate an already difficult and uncertain process.

The following summary of permits and approvals is included to show the various permits and agency approvals required of non-Federal and Federal projects. The summary is not intended to show the technicalities of the permits and approvals, but is included as a general overview of the process.

Non-Federal Permit Process

This section provides a summary of permits and related approvals that might reasonably apply to the opening and operation of a non-Federal surface coal mine in northwest Colorado. Northwest Colorado was chosen as the site for the mine because of a definite familiarity with the local, county, and state government in that area. The summary has been based upon research to determine all possible permits and approvals that might exist at any level of government. The summary is generally broken down into city and county, state of Colorado, Federal government areas of authority, in that order.

City and County.

1. Zoning Regulations
 - a. Required in areas where mining is not a use by right, but is allowed with a special uses permit.
 - b. Additional zoning approval required for the construction of railroads, any electrical substations, new electrical transmission lines, or any other facility away from the mining site.
2. Building Codes - Electrical
Plumbing
Structural
Sewage
3. Local designations under Colorado Land Use Law
(HB. 1041 CRS 1973)

State of Colorado

1. Permit under Colorado Mined Reclamation Act (HB. 1041 CRS 1973).
2. Net Pollutant Discharge Elimination System (NPDES) permit from Colorado Department of Health. Generally required for any facility having a water discharge from a point source; need a permit and approval before commencement of any discharge.
3. Air pollution source permit for fugitive dust and for machinery emissions for engines greater than 1,000 horsepower. Permit is issued by Colorado Department of Health.

Separate permits for:
 1. mining;
 2. haulage; and
 3. crushing and loadingif, respectively, the three are at different locations.
4. Colorado Division of Mines mining permit and fees. Tax equals 7¢ per ton payable quarterly.
5. On-highway truck permit from Colorado Public Utilities Commission for haulage on public roads, also includes weight limitations.
6. Department of Highway approval to connect project roads to state or county roads and highways.
7. Solid waste disposal permit from Colorado Department of Health for any solid wastes (trash) to be disposed of on the property.
8. Noise pollution abatement procedures for noise at the property lines of the mine. (HB. 1041 CRS 1973).
9. Comply with safety regulations of Colorado Occupational Health and Safety Act.
10. Comply with blasting regulations of Colorado Division of Mines. Regulations for transportation, storage, and use of explosives.

11. Water pollution requirements. (CRS 1973).
12. Monthly report to Division of Mines on production and accidents.

Federal Government.

1. Air quality permit from Environmental Protection Agency (EPA).
2. Mine Enforcement and Safety Act (MESA) - very extensive safety regulations.
3. Occupational Safety and Health Act (OSHA) - where MESA does not apply.
4. Federal Communications Commission (FCC) license for radio communications.
5. Storage and use of explosives may come under regulation of Internal Revenue Service (IRS) from Federal Crime Control Act.

The time frame to obtain the permits and approvals for a non-Federal mine can be reasonably approximated. The critical permit to obtain in the non-Federal permit process is the air quality permit issued by the EPA. This permit requires that the air quality be monitored for a full year before issuance of the permit. Non-Federal mine developers feel that this is the critical permit to obtain and that all the other permits can be obtained within the 12-15 month time frame required to obtain the EPA permit. This is largely due to the fact that the non-Federal permit process is subject to little of the Federal bureaucratic process.

The principal points to remember about the permit process for a non-Federal coal mine are:

- The critical permit to obtain is the EPA air quality permit.
- The risk to the operator of committing substantial capital to construction and ordering multi-million dollar equipment is significantly diminished because of the easier approximated lead time for the permit process.
- Specific amounts of lead times can be more accurately estimated for non-Federal mines. This can significantly reduce interest payments on borrowed funds and avoid possible penalties for failure to deliver coal as specified in sales contracts.
- The permit process will require 12-15 months and should not significantly delay the development of the mine.

Federal Permit Process

The following is a summary of the additional permits and agency approvals required when the coal reserve is owned by the Federal government as opposed to a non-Federal owner. A Federal coal lessee is required to obtain nearly all the permits and approvals required of non-Federal projects plus the additional permits and approvals required of Federal projects. The following summarizes these additional permits and approvals along with the problems they may present.

Additional Federal Permits and Approvals

1. Mining and reclamation plan approvals from the GS. Approval required whenever Federally-owned coal is to be mined; approval subject to the lengthy NEPA process.
2. Comply with National Environmental Policy Act (NEPA).

3. Possible compliance with EMARS, a process which has not been fully implemented.
4. Comply with requirements of Federal Pollution Control Acts.
5. Archaeological Preservation Legislation - There are several permits and statutes dealing with historical and archaeological preservation which may have effect upon the opening and the operation of Federal coal mines.
6. Right-of-Way Permits for BLM lands.
7. Endangered Species Act.

The time required to obtain the permits for a Federal mine has become a matter of estimation on the part of the mining firm. Current industry estimates are approximately three years for the permit process of a Federal mine. The principal points to remember about this process can be summarized as follows:

- The length of time required to obtain the additional Federal approvals will significantly lengthen the mine development process.
- Specific amount of lead times cannot be accurately estimated.
- A mine operator cannot safely assume that he can order the capital equipment until he has all permits and approvals in hand. The operator could find himself with substantial capital invested in equipment but not have all the required permits.
- Delays of obtaining permits can substantially increase the interest payments of funds borrowed to finance a project; there may also be penalties for the non-delivery of coal to customers as specified in sales contracts.

- A great deal of uncertainty and risk prevalent in the Federal permit process may require the operator to require an higher rate-of-return before starting a project.

Leasing Requirements

This section provides a brief discussion of the Federal and non-Federal leasing requirements and the effect they may have on the respective mining operations.

The Department of Interior promulgates a series of regulations dealing with the leasing requirements of Federal coal. In general, these regulations are very specific and very restrictive of the mining operation of Federal coal. These regulations may be summarized as follows:

43CFR3041 - governs such aspects as leasing, permitting, licensing, planning procedures, reclamation standards, surface uses, bond requirements, and reports.

30CFR211 - governs operations for the discovery, testing, development, mining, preparation, and handling of Federal coal.

43CFR3500 - requires commencing of coal production from a Logical Mining Unit (LMU), diligent development, and continuous operation requirements.

43CFR3520 - defines commercial quantities of coal and requires that lease applicants show that coal can be developed and marketed at a profit, or in other words, the applicant must produce a mine plan and profit/loss statement.

In addition, if the EMARS program is implemented, there will be additional requirements associated with its regulation.

In contrast to the Federal leasing system, the leasing requirements for non-Federal coal operations are usually very general and non-restrictive of the mining operation. The requirements of the state leases are set forth in the mining laws of the state. The balance of the non-Federal leasing requirements, much like the state requirements, call for mining and reclamation methods which are consistent with prevailing good practices. The leasing requirements appear to allow the individual mining firms a great deal of flexibility in determining the mining operations.

One example of this flexibility would be in the case which the mining firm needs to change the mine plan to keep the operation working efficiently. Under most non-Federal leases the new mine plan would gain approval from the lessor in a matter of a few weeks as long as the change was consistent with good mining practice. A change of the mine plan of a Federal mine plan would not be so simple. This change requires Federal action to make a decision on the plan and possibly may require additional environmental analysis. All of which can result in costly time delays in the mining operation.

Another possible leasing requirement under Federal leases is the mining of all the coal seams to a certain depth. The coal operator may be required on Federal leases to mine a seam which is uneconomical so that it may mine an economical

seam at a greater depth. This phenomena may cause companies to expend resources and time on a money losing seam while they could be mining a profitable seam at a greater depth. In addition, the flexibility of the operation provided in non-Federal leases permits each mine to operate at an optimal annual production rate. This optimum rate of production is a function of many factors among which are seam thickness, strip ratios, capital equipment utilized, and available manpower. Clearly the flexibility inherent in non-Federal lease requirements will enhance the coal operator's reaching this optimum annual production rate.

Production Royalties

In the past, royalties for non-Federal leases have been at a depressed level due to the condition of the market. Production royalties have been as low as seventeen and one-half cents (17 1/2¢) per ton as recent as 1974 (Proprietary Information). The current royalty rate for many private and county leases appears to be approximately five percent. The State of Colorado coal lease requires a production royalty of twelve and one-half percent for surface mines.

A Federal coal lease requires that production royalties be at a minimum twelve and one-half percent for surface mines. In a recent short-term Federal coal lease in Routt

County granted to Energy Fuels Company the Federal government charged a royalty of fifteen and one-half percent. All Federal coal leases preceding this short term lease had called for a twelve and one-half percent royalty rate. However, this royalty rate may be indicative of rates to come.

The production royalty charged in any lease will lower a project's profitability. The production royalty directly reduces the pre-tax net profit. Production royalties are based on gross revenue and are paid to the lease owner regardless of the amount of net income derived from the lease. Royalties are deducted from gross revenue in calculating the statutory depletion allowance. The reduction of the depletion allowance places a greater tax burden on the mining firm. The production royalties combined effect of reducing pre-tax net income and the depletion allowance lowers not only the cash flow but also the project's rate-of-return. The non-Federal leases, typically with smaller royalties, will have a decided economic advantage over the Federal leases which charge a higher royalty rate.

Development Schedule

This section will present the mine development schedule for Federal and non-Federal coal projects. The time frame needed to complete the major steps of the mine development

