CHAPTER I

Introduction and Summary of Permit Application

1.1 SCOPE OF OPERATION

Introduction

The Soldier Canyon Mine is leased and operated by Soldier Creek Coal Company, a division of California Portland Cement Company. It is located in the heart of the Book Cliffs Coal Field at the mouth of Nine Mile Canyon, approximately 22 miles northeast of Price, Utah.

The origin of the mine dates back to 1906, when limited prospecting was done on the property. In 1935, Premium Coal Company was granted the lease on the property and mining commenced. This was a small, family-owned, non-union company which operated the mine continuously until 1972, producing approximately 1.2 million tons in its duration. In June of 1974, California Portland Cement purchased the property and began limited production on June 15, 1976. Since that time many changes have been made to the mine and surroundings to bring it to its present stature.

The Operation

The mine operates in the Rock Canyon Seam, the middle seam of the three coal beds occurring on the property. The other two seams, the Sunnyside and the Gilson lie some 150 feet over and 40 feet under the Rock Canyon, respectively, and are not of minable thickness over the entire lease area. The present lease is comprised of 1,711 acres with an additional lease of 1262 acres which has been applied for.

The annual production totals since beginning mining are as follows:

Year	Tonnage
1976 (6/15/76 to 1/1/77)	187,480
1977	536,088
1978	509,190
1979	624,508
1980	707,802

Presently, three sections are producing(four machine shifts total) a daily average of 3,600 tons. This coal is then trucked from the mine to the Banning Siding Loadout, located 18 miles southeast of the minesite.

General

1. Location:

   Reference: Salt Lake Baseline and Meridian
   Township 12S Ranges 11E and 12E
   Township 13S Ranges 11E and 12E

2. Area contained in leases:
   Present Lease: 1,711 acres
   Applied For: 1,262 acres

3. Owner and/or lease holder of mining area:
   California Portland Cement Company

Geology and Coal Occurence

1. Coal seam geological classification:
   Group: Book Cliff Coal Fields
   Formation: Blackhawk Formation
   Age: Upper Cretaceous

2. Strike of coal seam: S 70° E
   Dip of coal seam: maximum - 7.5° to the north
   minimum - 7°

3. Thickness of coal seam (feet or inches: Rock Canyon Seam
   Average: 10.0 feet
   Maximum: 12.5 feet
   Minimum: 9.0 feet

4. Thickness of coal in the coal seam (feet or inches):
   Average: 10.0 feet
   Maximum: 12.5 feet
   Minimum: 9.0 feet

5. Hardness of coal: 45 (hardgrove index)

6. Name of roof rock: Sandy Shale
   Thickness: 6-31 feet

8. Name of parting in coal seam: None

9. Condition of coal seam: Stable

10. Number of faults in mining area: No faulting, only undulations

11. Depth of coal seam from surface in mining area (Rock Canyon Seam):
    Maximum: 2,050 feet
    Average: 1,250 feet

12. Topography:
    Highest point on present lease: 8,293 feet
    Lowest point on present lease: 6,680 feet

13. Coal Reserves (short tons, approximate):

	Proven	Possible
Present Lease:		
Rock Canyon	17,667,000	5,550,000
Sunnyside	3,036,000	5,364,000
Gilson	3,922,000	10,521,000
Total	24,625,000	21,435,000
Combined Total	46,060,000	
Applied for:		
Total	41,000,000	23,000,000
Combined Total	64,000,000	

Prospecting

1. Drilling:
   Method: Coring
   Number of drill holes: 3
   Maximum length: 1,040 feet
   Total Length: 2,304 feet
   Diameter of core (inch): 3"

2. Tunnelling or aditting:
   Old workings of previous owners where approximately 1.2 million tons had been extracted.

Opening of Mine

1. Opening method: Drift

2. Details of the above:
   Number of portals: 4
   Dimension (feet x feet or feet diameter: 20' wide x 10' high
   Intake or return of air: 2 intake portals - 6,742-6,790 (altitude)
   1 return portal - 6,880 (altitude)
   1 belt portal - 6,742 (altitude)

Mine Transportation

1. Coal Transportation from face haulage to main haulage:
   Method: Conveyor
   Maker: Georgia Duck--Belting   Long Airdox--Structure & Drives
   Width or Gage: 42" wide
   Capacity: 300 tons/hour
   Speed: 460 feet/minute

2. Main haulage of coal:
   Method: Conveyor
   Maker: Georgia Duck--Belting   Long Airdox--Structure & Drives
   Width or Gage: 42" wide
   Capacity: 1,000 tons/hour
   Speed: 600 feet/minute

3. From portal to mine loadout:
   Method: Conveyor
   Maker: Georgia Duck--Belting   Long Airdox--Structure & Drives
   Capacity: 1,000 tons/hour
   Width or Gage: 42" wide
   Speed: 600 feet/minute

4. Capacity of surge bin:
   Portal: 600 tons (truck loadout)

5. Underground transportation of man and supply:
   Method: Diesel trucks and loaders
   Maker: Eimco 913 LHD--Supplies   Elmac & Dodge--Mantrips

6. Workers' travelling time from portal to workings:
   Average: 15 minutes
   Maximum: 20 minutes

Mining

1. Mining method: Room and pillar mining

2. Total working days in one year: 235 average

3. Number of shifts per day: 3 (4 machine shifts/day)

4. Working:
   Number of working faces: 5 entries on mains   4 entries on sections
   Face length or dimension of heading: 20 feet wide entries
   Working thickness of coal seam: 10 foot average
   Working thickness of coal in coal seam: 10 feet
   Dimension of room and pillar: 80' x 80' mains   80' x 80' sections
   Average advancing length (feet/shift): 11.7 feet/day on 5 entries
   18.2 feet/day on 4 entries

5. Mining equipment (Typical Section):
   Type: Joy 12CM-6 continuous miners
   Performance:
   Horse Power: Electric motor
   Number of units, including standby: 4
   Actual operating time (minutes/shift): Approximately 5 hours
   Cutting times per shift: Approximately 3 hours

6. Roof support:
   Type: Roof bolts (conventional and resin)
   Length (feet): 5 feet
   Capacity or load: Conventional--8 to 12 tons   Resin--17 to 22 tons
   Interval of support or number of sets: 5 foot centers both ways

7. Haulage equipment at face (Typical):
   Type: Shuttle cars
   Maker: Joy 10SC-22
   Capacity: 10 tons
   Number of units: 6

8. Personnel arrangement for mining/unit shift:
   Section crew:
   1 Foreman
   1 Miner operator
   1 Miner helper
   2 Shuttle car operators
   2 Roof bolters
   1 Mechanic
   1 Utility man

   9 Total

Mine Drainage

1. Maximum recorded drainage volume of mine water per hour:
   112 gallons/minute

2. Piping underground
   Diameter of pipes (inch): 2", 4", and 6"

Mine Ventilation and Safety

1. Ventilation method:
   Exhausting

2. Main Fan:
   Type: Joy Axivane
   Fan pressure: 4.2" 2.g.
   Quantity of air flow: 420,000 c.f.m.
   Motor horse power: 500 h.p. electric

3. Air flow:
   Air volume and speed to one development heading: 40,000 c.f.m. to section
   To one mining face: 9,000 c.f.m.

4. Methane gas:
   Content in air at mining face: 0.2%
   Content in air at bottom of air shaft: .15%

5. Coal dust control:
   Prevention method: Rock dusting periodically;
   Water sprays on miners and transfer point
   Coal dust content in air at working face: 1.3 m.g./8 hours
   Detection method of coal dust: Dust pumps

Preparation

1. No preparation other than crushing at train loadout facility to finish product of 1-5/8" x 0

2. Specification of raw coal:
   Size: 1-5/8" x 0
   Ash: 12.0%
   Moisture: 6.0%
   Volatile matter: 35.5%
   Fixed carbon: 46.5%
   Sulphur: 0.50%
   BTU: 11,500
   FSI: 2

Transportation

1. From mine site to shipping point:
   Method: Truck
   Capacity per truck: 42 tons/truck
   Distance: 18 miles one way
   Running speed: 55 m.p.h.
   Travelling time of one round trip: 1 hour

2. Storage capacity of clean coal:
   Mine site: 600 ton silo
   Shipping point: 50,000 ton--live storage
   400,000 ton+--open stockpile

3. Loading at mine site:
   Method: Automatic truck loadout
   Capacity: 250 ton/hour

4. Siding:
   Location: 14 miles southeast of Price, Utah
   Method of loadout: From reclaim tunnel to 200 ton surge bin to railroad cars
   Loadout capacity: 3,000 tons/hours
   Siding capacity: 55-100 ton cars

5. Railroad:
   Initial carrier: Denver & Rio Grande Western

Miscellaneous

1. Electric Power:
   Supply source: 44 kv to our substation reduced to 4160 v for the mine and reduced to 460 v for the section

2. Water for mine useage:
   Supply source: Sumps in old workings

3. Treatment of waste water:
   Method: Used culinary water is run through our sewage treatment facility and pumped into the mine for use during mining

4. Climate:
   Highest temperature: 100^{o} F
   Lowest temperature: -30^{o} F

5. History:
   Record of the past production: 1.2 million tons extracted by past owners until closure in 1972

1.2 SUMMARY OF ENVIRONMENTAL IMPACTS

The majority of the environmental impacts of the Soldier Canyon Mine occurred upon the opening of the mine. Additional minor impacts will occur during the installation of two air shafts during the summer of 1981. The shafts will be located on less than one acre. The total impact for the mine has been and will continue to be minimized by complying with the performance standards established by the Environmental Protection Agency and the Office of Surface Mining.

1.3 REVIEWS CHECK LISTS

Located in the appendix of this chapter is the check list submitted by the Utah Department of Oil, Gas and Mining.

1.4 ACKNOWLEDGEMENTS

The Engineering Department of the Soldier Creek Coal Company, during a period of transition, submits this permit proposal. This report has taken the efforts of many private and governmental organizations to form one comprehensive permit.

REVIEWERS CHECKLIST

MINE ______________ MINE PLAN DATE ______________ DATE RECEIVED ______ ____

REGULATION	SEPARATE ITEMS	INCLUDED IN PLAN	ADEQUATE	COMMENTS
(1) Names, addresses, and telephone numbers of persons responsible for operations under the plan to whom notices and orders are to be delivered; and the names and addresses of lessees and surface and mineral owners of record, if other than the United States.	OPERATIONS			
	LESSEES			
	SURFACE OWNERS			
	MINERAL OWNERS			
	MSHA I.D. #			
(2) A description of geologic condi-dition, with maps and tables where appropriate, within the area where mining is to be conducted. Such des-cription shall include, as a minimum, protential geologic hazards; and a description of the structural features of the coal and overlying strata, including faults, cleats, joints, and fractures, and any other information required by the Mining Supervisor which would affect the orientation of the mine or production methods.	DESCRIPTION			
	Geologic Hazards			
	Coal Structure			
	Overburden "			
	Faults			
	Cleats			
	Joints			
	Fractures			
	MAPS			
	TABLES			
(3) A description, with maps and tables where appropriate, of other mineral resources within the LMU.	DESCRIPTION			
	MAPS			
	TABLES			
(4) A description of the proposed operation including:	PROPOSED OPERATIONS			
(i) The quality of the coal in terms of Btu content, ash, moisture, sulphur, volatile matter, and fixed carbon content over the extent of the coal deposit. If available information on other chemical or physical properties of the coal that may affect blending or combustion should be included.	COAL QUALITY			
	Btu			
	Ash			
	Moisture			
	Sulphur			
	Volatile Matter			
	Fixed Carbon			

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MINE ______ MINE PLAN DATE ______ DATE RECEIVED ______

REGULATION	SEPARATE ITEMS	INCLUDED IN PLAN	ADEQUATE	COMMENTS
(ii) The method of mining, including mining sequence, proposed production rate, and estimated recovery factors.	MINING METHOD			
	MINING SEQUENCE			
	PRODUCTION RATE			
	EST. RECOVERY FACTOR			
(iii) Coal reserve base, minable reserve base, and recoverable reserves for each Federal lease covered in the mining plan. If the mining and operations plan covers an approved LMU, recoverable reserves will be reported for the non-Federal lands included in the plan. The recoverable reserves shall be reported for all coal seams considered to be of minable thickness, considering the type of mining and the value of the coal.	RESERVES			
	Each Federal Lease			
	LMU			
	ALL MINABLE SEAMS			
	COAL RESERVE BASE			
	MINABLE RESERVE BASE			
	RECOVERABLE			
(iv) Sufficient data to assure MER and to determine the recovery factor for the coal reserve base. Data includes sufficient information in the form of a narrative, cross sections, coal thickness isopachs, overburden isopachs, and quality and quantity data of all known potentially minable seams on the lands involved. The areal extent of mining of each seam to be mined should be	MAXIMUM ECONOMIC RECOVERY			
	Narrative			
	Cross Sections			
	Isopachs--Coal			
	" Overburden			
	" Interburden			
	Coal Quality			
	Coal Quantity			
	EXTENT OF MINING EACH SEAM			

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MINE ________ MINE PLAN DATE ________ DATE RECEIVED ________

REGULATION	SEPARATE ITEMS	INCLUDED IN PLAN	ADEQUATE	COMMENTS
(v) The engineering techniques to be used to ensure maximum economic recovery. The plan shall describe the method of mining, compare other mining methods, and present the justification for the method selected. For underground mining, longwall and room and pillar or conventional mining should be compared. For strip mining, draglines, shovels, scraper units, truck and shovel, or any combination of these systems should be evaluated. The selected mining system must conform to sound mining practices and be based on current technology and economics. Justification for not recovering any coal seams that may be damaged by future recovery of development of the proposed operation should be presented.	ENGINEERING TECHNIQUES			
	METHOD OF MINING			
	Justification			
	Sound Mining Practice			
(vi) Sufficient economic data and analyses to indicate that the incremental cost of recovery (including reclamation and opportunity costs) of the coal seam (s) that are proposed to be mined would be less than or equal to the market value of the coal, and sufficient economic data and analyses to indicate that the cost of recovery (including reclamation and opportunity costs) of coal seam (s) that are not being recovered are greater than the market value of the coal.	TO BE RECOVERED			
	Economic Data			
	Analysis			
	Cost of Recovery			
	Market Value			
	NOT TO BE RECOVERED			
	Cost of Recovery			
	Market Value			

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MINE ______ MINE PLAN DATE ______ DATE RECEIVED ______

REGULATION	SEPARATE ITEMS	INCLUDED IN PLAN	ADEQUATE	COMMENTS
(vii) The economic and engineering analyses should include processing costs and techniques for coal preparation, especially costs and techniques for coal washing or cleaning. Estimated recovery rates and comparisons of raw coal to processed coal should be included. If no coal preparation plant is planned and if the operator plans not to mine coal beds or portions of coal beds because of high sulfur, high ash, or other chemical or physical properties, the operator shall submit a narrative and analyses of the rationale for not mining such beds or portions of seams, and a rationale, including economic and engineering analyses, why a preparation plant to process such beds is not feasible.	COAL PREPARATION			
	Economic			
	Engineering Analysis			
	Cost			
	Techniques			
	Estimated recovery Rate			
	Washed			
	Raw			
	NO PREPARATION			
	Narrative			
	Analysis of Rational			
(viii) A list of all major equipment.	LIST			
(ix) A description of the method of operation and measures by which the operator plans to comply with the obligations and requirements set forth in 211.4 and 211.40 of this part and any special terms and conditions of the lease or license.	METHOD OF OPERATION			
	MEASURES OF COMPLIANCE 211.4			
	211.40			
	Lease			
(x) The anticipated starting and termination dates of each phase of the mining operation and number of acres of land to be affected.	DATES OF EACH PHASE			
	ACRES AFFECTED			
	SURFACE ONLY			

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MINE ______________ MINE PLAN DATE ______________ DATE RECEIVED ______________

REGULATION	SEPARATE ITEMS	INCLUDED IN PLAN	ADEQUATE	COMMENTS
(xi) The method of mineral abandonment proposed to protect the unmined coal deposits and other mineral resources.	METHOD			
(xii) The hydrology of the area as it may relate to the mining operations and recovery of the coal resource.	HYDROLOGY Mining Recovery			
(xiii) Plans for protecting oil and gas wells as well as oil and gas resources when encountered. Plans should include any facilities for collection and use of gas from the coal seam or immediate overlying or underlying strata. When mining operations are conducted in areas of known wells or bore holes that may liberate oil, gas, water, or other fluid substances, the operator shall include in the proposed plan all measures determined necessary by the Mining Supervisor in consulation with the appropriate Oil and Gas Supervisor of the GS to protect wells or bore holes and obtain maximum recovery of the coal resource.	PROTECTING PLANS Oil and Gas Wells Water Wells Other Wells COLLECTING PLANS			
(5) Maps and Cross Sections. (i) General. Plan map of the area to be mined on a suitable topographic base showing: (A) Lease boundaries and numbers. (B) Boundaries of non-Federal coal. (C) LMU boundaries. (D) Surface ownership boundaries (E) Coal outcrop showing dips and strikes. (F) Locations of abandoned surface and underground mines.	PLAN MAP A B C D E F			

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MINE ______ MINE PLAN DATE ______ DATE RECEIVED ______

REGULATION	SEPARATE ITEMS	INCLUDED IN PLAN	ADEQUATE	COMMENTS
(ii) Structural contour map of coal bed (s) to be mined.	MAPS			
(iii) Isopach map of coal bed (s) to be mined.	MAPS			
(iv) Isopach map of overburden of surface mines on 20-foot intervals. If several seams are involved, interburden isopac map (s) on 10-foot intervals.	MAPS			
	MAPS			
(v) Isopach map of overlying strata over underground mines on 250-foot intervals.	MAPS			
(vi) Drill hole location map showing elevations of collar and top of coal bed (s).	MAP			
(vii) Cross-section showing thickness of any coal, any rider seams above coal to be mined, location of next known deeper coal seam below deepest coal to be mined, and nature of strata beneath the coal for 20 meters.	CROSS-SECTIONS			
(viii) Surface Mining (see page 8)				
(ix) General layout of proposed underground mine (s) showing: (A) Planned sequence of mining by year for first 5 years and by number in 5-year increments for the remainder of mine life.	UNDERGROUND LAYOUT			
	A			
	B			
	C			
	D			
	E			
	F			

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MINE ______ MINE PLAN DATE ______ DATE RECEIVED ______

REGULATION	SEPARATE ITEMS	INCLUDED IN PLAN	ADEQUATE	COMMENTS
(B) Location of shafts, slopes, main haulage entries, main return air courses, bleeder entries, and permanent barrier pillars.	ROOF CONTROL PLAN			
	VENTILATION SYSTEM AND METHANE AND DUST CONTROL SYSTEM			
(C) Sketch of typical panel showing width and length.				
(D) Sketch showing typical entry system with centerline distances between entries and crosscuts.				
(E) Sketch showing typical panel recovery, i.e., room and pillar, longwall, or other mining method which shows, by numbering such mining, the sequence of development and retreat.				
(F) Sketch showing shaft and slope plan where applicable.				
(x) Copy of any subsidence control plan required by 30 CFR 784.20.				
(xi) Map showing location of surface building, tipple, coal storage area, load-out facilities, and railroad right-of-way.	MAP			
	GENERAL LOCATION MAP			
(xii) Cross-section maps through mine area showing nature and thickness of overburden strata and the coal seam (s) involved.	CROSS SECTION MAPS			
(xiii) Auger Mining (see page 8)				

*THE MINING AND OPERATIONS PLAN UNDER 30 CFR 211.10 (c) PROVIDES FOR THE REQUIREMENTS OF THE MINERAL LEASING ACT (MLA) AND SHALL BE SUBMITTED AS PART OF THE MINING PLAN REQUIRED UNDER 30 CFR PART 741 (MORE SPECIFICALLY 30 CFR 741.12)

Mine ______________ Mine Plan Date ______________ Date Received ______________

Regulation	Separate Items	Included in Plan	Adequate	Comments
(6) Map and coal reserve base estimate of that coal within the LMU which is left in the ground due to designation of lands as unsuitable for all or certain types of surface coal mining operations or because of alluvial valley floor provisions.	MAP RESERVE ESTIMATE			
(viii) General layout of proposed surface or strip mine showing: (A) Planned sequence of mining by year for first 5 years, thereafter in 5-year increments for the remainder of mine life. (B) Location and width of box cut (s). (C) Location of main haulroads. (F) Location and width of coal fenders.	STRIP LAYOUT A B C D F			
(xiii) For auger mining, a plan map showing: (A) Area to be auger mined and the location of pillars to be left for access to deeper coal. (B) Cross sections through area to be mined showing overburden strata and coal seam. (C) Sketch showing details of operations including coal seam thickness, auger hole spacing, diameter of holes and depth or length of auger holes.	AUGER MINING A B C			

*The mining and operations plan under 30 CFR 211.10 (c) provides for the requirements of the Mineral Leasing Act (MLA) and shall be submitted as part of the mining plan required under 30 CFR Part 741 (more specifically 30 CFR 741.12)

CHAPTER II

LEGAL, FINANCIAL, COMPLIANCE AND RELATED INFORMATION

CHAPTER II

LEGAL, FINANCIAL, COMPLIANCE AND RELATED INFORMATION

2.1 SCOPE

Chapter II follows the format of the related regulations in UMC 782.

2.2 (782.13) IDENTIFICATION OF INTEREST

(a)(1) Applicant: Soldier Creek Coal Company
Soldier Canyon Mine
P.O. Box I
Price, Utah 84501
Phone Number: 801-637-6360

(2) Surface owners of areas affected by surface facilities:

United States of American

Managed by: Bureau of Land Management

Surface rights have been leased to the Soldier Canyon Mine.

(3) Lease holder of coal:

Soldier Creek Coal Company
P.O. Box I
Price, Utah 84501

Manager of leases: United States Geological Service

(4) Does not apply.

(5) Same as the applicant

(6) Mr. M. D. Ross
Vice President and General Manager
Soldier Creek Coal Company
801-637-6360

(b) The Soldier Creek Coal Company is a division of California Portland Cement.

(1) Michael A. Morphy, President
California Portland Cement Company
800 Wilshire Bld.
Los Angles, California 90017

(2) Does not apply.

(3) Does not apply.

(c) Michael A. Morphy, President
California Portland Cement Company
800 Wilshire Bld.
Los Angles, California 90017

M. D. Ross, Vice President and General Manager
Soldier Creek Coal Company
Price, Utah 84501

(d) Does not apply.

(e) Surface Owners:

United States of America

The Bernard Iriart Estate
503 East 1st North
Price, Utah 84501

Lawrence C. Nelson
Price, Utah 84501

Eureka Energy Company
90 W 100 N
Price, Utah 84501

(f) Soldier Canyon Mine
MSHA Identification Number 42-000-77

(g) Soldier Creek Coal Coal Company is presently submitting for additional federal coal under 43 CFR 3400, subpart 3425, for the Soldier Canyon Mine. The additional coal is located in the Salt Lake Meridian:

Township 12 South, Range 12 East
Section 31 - All

Township 13 South, Range 11 East
Section 1 - Lot 1 and 8

Township 13 South, Range 12 East
Section 5 - West ½
Section 6 - All

2.3 (732.14) COMPLIANCE INFORMATION

(a)(1) No, the Soldier Creek Coal Company has not had a mining permit suspended or revoked in the last 5 years.

(2) No, the Soldier Creek Coal Company has not forfeited a mining bond or a similar security deposite.

(b) Does not apply.

(c) The requirements for this section are being compiled presently by the Safety Department of the Soldier Canyon Mine.

2.4 (782.15) RIGHT OF ENTRY AND OPERATION INFORMATION

Soldier Creek Coal Company bases its right of entry on the control of lease SL 051279-063188 and a State Mine Permit, Act-007-018.

2.5 (782.16) RELATIONSHIP TO AREAS DESIGNATED UNSUITABLE TO MINING

(a) Soldier Canyon Mine is an existing operation.

(b) Does not apply.

(c) There are no occupied dwellings within 300 feet of surface facilities.

2.6 (782.12) PERMIT TERM INFORMATION

(a) The Soldier Canyon Mine has been in operation since 1975. The mine surface disturbance should never exceed 10 acres. The extent of the proposed underground working, are projected to the limits of the mine area. The projected mine plans can be obtained from U.S.G.S.

(b) (UMC 786.25) Due to the extensive coal reserves located in the Soldier Canyon Mine area, a 10 year permit terms is requested.

2.7 (782.18) PERSONAL INJURY AND PROPERTY DAMAGE

The Soldier Canyon Mine is self insured through its parent company, California Portland Cement. The Securities and Exhange Commission has copies of California Portland Cement's Form 10-K, which illustrates their ability to insure Soldier Canyon Mine.

2.8 PROPOSED PERFORMANCE BOND

The Soldier Canyon Mine would like to assure reclamation financing through the use of a corporate guarantee. The amount of this guarantee is illustrated in Chapter 3 as $128,000.

2.9 (782.19) IDENTIFICATION OF OTHER LICENSES AND PERMITS

The Soldier Canyon Mine has two other permits:

a. N.P.D.E.S. discharge permit, which is illustrated in Chapter 7.

b. Utah Division of Oil, Gas, and Mining Permit, numbered ACT-007-018.
(This permit was issued by your office).

2.10 LOCATION OF PUBLIC OFFICE FOR FILING APPLICATION

One copy of the permit application will be filed at the:

Carbon County Recorder Office
Main Street
Price, Utah 84501

2.11 (782.21, 786.11(a)) NEWSPAPER ADVERTISEMENT

(Upon publication, the advertisement will be placed in the permit.)

CHAPTER III

OPERATION AND RECLAMATION PLAN

CHAPTER III

Operation and Reclamation Plan

3.1 SCOPE

The objective of this portion of the permit application is to identify future plans of the Soldier Canyon Mine. Through a variety of sources, the information contained herein should adequately meet the Division's requirements on existing surface facilities, future construction plans, environmental protection, and plans of reclamation.

3.2 SURFACE FACILITIES / CONSTRUCTION PLANS

3.2.1 Site Selection and Preparation

The existing site of the Soldier Canyon Mine had been selected and prepared previously through the mining activities of other small, family owned type companies.

California Portland Cement Company purchased the mine at its present site from the Premium Coal Company in 1975. Since the date of that purchase, vast improvements have been made with the construction of clean, attractive, and functional surface facilities. These facilities have been built to coexist favorably with the surrounding environment.

At this time, one change is planned with regards to surface facilities. Additional shop space will be constructed on the same site where a wash plant had been previously located. The wash plant has been removed but its foundation will be used for this shop construction. Therefore, no surface disturbance will occur.

For more information see Figure 1 at the end of this chapter and the surface facilities map in the appendix of the permit application.

3.2.2 Portals

At present, the Soldier Canyon Mine employs four portals for mine ventilation purposes. A main intake portal is used for fresh air and for transportation, one for the main haulage belt, a portal for return air including an exhausting fan, and the fourth portal, referred to as the "rock slope", serving as an additional intake entry.

There is a possibility that future construction plans may include the addition of two shafts for ventilation purposes. At the time of this writing, plans for construction of these shafts have not been completed. See Figure 2 for possible shaft location and Figure 3 for a visual description of portal location.

3.2.3 Surface Buildings and Structures

Surface buildings and structures for the Soldier Canyon Mine are located 12 miles north of Wellington, Utah, in Section 18, Township 13 South, Range 12 East. (see Figure 1). These existing structures were completed in April of 1978 after approximately ten months of construction. For more information on surface buildings see the surface facilities map located in the appendix.

3.2.4 Coal Handling, Processing, Preparation, and Storage

Coal extracted from the Soldier Canyon Mine is transported from each section to the main haulage system by a 42" belt conveyor with a capacity of 300 tons/hr., and a speed of 460 ft./min.

The main haulage system of the mine consists of a 42" wide belt conveyor with a capacity of 100 tons/hr. and a speed of 600 ft./min. From this main haulage belt, coal is dumped into a surge bin with a capacity of 600 tons. At this point the coal is loaded into trucks owned and operated by Savage Brothers Company and transported from the mine.

3.2.5 Power System, Transmission Lines, Substations, Mine Feeders

The electrical supply source used by the Soldier Canyon Mine employs a 46, KV substation where the supply is reduced to 4160 volts for transfer into the mine. This electrical supply is reduced further to 480 volts for use in each individual section of the mine.

3.2.6 Water Supply System

Soldier Creek Coal Company purchases its culinary water supply from D & D Equipment and Supply Distributors of Helper, Utah. This company gets its water from Price City.

Generally, deliveries are made twice a day for a total one-day delivery of 6100 gallons. This water supply is stored in a holding tank at the mine with a capacity of 80,000 gallons.

3.2.7 Sewage System

Soldier Creek Coal Company employs an Ecolo-Chief wastewater treatment system. After wastewater is treated it is pumped back into the mine for reuse.

In this system, sewage enters the digester tank in which the septic tank principal is employed where some of the sledge settles to the bottom of the tank.

In the aeration tanks, decomposition of sewage takes place through an aerobic process. Air is supplied into the system by a rotary blower which is enclosed in a metal housing. The purpose of air in the system is to feed the bacteria.

Along with these steps mentioned above, other processes are utilized to complete the operation, giving the Soldier Canyon Mine an effective and reliable sewage treatment system. Prior to being discharged into the mine, the water passes through a sand filter for final treatment.

3.2.8 Water Diversion Structures

Water diversion structures used have been accepted as part of the sedimentation control plan. For more information see Sedimentation Control under part 7.2.3.2.

3.2.9 Sedimentation Control Structures

Runoff control plans for the Soldier Canyon Mine were approved November 23, 1979. A copy of this letter of approval is included at the end of chapter 7.

For more information on Sedimentation control see Chapter VII.

3.2.10 Transportation, Roads, Parking Areas, Railroad Spurs

There is one road leading to the Soldier Canyon Mine. This road is paved to the mine and a short distance beyond. This road is maintained by Carbon County.

There are no railroad spurs in the mine permit area. For additonal information see map in the appendix.

3.2.11 Total Area for Surface Disturbance During Permit Term

Total acreage of surface disturbance equals 6 acres. At this time, surface disturbance has not been extended beyond that which was necessary for the construction of the existing surface facilities. The plans for more shop space include using the removed wash plant foundation. Therefore no additional surface disturbance will be necessary.

3.2.12 Additional Areas for Surface Disturbance

Consideration is being given to the possible construction of two shafts to aid in our mine ventilation. If the shafts are constructed the total amount of additional disturbance will be small at less than one acre.

3.3 OPERATION PLAN

3.3.1 Mining Plans

3.3.1.1 Orientation and Multiple Seam Considerations

During mine advancement accurate surveys are run and later plotted on mine maps.

3.3.1.2 Portals and Shafts

Portals and shaft locations have been illustraded in 3.2.

3.3.1.3 Mining Methods

The Soldier Canyon Mine employs room and pillar mining, with pillar extraction taking place on designated panels.

3.3.1.4 Projected Mine Development

The projected mine developments have been established by past practice.

3.3.1.5 Retreat Mining

Note - Roof control plan.

3.3.1.6 Roof Control Ventilation

Note the approved ventilation and roof control plans at the end of the chapter.

3.3.2 Barrier Pillars

State and Federal laws are quite specific on sizes and needs for barrier pillars. These laws are strictly followed by Soldier Canyon Mine. Only when it becomes necessary to protect active mine workings will additional barrier pillars be needed.

3.3.3 Conservation of Coal Resource

The federal coal mine at the Soldier Canyon Mine is under the jurisdiction of the U.S.G.S. to assure maximum coal recovery. This subject is also covered in Chapter 6 (U.S.G.S. General No. 1 order.)

3.3.4 Equipment Selection

Note equipment list in the end of this chapter.