Table 1

Non-Federal Surface Mine

Pre-Production Development Schedule

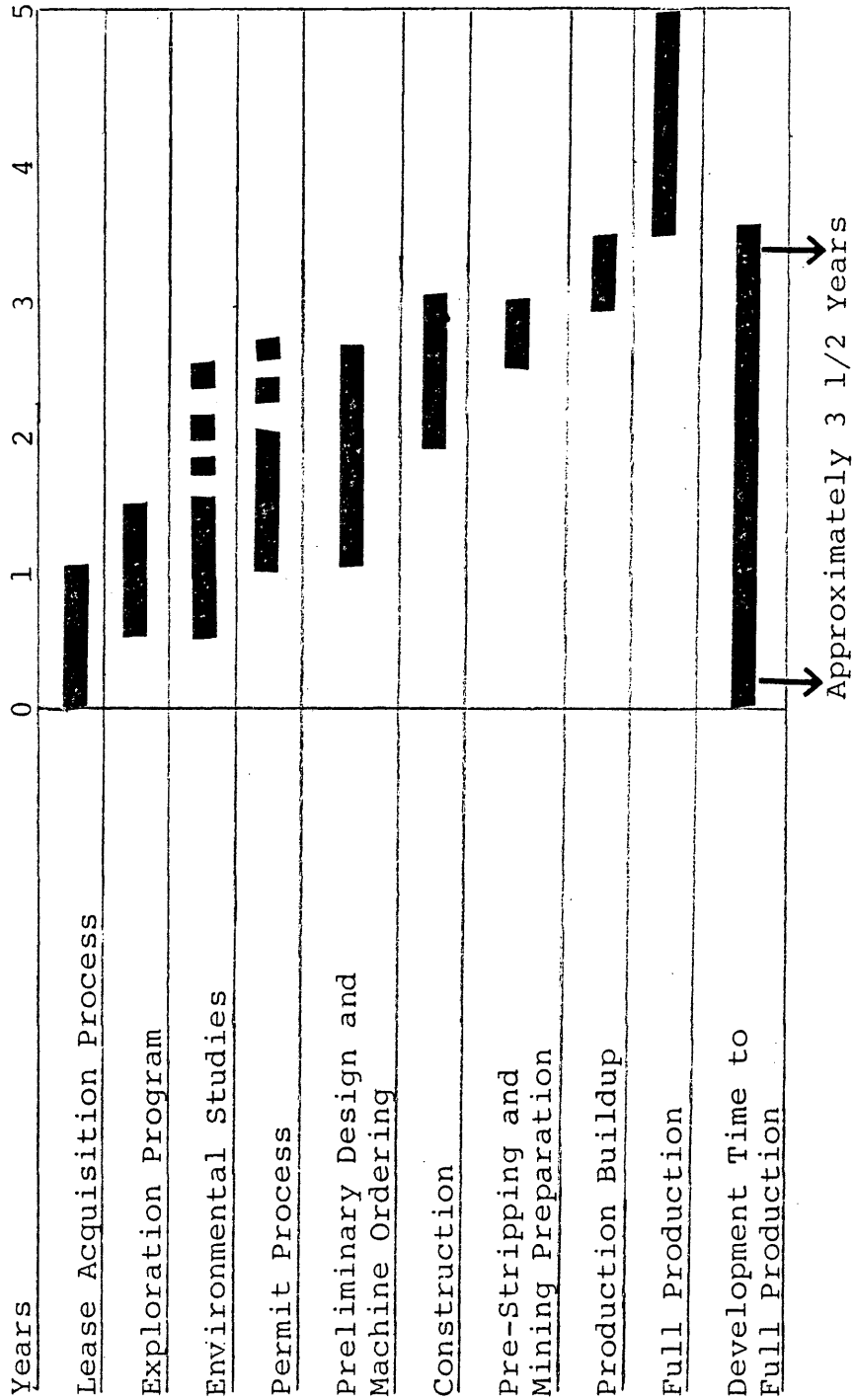
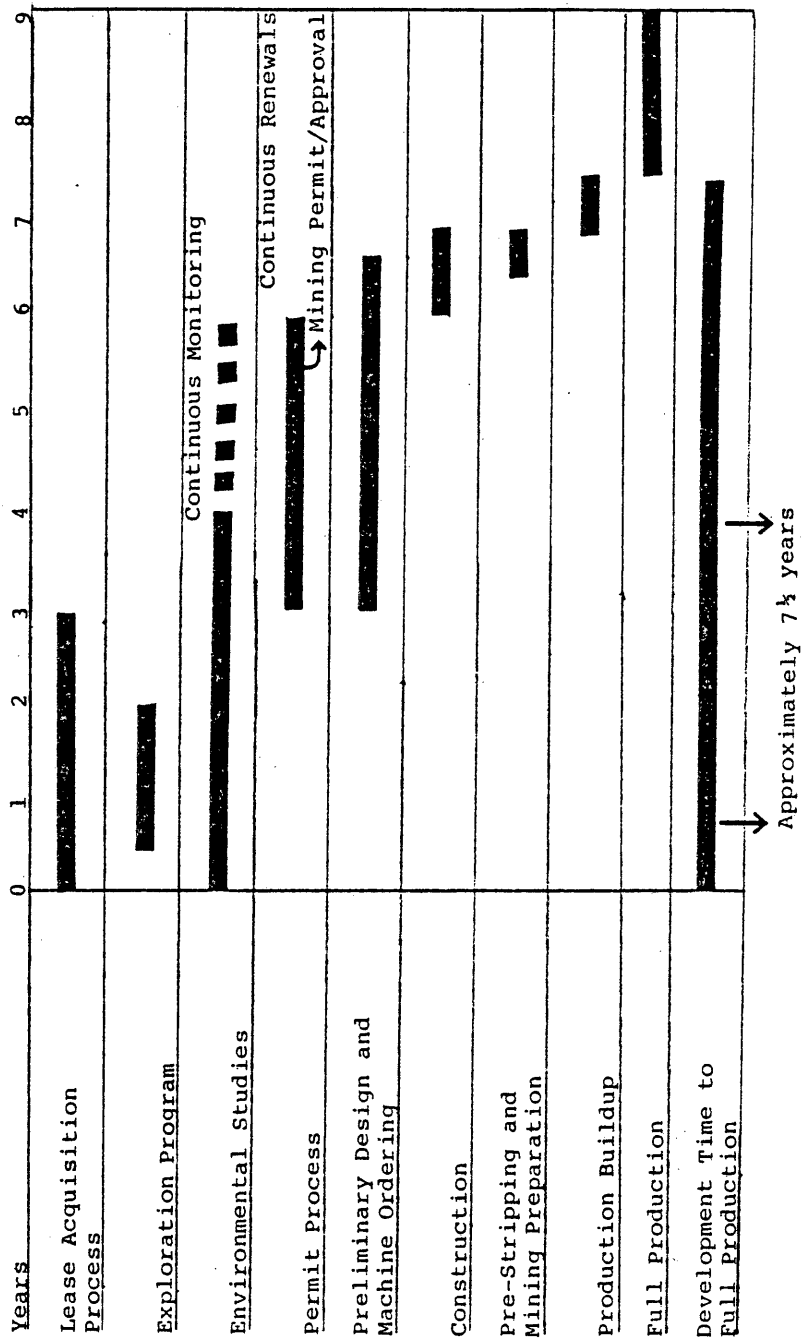


Table 2
Federal Surface Mine
Pre-Production Development Schedule



process are displayed on a timing-bar chart (Table 1 and 2). This chart was developed for a small scale northwest Colorado strip mine (1 MM/yr). For larger mines the time frames for certain steps would have to be lengthened. However, timing requirements are not directly proportional to the size of the mining operation. The timing requirements for lease acquisition, the exploration program, environmental studies, and the permit process have been estimated in their respective sections earlier in this thesis. Industry estimates will be used for market development, preliminary design and machine ordering, mining preparation, production buildup, and full production. Each of these sections is presented in the timing-bar chart. This bar chart is a typical example only. The timing requirements for each specific mine must be developed on a site-specific basis.

Tables 1 and 2 show that the development time for a small scale Federal surface mine is considerably longer than for a non-Federal mine. With the uncertainty of current governmental policy, the risks of bringing a leased Federal mine into production have multiplied. These risks along with the excessive lead time have increased development costs significantly. Note Tables 1 and 2; the development time for bringing a Federal mine into production is approximately 7 1/2 years at the present time. A non-Federal mine of comparable size has an estimated lead time of approximately 3 1/2 years.

COMPARATIVE ECONOMIC ANALYSIS OF A FEDERAL AND
A NON-FEDERAL COAL PROJECT

This chapter provides a comparative economic analysis of the leasing, developing, and mining of non-Federal coal as opposed to Federally owned coal. The economic comparison is based on the Hayden Gulch mine, a small scale strip mine. The project is first economically evaluated as a non-Federal lease, the actual case in this instance. The project is then evaluated as if the lease were Federal. The economic results of the two evaluations are then compared and in turn demonstrate the effect that each of the two leasing systems has upon a firm's profit. The use of the same lease area in the economic evaluation gives a just representation of the economic effects of the two leasing systems.

The lease area chosen for the strip mine example, hereafter referred to as Hayden Gulch, is located in Routt County (see geographic environment). Hayden Gulch is being commercially developed by W.R. Grace and Company. Production from this lease is scheduled for late this year (1978).

Geographic Environment

Location

The Hayden Gulch property lies in the eastern Williams Fork Mountain area of Routt County in northwest Colorado. The property is approximately ten miles southwest of Hayden, Colorado on the Hayden Divide road. It lies near the west end of the eastern Williams Fork Mountain in Sections 30 and 31 of T5N, R88W, 6th P.M. This places the property in the approximate center of the Yampa coal field. The property consists of 1,360 acres of leased coal and 240 acres of deeded coal. The strippable portion of the property is 10.5 miles from the Denver and Rio Grande railroad. Coal haulage would enter County Road No. 53 and proceed to connecting rail spur (see map, Appendix B).

Topography

The topography of the Hayden Gulch properties is quite rugged. The property lies on the crest of the Williams Fork Mountains, where elevations range from 7,300 to 7,900 feet above sea level. The Williams Fork Mountains are a hogback-like structure with 6-12 degree dip slopes of sedimentary beds facing to the north and northeast. The mountains also have steep cliffs facing south which have been formed by the outcrops of more resistant beds. The area is cut by northeast-

southwest trenching valleys from incised drainage channels of the area. The property covers the divide between the Hayden Gulch and Dry Creek drainages.

Climate

Average annual precipitation in the area ranges from 16-20 inches. Approximately half of this precipitation is in the form of rain during the spring and summer months, and half in the form of snowfall during the fall and winter. Average snowfall is from 90-130 inches per year.

Temperatures range from an average annual high of approximately 85 degrees for July to an average annual low of approximately 15 degrees for January. From March until early-late May the warmer spring weather melts the accumulated snow cover and causes a period of extremely muddy conditions. Summers often have lengthy hot, dry spells, while winters have lengthy periods of heavy snow and sub-zero weather.

Geologic Environment

Depositional Environment

The sedimentary section which outcrops throughout the Hayden Gulch area is entirely of upper Cretaceous age. These sediments represent a period of continuous deposition of primarily clastic material through three major epochs and several minor periods of transgression and regression of the

late Cretaceous epi-eric sea. The formations exposed in the Hayden Gulch area include the Mancos Shale, Iles, and Williams Fork formations of the Mesa Verde Group, and the Lewis Shale. These formations display a genetically controlled cyclothem of clastic sediments which are characteristic of facies deposited in a linear clastic shoreline environment.

Structure

The Hayden Gulch property lies on the southwestern limb of a small synclinal prong of the northwesterly plunging Hayden syncline. The property is located near the trough of this synclinal prong and consequently, the strata has a gentle northeasterly dip.

The Hayden syncline is part of a larger structural basin extending northward into Southern Wyoming. The regional structure is modified by many folds and faults, especially to the south and east of the Hayden Gulch properties. This folding, which is relatively tight, lends an overall northerly structural fabric to the area. Faulting within the area of interest is apparently limited to the extreme northern part.

Effect of Structure on Topography and Mining

The Hayden Gulch property, structurally located near the trough of the syncline, exhibits gentle northeasterly dips that gradually change to a more northerly direction along the eastern edge of the property. The gentle dip of the

strata (6°) has resulted in the formation of erosion slopes that roughly coincide with the structural dip. These "dip slopes" are supported by the cliff forming Trout Creek Sandstone and Twenty Mile Sandstone of the Williams Fork formation. The slopes are rather narrow and elongate in a northeasterly direction.

Several workable coal seams lie above the Twenty Mile Sandstone under a rather thin veneer of overburden. This will make the central part of the lease area suitable to strip mining. The steepness of topography in non-strippable areas may limit and control pit size and orientation by limiting amounts of soil and initial spoil which can be disposed of in the operation area.

Coal

The coals of the Mesa Verde group in this area are divided into three groups. The coals of the Iles Formation make up the lower coal group. The coals between the top of the Trout Creek Sandstone and the bottom of the Twenty Mile Sandstone make up the middle coal group. The coals between the Twenty Mile Sandstone and the Lewis Shale, in the upper Williams Fork formation, make up the upper coal group.

All of the strippable reserves on the Hayden Gulch property lie within the upper coal group. The coals of the lower and middle coal groups would be recoverable only by

underground methods. This would require additional property to be obtained to the south. This option will not be considered in this evaluation.

The upper Williams Fork formation is quite thin in this area (approximately 425 feet). The recoverable coal seams of the upper coal group are found in a zone from 100 - 250 feet above the Twenty Mile Sandstone. The seams have been identified by a numbering system from the top down. Of the six major seams found on the property, five may be surface recoverable over part of the property. Seam and reserve information are displayed in Appendix C.

Coal Quality

BTU

The coal reserves of the Hayden Gulch property are of B-grade subbituminous rank. The heating values lie between 9,500 and 10,500 per pound and the coal is non-agglomerating.

Sulfur

Sulfur values over the property range on the average from 0.35 to 0.55 percent by weight. The average sulfur value for all seams is approximately 0.40 - 0.45 percent, making it compliance coal by the current EPA secondary standards for sulphur dioxide emissions in coal fired power plants.

Moisture

Analysis of the coals at Hayden Gulch show values ranging from 16 - 19 percent. This is relatively high moisture for coals in the Mesa Verde Group in this area. This can be attributed to the shallow depth of the coal. Air drying losses should reduce these values during shipment if the coal is shipped for any distance or stockpiled for a period of time after mining.

Ash and Grindability

Ash values for coals within the strippable area range from 5 to 7 percent. Hardgrove grindabilities for samples of the coal average approximately 40.

Operating Environment

Lease Terms

The lease terms are as follows:

- 1) For purposes of the non-Federal leasing system evaluation, the mining firm owns the surface of the mine and the coal reserves are leased from Routt County.
- 2) For purposes of the Federal leasing system evaluation, the mining firms own the surface of the mine and the coal reserves are obtained in a lease from the Federal government under the short-term leasing criteria (see Federal Leasing Systems).

Mining Feasibility and Assumptions

The surface recoverable reserves of the Hayden Gulch property are not adequate to justify the use of large stripping equipment. The reserves would be exhausted far short of the depreciation life of the larger stripping equipment.

The seven million tons of surface recoverable coal reserves can be best mined using small earth moving equipment (bulldozers, scrapers, front-end loaders, and trucks). The following is a list of basic assumptions used in the mine design and economic evaluation:

1) Equipment and facilities selected must be depreciated over a period no greater than the life of the mine.

2) Production would be 500,000 tons of coal in years 1 and 8 of production. In years 2-7, the production would be 1,000,000 tons of coal per year.