3.3.5 Mine Safety, Fire Protection, and Security

3.3.5.1 Signs

Adequate signs and markers have been posted at each point of access to the mine from public roads to existing surface facilities. These signs and markers conform to the regulations contained in UMC 817.11 for durability, readibility and conformity to to local laws and regulations as well as other requirements contained therein.

3.3.5.2 Fences and Gates

The fences and gates are located on the surface facility map in the appendix.

3.3.5.3 Fire Protection

Fire protection is obtained by complying with State and Federal regulations.

3.3.5.4 Explosives

Each explosives container used at the mine, portable and permanent, meet or exceed the specified requirements as set forth by the Mine Safety and Health Administration (MSHA). The permanent storage container located on the surface is set on skids and made of 1/4"-1/2" steel plate with a wood lining of 1/2" plywood. Two five tumbler locks, adequately protected, are used. Two vents measuring approximately 3"x3" are also used.

The portable container used for the transportation of explosives underground is a small metal utility trailer. The trailer is wood lined with caps and powder kept separate. No metal screws or metal parts are exposed as required by law.

3.3.6 Operations Schedule

Submitted to U.S.G.S.

3.3.6.1 Annual Production Per Year for Permit Term

With an average of 235 working days per year and a daily average of 3,600 tons annual production can be estimated at 850,000 tons per year under present mining operations and conditions.

An additional lease comprised of 1,262 acres has been applied for. This could vary the annual production figure given above. It's probable that mining will not begin in the new lease area (if granted) before the next year.

3.3.6.2 Operating Schedule-Days-Shifts

Total working days in one year: 235 average

Number of shifts per day: 3 (4 machine shifts/day)

3.3.6.3 Operation Employment

Soldier Canyon Mine employes 140 personnel.

3.3.7 Mine Permit Area

The present lease is comprised of 1,711 acres with an additional lease of 1,262 acres applied for.

See map in appendix.

3.3.7.1 Projected Mining by Year

3.3.7.2 Acreage and Delineation of Mine Permit Area

3.3.8 Mine Plan Area

Please contact the U.S.G.S. office for a current copy of Soldier Canyon Mine's projected mine plan.

3.4 Environmental Protection

3.4.1 Preservation of Land-Use

3.4.1.1 Projected Impacts of Mining on Current and Future Land-Use

See chapter 4.

3.4.1.2 Control Measures to Mitigate Impacts

3.4.2 Protection of Human Values

3.4.2.1 Projected Impacts of Mining on Human Values-Historical and Cultural

3.4.2.2 Control Measures to Mitigate Impacts

See chapter 5.

3.4.3 Protection of Hydrologic Balance

3.4.3.1 Projected Impacts of Mining on Hydrologic Balance

3.4.3.2 Control Measures to Mitigate Impacts

3.4.3.3 Monitoring Procedures to Measure Projected Impacts and Control

See chapter 7.

3.4.4 Preservation of Soil Resources

3.4.4.1 Projected Impacts of Mining on Soil Resources

3.4.4.2 Control Measures to Mitigate Impacts

See chapter 8.

3.4.5 Protection of Vegetative Resources

3.4.5.1 Projected Impacts of Mining on Vegetative Resources

3.4.5.2 Mitigating Measures to be Employed to Reduce Impacts on Vegetative Resources

3.4.5.3 Monitoring Procedures-Reference Areas, and Revegetation

See chapter 9.

3.4.6 Protection of Fish and Wildlife

3.4.6.1 Projected Impacts of Mining on Fish and Wildlife

3.4.6.2 Mitigating Measures to be Employed to Protect Fish and Wildlife

See chapter 10.

3.4.6.3 Monitoring Procedures

3.4.7 Protection of Air Quality

3.4.7.1 Projected Impacts of Minig Operation on Air Quality

3.4.7.2 Mitigating Measure to be Employed to Control Air Pollutants

3.4.7.3 Air Quality Monitoring Plans

See chapter 11.

3.4.8 Subsidence Control Plan

3.4.8.1 Projected Impacts of Subsidence

3.4.8.2 Control Measures to Mitigate Impacts

3.4.8.3 Monitoring Procedures to Measure Projected Impacts and Controls

See chapter 12.

3.4.9 Waste Disposal Plans

3.4.9.1 Projected Impacts of Disposal Areas and Methods on Environment

3.4.9.2 Control Measures to Mitigate Impacts.

There are no coal washing facilities on the property. This does not apply.

3.5 RECLAMATION PLAN

3.5.1 Contemporaneous Reclamation

3.5.2 Soil Removal and Storage

See chapter 8.

3.5.3 Final Abandonment

3.5.3.1 Sealing of Mine Openings

Note permanent seals in ventilation plan.

3.5.3.2 Removal of Surface Structures

All structures will be removed in a safe manner.

3.5.3.3 Disposition of Dams, Ponds, and Diversions

See chapter 9 & 10.

3.5.4 Backfilling and Grading Plans

3.5.4.1 Recontouring

Note recontouring map.

3.5.4.2 Removal or Reduction of Highwalls

Does not apply.

3.5.4.3 Terracing and Erosion Control

3.5.4.4 Soil Redistribution and Stabilization

See chapter 7 & 8.

3.5.5 Soil Preparation

3.5.5.2 Seeding and Transplanting

3.5.5.3 Mulching

3.5.5.4 Management

3.5.5.5 Revegetation Monitoring

See chapter 9 & 10.

3.5.6 Schedule of Reclamation

Upon completion of economic reserves, reclamation will begin.

3.5.7 Cost Estimate for Reclamation

3.5.7.1 Cost Estimate of Each Step of Reclamation

Note the following reclamation estimate.

SOLDIER CREEK COAL COMPANY

RECLAMATION ESTIMATE

OPERATOR: Soldier Creek Coal Company
MINE NAME: Soldier Canyon Mine

	OPERATIONS	COST
A.	CLEAN-UP	
	1. Removal of structures and equipment.	$64,000
	2. Removal of trash and debris.	2,000
	3. Leveling of ancillary facilities, pads an access roads.	8,000
B.	REGRADING AND RECONTOURING	
	1. Earthwork including haulage and grading of spoils, waste and overburden	*- - -
	2. Recontouring and excavation.	4,000
	3. Spreading of soil or surficial materials.	30,000
C.	STABILIZATION	
	1. Soil preparation, scarification, fertilization, seeding or planting, etc.	4,000
	2. Construction of terraces, waterbars, etc.	*- - -
D.	LABOR	
	1. Supervision.	9,000
	2. Labor exclusive of bulldozer time.	**- - -
E.	SAFETY	
	1. Erection of fences, portal coverings, etc.	2,000
	2. Removal or neutralization of explosive or hazardous materials.	*- - -
F.	MONITORING	
	1. Continuing or periodic monitoring, sampling and testing deemed necessary.	5,000
	TOTAL	$128,000

*Operations which would be completed or require minimal expenditure at the time of final reclamation.
**Labor costs have been incorporated into all estimates.

CLEAN-UP

1. Removal of Structures and Equipment

   Estimate for removal of all structures assume that the contractor would retain full salvage rights. Contractor will also be responsible for removal of all foundations, pads, and leveling of surface material. Parameters used in estimates are as follows:

Labor

Number of men required for specific job, exclusive of supervision. Estimated cost is $100.00 per day, per man.

Days Required

Estimated time required in days assuming 8 working hours a day.

Equipment (hrs.)

Estimated total hours of time, for a specific job, requiring the use of a major piece of equipment, including operator.

Structure	Labor (# of men)	Days	Equipment (hrs)	COSTS Labor	Equip.	Total
Office	3	4	16	$1,200	$1,600	$2,800
Shop	4	5	40	2,000	4,000	6,000
Bathhouse	4	3	24	1,200	2,400	3,600
Warehouse	4	3	24	1,200	2,400	3,600
Sewer Plant	4	3	24	1,200	2,400	3,600
Open Shed	3	2	8	600	800	1,400
Closed Shed	3	2	8	600	800	1,400
Service Station	3	1	8	300	800	1,100
Training Center	4	17	160	2,000	4,000	6,000
Crusher	3	3	24	900	2,400	3,300
Stacking Tube	3	2	16	600	1,600	2,200
Loadout Bin	3	4	32	1,200	3.200	4,400
Refuse Bin	3	4	32	1,200	3,200	4,400
Water Storage	3	2	12	600	1,200	1,800

Structure	Labor (# of men)	Days	Equipment (hrs.)	COSTS Labor	Equip.	Total
Rock Dust Bin	3	2	8	$ 600	$ 800	$1,400
Mine Fan	3	2	16	600	1,600	2,200
Conveyor Structure	3	20	80	6,000	8,000	14,000
						$64,000

2. Removal of Trash and Debris

Trash and debris will be systematically removed and properly disposed of throughout the mine life. Any such accumulations at the time of final reclamation will be minimal.

Estimated cost -	Labor: 2 men @ $100 per day for 5 days	$1,000
	Equipment: $100 per day for 5 days	1,000
	Total	$2,000

3. Leveling of Ancillary Facilities, Pads, and Access Roads

Leveling of ancillary facilities is included with the structural removal. Estimation of the access road removal is as follows:

Labor: 4 men @ $100 per day for 5 days	$2,000
Equipment: 4 pieces of equipment total $150 per hour - 5 days	6,000
Total	$8,000

B. REGRADING AND RECONTOURING

1. Earthwork Including Haulage and Grading of Spoils, Waste, and Overburden

Refuse material will be deposited in a systematic and orderly manner. Refuse will require no further grading at the time of final reclamation.

2. Recontouring and Excavations

Recontouring of mine portals would require a bulldozer for approximately 5 days at $100 per hour.

($100) x (8) x (5) = $4,000

This amount includes labor costs.

3. Spreading of Soil or Surficial Materials

The cost of moving and spreading of surficial materials is estimated at $2.00 per yd^3.

Surface Facility Area

Disturbed area	9 acres
Average depth of surficial material	.5 foot
Total yd^3	7,300 yd^3
Cost	$14,600

Additional trucking and grading costs.

Cost	$11,400

Sediment Ponds and Portal Area

(These areas will not require a large volume of material to be moved in order to achieve final reclamation.)

Estimated cost	$4,000
TOTAL	$30,000

C. STABILIZATION

1. Soil preparation, scarification, fertilization, seeding, or planting, etc.

Cost

Alfalfa hay mulch	$150 per acre
Labor and equipment	200 per acre
Seed mixture	150 per acre
Total	$500 per acre

Acreage 8 acres

Total cost

($500) x (8) = $4,000

2. Construction of Terraces, Waterbars, etc.

The need for such structures is assumed to be minimal and costs for such construction would be absorbed by previous estimates.

D. LABOR

1. Supervision

One individual would be required at $3,000 per month for approximately 3 months.

(3) x (3,000) = $9,000

2. Labor Exclusive of Bulldozer Time

General labor was estimated at $100 per day, per man. Labor costs have been incorporated into all previous estimated costs.

E. SAFETY

1. Portal Seals

Number required	4
Cost per seal	$ 500
Total	$2,000

2. Removal of Neutralization of Explosive or Hazardous Materials.

Accumulations of explosives or hazardous materials will not be permitted. The cost of removal or neutralization of any such material can be considered minimal.

F. MONITORING

1. Continuing or Periodic Monitoring, Sampling and Testing Deemed Necessary.

Cost - $5,000

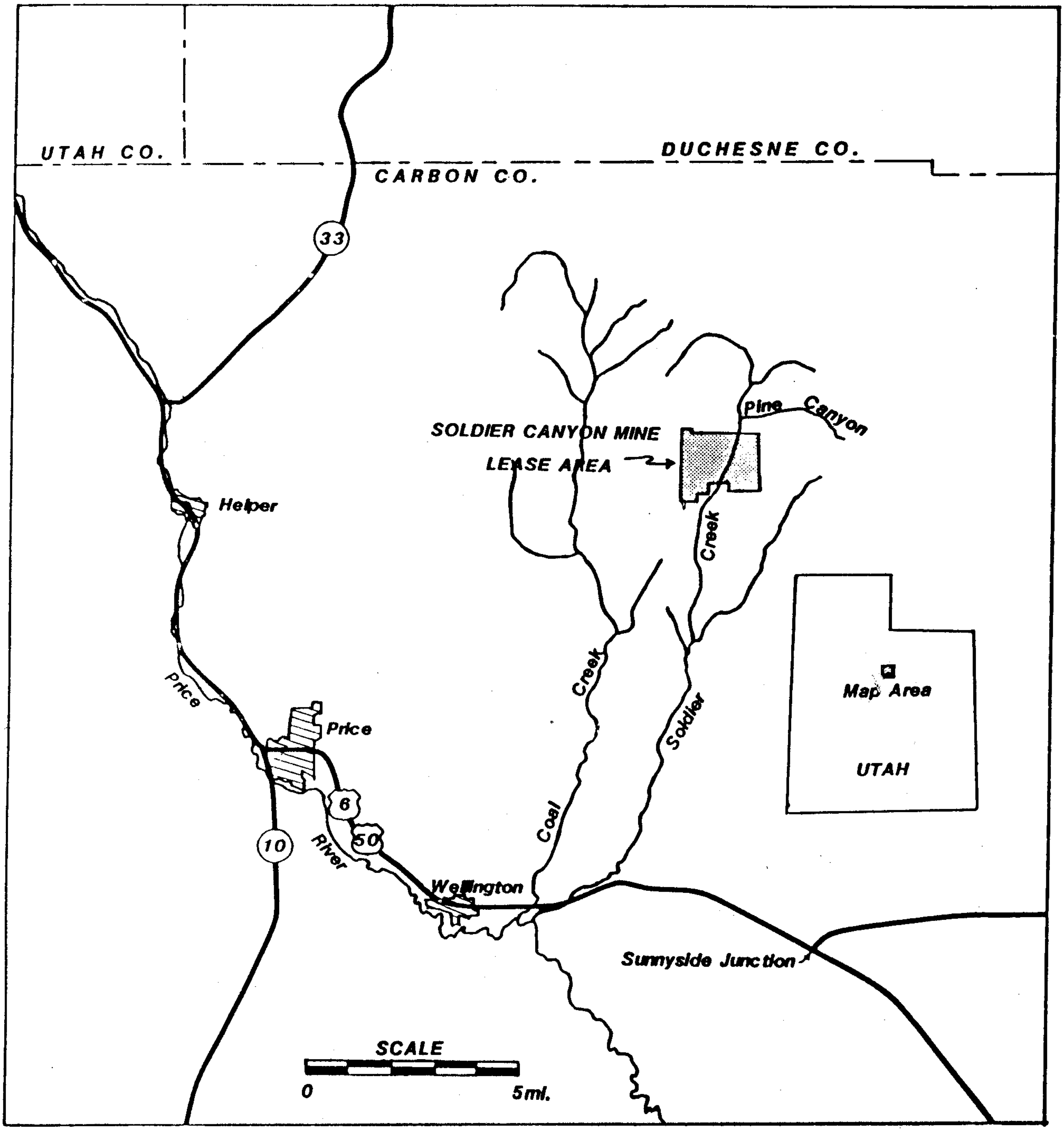


Figure 1. Location of the Soldier Canyon Mine lease area.