3) Coal production would be trucked to the rail spurs which in turn would deliver the coal to the tipples.

4) Haulage to the rail spur and reclamation would be contracted.

5) Mining and tipping would be performed by the mining firm.

6) At the termination of production, a salvage value would be assumed for the land, mine equipment, mine facilities, loading facilities, and rail spur.

7) An estimated 600 acres of land will be disturbed and require reclamation. Approximately 50 acres per year will be reclaimed in years 2-8 of production. The remaining 250 acres will be reclaimed in year 9.

Reserve Estimates

The following table summarizes the surface recoverable reserves for the Hayden Gulch properties.

<u>Seam</u>	<u>Feet Thickness</u>	<u>Tons Recoverable Reserves</u>
1	3.5	846,000
2	8.0	2,084,00
3	2.0	531,000
4	4.5	1,404,000
5	<u>6.5</u>	<u>2,138,000</u>
Total	<u>24.5</u>	<u>7,003,000</u>

The total surface recoverable reserves (7,003,000) cover an average mine area of 225 acres. The strip ratio (tons of overburden per ton of coal) through seam 5 is approximately 4.57 to 1. (See Appendix C).

Capital Investment

The non-Federal and the Federally leased mines at Hayden Gulch will both require the same amount of capital investment

for the mine equipment, mine facilities, loadout facilities, mine design, haul road improvements, rail spur construction, and working capital. The capital investment required for the exploration program, environmental studies, administrative costs, purchase of reserves, and overlying surface will be different for the two projects. Tables 3 and 4 summarize the estimated capital costs for the two projects.

Mine Equipment

The mine plan devised for Hayden Gulch calls for a truck and front-end loader stripping operation capable of producing one million tons of coal per year. The equipment list and required expenditures for an operation of this scale are summarized in Appendix D.

Mine and Loading Facilities

Mine facilities consist of an office, washhouse, shop and warehouse, oil and fuel storage, and parking for field equipment and passenger cars. Loading facilities consist of a tipple with a primary crusher, secondary crusher, belts, and automatic sampler. The tipple has a capacity of 1,000 tons per hour and will be loaded by a 988 front-end loader. The capital cost estimates for the mine and loading facilities are summarized in Appendix D.

Table 3Estimated Capital Costs
(\$000)Hayden Gulch, Federal Lease

	<u>\$</u>
Mine	6,261
Loading Facilities (Tipple)	660
Land (Mine Site, Rail Spur, Loading Facilities)	1,890
Coal Reserves (Bonus Bid, \$1,000/Acre)	1,440
Exploration Program	400
Environmental Studies	230
Administrative Costs	350
Mine Design	350
Haul Road Construction	1,350
Rail Spur	3,350
Working Capital	<u>1,178</u>
Total:	\$17,459

Table 4
Estimated Capital Costs
 (\$000)
Hayden Gulch, Non-Federal Lease

	<u>\$</u>
Mine	6,261
Loading Facilities (Tipple)	660
Land (Mine Site, Rail Spur, Loading Facilities) (1,000/Acre)	1,890
Coal Reserves	1,000
Exploration Program	250
Environmental Studies	100
Administrative Costs	175
Mine Design	350
Haul Road Construction	1,350
Rail Spur	3,350
Working Capital	<u>1,178</u>
Total:	<u>\$16,564</u>

Land

The Hayden Gulch project will require the purchasing of 1,900 acres of surface at an estimated cost of approximately \$1,890,000. Of this 1,900 acres, 1,440 acres are required for mine site and mine facilities. The remaining 460 acres are required for the rail spur right-of-way, the new portion of haul road (0.8 miles) and the loadout facilities south of Hayden.

Coal Reserves

The coal reserves for a non-Federally leased Hayden Gulch are estimated to cost approximately one million dollars (\$1,000,000). The coal reserves for a Federally leased Hayden Gulch are estimated to cost \$1,440,000. This cost would be in the form of a bonus bid of approximately \$1,000 per acre.

Exploration Program

The non-Federal exploration program for the Hayden Gulch project has an estimated capital cost of \$250,000. The principal components of this exploration program are the exploration drilling, geophysical work, professional fees for reserve studies, detailed maps, and engineering reports. The Federal exploration program has an estimated cost of \$400,000. The additional cost components of the Federal exploration program are the legal and administrative costs

of obtaining the exploration license, bonding fees, detailed maps and engineering support for government personnel, and additional time, travel expense, and personnel to conduct the exploration program.

Environmental Studies

The environmental studies for the non-Federal development of Hayden Gulch are estimated at a cost of \$100,000. The principal environmental studies for a non-Federal mine are air quality (EPA), flora and fauna, interburden analysis, and revegetation/reclamation. The environmental studies for the Federal development of Hayden Gulch are estimated to cost \$230,000. This estimate includes the cost of the environmental studies required of non-Federal projects along with the additional studies required to obtain the necessary Federal permits and approvals. Additional environmental costs for Federal projects include the following: costs of lending technical support to EIS procedure, preparing reports for and participating in local and regional EIS hearings, time and salaries related to the collection and interpreting of a greater amount of environmental data required of Federal coal projects.

Mine Design

Mine design for both the non-Federal and the Federally leased Hayden Gulch are estimated at \$350,000. Mine design

consists of the preliminary mine design, detailed mine plans, equipment selection, and mine feasibility studies.

Haul Road

The Hayden Gulch project will require the upgrading of 8.5 miles of Routt County road (Route #53) and maintenance of road subsequently. An additional 0.8 mile road is required from the county road to the loading facility. Total costs for haul road improvement and construction are estimated at \$1.35 million.

Rail Spur

The Hayden Gulch rail spur will be 3.3 miles long and has an estimated cost of \$3.35 million. The rail spur will be a private, industrial spur, and, hence, can be fully depreciated for tax purposes (contrary to tax regulations applicable to railroads). The cost estimate includes funds for road crossing, relocating power and gas lines, and reclamation.

Working Capital

Working capital is estimated at \$1,177,890. Appendix E summarizes the components of this estimate.

Project Timing of Capital Expenditures

The magnitude and timing of capital expenditures associated with the pre-production period of the non-Federal and

Federal projects are shown in Tables 5 and 6. The tables are based on the development schedule (Tables 1 and 2), described in the previous chapter along with the estimated capital costs summarized in Tables 3 and 4.

Non-Federal Capital Expenditures

Table 5 shows the timing of the non-Federal capital expenditures. Year 1 includes the cost of holding a purchase option for the surface, environmental costs, the initial exploration, and the associated administrative costs.

In Year 2, the detailed exploration program is completed along with the remainder of the environmental studies. The balance of the administrative costs associated with the permitting, engineering, and lease acquisition are also included along with the cost of the detailed mine design.

The major capital allocation is made in Year 3. This allocation includes expenditures for mine facilities, mine equipment, land, tipple, coal reserves, construction, rail spur, and working capital.

Table 5 also shows the amount of cash generated in the pre-production years. The cash generation results from the assumption that the corporation is in the position to expense whenever possible.

Table 5
 Magnitude and/or Timing of Capital Expenditures
 (\$1,000)

Year	Non-Federal Lease			Total
	1	2	3	
Capital Expenditures				
Property Payments	50	50	1,790	1,890
Coal Reserves			1,000	1,000
Exploration Program	100	150		250
Environmental Studies	50	50		100
Administrative Costs	25	100	50	175
Mine Design			350	350
Mine Equipment and Facilities			6,261	6,261
Loading Facilities			660	660
Rail Spur			3,350	3,350
Haul Road			1,350	1,350
Working Capital			1,178	1,178
Total Capital Expenditures	-225	-350	-15,989	-16,564
Cash Generated				
Tax Savings				
Exploration Program ¹	48	72		120
Environmental Studies ²	24	24		48
Administrative Costs ³	12	48	24	84
Mine Design ⁴			168	168
Investment Tax Credit (10%)			967	967
Total Cash Generated	84	144	1,159	1,387
Net Cash Flow	-141	-206	-14,830	-15,177

¹Tax saving = .48 x Exploration; ²Tax savings = .48 x Environmental; ³Tax savings = .48 x Administrative; ⁴Investment Credit = .10 x Qualifying Investment.

Table 6
Magnitude and/or Timing of Capital Expenditures

Year	Federal Lease							Total
	1	2	3	4	5	6	7	
<u>Capital Expenditures</u>								
Property Payments	50	50	50	50	50	50	1,590	1,890
Bonus Bid				1,440				1,440
Exploration Program	150			250				440
Environmental Studies	50	75	75	10	10	10	25	230
Administrative Costs	25	25	25	75	100	75		350
Mine Design				50	300			350
Mine Equipment and Facilities							6,261	6,261
Loading Facilities							660	660
Rail Spur							3,350	3,350
Haul Road							1,350	1,350
Working Capital							1,178	1,178
Total Capital Expenditures	-275	-150	-150	-1,875	-460	-135	-14,414	-17,459
<u>Cash Generated</u>								
<u>Tax Savings</u>								
Exploration Program ¹	72			120				192
Environmental Studies ²	24	36	36	5	5			111
Administrative Costs ³	12	12	12	36	48	36	12	168
Mine Design ⁴				24	144			168
Investment Tax Credit							967	967
Total Cash Generated	108	48	48	185	197	41	979	1,606
Net Cash Flow	-167	-102	-102	-1,690	-263	-94	-13,435	-15,853

¹Tax savings = .48 x Exploration; ²Tax savings = .48 x Environmental; ³Tax savings = .48 x Administrative; ⁴Investment Credit = .10 x Qualifying Investment.

Federal Capital Expenditures

Table 6 shows the timing of the Federal capital expenditures. Years 1 - 3 include the cost of holding a surface purchase option, exploration program, environmental studies, and the administrative costs. In Year 4, the lease is acquired which requires the payment of the bonus bid to the government. Expenditures for the detailed exploration program and mine design are also incurred in Years 4 and 5.

The remaining pre-production capital expenditures are made in Year 7. This allocation includes expenditures for mine equipment, mine facilities, land, tipple construction, haul road, and rail spur. Table 6 also shows the amount of cash generated in the pre-production years.

Cost Analysis

Operating Costs

Direct operating costs are summarized in Table 7. Mine, tipple, and haulage costs are estimated at \$5.90 per ton of coal. Appendix E summarizes the different cost components of this estimate.

Reclamation Costs

Reclamation costs are estimated to be approximately \$2,185 per acre. This estimate was based upon a recent Bureau of Mines study (IC 8737), on reclamation costs for

Table 7

Mine, Tipple, and Haulage Costs

Labor

Mine	\$2,194,598
Tipple	233,016

Operating Costs

Tipple	105,600
Mine: Spare parts	180,000
Fuel-Oil-Lub.-Filter	481,760
Drill Bits	44,000
Tires	330,000
Blasting Costs	475,000
Miscellaneous	170,000
Indirect Costs	375,000
Power	10,000
	<u>\$4,598,974</u>

Total Mine and Tipple Costs (Rounded)	\$4,600,000
Haulage Costs (Mine-Rail Spur-Tipple)	<u>1,300,000</u>
Total Mine, Tipple, Haulage Costs	<u>\$5,900,000</u>
Total Cost/Ton	\$5.90/Ton

surface mines in the Western United States. It is estimated that approximately 600 acres will be disturbed and have to be reclaimed.

Royalties

Production royalties for the non-Federal lease are five percent of gross value at point of shipment from the leased premises. Production royalties for the Federal lease are fifteen and one-half percent of gross value at the point of shipment from the leased premises. The Federal royalty was based on the royalty rate charged in a recent short-term Federal coal lease granted to Energy Fuels Company in Routt County.

Taxes

Property taxes are levied on the assessed value of the mine equipment, mine facilities, tipple, and rail spur. For purposes of this thesis, the assessed value is 30 percent of the book value of the property using straight line depreciation. A coal production tax is also assessed and payable to the state. The State of Colorado levies a severance tax of \$.60 per ton of coal with the first 8,000 tons each quarter tax exempt. The property and severance tax calculations are summarized in Appendix F.

The State of Colorado income tax rate is five percent. This tax, based on net income after depletion, is an allowable deduction in the calculating of Federal income taxes. The Federal tax rate is forty-eight percent.

Market Value

A market value of \$14 per ton of coal was assumed for both the Federal and non-Federal leases. This is based on a \$.70 price per million Btu's. This market value is used for the base case assumptions (Case 1, most likely).