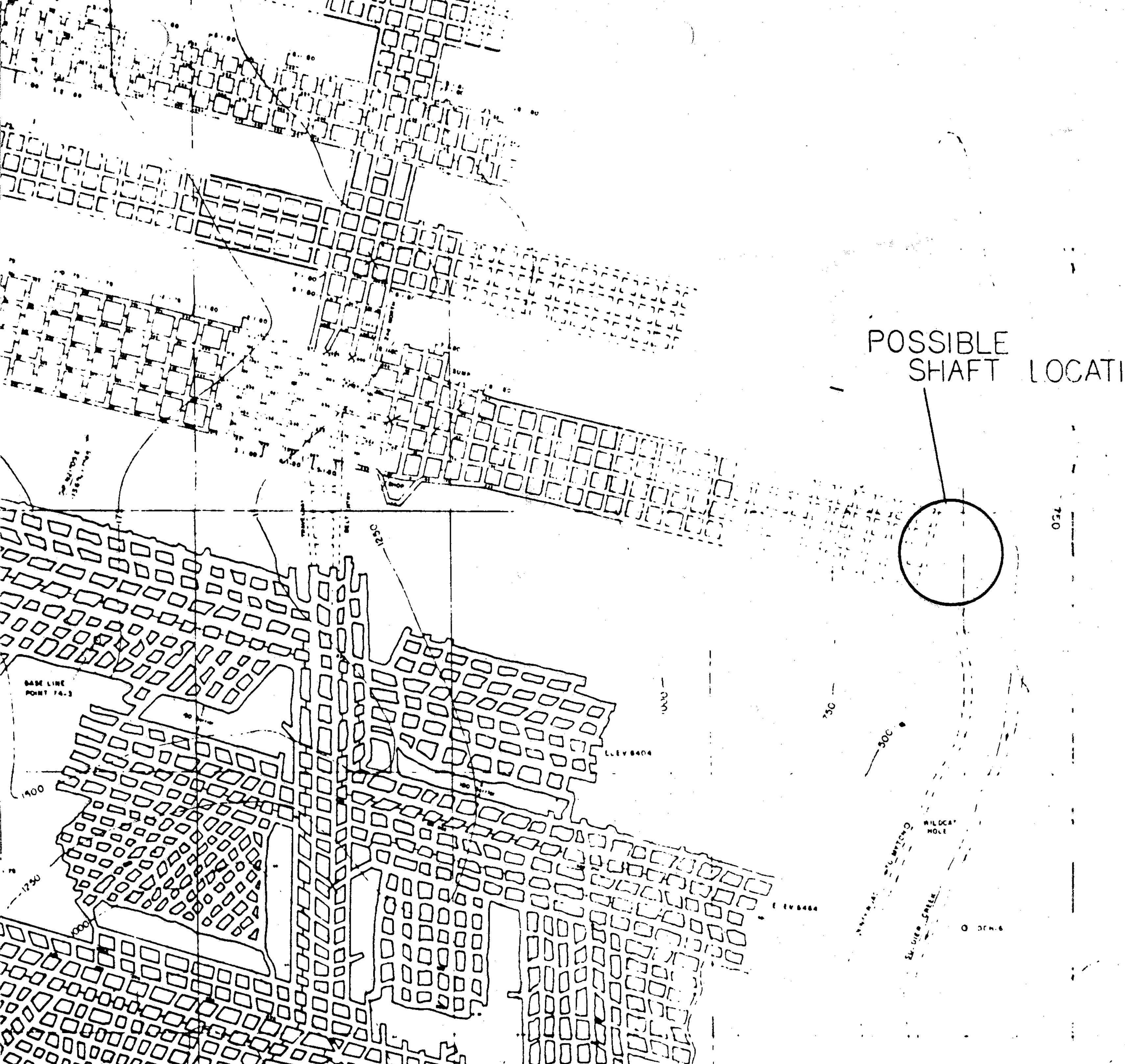

POSSIBLE
SHAFT LOCATION
750
1250
750
500
1500
1250
1000
WILDCAT
HOLE

FIG. 2

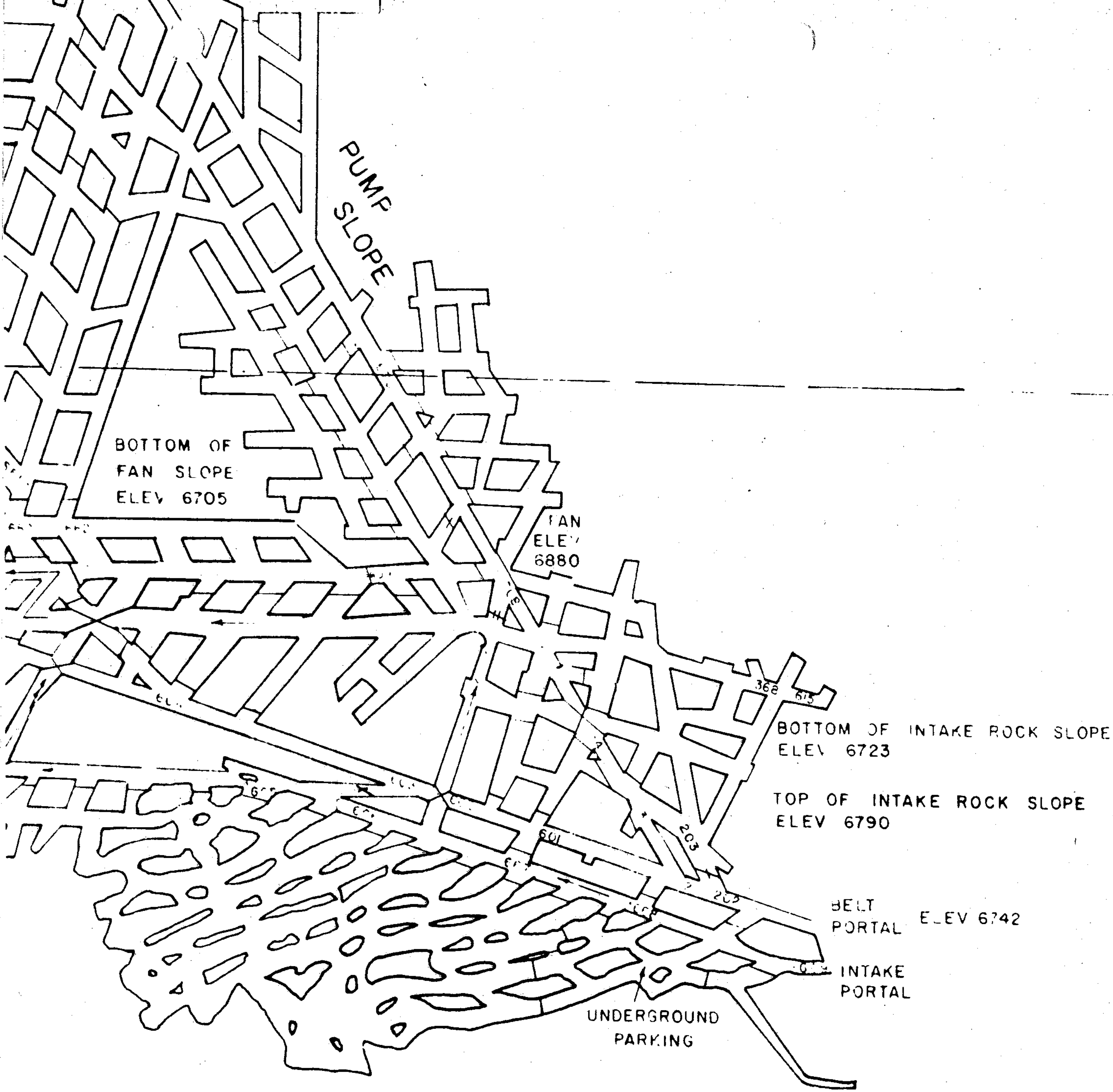


FIG. 3 PORTAL LOCATION

Coal Mine Safety and Health
District 9

February 25, 1981

Mr. Tom Paluso
Chief Mining Engineer
Soldier Creek Coal Company
P. O. Box I
Price, Utah 84501

Re: Soldier Canyon Mine
I. D. No. 42-00077
Roof Control Plan

Dear Mr. Paluso:

The roof control plan submitted February 16, 1981, has been reviewed by MSHA personnel and is approved. This plan supercedes all previous plans.

Sincerely,

John W. Barton
District Manager

JWB:J.S.Miller:mh

cc: Price
DTSC
St Dept of Mines

SOLDIER CANYON MINE
I.D. 42-00077
ROOF CONTROL PLAN

Date February 16, 1981

ROOF-CONTROL PLAN

General Information

A. This plan contains the minimum roof-control measures to be used and is formulated for normal roof conditions and the mining system(s) described. In active working areas, where subnormal roof conditions are encountered, the minimum roof-control method will be supplemented with either longer and/or additional roof bolts, posts or crossbars. All provisions of this plan will be fully explained to all workmen whose duties require them to be in a "working section"; such training will be conducted within three (3) weeks after receipt of notification that such plan has been approved, and thereafter, at periodic intervals not to exceed six (6) months. Before a person is assigned the sole reponsibility of installing roof bolts, such person will receive training from a competent and experienced person under the direction of a supervisor. The supervisor will be thoroughly familiar with the contents of the roof-control plan and the mining system used, and will ascertain that proper instruction has been given the trainee. All new underground employees will have the hazards of mine roof, face, and ribs, and the contents of the approved roof-control plan explained to them before they begin work. Any change made in the roof-control measures outlined in this plan will be submitted and approved before it is implemented.

B. Company Soldier Creek Coal Company P. O. Box I

Address Price (City) Utah 84501 (State)

C. Mine Soldier Canyon Mine I.D. No. 42-00077

Mine Location

Price (City) Carbon (County) Utah (State)

D. Location (reference to nearest highway route, direction, and distance)

12.4 Miles North Off Route No. U.S. 50 & 6

E. Type(s) of Plan Full Bolting

F. Area(s) of mine covered by the plan All of Lease No. SL051279-063188

G. R. W. Olsen Mine Manager 2/16/81

Company Official's Signature (Title) (Date)

Signature of miner(s) with whom plan was discussed (Date)

Roof-Control Investigator A. Kendzerski Feb. 23, 1981

Approved by ____________________ ____________________ (Date)

Title ____________________

ROOF SUPPORT MATERIALS - All components of the roof bolt assembly will comply with the American National Standards Institute "Specifications for Roof Bolting Materials in Coal Mines".

H. ROOF BOLTS

Manufacturer: CF&I Corporation; Armco Steel Corporation; Mikco Industries; Pattin West Manufacturing; Birmingham Bolt

Manufacturer's Designation: Expansion Type

Minimum Length: 4 Feet

Diameter: 5/8" (EHS) or 3/4" (Gd 80)

Type Steel: 5/8"- Extra High Strength; 3/4" ASTM A-306 Grade 80

Type Thread: Rolled

Length of Thread: 8"

Type Head: Standard
(Standard, Self-centering, Cone neck)

Dimensions of Bolt Head: Nut 1 1/8" square

Flange: 1 1/2"

I. RESIN GROUTED RODS

Manufacturer: Pattin West; Mikco; CF&I; Birmingham Bolt

Manufacturer's Designation: ____________________

Minimum Length: 4'

Diameter: 7/8"

Type Steel: Grade 40

Type Head: Square

Minimum Yield: 48,000 psi

Dimensions of Rod: Head 1 1/8"

Flange: 1 3/4"

Maximum Length of Hole: ____________________

Size of Finishing Bit: ____________________

RESIN

Manufacturer: Celtite; Dupont; Atlas; Carboloy

Type: FAS-LOC "A" 22-12 or Equivalent

J. BEARING PLATES

Manufacturer: CF&I Corporation; Armco Steel Corporation; Mikco Industries; Pattin West Manufacturing; Calumet Manufacturing

Manufacturer's Designation: ____________________

Dimensions 6" x 6" x 1/4" Embossed 6" x 6" x 3/8" Flat
6" x 6" x 3/16" Embossed

Shape Square
(Donut Embossed, Bell Embossed, Flat)

Center Hole Size 7/8"

K. WASHERS

Manufacturer ______

Manufacturer's Designation ______

*Type Steel Hardened

Size ______

* Washers shall be through hardened to a hardness of 35 to 45 as measured on the Rockwell C Scale. Washers shall conform to the shape of the bearing plate and be of sufficient strength to withstand loads up to the yield point of the roof bolt.

Shape ______

Hole Size ______

L. ANCHORAGE UNIT

Manufacturer Ohio Brass
Pattin Ohio Brass
Pattin D. Manufacturing

Manufacturer's Designation OB 22378
Pattin D1
F-2B and D-8B

Type ______
(Finishing bits shall be easily identifiable by sight or feel)

Size Finishing Bit =0.030" - 0

Method of Drilling Rotary, Percussion or Combination

Dust Control Vacuum or Water

Installed Torque 150 Ft. LBS minimum - 250 Ft. LBS maximum (conventional)

M. MATERIALS USED IN CONJUNCTION WITH ROOF BOLTS

Wooden Header Blocks - 2" x 8" x 16" Minimum Steel Roof Mats - Solid and Wire

Prior approval shall be obtained before making any changes in the material listed.

N. ROOF SUPPORT MATERIAL--CONVENTIONAL OR TEMPORARY AND SUPPLEMENTAL

WOODEN POST SPECIFICATIONS--Posts will be of solid straight grain wood, free from defects which would affect their strength, and sawed square on the ends. Round posts will be at least one inch in diameter for each 15 inches of length up to 8 feet, but in no case will the diameter be less than 4 inches. For heights over 8 feet, the diameter of the posts shall be no less than 7 inches. If split posts are used, they will have a cross-sectional area equal to that of round post of equal length.

CAP BLOCKS AND WEDGES, SIZE AND SHAPE--Cap blocks and footers will have flat paralleled or tapered sides and be not less than 2" x 6" x 24" in size. The minimum dimensions of wedges will be 1" x 3-1/2" x 10".

CROSSBARS, TYPE AND SIZE--Wooden crossbars will have a minimum cross-sectional area of 24 inches, with a minimum thickness of 3 inches.

PLANKS, SIZE--Planks will have a minimum cross-sectional area of 5 square inches with a minimum thickness of 1 inch.

CRIBBING BLOCKS, SIZE AND SHAPE--Cribbing blocks will have flat parallel sides and be at least 30 inches long.

O. Maximum Cover: 2,000 Feet

Main Roof	Sandstone
Immediate Roof	Shaly Sandstone
Coalbed	Rock Canyon Seam
Bottom	Sandy Shale

SIGHT LINES WILL BE ESTABLISHED TO ASSURE THAT MINING PROJECTIONS IN ENTRIES, ROOMS, CROSSCUTS, AND PILLAR SPLITS ARE FOLLOWED.

Entry Width	20 Feet	Centers	60-100 Feet
Crosscut Width	20 Feet	Centers	80-100 Feet
Room Width	20 Feet	Centers	60-100 Feet
Room Crosscut Width	20 Feet	Centers	80-100 Feet

Maximum diagonal distance at 4-way intersection ______

AUTOMATED TEMPORARY ROOF SUPPORT (ATS) SAFETY PRECAUTIONS

A.

Roof Bolter Manufacturer	Model Number	Serial Number	Minimum Load Carrying Capacity
1. Lee Norse #1	TD1-43	20819	11,500
2. Lee Norse #2	TD2-43	20979	11,500
3. Fletcher #4	DDM-13	76136	11,500
4. Fletcher #5	DDM-13	76137	11,500
5. Fletcher #6	DDM-13	79074	11,500
6. Fletcher #7	DDM-13	80052	11,500

B.

Continuous Miner Manufacturer	Model Number	Serial Number	Minimum Load Carrying Capacity
1. Joy #3	12CM-6-10CH	JM2414	11,500
2. Joy #4	12CM-6-10CH	JM2415	11,500
3. Joy #5	12CM-6-10CH	JM2896	11,500

C. A registered professional engineer shall certify that each ATS is capable of supporting the above minimum load carrying capacities. Evidence of the certification shall be furnished by attaching a plate, label, or other appropriate marking to the ATS system. Written evidence of this certification shall be retained by the operator.

D. Two safety jacks must be kept on the bolting machine at all times to be used when adverse roof conditions are encountered and the automated support does not supply adequate protection for the bolter operator.

E. No one shall proceed inby the automated temporary support system unless a minimum of 2 temporary supports are installed. This minimum is applicable only if the supports are not more than 5-feet apart, within 5-feet of permanent support, face, or rib and the work is done between such supports and the nearest face or rib.

F. Holes will not be drilled or bolts will not be installed to the left or right of the outer roof contact points of the automated temporary support system unless the coal rib or a temporary or permanent support is within 5-feet of these contacts. The bolting machine will begin the bolting cycle from a position which affords maximum protection for the operator.

G. The automated temporary support system shall be placed firmly against the roof not more than 5-feet inby the last row of permanent supports, before any person proceeds inby permanent support.

H. There will be no installation of roof bolts inby the temporary roof support.

I. The controls necessary to position and set the automated support shall be located in such a manner that they can be operated from under permanent support.

J. A check valve or equivalent protection shall be incorporated in the automated temporary support system to eliminate the danger of collapse through sudden loss of hydraulic fluid from a broken hose.

K. The temporary roof supports as required in the approved roof control plan do not apply where the roof bolting machine is equipped with an acceptable ATS system. This does not preclude the use of temporary supports where needed to make necessary tests or for ventilation purposes.

L. The drawings in figures 5-7 show how the ATS system shall be positioned and re-positioned as bolting progresses, and show the sequence of installation of roof bolts in a typical face area.

M. It should be noted that certification or approval of an ATS by equipment manufacturer's does not constitute approval of an ATS system in lieu of temporary supports. Only the District Manager or his representative can approve an ATS system in lieu of temporary supports.

N. DELETED ~~The head of the continuous miner may be used as a temporary roof support. It will meet or exceed all existing requirements of a TRS and will be used during the mining cycle as shown on figure 2.~~

SAFETY PRECAUTIONS FOR ROOF BOLTING

1. Roof bolting is done throughout the mine and installed in the pattern and spacing outlined in Figure 1 - "Typical Bolt Pattern & Spacing at Intersection". Roof bolts will be installed row by row crosswise beginning with the row farthest outby the face and advancing toward the face.

2. Bearing plates used directly against the mine roof will be no less than 6 inches square or of equivalent area. In exceptional cases, where the mine roof is firm and not susceptible to sloughing, bearing plates 5 inches square or of equivalent area may be used.

3. A calibrated torque wrench that will indicate the actual torque on the roof bolts by a direct reading will be provided and maintained in operable condition on each roof-bolting machine in operation.

4. Immediately after the first bolt is installed in each place, the torque shall be tested and thereafter at least one roof bolt out of every four shall be tested by a qualified person. If any of the bolts tested do not fall within the required torque range, the remaining previously installed bolts on this cycle shall be tested.

   If the majority of the bolts fall outside the required torque range, necessary adjustments shall be made immediately. If, after these adjustments are made, the required torque ranges are still not obtained, supplementary supports such as different length roof bolts with adequate anchorage, posts, cribs or crossbars shall be installed. (conventional only)

5. During each 24-hour period, in a working place that has been utilized for coal production, spot-check torques on at least 10 percent of the roof bolts from the outby corner of the last open crosscut of each workplace to the face will be made and a record kept of the results. The record will show the number of bolts tested and the number above and below the required range. If the tests show that the majority of the bolts in any workplace are not maintaining at least ** 120 foot-pounds
   * 100

   of torque or have loaded to where they exceed 350 foot-pounds, prompt action will be taken to install supplementary supports such as crossbars or bolts with adequate anchorage. (conventional only)

6. Devices will be used to compensate for the angle when roof bolts are installed at angles greater than 5 degrees form the perpendicular to the roof line.

7. Where posts are installed as permanent support they will have one wooden cap block between the post and the roof. Post will be installed tight and on solid footing and no more than two wedges will be used to tighten such posts.

** Plates directly against roof
* Plates against wood

8. In active working places during any shift that roof bolts are being installed, at least one (1) test hole will be drilled to a depth of at least 12 inches above the anchorage horizon of the bolt being used to evaluate the nature of the strata. Such test holes will be identified in the manner that will distinguish them from other bolt holes in the normal pattern. If the test hole indicates the anchorage zone has changed to the extent that it could affect the ability of roof bolts to adequately support the roof, then adequate supplemental roof supports will be installed.

9. All roof support material will be stored and handled in a manner to minimize rusting and/or damage.

10. A bar of suitable length and design will be provided on all mobile face equipment, except haulage equipment. The length of the bar will be suitable for the area of application.

11. An additional supply of supplementary roof support material, such as roof bolts at least 12 inches longer than the bolts being used, posts, crib blocks, cap blocks and wedges will be available at the minesite and could be delivered to any section of the mine in less than 30 minutes.

12. (a) Mine openings will not be cut through into areas that are not supported by either temporary supports on a maximum of five (5) foot centers or permanent supports installed on pattern as required by the approved plan. (b) When a mine opening holes into a per- manently supported entry, room, or crosscut, no work shall be done in or inby such intersection until the new opening is either per- manently supported as indicated in the approved plan or timbered off with at least one (1) row of posts on not more than five (5) foot centers across the opening. In the mining systems using con- ventional mining equipment, paragraph (b) does not apply until the loading operation is completed.

13. Side cuts will be started only in areas that are permanently supported. The first side cut on either side of a room or entry will be supported by either temporary or permanent supports before any work is done in or inby the intersection. Where temporary supports are used, the distance between the permanent supports and temporary supports will not exceed 5 feet, and at least one row of posts on 5-foot centers will be installed across the unsupported place.

14. (a) When crossbars are required, they will be installed so that the load on the support is equally distributed.
(b) On mobile equipment haulageways, all crossbars, or beams shall be installed with some means of support that will prevent the beam or crossbar from falling in the event the supporting legs are accidently dislodged. Where crossbars or beams are installed on track haulage- ways, this requirement shall be compiled with no later than the first weekend following the initial installation of the crossbars or beams.

15. The minimum length roof bolt specified in the material list shall

apply only if it permits anchorage in at least 12 inches of solid strata.

16. Adverse conditions may require deviation from the normal plan for safety reasons only.

17. Upon completion of the loading cycle, a reflectorized warning tag shall be conspicuously placed to warn persons approaching any area that is not permanently supported, and shall remain in place until permanent supports have been installed.

18. Resin grouted rods installed in a pattern according to the approved plan may be used as anchor point for shuttle cars.

SAFETY PRECAUTIONS FOR TEMPORARY SUPPORT AND REHABILITATION WORK

1. Upon completion of the loading cycle, a reflectorized warning tag shall be conspicuously placed to warn persons approaching any area that is not permanently supported, and shall remain in place until permanent supports have been installed.

2. The depth of the cut (L), referred to in Figures 2-7, shall be determined by the distance from the face that the equipment can be operated with the operator remaining under permanently supported roof. No one shall proceed 5 feet beyond the temporary support unless adequate temporary support is installed.

3. Unless roof-bolting machines are equipped with acceptable automated temporary support devices, the installation of temporary supports shall be started no later than 30 minutes after the loading cycle is completed; and after the installation of such supports is started, installation shall be continued until at least the minimum number are installed as required by the approved plan.

4. When installing permanent supports with machines not provided with acceptable automated temporary support devices, temporary supports shall be repositioned in the sequence indicated on Figure 4 - "Temporary Support Layout". If it is necessary to remove temporary supports before permanent supports are installed, such supports shall be removed by some remote means, or other temporary support shall be installed in such a manner that the workman removing the support remains in a supported area.

5. In areas where temporary supports are required, only those persons engaged in installing the temporary supports will be allowed to proceed beyond the permanently supported roof.

6. Work such as extending face ventilation devices or making tests for methane beyond permanently supported roof will not be done unless a minimum of one temporary support is installed. This minimum is applicable only if the support is within 5 feet of permanent support, face, or rib and the work is done between such supports and the nearest face or rib.

7. Metal jacks will have one (1) wooden cap block between the jack and roof, except a bearing plate with a cross-sectional area of at least 17 square inches may be used in lieu of the cap block.

8. Temporary supports shall be installed tight and on solid footing. Temporary supports may be installed using a maximum of one (1) cap block on top and one (1) on the bottom plus two (2) wedges.

9. Where acceptable, automated roof support devices are provided and maintained on roof bolting-machines; such devices will be used in lieu of temporary support. The controls necessary to position the automated support will be operated from under permanently supported roof, as shown in Figures 5-6. Roof bolt machine operators will

not be permitted inby permanent supports until the automated supports have been pressurized against the mine roof at the point where work is to be performed.

10. At least (2) safety jacks shall be carried on each roof-bolting machine provided with acceptable automated roof support devices to be used when adverse roof conditions are encountered and the automated support does not provide adequate protection for the bolter operator.

11. Where rehabilitation work is being done, the following temporary support pattern will apply:

    (a) Where crossbars or roof bolts are being installed in an area where roof failure is indicated, a minimum of two (2) rows of temporary supports will be installed on not more than 5-foot centers across the place so that the work in progress is done between the installed temporary supports and adequate permanent support.

    (b) Where loose material is being taken down, a minimum of two (2) temporary supports on not more than 5-foot centers will be installed between the workmen and the material being taken down unless such work can be done from an area supported adequately by permanent supports.

    (c) Where roof bolts are being replaced in isolated instances (such as where equipment has knocked bolts loose) one (1) temporary support shall be installed within a radius of 2 feet of each bolt to be installed.

12. Where roof falls have occurred and at all overcasts, boom holes, and other construction sites that require removal of mine roof material, (e.g., by blasting, by ripping with a continuous mining machine, by cutting with a cutting machine, or by any other means), the roof shall be considered unsupported. If miners are required to enter such areas, either to travel over the fallen material, to clean it up, or to perform other duties, the roof shall be supported adequately. Mine management shall devise and have in writing at the scene of such unsupported roof a plan incorporating the following procedures:

    (a) Such work will be conducted under the constant supervision of a company official unless the workmen are specially trained to do such work.

    (b) A minimum of four (4) temporary supports on not more than 5-foot centers will be set near the edge of the roof fall where work is started.

    (c) Bolting or timbering shall proceed from permanently supported roof to the temporary supports before other work is performed and roof supports (temporary and permanent) advanced as clean-up work progresses.

    (d) The loading of the fallen roof material will always be done with the machine operator under supported roof.

13. All roof falls in active areas that are not cleaned up shall be posted off at each entrance to the area by at least one (1) row of posts (or the equivalent) installed on not more than 5-foot centers across the opening and "Danger" signs placed at all entrances into the fall area.

14. Where roof falls have occurred, or where the mine roof has been intentionally disturbed by any means, roof bolts of a length less than required in the approved roof-control plan may be used to support the remaining roof; but the bolt length will not be less than 36 inches and must anchor at least 12 inches in solid strata.

15. Before any person proceeds inby permanently supported roof to install temporary supports, a thorough visual examination of the unsupported roof and ribs shall be made. If the visual examination does not disclose any hazardous condition, persons proceeding inby permanent supports shall do so with caution and shall test the roof by the sound and vibration method as they advance into the area.

SAFETY PRECAUTIONS FOR RESIN GROUTED RODS

1. All safety precautions required in the regular roof-control plan will be followed, except the torque tests required for conventional-type roof bolts will not apply. Should there be indications or suspected indications that resin is failing, then a torque check shall be made of all the rods installed in that cycle. Should more than one rod turn in its hole, the resin installation shall be discontinued until such failure is determined and corrected. If the reason for resin failure cannot be determined, roof bolting procedures will be altered such that the roof will be adequately supported.

2. Persons responsible for the installation of resin rods will be taught the installation procedures recommended by the manufacturer, including the safe handling precautions of the resin material.

3. Drill steels will be equivalent in length to the rods used or adequately marked to assure proper hole depth. Each drill hole will be filled the entire length with resin.

4. All resin grouted rods will be used with bearing plates approved for use. The bearing plate or the wood material between the bearing plate and the roof will be tight against the mine roof.

5. Resin packages will be stored in an area where the temperature is within the range recommended by the manufacturer.

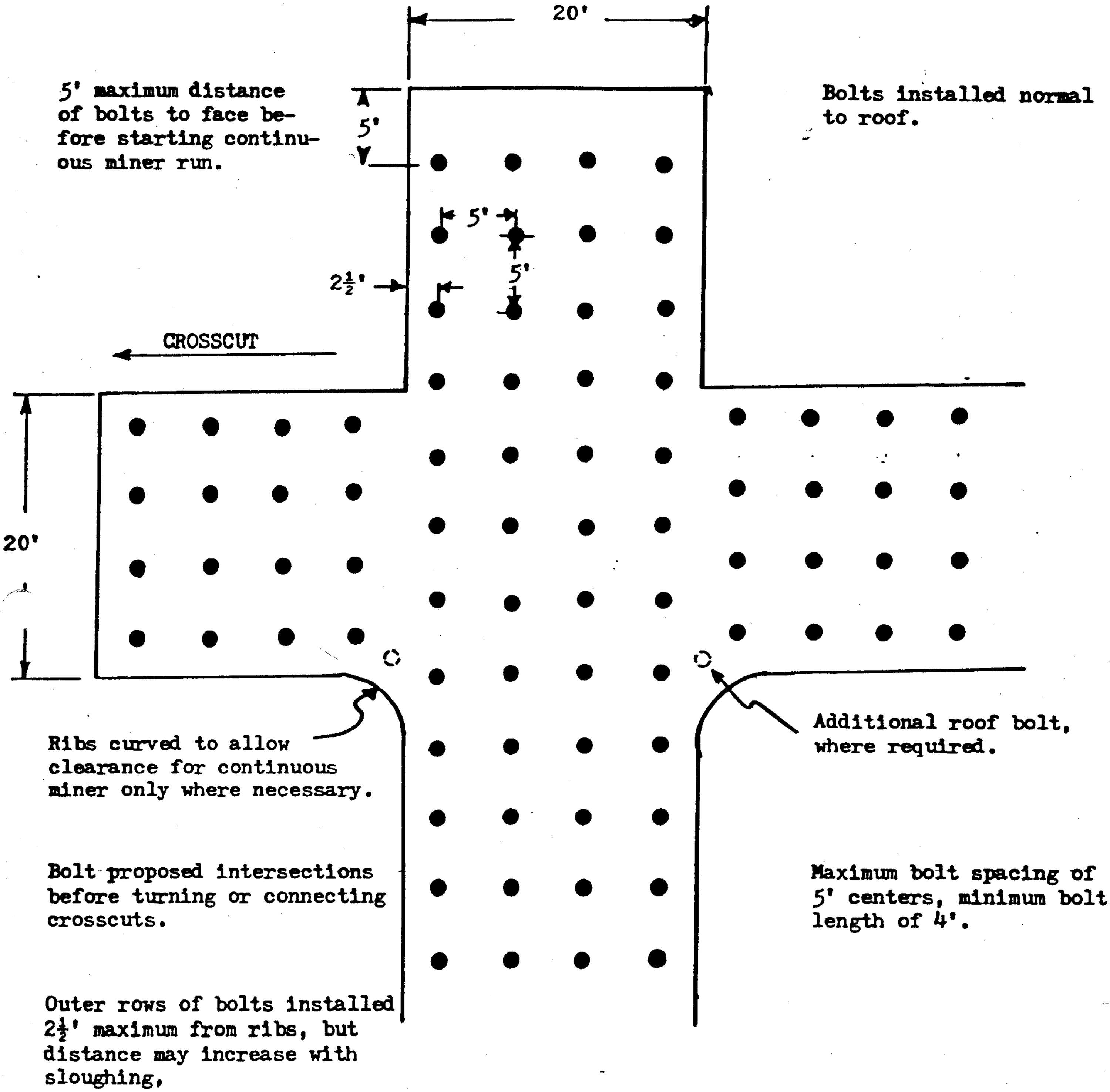
6. Broken cartridges or cartridges which show signs of deterioration will not be used and will be removed from the mine.

7. Resin grouted rods and conventional roof bolts will not be intermixed during systematic bolting cycles, except that intermixing may occur in areas where supplementary supports are required.

8. Resin cartridges will not be used if the recommended shelf life has been exceeded, unless written authorization for use is permitted by the manufacturer or an authorized representative of the manufacturer.