Salvage Value

The following table summarizes the estimated salvage values:

	<u>Dollars</u>
Mine facilities and equip. (10\$ initial cost)	626
Tipple (20% of initial cost)	132
Land (\$300/acre)	380
Rail Spur (50% initial cost)	<u>1,675</u>
TOTAL	<u><u>2,813</u></u>

Economic Results

Cash Flow Analysis

The production cash flow calculations for the non-Federal and the hypothetical Federally leased Hayden Gulch are summarized in Appendix G. For purposes of this study,

cash flow is defined as net income after taxes plus depreciation and depletion minus capital expenditures. Table 8 summarizes the components of the cash flow calculation. The depreciable assumptions and associated calculations are also summarized in Appendix G. Under the base case assumption, the estimate of the undiscounted net cash flow for the non-Federally leased Hayden Gulch was \$19,157,000 and for the hypothetical Federal lease, it was \$12,138,000.

Project Evaluation Criteria

The project evaluation criteria chosen to evaluate the Hayden Gulch property under the non-Federal and hypothetical Federal Lease assumptions are as follows:

1) Discounted Cash Flow Rate of Return (DCFROR) - defined as the discount rate which equates the present value of benefits with the present value of costs.

2) Net Present Value - defined as the present value of benefits minus the present value of costs at the company's required rate of return.

3) Payback Period - defined as the number of years to recover original estimate at zero interest rate. (Gives some indication of risk when risk is proportional to time.)

In the calculation of the selected evaluation criteria the following assumptions were made: 1) the time of evaluation was at time zero, 2) the discount rate or required rate of return is twenty percent. The economic analysis was performed at time zero to give a clear picture of the economic viability of beginning such mining projects. The required

Table 8

Components of an Annual Cash Flow Calculation

<u>Calculation</u>	<u>Component</u>
	Revenue
Less	Operating Costs
	Net Income Before Depreciation and Depletion
Less	Depreciation and Amortization Allowance
	Net Income After Depreciation and Amortization
Less	Depletion Allowance
	Net Taxable Income
Less	State Income Tax
	Net Federal Taxable Income
Less	Federal Income Tax
	Net Profit After Taxes
Add	Depreciation and Amortization Allowances
Add	Depletion Allowance
	Operating Cash Flow
Less	Capital Expenditures
Less	Working Capital
	Net Annual Cash Flow

rate of return (20%) is the rate of return that a mining firm feels that they must have to begin mining projects of this type. The adjusting of this required rate of return is a common method of adjusting accounting for the risks inherent in mining projects. Appendix H summarizes the results of the project evaluation criteria for the Federal and the non-Federally leased Hayden Gulch.

Sensitivity Analysis

Sensitivity analysis is a means of evaluating the effects of uncertainty on investment by determining how an investment alternative's profitability varies as parameters that affect the economic evaluation are changed. Sensitivity analysis is performed by allowing one parameter to change while holding all others constant. For purposes of this thesis, sensitivity analysis involves the evaluation of how the rate of return varies with changes in the royalty rate and sales price. The base cases (most likely) are when the non-Federal lease royalty rate is five percent and the sales price is fourteen dollars (\$14) per ton and the Federal lease royalty rate and sales price are fifteen and one-half percent and fourteen dollars (\$14) per ton, respectively.

Appendix I summarizes the effect on rate-of-return when the royalty rate and sales price are varied. The sales price and royalty rate have been varied because of their

uncertainty at the time of this evaluation. Sensitivity analysis shows that the percent variations in the rate of return from changes in the royalty rate and sales price are very significant for both the non-Federal and the hypothetical Federally leased Hayden Gulch. Thus, it is important that the mining firm have a good estimate of these parameters before pursuing the development of any coal mining project of this type.

Summary of Economic Results

The project evaluation criteria show that using the same sales price and the appropriate royalty rate assumptions that the non-Federally leased Hayden Gulch has a distinct economic advantage over a hypothetical Federally leased Hayden Gulch. The base case (Case 1, most likely) assumes a sales price of fourteen dollars (\$14) per ton and a non-Federal lease royalty rate of five percent and a Federal lease royalty rate of fifteen and one-half percent. Under these assumptions, the non-Federally leased Hayden Gulch is economically viable based on the analysis performed with a DCFROR of twenty-one percent and a NPV at twenty percent of \$446,000. Meanwhile, the hypothetical Federally leased Hayden Gulch appears to be unfeasible to develop with a DCFROR of twelve percent and a NPV at twenty percent of -\$1,646,000. The undiscounted payback period is also five years longer for the hypothetical Federally leased Hayden Gulch as opposed to a non-Federally leased Hayden Gulch. The projected twelve percent DCFROR for the

Federally leased Hayden Gulch would not be adequate compensation to incur the risks of developing such a project. Table 9 summarizes the project evaluation criteria under the different royalty rate and price assumptions. The royalty rate and sales price have been varied due to the uncertainty at the time of this evaluation. The range over which they have been evaluated is based on industry estimates.

In looking at Table 9, it is apparent that the non-Federally leased Hayden Gulch has a distinct economic advantage over a hypothetical Federally leased Hayden Gulch. The non-Federal lease is economically feasible to develop in all cases except Case 3. Case 3 assumes that this non-Federal lease is a state lease. Using a discount rate of twenty percent, Case 3 has a NPV of $-\$1,063$ and a DCFROR of seventeen percent. However, the DCFROR of seventeen percent may be adequate compensation to develop a state lease. This is due to the shorter pre-production period for the state lease (3 years), which in turn gives a higher certainty of the projected cash flows. A possibly more appropriate rate of discount or required rate of return for non-Federal leases may have been fifteen percent.

The large comparative economic advantage of the non-Federally leased Hayden Gulch over the hypothetical Federally leased Hayden Gulch can be attributed to the following factors:

Table 9

Project Evaluation Results

<u>Case</u>	<u>Lease</u>	<u>Royalty (percent)</u>	<u>Sales Price (\$ ton)</u>	<u>DCFROR (percent)</u>	<u>(000) NPV@20%</u>	<u>Undiscounted Payback Period (years)</u>
1	Non-Federal	5%	\$14	21	\$ 446	5.7
2	Non-Federal	5%	15	25	1,723	5.3
3	Non-Federal	12 1/2%	14	17	-1,063	6.2
4	Non-Federal	12 1/2%	15	20	113	5.8
1	Federal	15 1/2%	14	12	-1,646	10.7
2	Federal	15 1/2%	15	15	-1,101	10.2
3	Federal	12 1/2%	14	14	-1,367	10.4
4	Federal	12 1/2%	15	16	- 799	9.9

1) The excessive lead time required for the development of the Federally leased Hayden Gulch (approximately 7 1/2 years).

2) The Federally leased Hayden Gulch has higher pre-production costs than a non-Federally leased Hayden Gulch. The net difference in pre-production costs are approximately \$676,000 (undiscounted).

3) The Federally leased Hayden Gulch has higher property taxes resulting from a higher coal production tax. The coal production tax is based on a net present value of the production royalties (see Appendix E).

4) The Federally leased Hayden Gulch higher production royalty has the combined effect of reducing pre-tax net income and the depletion allowance. This phenomenon lowers not only the cash flow but also the projects rate of return.

SUMMARY AND CONCLUSIONS

The purpose of this thesis was to study the comparative economics involved in the leasing and mining of Federal coal as opposed to non-Federal coal. The study used a small scale (1 mm/yr) strip mine in northwest Colorado as a basis for the economic comparison.

A small scale project of this type was chosen, not only because of the availability of good information, but also for the role coal reserve tracts of this size will play in fulfilling the nation's energy needs. For discussion, assume that the seven million tons of recoverable coal from such a lease could be placed in the nation's energy stream. This would replace approximately twenty-eight million barrels of OPEC oil, which, at a cost of fourteen dollars (\$14) per barrel, could reduce the nation's foreign oil bill by approximately \$392 million. It should be apparent from this example that coal lease tracts of this size play an important role in the nation's energy picture.

The study focused on evaluation of the non-Federal and Federal coal leasing systems and their major differences.

The strip mine example comparing a non-Federally leased mine as opposed to a hypothetical Federally leased mine showed that the non-Federally leased mine has a distinct comparative economic advantage. On the basis of the results of this investigation, it is concluded that the cost of complying with all the Federal regulations, including the costs of environmental studies and monitoring, and the costs of delays attendant to the permitting process, has the effect of making it difficult, if not economically impossible, for mining firms to open new mines on small scale Federal coal leases. This situation could also tend to force some small mine operators out of business and possibly seek out large companies that have the financial resources to undertake the large amount of studies and wait out the long delays of the mine development process.

The major factors causing the comparative economic advantage for non-Federally leased coal projects as compared to Federally leased coal projects can be summarized as follows:

- 1) The development costs for Federally leased coal projects are significantly higher.
- 2) Development and lead time for Federal coal leases is two to three times longer.
- 3) Due to the uncertainty of the government's policies, regulations, and permit process, the risks of bringing a Federally leased coal mine into production are multiplied.

4) The non-Federal leases, typically with small production royalties, have a decided economic advantage over the Federal leases which charge a higher production royalty.

To alleviate this comparative economic advantage and make the development of Federally leased coal more attractive, government and industry need to develop effective ways to deal with these factors. Development costs and lead time need to be cut. The permit process needs to be clearly defined so that the mining firms know what the required permits are and how long it will take to obtain these permits. A clearly defined permit process will help reduce the risk of ordering equipment while the permitting process is going on. The uncertainty of government regulations and policies must be removed. If mining firms are to effectively develop the Federal coal resources, they need to clearly know the "rules of the game." Royalty rates may need to be set for coal leases on an individual basis. Factors such as market value, location, coal quality, and mining costs should be considered in the setting of the royalty rates. The production royalty should not be the determining economic factor in the decision whether or not to develop a Federal coal lease.

The comparative economic conclusions drawn in this thesis clearly favor the development of non-Federal coal leases as opposed to Federal coal leases. There is one problem with this conclusion: the Federal government owns approximately

sixty percent (60%) of the coal reserves in the West, and effectively controls eighty percent (80%) of these reserves through surface ownership and adjoining properties. Thus, it is paramount that Federal coal leases be developed to meet the nation's energy needs. It is sincerely hoped that both industry and government can meet on some common ground and remove some of the unnecessary roadblocks impeding the development of the nation's coal. This common ground must be able to satisfy both energy and environmental requirements.

BIBLIOGRAPHY

A. Literature Cited

- Cloues, Phil. An Economic Analysis of Federal Leasing Policies of Selected Minerals in Western United States. Mineral Economics Thesis. Colorado School of Mines, Golden, Colorado. 1971
- Code of Federal Regulations. Part 211 of Title 30 (30CFR211). Coal Mining Operating Regulations. Circular Number 2342. May 17, 1976.
- Code of Federal Regulations. Sub-part 3041 of Title 43 (43CFR3041). Surface Management Federal Coal Reserves. Circular Number 2392. May 17, 1976.
- Code of Federal Regulations. Part 3500 of Title 43 (43CFR3500). Leasing of Minerals Other Than Oil and Gas. Circular Number 2321. March 7, 1972.
- Code of Federal Regulations. Part 3520 of Title 43 (43CFR3520). Preference Right and Competitive Leases. Circular Number 2418. January 25, 1977.
- Code of Federal Regulation. Sub-part 3525 of Title 43 (43CFR3525). EMARS. Circular Number. January 25, 1977.
- Grace, W.R. and Co. Memo. November 20, 1977.
- Grace, W.R. and Co. Hayden Gulch Preliminary Report on Geological Reserves and Mining Feasibility. November, 1976.
- Jones, James, R. Process of Developing a Western Coal Mine. Mining Year Book, The Colorado Mining Association. 1977.
- Larson, James A. Statement Before the Committee on Energy and Natural Resources. November 15, 1977. (Mineographed).
- Margolf, Charles, W. Testimony Before the Senate Subcommittee on Energy Production and Supply. November 16, 1977. (Mimeographed).

Natural Resources Defense Council et al. vs. Royston C. Hughes et al. United States District Court for the District of Columbia. Civil Action Number 75-1749. Memorandum Opinion. September 25, 1977. (Mimeographed).

Proprietary Information. 1974.

Proprietary Information. 1977.

Routt County Coal Lease. February 24, 1976.

State of Colorado. Coal Mining Lease. 1977. (Sample Copy).

Stermole, Franklin J. Economic Evaluation and Investment Decision Methods. Investment Evaluation Corporations. 1974.

B. Additional References

Blakely, Wes I. One Ton of Coal Produces One Ton of Paper. Coal Mining and Processing. June 1976.