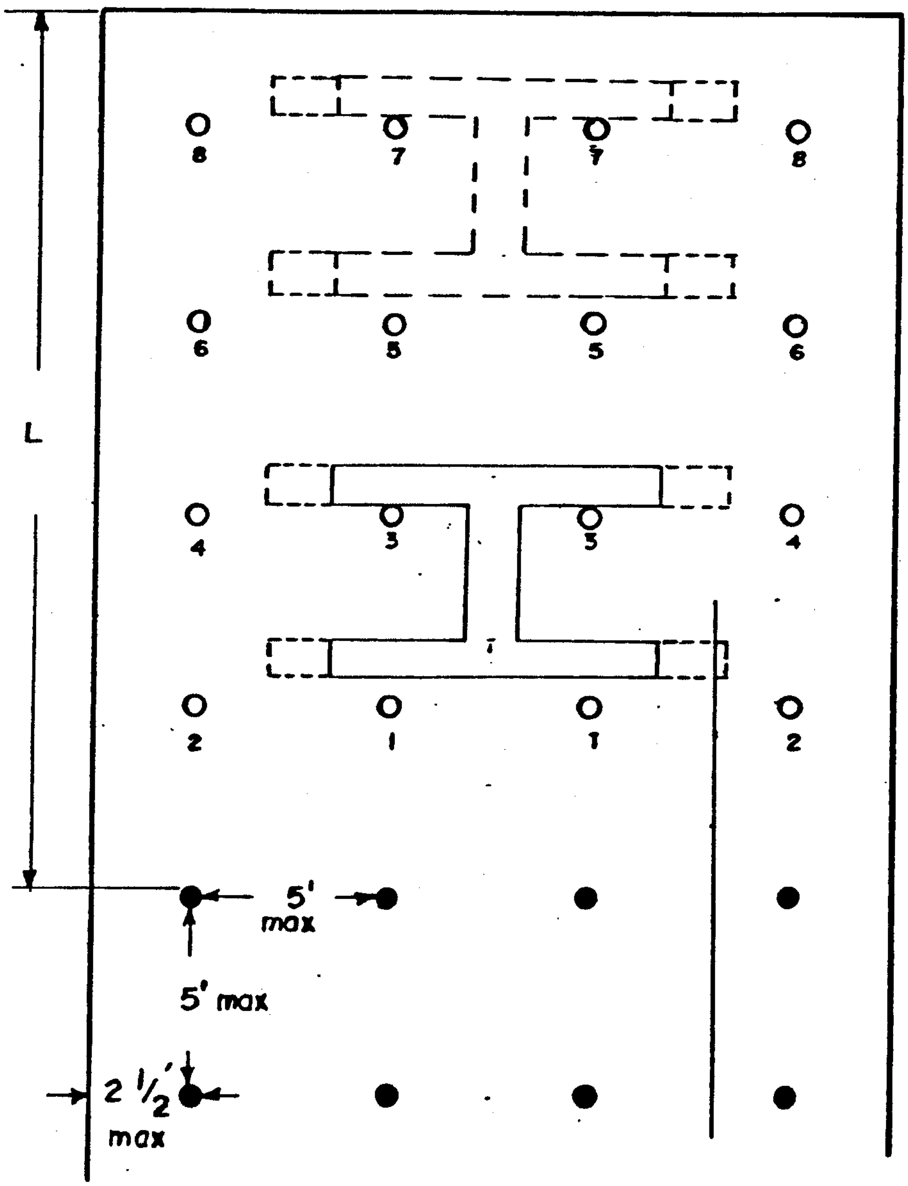
ROOF SUPPORT PROCEDURES AND ILLUSTRATIONS

TYPICAL BOLT PATTERN AND
SPACING AT INTERSECTION
(Figure 1)



Scale- 1" = 10'

BOLTING SEQUENCE FOR
FLETCHER DDM 13 ROOF BOLTER
(Double Boom)
(Figure 2)



Brattice within 15' of the face.

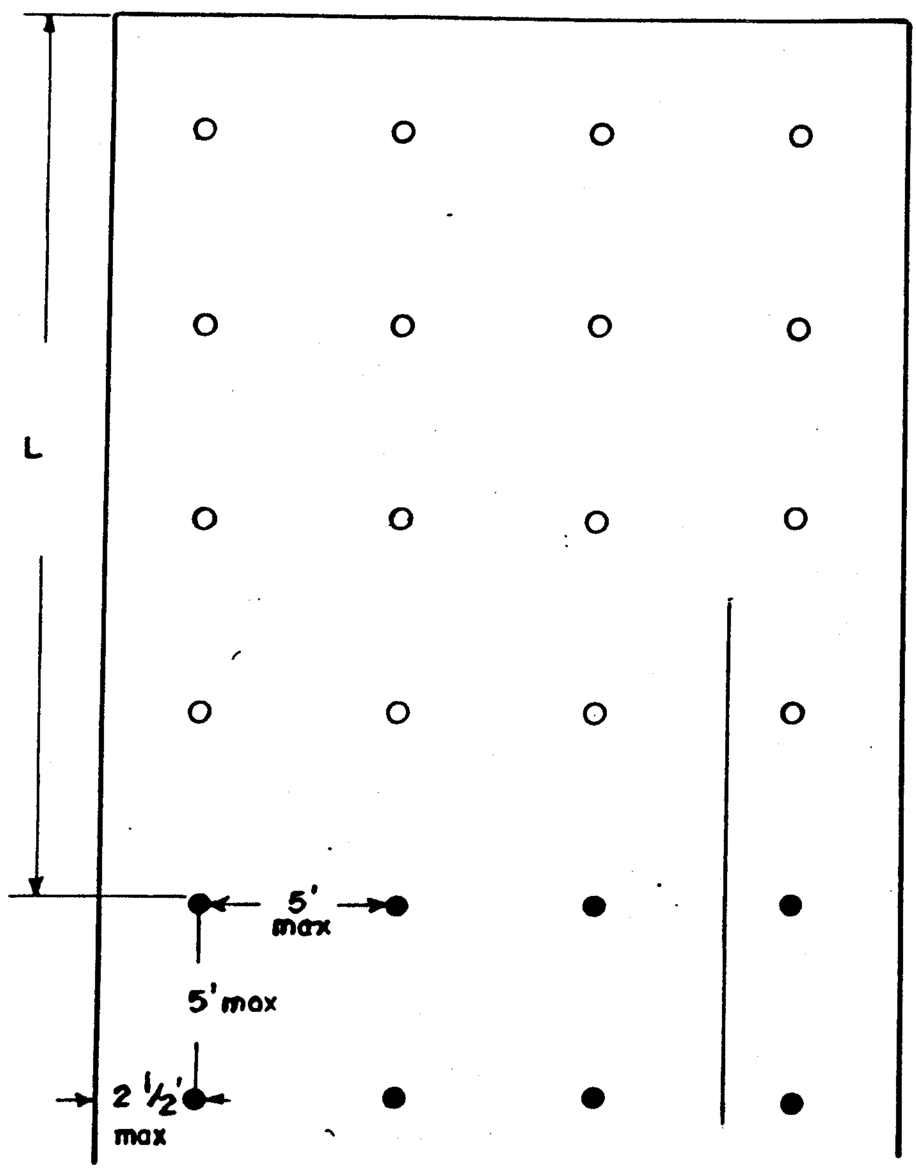
Bolting may not begin until ATRS is pressurized against the roof.

Bolting may not be carried on beyond the ATRS.

Scale- 1" = 5'

● Permanent Support
O Future Permanent Support

RECENTLY MINED OUT FACE
WITH NO
TEMPORARY SUPPORTS
(Figure 3)



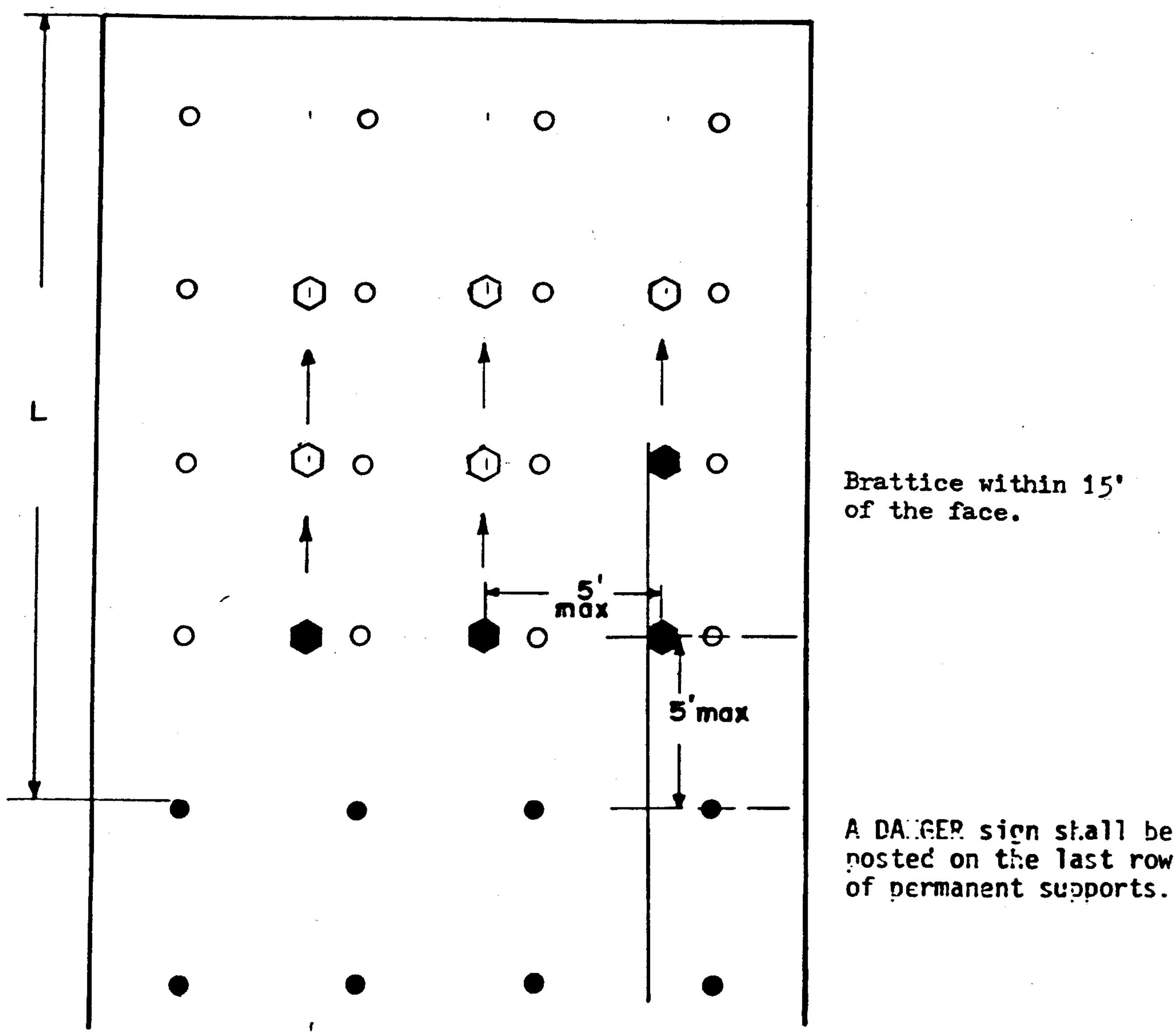
Brattice within 15' of the face.

A DANGER tag shall be posted on the last row of permanent supports.

Scale- 1" = 5'

● Permanent Support
O Future Permanent Support

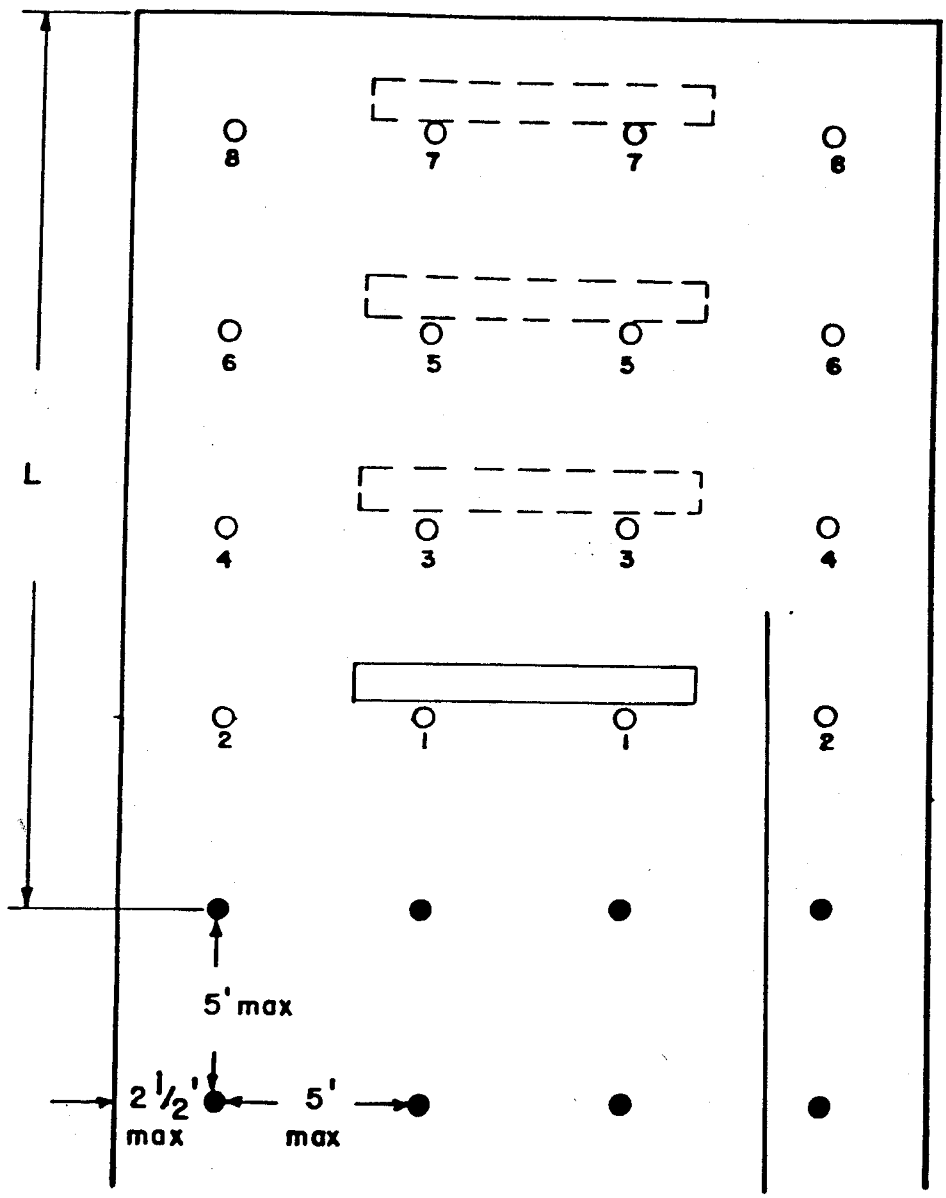
TEMPORARY SUPPORT LAYOUT FOR:
ATRS FAILURE OR
FAILURE TO BOLT IN
REQUIRED TIME
(Figure 4)



Scale- 1" = 5'

● Permanent Support
○ Furture Permanent Support
⬢ Temporary Support
⬡ Future Temporary Support

BOLTING SEQUENCE FOR
LONG-AIRDOX LRB 22 ROOF BOLTER
(Double Boom)
(Figure 5)



Brattice within ' of the face.

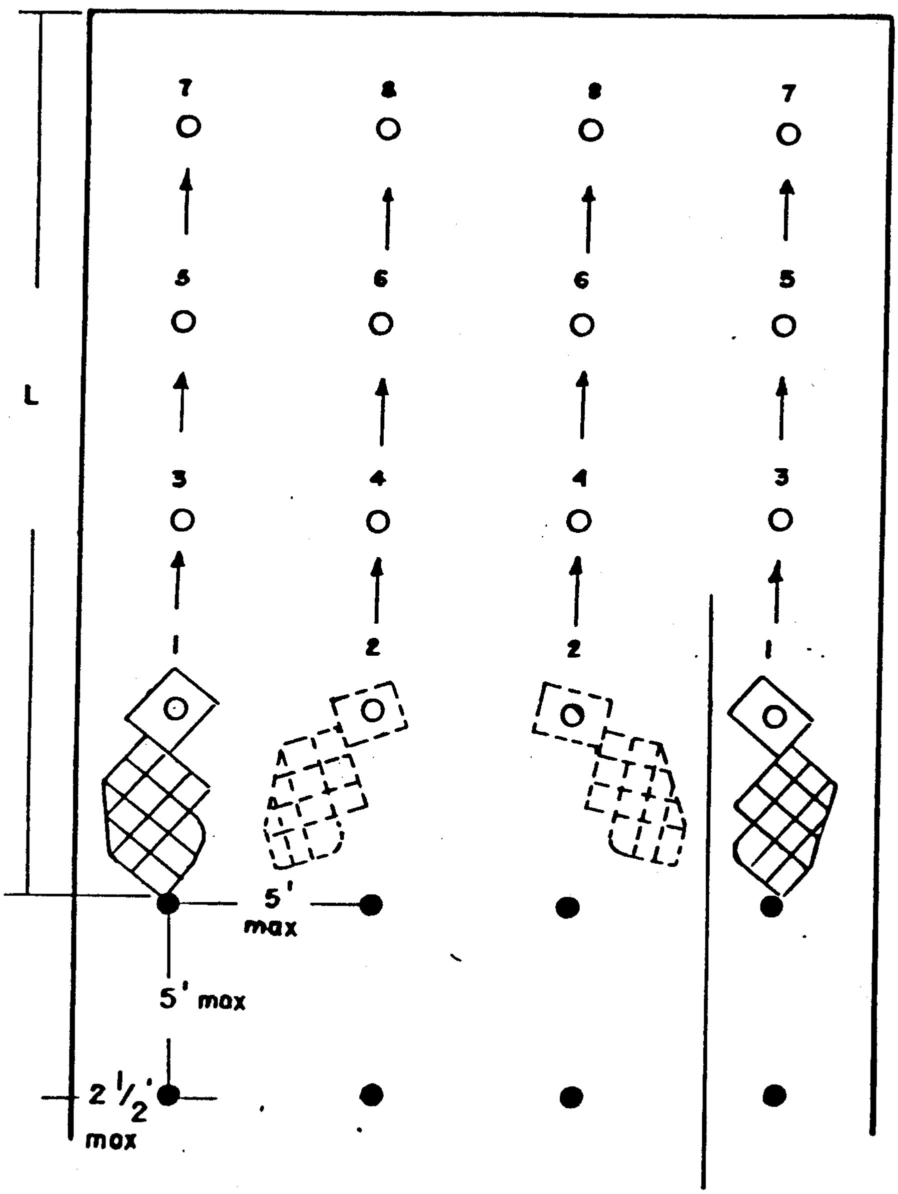
Bolting may not begin until ATRS is pressurized against the roof.

Bolting may not be carried on beyond the ATRS.

Scale- 1" = 5'

● Permanent Support
O Future Permanent Support

BOLTING SEQUENCE FOR
LEE-NORSE TDII ROOF BOLTER
(Double Boom)
(Figure 6)



Brattice within 15' of the face.

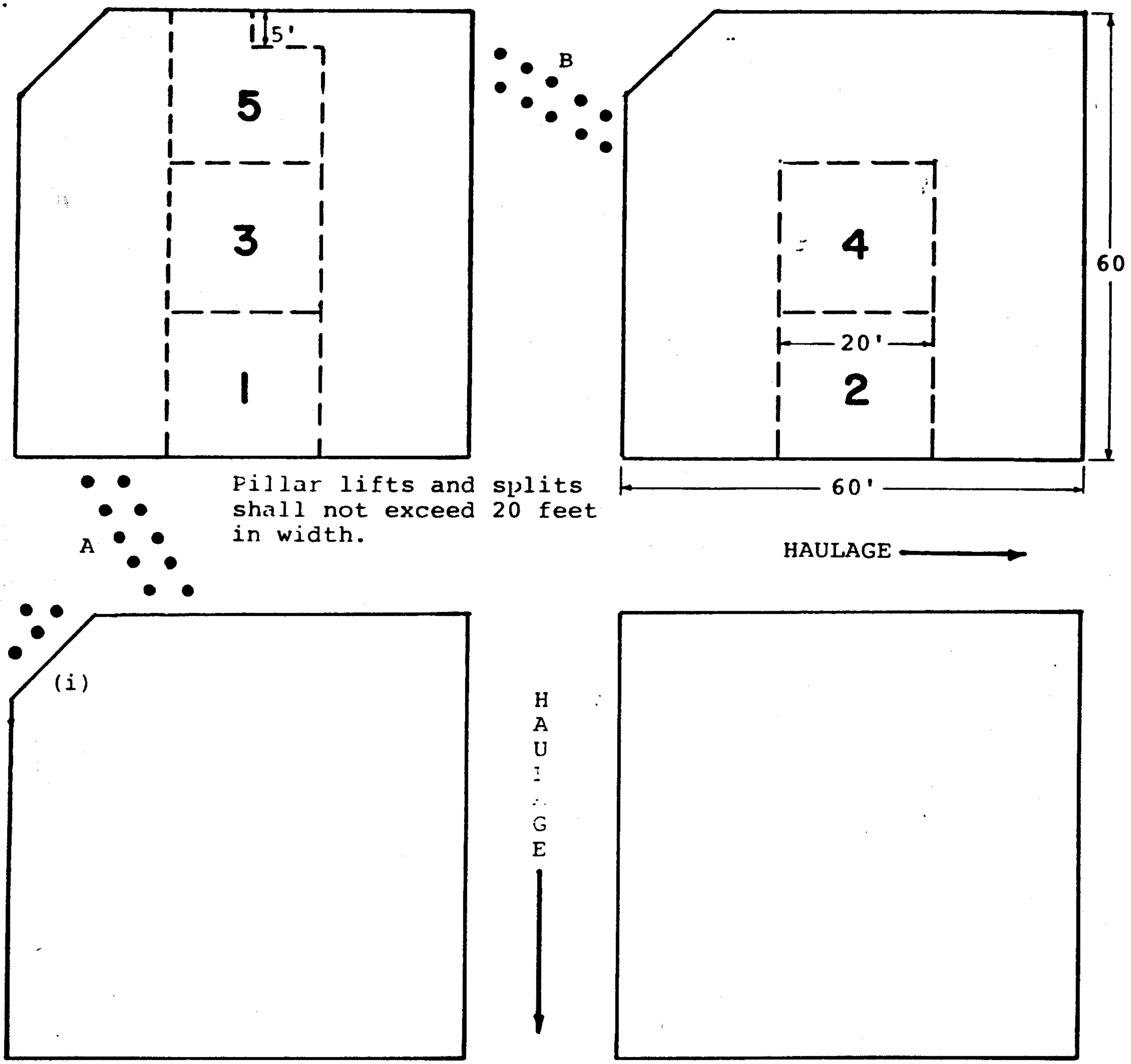
Bolting may not begin until ATRS is pressurized against the roof.

Bolting may not be carried on beyond the ATRS.

Scale- 1" = 5'

● Permanent Support
○ Future Permanent Support

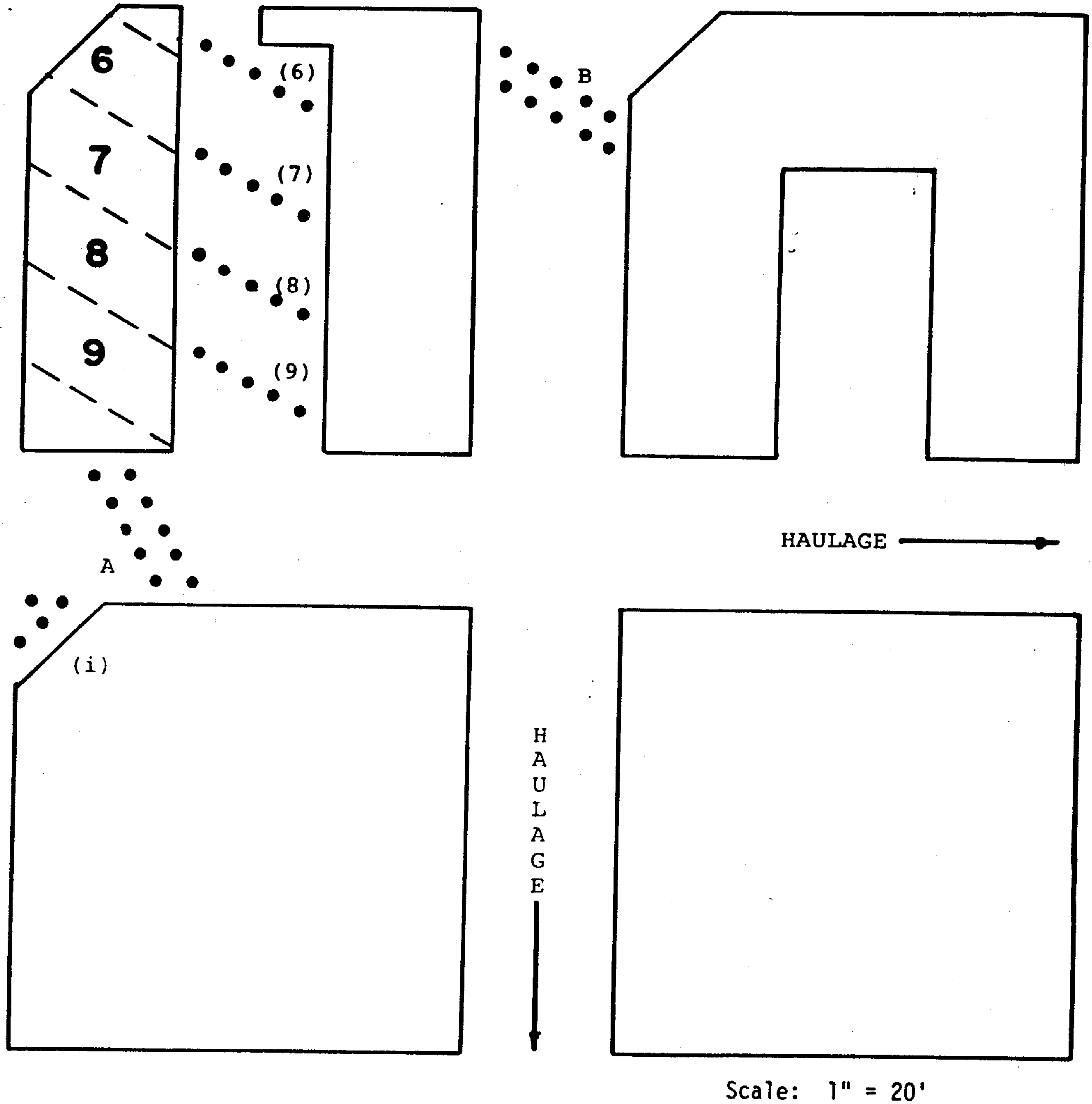
PILLAR EXTRACTION
SUPPLEMENT



Scale: 1" = 20'

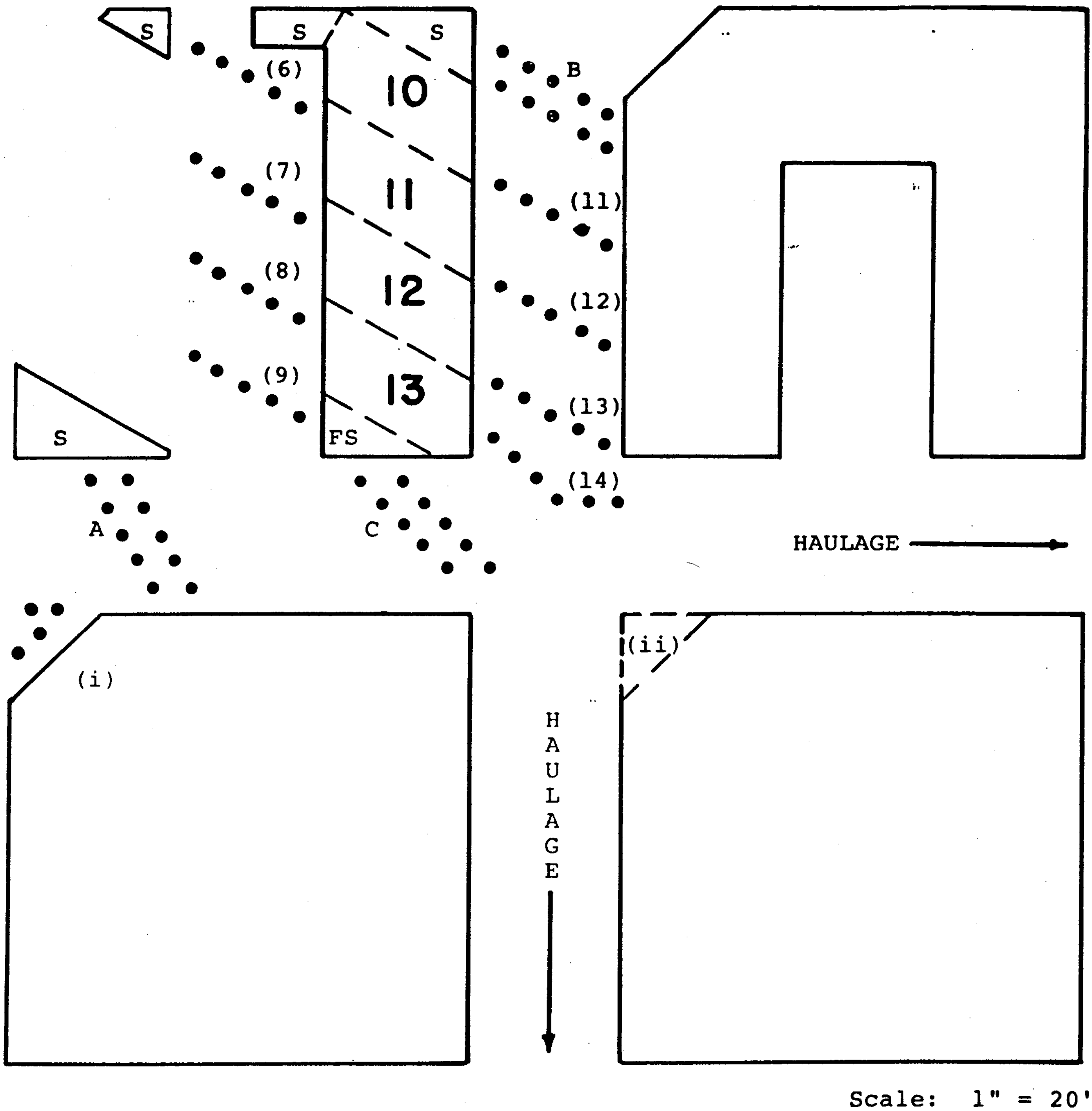
PILLAR EXTRACTION SEQUENCE
(Figure 1)

1. All entries, crosscuts, and intersections shall be bolted in accordance with the approved roof control plan before starting splits.
2. Pillar corners (i) will be cut, if necessary, to ensure complete extraction of the fender and will be made prior to installation of breaker row A.
3. Pillar breaker rows A & B shall be installed prior to the first cut and shall be double rows on 4 foot centers maximum.
4. Cuts 1 thru 5 will be mined as shown. Generally, cut 1 will be bolted as cut 2 is being ined, cut 2 bolted as 3 is mined and so on. Cuts 1 thru 4 will be permanently supported according to the roof control plan.
5. A 5 foot stump may be left on either side of cut 5. If cut 5 is completely mined without leaving a stump, a double breaker row will be installed within 5 feet of the last row of permanent supports.