Gentry, D.W. and Hrebar, M.J. Procedure for Determining Economics of Small Underground Mines. Minerals Industries Bulletin, Colorado School of Mines, Golden, Colorado. Volume 19, Number 1. January 1976.

Gentry, D.W. and Hrebar, M.J. Economic Principles for Coal Property Valuation. Mineral Engineering Department, Colorado School of Mines, Golden, Colorado. October 18, 1977.

Phelps, E.R. Federal Coal Leasing Policy. Mining Congress Journal. January 1975.

State of Colorado. State Mining Laws. 1977.

Statement by Lew Gray. Personal Interview. March 1978.

Statement by Joe Phillips. Personal Interview. February 1978.

United States Department of the Interior, Bureau of Land Management. Coal Exploration License. 1977. (Sample Copy).

Weston, J. Fred and Brigham, Eugene F. Managerial Finance. The Dryden Press. 1975.

APPENDIX A

EIS PROCESS DESCRIPTION

Environmental Impact Statement (EIS)

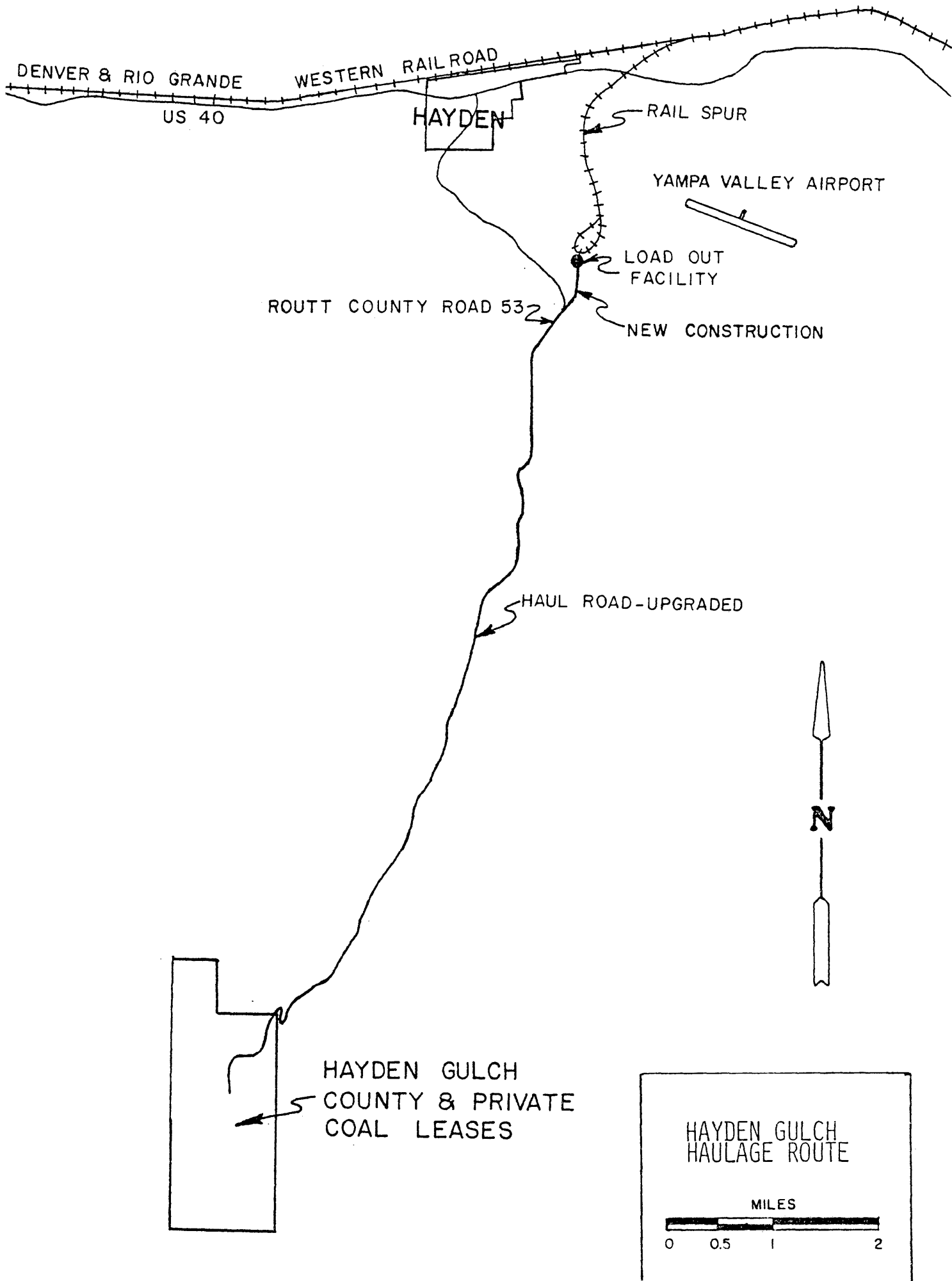
The steps involved are listed below:

1. Identification of lead agency for EIS.
2. Draft EIS
3. EIS Review and Comments
4. EIS Hearing and Record
5. Federal EIS Review
6. Council of Environmental Quality (CEQ) filing
7. Mining and/or Reclamation plan approval

Current industry estimates for this EIS process are 3-4 years.

APPENDIX B

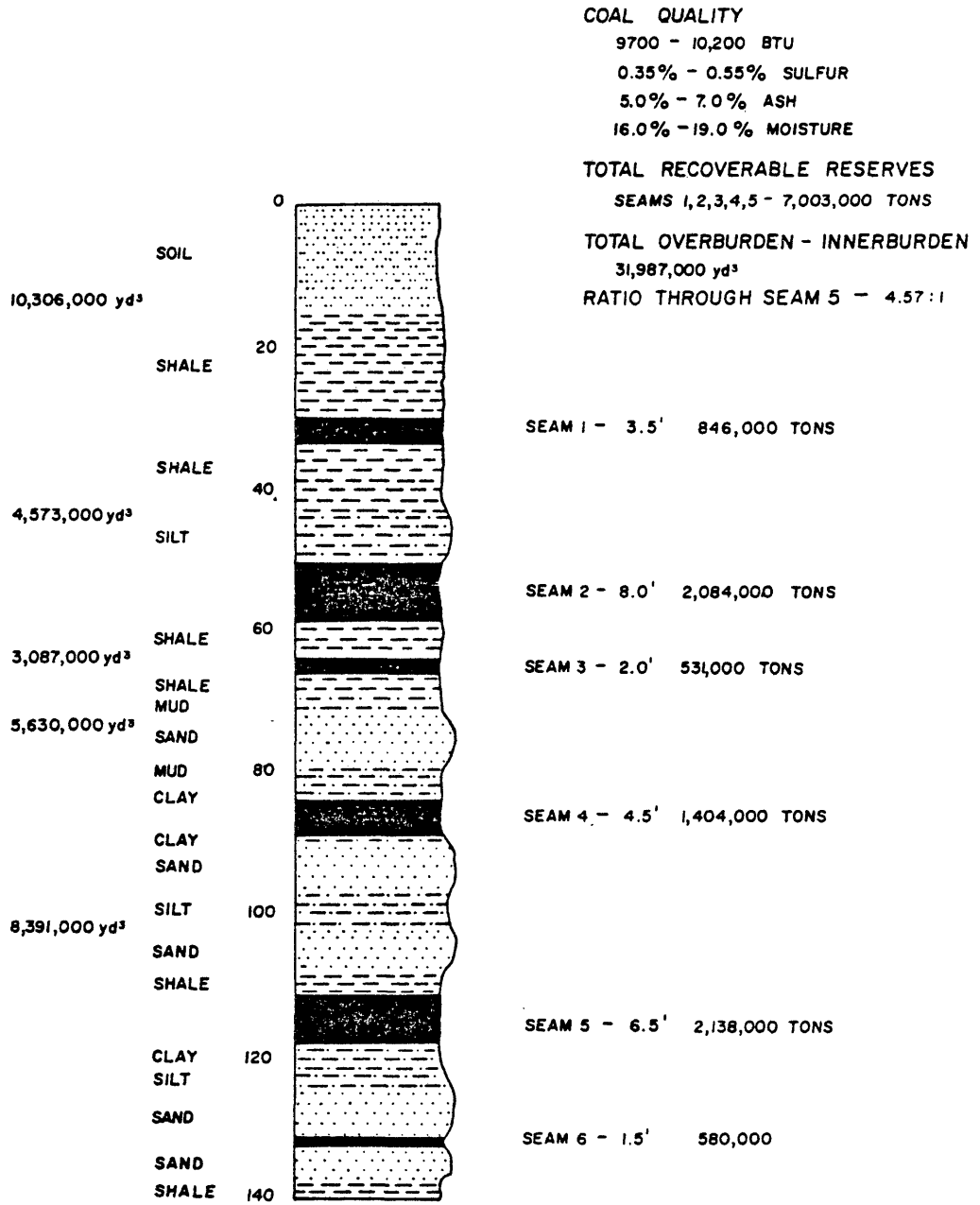
LOCATION MAP FOR HAYDEN GULCH MINE



APPENDIX C

GENERALIZED SECTION

HAYDEN GULCH GENERALIZED SECTION



APPENDIX D

CAPITAL EQUIPMENT AND FACILITIES LIST

Mine Equipment Summary List

<u>Mine Equipment</u>	<u>No.</u>	<u>Cost/Unit</u>	<u>Total Cost</u>
988B FEL Coal and Rock	7	\$ 215	\$1,505
769B 35 Ton Haul Trucks	12	180	2,160
D9H Track Dozer and Ripper	2	260	520
D8H Track Dozer	1	175	175
824 Rubber Tired Dozer	1	165	165
146 Grader	1	110	110
657B Tandem Powered Scraper	1	420	420
14W Gardner - Denver 200' Pipe	1	193	193
Coal Drill	1	16	16
Brandise - Sweeper Grader	1	22	22
Water Truck - 4000 Gal.	1	30	30
Lub. Truck - 2 1/2 Ton	1	55	55
Welding Truck - 1 Ton	1	11	11
Explosives Truck - 2 1/2 Ton	1	35	35
Supply Truck - 2 1/2 Ton	1	20	20
Pickups - 3/4 Ton	6	8	48
1 Ton Fuel Tank	2	1	2
Forklift - 10 Ton	1	53	53
Pumps - Portable	3	3	9
Flood Lights and Towers	4	10	40
Communications		20	20
Safety Equipment		20	20
Tools		30	<u>30</u>
Total Mine Equipment Cost			<u>\$5,661</u>

Mine and Loading Facilities
(\$000)

<u>Mine Facilities</u>	<u>Cost</u>
Office and washhouse	\$175
Shop and warehouse	340
Oil and fuel storage facility	30
Explosives storage facility	40
Parking facility	<u>15</u>
Total Mine Facilities	<u>\$600</u>
<u>Loading Facilities</u>	
Tipple	\$425
988B FEL	<u>235</u>
Total Loading Facilities	<u>\$660</u>

APPENDIX E

OPERATING COST SUMMARY

Mine Labor Costs

(40 hrs/wk) (50 wks/yr)

	(1)	(2)	(3)	(4)	(5)	(6)
	Number	Base Pay(\$)	Overtime+Shift Differential+ Bonus(16%)(\$)	Benefits (30%)(\$)	Pay/Year Each Man Plus Benefits(\$)	Total(\$)
Superintendent	1	\$12.00	\$1.92	\$3.60	\$35,040.00	\$35,040.00
Mine Foreman	2	10.00	1.60	3.00	29,200.00	58,400.00
Mining Eng. & Safety	2	9.50	1.52	2.85	27,740.00	55,480.00
Blasting Foreman	1	9.50	1.52	2.85	27,740.00	27,740.00
Warehouse Foreman	1	9.00	1.44	2.70	26,280.00	26,280.00
Accountant	1	9.00	1.44	2.70	26,280.00	26,280.00
Bookkeeper	3	7.50	1.20	2.25	21,900.00	65,700.00
Master Electrician	2	9.25	1.48	2.78	27,010.00	27,010.00
Master Mechanic	1	9.25	1.48	2.78	27,010.00	27,010.00
Front-End Loader Operators	10	9.15	1.46	2.75	26,718.00	267,180.00
Electrician	2	8.80	1.41	2.64	25,696.00	51,392.00
Welder	2	8.80	1.41	2.64	25,696.00	51,392.00
Mechanics	6	8.80	1.41	2.64	25,696.00	154,176.00
Dragline Oiler	0	8.50	1.36	2.55	24,820.00	0.00
Driller-Overburden	2	8.50	1.36	2.55	24,820.00	49,640.00
Driller-Coal	2	8.50	1.36	2.55	24,820.00	49,640.00
Grader Operator	2	8.50	1.36	2.55	24,820.00	49,640.00
Dozer Operator	8	8.50	1.36	2.55	24,820.00	198,560.00
Scrapper Operator	2	8.50	1.36	2.55	24,820.00	49,640.00
Explosives Shooter	1	8.15	1.30	2.45	23,798.00	23,798.00
Haul Truck Operator	24	8.15	1.30	2.45	23,798.00	571,152.00
Tractor-Sweeper Operator	1	8.00	1.28	2.40	23,360.00	23,360.00
Warehouse Man	2	8.00	1.28	2.40	23,360.00	46,720.00
Greaser	2	7.60	1.22	2.28	22,192.00	44,384.00
Supply Truck Operator	2	7.60	1.22	2.28	22,192.00	44,384.00
Utility Man	2	7.50	1.20	2.25	21,900.00	43,800.00
Explosives Helper	2	7.50	1.20	2.25	21,900.00	43,800.00
Driller's Helper	2	7.50	1.20	2.25	21,900.00	43,800.00
Summer Help	2	5.00			5,000.00	10,000.00
Watchman	2	5.00	.80	1.50	14,600.00	29,200.00
Total	90					\$2,194,598.00

Blasting Costs

Waste Blasting Cost

4.57 yd. overburden per 1 ton of coal
 Powder factor (pf) = .60 lbs explosive (ANFO)/cu yd. overburden

2.74 lbs ANFO/ton of coal
 ANFO Costs - \$.10/lb. of ANFO - \$2.27/ton coal

Waste blasting costs/yr ANFO	\$274,200
Primers, cord, etc.	100,000
Total waste blasting costs/hr.	<u>\$374,200</u>

Coal blasting costs

pf = .25 lb. explosive/ton coal
 explosives cost - \$.40/lb explosives
 plus (primers, cord, etc.)

Total coal blasting costs/yr	\$100,000
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Total blasting costs per year (rounded)	<u>374,200</u>
--	----------------

	<u>\$475,000</u>
--	------------------

Drill Bit Costs

6 1/4" drill bit - \$330 each
 Bit Life - 2500 ft.
 Footage per year 320,000 ft.

Cost per year $\$320,000 / 2,500 \text{ ft. (330)} = \$42,240$

Total Drill Bit Costs per year (rounded)	
---	--

	<u>\$44,000</u>
--	-----------------

Tire Costs

Equipment	(1) Tire Life-New (hours)	(2) Cost New	(3) Tire Life Retread (Hours)	(4) Cost Retread	(5) Total Life (Hrs)	(6) Total Cost	(7) Cost Per Tire Per Year	(8) Total Cost Per Year
988	2,000	\$4,000	2,000	\$2,400	4,000	\$6,400	\$7,360	\$117,760
824B	2,000	4,000	2,000	2,400	4,000	6,400	9,360	29,440
769B	2,500	1,500	2,000	700	4,500	2,200	2,249	121,440
651B	2,500	6,500	2,000	3,400	4,500	9,900	10,120	40,480
14G	2,000	800	2,000	350	4,000	1,150	1,322	7,935
GD1400 Drill	4,000	300	3,000	100	7,000	400	263	2,628
Coal Drill	3,000	200	2,000	100	5,000	300	276	1,104
Lub. Truck	3,000	200	2,000	100	5,000	300	276	1,104
Supply Truck	3,000	200	2,000	100	5,000	300	276	1,656
Explosives Truck	3,000	200	2,000	100	5,000	300	276	1,104
Water Truck	3,000	200	2,000	100	5,000	300	138	828
Welding Truck	3,000	200	2,000	100	5,000	300	276	1,104
Fork Lift	3,000	150	2,000	75	5,000	225	207	828
Pickups	6,000	50	--	--	6,000	50	38	920
Total Tire Costs Per Year								\$328,607
Total Tire Costs Per Year (rounded)								\$330,000

Estimated Working Capital

	<u>Cost</u>
Direct Labor	\$ 606,900
Operating Supplies	323,500
Indirect Costs	139,670
Fixed Costs	27,820
Spare Parts	30,000
Miscellaneous	<u>50,000</u>
Totla Working Capital	<u><u>\$1,177,890</u></u>

APPENDIX F

PROPERTY AND SEVERANCE TAX CALCULATIONS

Book Value - Property Tax Purposes
(\$000)

Straight Line 8-Yr. Life

Mine Equipment, Mine Facilities, Tipple

<u>Year of Production</u>	<u>Rate</u>	<u>Basis</u>	<u>Deduction</u>	<u>Book Value</u>
1	1/8	\$6,921	\$865	\$6,056
2	1/8	6,921	865	5,191
3	1/8	6,921	865	4,326
4	1/8	6,921	865	3,461
5	1/8	6,921	865	2,596
6	1/8	6,921	865	1,731
7	1/8	6,921	865	866
8	1/8	6,921	866	-0-

Rail Spur
(\$000)

Straight Line 8-Yr. Life

<u>Year of Production</u>	<u>Rate</u>	<u>Basis</u>	<u>Deduction</u>	<u>Book Value</u>
1	1/8	\$3,350	\$419	\$2,931
2	1/8	3,350	419	2,512
3	1/8	3,350	419	2,093
4	1/8	3,350	419	1,674
5	1/8	3,350	419	1,255
6	1/8	3,350	419	836
7	1/8	3,350	419	417
8	1/8	3,350	417	-0-

Agricultural Value of Land/Acre Land (Mine Site, Rail Spur, Loading Facilities)	\$ 200
	<u>x1,900</u>
Total Land Book Value	<u><u>\$380,000</u></u>

Coal Production Tax
(\$000)

NPV @ 11 1/2% of remaining Royalties
x 30%

Assessed Coal Value
x Mill Levy

Coal Production Tax

<u>Year of Production</u>	Royalty 5%		Sales Price \$14 per ton	
	<u>Revenue</u>	<u>Royalty</u>	<u>NPV @ 11 1/2%</u>	<u>Assessed Coal Value</u>
1	\$ 7,000	\$350	\$3,433	\$1,030
2	14,000	700	3,437	1,031
3	14,000	700	3,052	916
4	14,000	700	2,622	787
5	14,000	700	2,143	643
6	14,000	700	1,609	483
7	14,000	700	1,014	304
8	7,000	350	350	105

<u>Year of Production</u>	Royalty 15 1/2%		Sales Price \$14 per ton	
	<u>Revenue</u>	<u>Royalty</u>	<u>NPV @ 11 1/2%</u>	<u>Assessed Coal Value</u>
1	\$ 7,000	\$1,085	\$10,641	\$3,192
2	14,000	2,170	10,655	3,196
3	14,000	2,170	8,461	2,838
4	14,000	2,170	9,461	2,838
5	14,000	2,170	6,644	1,993
6	14,000	2,170	4,989	1,993
7	14,000	2,170	3,143	943
8	8,000	1,085	1,085	326

Royalty 12 1/2% Sales Price \$14 per ton

<u>Year of Production</u>	<u>Revenue</u>	<u>Royalty</u>	<u>NPV @ 11 1/2%</u>	<u>Assessed Coal Value</u>
1	\$ 7,000	\$ 875	\$8,581	\$2,574
2	14,000	1,750	8,593	2,578
3	14,000	1,750	7,630	2,289
4	14,000	1,750	6,556	1,967
5	14,000	1,750	5,358	1,608
6	14,000	1,750	4,023	1,207
7	14,000	1,750	2,535	760
8	14,000	875	875	263

Coal Production Tax

Royalty 5% - \$15 per ton

<u>Years of Production</u>	<u>Revenue</u>	<u>Royalty</u>	<u>NPV @ 11 1/2%</u>	<u>Assessed Coal Value</u>
1	\$ 7,500	\$375	\$3,678	\$1,103
2	15,000	750	3,683	1,105
3	15,000	750	3,270	981
4	15,000	750	2,810	843
5	15,000	750	2,296	689
6	15,000	750	1,724	517
7	15,000	750	1,086	326
8	7,500	375	375	113

Royalty 12 1/2% Sales Price \$15 per ton

1	\$ 7,500	\$ 938	\$9,195	\$2,759
2	15,000	1,875	9,207	2,762
3	15,000	1,875	8,175	2,453
4	15,000	1,875	7,024	2,107
5	15,000	1,875	5,741	1,722
6	15,000	1,875	4,311	1,293
7	15,000	1,875	2,716	813
8	7,500	938	938	281

Royalty 15 1/2% Sales Price \$15 per ton

1	\$ 7,500	\$1,163	\$11,402	\$3,421
2	15,000	2,325	11,416	3,425
3	15,000	2,325	10,137	3,041
4	15,000	2,325	8,710	2,613
5	15,000	2,325	7,119	2,136
6	15,000	2,325	5,346	1,604
7	15,000	2,325	3,368	1,010
8	7,500	1,163	1,163	349

Property Taxes
(\$000)

Royalty 5% Sales Price \$14 per ton

<u>Year of Production</u>	<u>Book Value</u>	<u>Assessed Value¹</u>	<u>Assessed Coal Value</u>	<u>Total Assessed Value</u>	<u>Total Property Tax²</u>
1	\$9,367	\$2,810	\$1,030	\$3,840	\$169
2	8,083	2,415	1,031	3,456	152
3	6,799	2,040	916	2,956	130
4	5,515	1,655	787	2,442	107
5	4,231	1,269	643	1,912	84
6	1,947	884	483	1,367	60
7	1,663	499	304	803	35
8	380	114	105	219	10

Royalty 15 1/2% Sales Price \$14 per ton

1	\$9,367	\$2,810	\$3,192	\$6,002	\$264
2	8,083	2,425	3,196	5,621	247
3	6,799	2,040	2,838	4,878	215
4	5,515	1,655	2,439	4,094	215
5	4,231	1,269	1,993	3,262	144
6	2,947	884	1,497	2,381	144
7	1,663	499	943	1,472	65
8	380	114	326	440	19

Royalty 12 1/2% Sales Price \$14 per ton

1	\$9,367	\$2,810	\$2,574	\$5,384	\$237
2	8,083	2,425	2,578	5,003	220
3	6,799	2,040	2,289	4,329	190
4	5,515	1,655	1,967	3,622	159
5	4,231	1,269	1,608	2,877	127
6	2,947	884	1,207	2,091	92
7	1,663	499	760	1,259	55
8	380	114	263	377	17

¹ Assessed Value = 30% x Book Value

² Property Tax calculated on basis of Routt County Mil Levy of 44 mils times the total assessed value.

Property Taxes
(\$000)

Royalty Rate 5% Sales Price \$15 per ton

<u>Year of Production</u>	<u>Book Value</u>	<u>Assessed Value¹</u>	<u>Assessed Coal Value</u>	<u>Total Assessed Value</u>	<u>Total Property Taxes²</u>
1	\$9,367	\$2,810	\$1,103	\$3,913	\$172
2	8,083	2,425	1,105	3,530	155
3	6,799	2,040	981	3,021	133
4	5,515	1,655	843	2,498	110
5	4,231	1,269	689	1,957	86
6	2,947	884	517	1,401	62
7	1,663	499	326	825	36
8	380	114	113	227	10

Royalty Rate 12 1/2% Sales Price \$15 per ton

1	\$9,367	\$2,810	\$2,759	\$5,569	\$245
2	8,083	2,425	2,762	5,187	228
3	6,799	2,040	2,453	4,493	198
4	5,515	1,655	2,107	3,762	166
5	4,231	1,269	1,722	2,991	132
6	2,947	884	1,793	2,177	96
7	1,663	499	815	1,314	58
8	380	114	201	395	17

Royalty Rate 15 1/2% Sales Price \$15 per ton

1	\$9,367	\$2,810	\$3,421	\$6,231	\$274
2	8,083	2,425	3,425	5,850	257
3	6,799	2,040	3,041	5,081	224
4	5,515	1,655	2,613	4,268	188
5	4,231	1,269	2,136	3,405	150
6	2,947	884	1,604	2,488	109
7	1,663	499	1,010	1,509	66
8	380	114	849	463	20

¹ Assessed Value = 30% x Book Value

² Property Tax calculated on basis of Routt County Mil Levy of 44 mils times the total assessed value.

Severance Tax
(\$000)

- First 8000 tons per quarter tax exempt
- \$.60 per ton severance tax

<u>Year</u>	<u>Tax</u>
1	\$281
2	581
3	581
4	581
5	581
6	581
7	581
8	281

APPENDIX G

DEPRECIABLE ASSUMPTIONS AND CALCULATIONS
AND PRODUCTION CASH FLOWS

Total Depreciation Deductions by Years
(\$000)

<u>Year of Production</u>	<u>Depreciation Deduction</u>
1	\$2,281
2	1,865
3	1,551
4	1,319
5	1,152
6	1,152
7	1,152
8	1,153

Depreciation Assumptions

- ADR System
- 8 year life for all depreciable items
- Placed into service first year of production
- Mine facilities 1.5 x SLD
- Mine equipment DDB
- Tipple DDB
- Rail spur SLD (Private spur totally depreciable for tax purposes)
- Haul road construction SLD

Mine Facilities

8 year life

1.5 Times Declining Balance
(\$000)

<u>Year of Production</u>	<u>Rate</u>	<u>Basis</u>	<u>Deduction</u>	<u>Adjusted Basis</u>
1	1.5 x 1.8	\$600	\$113	\$487
2	1.5 x 1.8	487	91	396
3	1.5 x 1.8	396	74	322
4	1/5	322	64	258
5	1/5	322	64	194
6	1/5	322	64	130
7	1/5	322	64	66
8	1/5	322	66	-0-

DDB = Double Declining Balance

SLD = Straight Line Depreciation

Mine EquipmentDDB - 8-year Life
(\$000)

<u>Year of Production</u>	<u>Rate</u>	<u>Basis</u>	<u>Deduction</u>	<u>Adjusted Basis</u>
1	2 x 1/8	\$5,661	\$1,415	\$4,246
2	2 x 1/8	4,246	1,062	3,184
3	2 x 1/8	3,184	796	2,388
4	2 x 1/8	2,388	597	1,791
5	1/4	1,791	448	1,343
6	1/4	1,791	448	895
7	1/4	1,791	448	447
8	1/4	1,791	447	-0-

Tipple + 988 FELDDB - 8-year Life
(\$000)

<u>Year of Production</u>	<u>Rate</u>	<u>Basis</u>	<u>Deduction</u>	<u>Adjusted Basis</u>
1	2 x 1/8	\$660	\$165	\$495
2	2 x 1/8	495	124	371
3	2 x 1/8	371	93	278
4	2 x 1/8	278	70	208
5	1/4	208	52	156
6	1/4	208	52	104
7	1/4	208	52	52
8	1/4	208	52	-0-

Rail SpurSLD - 8-Year Life
(\$000)

<u>Year of Production</u>	<u>Rate</u>	<u>Basis</u>	<u>Deduction</u>
1	1/8	\$3,350	\$419
2	1/8	3,350	419
3	1/8	3,350	419
4	1/8	3,350	419
5	1/8	3,350	419
6	1/8	3,350	419
7	1/8	3,350	419
8	1/8	3,350	419

Haul Road ConstructionSLD - 8-Year Life
(\$000)

<u>Year of Production</u>	<u>Rate</u>	<u>Basis</u>	<u>Deduction</u>
1	1/8	\$1,350	\$169
2	1/8	1,350	169
3	1/8	1,350	169
4	1/8	1,350	169
5	1/8	1,350	169
6	1/8	1,350	169
7	1/8	1,350	169
8	1/8	1,350	167

Production Cash Flows
(\\$000)

Year	Federal Lease								
	Royalty 12 1/2%	Sales Price \$14/ton							
	1	2	3	4	5	6	7	8	9
Tons Mined	500	1,000	1,000	1,000	1,000	1,000	1,000	500	
Revenue	7,000	14,000	14,000	14,000	14,000	14,000	14,000	7,000	
Mining Costs	2,950	5,900	2,900	5,900	5,900	5,900	5,900	2,850	
Reclamation Costs	--	109	109	109	109	109	109	109	
Insurance	175	175	175	175	175	175	175	175	546
Royalties	875	1,750	1,750	1,750	1,750	1,750	1,750	875	
Property Taxes	237	220	190	159	127	92	55	17	
Severance Taxes	281	581	581	581	581	581	581	281	
Net After Costs	2,482	5,265	5,295	5,326	5,358	5,393	5,430	2,293	(546)
Depreciation	2,281	1,865	1,551	1,319	1,152	1,152	1,152	1,153	
Net After Depreciation	201	3,400	3,744	4,007	4,206	4,241	4,278	1,140	(546)
Colo. State Inc. tax 5%	5	124	126	139	149	151	153	29	27
Net After State Tax	196	3,276	3,618	3,868	4,057	4,090	4,125	1,111	(519)
-Depletion	--	923	1,225	1,225	1,225	1,225	1,225	555	--
Pre tax-Net Profit	196	2,353	2,393	2,643	2,832	2,865	2,900	556	(519)
Fed Inc. tax @48%	94	1,129	1,149	1,269	1,359	1,375	1,392	267	+249
Tax Credits @10%									
Net After Taxes	102	1,224	1,244	1,374	1,473	1,490	1,508	289	(270)
+Depreciation	2,281	1,865	1,551	1,319	1,152	1,152	1,152	1,153	
+ Depletion	--	923	1,225	1,225	1,225	1,225	1,225	555	
Cash Flow	2,383	4,012	4,020	3,918	3,850	3,867	3,885	1,997	1,813
Salvage									2,813
-Capital Gains Tax									730
Net Salvage Value									2,083
Depletion Earned	98	1,225							
Depletion "Recaptured"	98	302							
Depletion Deduction	0	923							

Production Cash Flows
(\$000)

Year	Federal Lease								
	1	2	3	4	5	6	7	8	9
	Royalty 12 1/2% Sales Price \$15./ton								
Tons Mined	500	1,000	1,000	1,000	1,000	1,000	1,000	500	
Revenue	7,500	15,000	15,000	15,000	15,000	15,000	15,000	7,500	
Mining Costs	2,950	5,900	5,900	5,900	5,900	5,900	5,900	2,950	
Reclamation Costs		109	109	109	109	109	109		546
Insurance	175	175	175	175	175	175	175	175	
Royalties	938	1,875	1,875	1,875	1,875	1,875	1,875	938	
Property Taxes	245	228	198	166	132	96	58	17	
Severance Taxes	281	581	581	581	581	581	581	281	
Net After Costs	2,911	6,132	6,162	6,194	6,228	6,264	6,302	3,030	(546)
Depreciation	2,281	1,865	1,551	1,319	1,152	1,152	1,152	1,153	--
Net After Depreciation	630	4,267	4,611	4,875	5,076	5,112	5,150	1,877	(546)
COLO. State Inc. tax 5%	16	152	165	178	188	190	192	48	27
Net After State Tax	614	4,115	4,446	4,697	4,888	4,922	4,958	1,829	(519)
-Depletion	--	1,220	1,313	1,313	1,313	1,313	1,313	914	--
Pre tax-Net Profit	614	2,895	3,133	3,384	3,575	3,609	3,645	915	(519)
Fed Inc. tax @48%	295	1,389	1,504	1,624	1,715	1,732	1,750	439	+249
Tax Credits @10%									
Net After Taxes	319	1,505	1,629	1,760	1,859	1,877	1,895	476	(270)
+Depreciation	2,281	1,865	1,551	1,319	1,152	1,152	1,152	1,153	
+ Depletion	--	1,220	1,313	1,313	1,313	1,313	1,313	914	
Cash Flow	2,600	4,590	4,493	4,392	4,324	4,342	4,360	2,543	1,813
Salvage									2,813
-Capital Gains Tax									730
Net Salvage Value									2,083
Depletion Earned	307	1,313							
Depletion "Recaptured"	307	93							
Depletion Deduction	0	1,220							

Production Cash Flows
((\$000))

Year	Federal Lease								
	Royalty 15 1/2%	3	4	5	6	7	8	9	
Tons Mined	500	1,000	1,000	1,000	1,000	1,000	500		
Revenue	7,000	14,000	14,000	14,000	14,000	14,000	7,000		
Mining Costs	2,950	5,900	5,900	5,900	5,900	5,900	2,950		
Reclamation Costs		109	109	109	109	109	109		546
Insurance	175	175	175	175	175	175	175		
Royalties	1,085	2,170	2,170	2,170	2,170	2,170	1,085		
Property Taxes	264	247	215	180	144	105	19		
Severance Taxes	281	581	581	580	581	281	581		
Net After Costs	2,245	4,818	4,850	4,885	4,921	4,960	2,081		(546)
Depreciation	2,281	1,865	1,551	1,319	1,152	1,152	1,153		
Net After Depreciation	(36)	2,953	3,299	3,566	3,769	3,808	928		
Colo. State Inc. tax 5%	2	109	106	119	129	131	24		27
Net After State Tax	(34)	2,844	3,193	3,447	3,640	3,677	904		(519)
-Depletion	--	783	1,183	1,183	1,183	1,183	452		
Pre tax-Net Profit	(34)	2,061	2,010	2,264	2,457	2,494	452		(519)
Fed Inc. tax @48%	+16	989	965	1,087	1,179	1,197	217		+249
Tax Credits @10%									
Net After Taxes	(18)	1,072	1,045	1,177	1,278	1,317	235		(270)
+Depreciation	2,281	1,865	1,551	1,319	1,152	1,152	1,153		
+ Depletion	--	783	1,183	1,183	1,183	1,183	452		
Cash Flow	<u>2,263</u>	<u>3,720</u>	<u>3,779</u>	<u>3,679</u>	<u>3,613</u>	<u>3,652</u>	<u>1,840</u>		<u>1,813</u>
Salvage									2,813
-Capital Gains Tax									730
Net Salvage Value									<u>2,083</u>
Depletion Earned		1,183							
Depletion "Recaptured"		400							
Depletion Deduction		<u>783</u>							

Production Cash Flows
(\$000)

Federal Lease

	Royalty 15 1/2% Sales Price \$15/ton								
Year	1	2	3	4	5	6	7	8	9
Tons Mined	500	1,000	1,000	1,000	1,000	1,000	1,000	500	
Revenue	7,500	15,000	15,000	15,000	15,000	15,000	15,000	7,500	
Mining Costs	2,950	5,900	5,900	5,900	5,900	5,900	5,900	2,950	
Reclamation Costs	--	109	109	109	109	109	109	109	546
Insurance	175	175	175	175	175	175	175	175	
Royalties	1,163	2,325	2,325	2,325	2,325	2,325	2,325	1,163	
Property Taxes	1,274	257	224	188	150	109	66	20	
Severance Taxes	281	581	581	581	581	581	581	281	
Net After Costs	2,657	5,653	5,686	5,722	5,760	5,801	5,844	2,802	(546)
Depreciation	2,281	1,865	1,551	1,319	1,152	1,152	1,152	1,153	
Net After Depreciation	376	3,788	4,135	4,403	4,608	4,649	4,692	1,649	(546)
Colo. State Inc. tax 5%	10	137	143	157	167	169	171	42	27
Net After State Tax	366	3,651	3,992	4,248	4,441	4,480	4,521	1,607	(519)
-Depletion	--	1,051	1,268	1,268	1,268	1,268	1,268	804	
Pre tax-Net Profit	366	2,600	2,724	2,978	3,173	3,212	3,253	803	(519)
Fed Inc. tax @48%	176	1,248	1,307	1,430	1,523	1,542	1,561	385	+249
Tax Credits @10%									
Net After Taxes	190	1,352	1,416	1,549	1,650	1,670	1,691	417	(270)
+Depreciation	2,281	1,865	1,551	1,319	1,152	1,152	1,152	1,153	
+ Depletion	--	1,051	1,268	1,268	1,268	1,268	1,268	804	
Cash Flow	2,471	4,268	4,235	4,136	4,070	4,090	4,111	2,374	1,813
Salvage									2,813
-Capital Gains Tax									730
Net Salvage Value									2,083
Depletion Earned	183	1,268							
Depletion "Recaptured"	183	217							
Depletion Deduction	0	1,051							

APPENDIX H

SUMMARY OF PROJECT
EVALUATION CRITERIA

NON-FEDERAL LEASE ROYALTY RATE 5% SALES PRICE \$14
CASH FLOW SUMMARY

YEAR	CASH FLOW	YEAR	CASH FLOW	YEAR	CASH FLOW	YEAR	CASH FLOW
0	-141.	1	-206.	2	-14830.	3	2755.
4	4774.	5	4626.	6	4520.	7	4447.
8	4459.	9	4472.	10	2468.	11	1813.

THE DISCOUNTED CASH FLOW RATE OF RETURN
FOR THIS PROJECT IS

*** 21.21 *** PERCENT.

THE NET PRESENT VALUE IS \$ 445.555
(USING A MINIMUM ROR OF 20.0%)

(REMEMBER, THIS IS IN THOUSANDS OF DOLLARS)

THE PAYBACK PERIOD FOR THIS PROJECT IS 5.67 YEARS.

ROR/NPV SUMMARY

(UNITS SHOWN ARE THOUSANDS OF DOLLARS)

MIN ROR (%)	NPV	MIN ROR (%)	NPV
0	19157.	40	-3077.
2	15515.	45	-3338.
4	12479.	50	-3490.
6	9939.	55	-3564.
8	7808.	60	-3584.
10	6016.	65	-3566.
12	4503.	70	-3521.
14	3225.	75	-3458.
16	2143.	80	-3382.
18	1225.	85	-3299.
20	446.	90	-3211.
25	-1029.	95	-3121.
30	-2010.	100	-3029.
35	-2657.	110	-2849.

NON-FEDERAL LEASE ROYALTY RATE 5% SALES PRICE \$15
CASH FLOW SUMMARY

YEAR	CASH FLOW	YEAR	CASH FLOW	YEAR	CASH FLOW	YEAR	CASH FLOW
0	-141.	1	-206.	2	-14830.	3	3105.
4	5290.	5	5142.	6	5036.	7	4963.
8	4975.	9	4988.	10	2972.	11	1813.

THE DISCOUNTED CASH FLOW RATE OF RETURN
FOR THIS PROJECT IS

*** 24.84 *** PERCENT.

THE NET PRESENT VALUE IS \$ 1722.535
(USING A MINIMUM ROR OF 20.0%)

(REMEMBER, THIS IS IN THOUSANDS OF DOLLARS)

THE PAYBACK PERIOD FOR THIS PROJECT IS 5.33 YEARS.

ROR/NPV SUMMARY

(UNITS SHOWN ARE THOUSANDS OF DOLLARS)

MIN ROR (%)	NPV	MIN ROR (%)	NPV
0	23107.	40	-2524.
2	18982.	45	-2876.
4	15535.	50	-3098.
6	12645.	55	-3230.
8	10213.	60	-3296.
10	8161.	65	-3316.
12	6425.	70	-3303.
14	4952.	75	-3267.
16	3699.	80	-3214.
18	2633.	85	-3149.
20	1723.	90	-3077.
25	-16.	95	-3001.
30	-1193.	100	-2922.
35	-1990.	110	-2761.

NON-FEDERAL LEASE ROYALTY RATE 12 1/2% SALES PRICE \$14
CASH FLOW SUMMARY

YEAR	CASH FLOW	YEAR	CASH FLOW	YEAR	CASH FLOW	YEAR	CASH FLOW
0	-141.	1	-206.	2	-14830.	3	2388.
4	4017.	5	4025.	6	3923.	7	3855.
8	3872.	9	3890.	10	2002.	11	1813.

THE DISCOUNTED CASH FLOW RATE OF RETURN
FOR THIS PROJECT IS

*** 16.69 *** PERCENT.

THE NET PRESENT VALUE IS \$ -1063.148
(USING A MINIMUM ROR OF 20.0%)

(REMEMBER, THIS IS IN THOUSANDS OF DOLLARS)

THE PAYBACK PERIOD FOR THIS PROJECT IS 6.21 YEARS.

ROR/NPV SUMMARY

(UNITS SHOWN ARE THOUSANDS OF DOLLARS)

MIN ROR (%)	NPV	MIN ROR (%)	NPV
0	14608.	40	-3739.
2	11510.	45	-3894.
4	8937.	50	-3960.
6	6795.	55	-3966.
8	5006.	60	-3930.
10	3509.	65	-3866.
12	2253.	70	-3783.
14	1198.	75	-3688.
16	311.	80	-3586.
18	-435.	85	-3480.
20	-1063.	90	-3372.
25	-2231.	95	-3265.
30	-2982.	100	-3159.
35	-3455.	110	-2955.

NON-FEDERAL LEASE ROYALTY RATE 12 1/2% SALES PRICE \$15

CASH FLOW SUMMARY

YEAR	CASH FLOW	YEAR	CASH FLOW	YEAR	CASH FLOW	YEAR	CASH FLOW
0	-141.	1	-206.	2	-14830.	3	2605.
4	4595.	5	4498.	6	4397.	7	4329.
8	4347.	9	4365.	10	2548.	11	1813.

THE DISCOUNTED CASH FLOW RATE OF RETURN
FOR THIS PROJECT IS

*** 20.19 *** PERCENT.

THE NET PRESENT VALUE IS \$ 112.998
(USING A MINIMUM ROR OF 20.0%)

(REMEMBER, THIS IS IN THOUSANDS OF DOLLARS)

THE PAYBACK PERIOD FOR THIS PROJECT IS 5.79 YEARS.

ROR/NPV SUMMARY

(UNITS SHOWN ARE THOUSANDS OF DOLLARS)

MIN ROR (%)	NPV	MIN ROR (%)	NPV
0	18320.	40	-3239.
2	14761.	45	-3478.
4	11797.	50	-3610.
6	9322.	55	-3668.
8	7247.	60	-3675.
10	5504.	65	-3646.
12	4037.	70	-3592.
14	2799.	75	-3521.
16	1751.	80	-3439.
18	864.	85	-3350.
20	113.	90	-3257.
25	-1302.	95	-3162.
30	-2237.	100	-3067.
35	-2849.	110	-2880.

FEDERAL LEASE ROYALTY RATE 12 1/2% SALES PRICE \$14

CASH FLOW SUMMARY

YEAR	CASH FLOW	YEAR	CASH FLOW	YEAR	CASH FLOW	YEAR	CASH FLOW
0	-167.	1	-102.	2	-102.	3	-1690.
4	-263.	5	-94.	6	-13435.	7	2383.
8	4012.	9	4020.	10	3918.	11	3850.
12	3867.	13	3885.	14	1997.	15	1813.

THE DISCOUNTED CASH FLOW RATE OF RETURN
FOR THIS PROJECT IS

*** 13.51 *** PERCENT.

THE NET PRESENT VALUE IS \$ -1366.616
(USING A MINIMUM ROR OF 20.0%)

(REMEMBER, THIS IS IN THOUSANDS OF DOLLARS)

THE PAYBACK PERIOD FOR THIS PROJECT IS 10.39 YEARS.

ROR/NPV SUMMARY

(UNITS SHOWN ARE THOUSANDS OF DOLLARS)

MIN ROR (%)	NPV	MIN ROR (%)	NPV
0	13992.	40	-1708.
2	9870.	45	-1582.
4	6841.	50	-1451.
6	4558.	55	-1325.
8	2837.	60	-1208.
10	1541.	65	-1103.
12	570.	70	-1008.
14	-155.	75	-925.
16	-692.	80	-851.
18	-1084.	85	-787.
20	-1367.	90	-729.
25	-1745.	95	-679.
30	-1846.	100	-635.
35	-1809.	110	-560.

FEDERAL LEASE ROYALTY RATE 12 1/2% SALES PRICE \$15

CASH FLOW SUMMARY

YEAR	CASH FLOW	YEAR	CASH FLOW	YEAR	CASH FLOW	YEAR	CASH FLOW
0	-167.	1	-102.	2	-102.	3	-1690.
4	-263.	5	-94.	6	-13435.	7	2600.
8	4590.	9	4493.	10	4392.	11	4324.
12	4342.	13	4360.	14	2543.	15	1813.

THE DISCOUNTED CASH FLOW RATE OF RETURN
FOR THIS PROJECT IS

*** 16.28 *** PERCENT.

THE NET PRESENT VALUE IS \$ -799.416
(USING A MINIMUM ROR OF 20.0%)

(REMEMBER, THIS IS IN THOUSANDS OF DOLLARS)

THE PAYBACK PERIOD FOR THIS PROJECT IS 9.95 YEARS.

ROR/NPV SUMMARY

(UNITS SHOWN ARE THOUSANDS OF DOLLARS)

MIN ROR (%)	NPV	MIN ROR (%)	NPV
0	17604.	40	-1578.
2	12874.	45	-1488.
4	9286.	50	-1382.
6	6559.	55	-1273.
8	4484.	60	-1169.
10	2904.	65	-1073.
12	1703.	70	-986.
14	792.	75	-907.
16	103.	80	-837.
18	-414.	85	-775.
20	-799.	90	-721.
25	-1364.	95	-672.
30	-1585.	100	-629.
35	-1627.	110	-557.

FEDERAL LEASE ROYALTY RATE 15 1/2% SALES PRICE \$14

CASH FLOW SUMMARY

YEAR	CASH FLOW	YEAR	CASH FLOW	YEAR	CASH FLOW	YEAR	CASH FLOW
0	-167.	1	-102.	2	-102.	3	-1690.
4	-263.	5	-94.	6	-13435.	7	2263.
8	3720.	9	3779.	10	3679.	11	3613.
12	3632.	13	3652.	14	1840.	15	1813.

THE DISCOUNTED CASH FLOW RATE OF RETURN
FOR THIS PROJECT IS

*** 11.98 *** PERCENT.

THE NET PRESENT VALUE IS \$ -1645.582
(USING A MINIMUM ROR OF 20.0%)

(REMEMBER, THIS IS IN THOUSANDS OF DOLLARS)

THE PAYBACK PERIOD FOR THIS PROJECT IS 10.67 YEARS.

ROR/NPV SUMMARY

(UNITS SHOWN ARE THOUSANDS OF DOLLARS)

MIN ROR (%)	NPV	MIN ROR (%)	NPV
0	12130.	40	-1774.
2	8444.	45	-1630.
4	5675.	50	-1486.
6	3598.	55	-1351.
8	2043.	60	-1228.
10	882.	65	-1118.
12	20.	70	-1020.
14	-617.	75	-934.
16	-1080.	80	-859.
18	-1413.	85	-792.
20	-1646.	90	-734.
25	-1933.	95	-683.
30	-1976.	100	-638.
35	-1900.	110	-562.

FEDERAL LEASE ROYALTY RATE 15 1/2% SALES PRICE \$15

CASH FLOW SUMMARY

YEAR	CASH FLOW	YEAR	CASH FLOW	YEAR	CASH FLOW	YEAR	CASH FLOW
0	-167.	1	-102.	2	-102.	3	-1690.
4	-263.	5	-94.	6	-13435.	7	2471.
8	4268.	9	4235.	10	4136.	11	4070.
12	4090.	13	4111.	14	2374.	15	1813.

THE DISCOUNTED CASH FLOW RATE OF RETURN
FOR THIS PROJECT IS

*** 14.81 *** PERCENT.

THE NET PRESENT VALUE IS \$ -1100.536
(USING A MINIMUM ROR OF 20.0%)

(REMEMBER, THIS IS IN THOUSANDS OF DOLLARS)

THE PAYBACK PERIOD FOR THIS PROJECT IS 10.18 YEARS.

ROR/NPV SUMMARY

(UNITS SHOWN ARE THOUSANDS OF DOLLARS)

MIN ROR (%)	NPV	MIN ROR (%)	NPV
0	15715.	40	-1649.
2	11337.	45	-1540.
4	8029.	50	-1420.
6	5525.	55	-1302.
8	3629.	60	-1191.
10	2194.	65	-1089.
12	1110.	70	-998.
14	294.	75	-917.
16	-316.	80	-845.
18	-769.	85	-782.
20	-1101.	90	-726.
25	-1568.	95	-676.
30	-1725.	100	-632.
35	-1725.	110	-559.

APPENDIX I

SENSITIVITY ANALYSIS

Sensitivity Analysis

<u>Lease</u>	<u>Sales Price</u> \$	<u>Royalty</u> %	<u>Change in Sales Price</u>	<u>ROR</u> %	<u>% Change ROR</u>
Non-Federal	\$14	5	0	21	0
Non-Federal	15	5	1	25	+19
Non-Federal	14	12 1/2	0	17	0
Non-Federal	15	12 1/2	1	20	+18
Federal	14	12 1/2	0	14	0
Federal	15	12 1/2	1	16	+14
Federal	14	15 1/2	0	12	0
Federal	15	15 1/2	1	15	+25
			<u>Change in Royalty</u>		
Non-Federal	14	5	0	21	0
Non-Federal	14	12 1/2	7 1/2	17	-19
Non-Federal	15	5	0	25	0
Non-Federal	15	12 1/2	7 1/2	20	-25
Federal	14	15 1/2	0	12	0
Federal	14	12 1/2	-3	14	+17
Federal	15	15 1/2	0	15	0
Federal	15	12 1/2	-3	20	+33