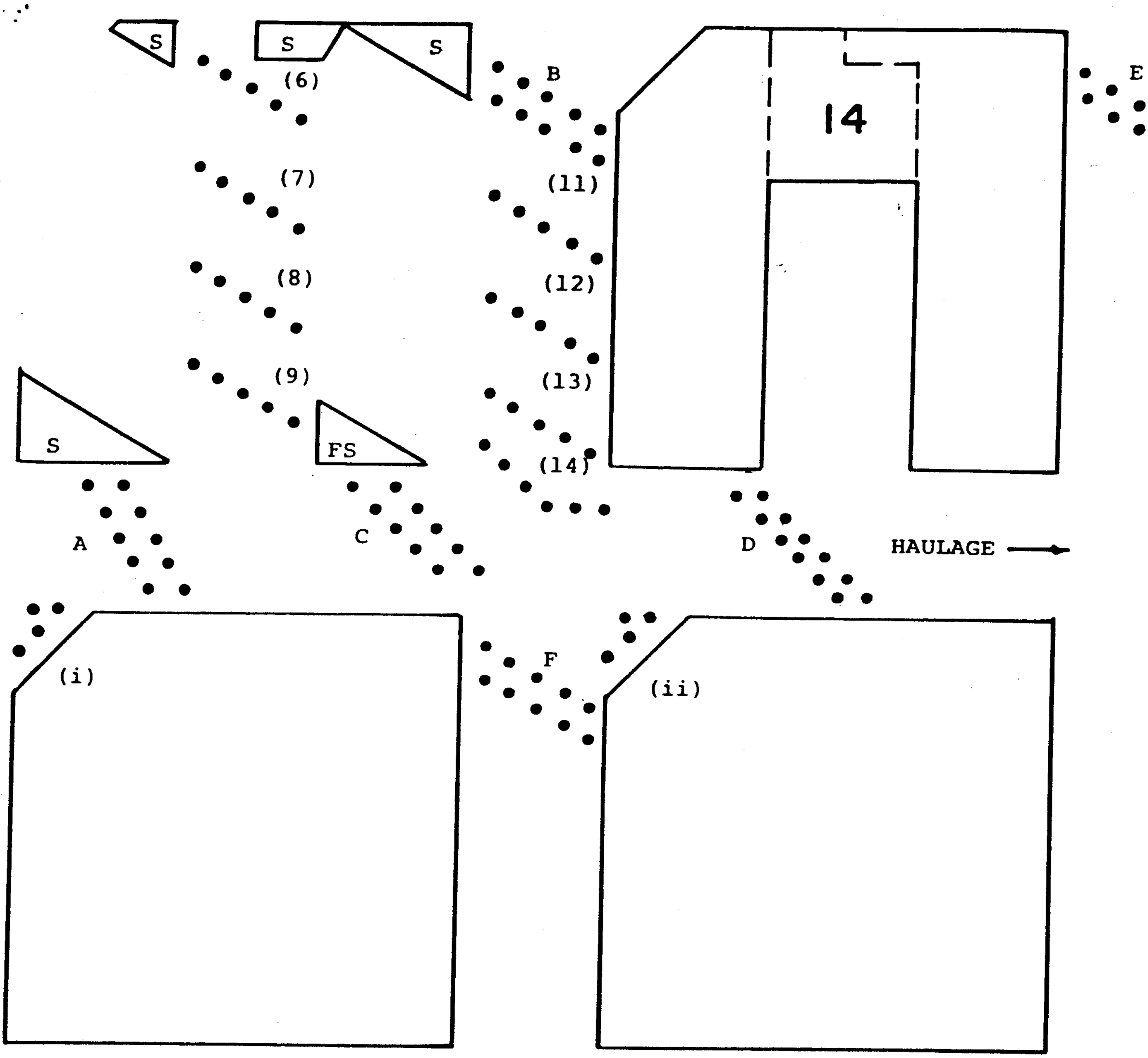
PILLAR EXTRACTION SEQUENCE
(Figure 2)

6. Double haulage from pillar shall be used.
7. Turn post row (6) shall be installed prior to cut 6 being mined. Before each proceeding lift is begun, a single row of turn posts on 4 foot centers (maximum) shall be installed (rows 7 thru 9).
8. The width of each lift shall not exceed 20 feet. The depth of each lift shall be determined by the distance from the face that the equipment can be operated with the operator remaining under permanently supported roof. In the case of an excessively wide fender, a maximum of one temporary support can be installed no greater than 4 feet from permanent support in order to safely minimize the size of the fender.



PILLAR EXTRACTION SEQUENCE
(Figure 3)

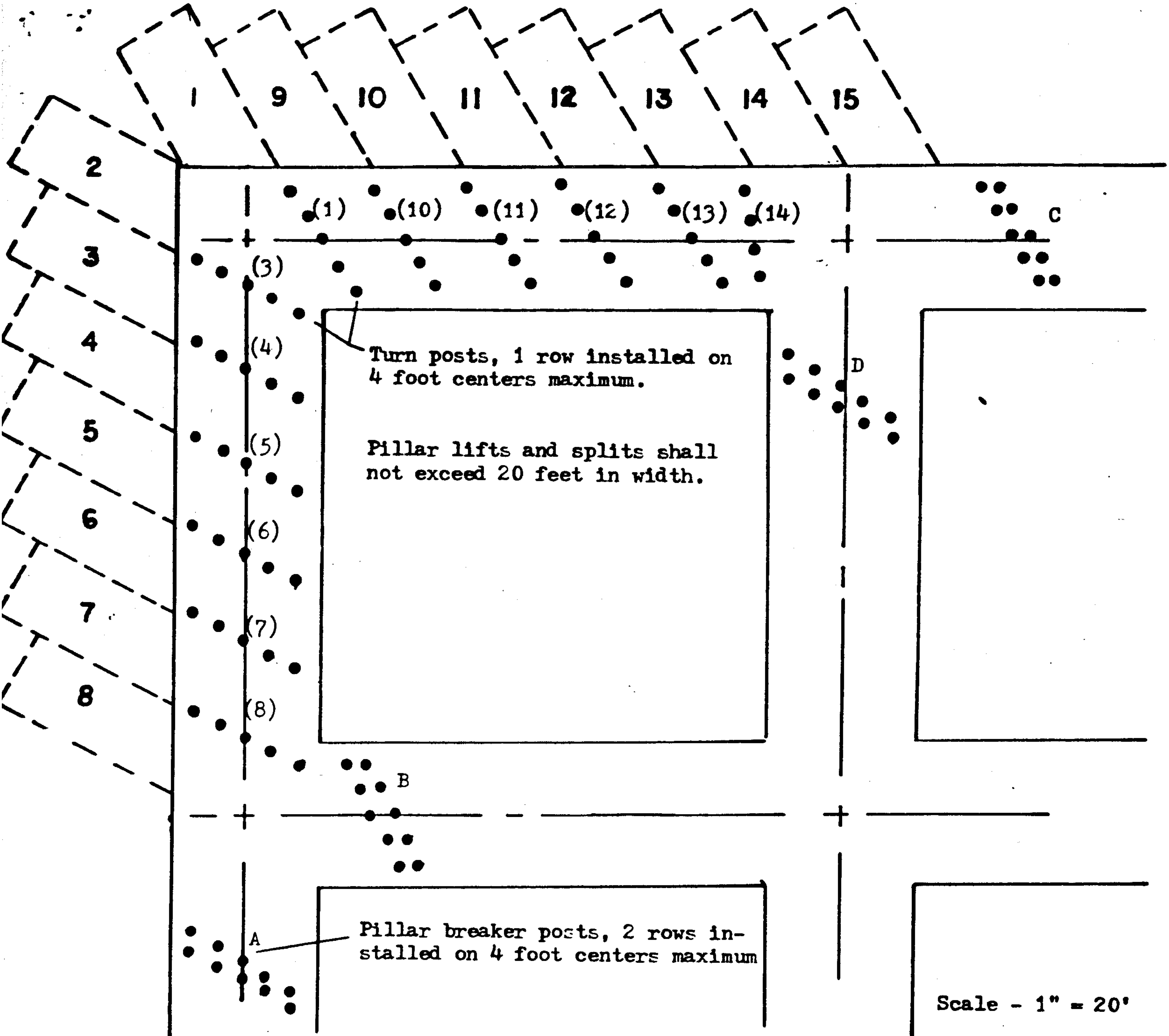
9. Breaker row C shall be installed after mining of cut 9 is completed.
10. Turn post row 11 shall be installed after cut 10 is completed and before 11 is begun and so on until cut 13 is completed. Cut (ii) will be made, if necessary, after the final pushout stump is mined.
11. Pushout stumps shall be reduced or eliminated during mining. Final size will be dependent upon mining conditions at the time. If the final pushout (FS) is to be mined, the width of the cutting face at the corner of the stump shall not exceed 14 feet.



PILLAR EXTRACTION SEQUENCE
(Figure 4)

Scale: 1" = 20'

2. After pillar is extracted, breaker rows D & E shall be installed. Breaker row F shall be installed before cut 14 is completed.
3. Cut 14 and remainder of the next pillar will be mined in the same manner as displayed in Figures 1-3.
4. Cut sequences may vary depending on pillar location, number of pillars being mined simultaneously, pillar size and dimension, haulroad direction, etc., so long as the timbering procedures outlined in this plan are followed. Direction of pillar attack is optional depending on existing conditions such as those stated previously.
5. Width of entry or crosscut will determine number of posts required per row.
6. Breaker and turn post timber will be extracted for the purpose of inducing caving. This will be carried out remotely with a wire rope placed around the timber(s) prior to extraction and a qualified man positioned at the corner of the adjacent outby pillar behind the breaker posts to activate the removal.



EXTRACTION SEQUENCE FOR BARRIER MINING
(Figure 5)

1- Turn post row (1) shall be installed before the mining of lift 1 is begun. Turn row (3) shall be installed before lift 3 is begun and so on thru row (8).
2- Pillar breaker row A shall be installed before lift 8 is begun and row B installed after 8 is completed.
3- Turn post row (10) shall be installed after lift 9 is completed and before 10 is begun and so on thru turn post row 14.
4- Pillar breaker row C shall be installed before lift 14 is begun. Breaker row D shall be installed after lift 15 is completed.

Soldier Creek Coal Co.
Telephone 801-637-6360
P.O. Box I
Price, Utah 84501

November 18, 1980

Mr. Harold E. Dolan
Supervisory Mining Engineer
Mine Safety and Health Administration
P.O. Box 25367
Denver, Colorado 80225

Re: Soldier Creek Coal Company
I.D. No. 42-00077
Ventilation System & Methane & Dust Control Review

Dear Mr. Dolan:

Enclosed is a copy of Soldier Canyon Mine's Ventilation and Methane and Dust Control Plan with an updated mine map. Also included are the designated areas for dust sampling.

This plan supercedes all previous plans. Any further questions or comments can be sent to this office.

Sincerely,

SOLDIER CREEK COAL COMPANY

J.T. Paluso

J.T. Paluso
Chief Engineer

JTP/nda

Encl.

RECEIVED
NOV 2 1 1980
DISTRICT

VENTILATION SYSTEM AND METHANE
AND DUST CONTROL PLAN

for the

SOLDIER CREEK COAL COMPANY
SOLDIER CANYON MINE
I.D. No. 4200077-0

November 20, 1980

The operator of the Soldier Canyon Mine hereby adopts and will follow the following ventilation system and methane and dust control plan and any approved supplements and/or revisions thereof:

Signatures

Company Representative ____________________

MSHA Investigator ____________________

A. General

The following information should be submitted to the District Manager:

1. Company name: Soldier Creek Coal

   Mine name: Soldier Canyon Mine

   Post Office address (Town, County, State): P.O. Box I, Price, Carbon, Utah 84501

   Telephone number: (801) 637-6360

   Identification number: 42-00077-0

   Operator's name: M. D. Ross

   Operator's title: Vice Pres. & Gen. Manager

   Operator's address: P.O. Box I, Price, Carbon, Utah 84501

   Operator's telephone number: (801) 637-6360

2. Indicate if life of mine is ____ less than one year

   __X__ greater than one year

3. Number of employees: (As of November 1, 1980)

Surface	33
Underground	92
Total	125

4. Face Equipment

   Continuous Miners - Joy 12CM-6, Lee Norse HH-5-455E, Lee Norse CH-60H-1E

   Shuttle Cars - Joy 10SC-22-48CH

   Loaders - Joy 14BU-10

Roof Bolters - Fletcher DDM-13, Lee Norse TD11 43,
Lee Norse TDI 43

Diesel Equipment

Face Haulage - Jeffery 4114 Ramcar

Face Clean Up - Eimco 911 LHD-31, Elmac S43EXE-31,
Eimco 913-31

Material Transportation - Eimco 913 LHD-24, Ford
Tractor DU 112R

Personnel Carriers - Elmac P14-4, Elmac M605,
Dodge G741, Kabota L245

Lubrication & Maintenance - Elmac 544A, Elmac 624,
Eimco 975, Huber ATO M-850

Ambulance - Dodge G741

5. Seam Mined / Average Thickness

Seam Mined	Average Thickness
Rock Canyon	10 ft.

B. Main Fan Installation

1. All main fan installations shall meet or exceed all criteria established in Sections 75.300-2 and 75.300-3, 30 CFR75. Any installation not meeting these requirements may be approved, provided the operator can satisfy the District Manager that the resultant installation will provide no less than the same measure of protection to the miners.

C. Dust Control Plan Outby Areas

1. Belt Lines

A. All belt lines will be equipped with water sprays at key locations on each side of the belt to prevent excess float coal dust generation in the belt entries and at transfer and loading points along their route. One functional spray will be maintained at each transfer point to be used when dust is being generated. These sprays will be operated by belt personnel during their regular inspections and will function at a minimum of 75 psi.

B. The belt lines are provided with sufficient personnel to keep all rollers and idlers maintained and to prevent the accumulation of float dust and loose coal spillage. All belt lines are re-rock dusted.

2. Haulageways

   A. Ribs along established haulageways are kept well rock dusted and clean. All haulageways will be maintained damp and well compacted to prevent dust from being generated. Due to the pitch of our seams, all water flows to the deepest portion of the mine, from where it is pumped to the surface.

D. <u>Methane and Dust Control Practices at Face Areas</u>

<u>General</u>

In the active development working sections, all riblines are initially cleaned to prevent the accumulation of loose coal and coal dust along the riblines. This is performed on the advance of the headings, as a daily routine. When a place is cut out, the continuous miner performs the initial clean up. It is then rock dusted by hand or by trickle dusters mounted on the miners whenever possible, prior to the roof bolters entering the place.

Each heading is provided with a sufficient volume of air to dilute methane concentrations to safe allowable limits. Velocity of the air is such as to carry away coal dust from the face, behind the line brattice system that is kept as close to the face as possible.

All continuous mining equipment is equipped with numerous water sprays to abate coal dust at its source during the coal cutting cycle. Sufficient quantities and pressures of water are provided in each section to insure adequate water from the sprays. All section foremen and miner operators are under instructions to keep the minimum number of sprays operative.

All sections are equipped with portable trickle dusters, which are used to rock dust the return areas during each production shift. In addition, heavier rock dust applications are reapplied to the return areas and intakes to comply with MSHA standards.

1. "Line brattice or ventilation tubing used to provide ventilation to the working face from which coal is being cut, mined or loaded shall be installed at a distance no greater than 15 feet from the area of deepest penetration, to which any portion of the face has been advanced."

2. "A minimum quantity of 9,000 cubic feet a minute of air shall reach each working face from which coal is being cut, mined, or loaded."

3. "The minimum mean entry face velocity as specified in Section 75.301-4, 30 CFR 75, shall be 60 feet per minute in all working places where coal is being cut, mined, or loaded."

4. "The minimum quantity of air reaching the last open crosscut in any pair or set of developing entries or rooms shall be 12,000 cubic feet a minute and the minimum quantity of air reaching the intake end of a pillar line shall be 9,000 cubic feet a minute."

5. "At least 90 percent of the sprays indicated for dust suppression on each piece of equipment shall be maintained and operated at the indicated water pressure and flow rate as follows:"

Equipment	Number of Sprays	Minimum Water Pressure	Minimum Flow Rate
Joy Miners	31	75 psi	30 gpm
Lee-Norse Miners	20	75 psi	30 gpm

NOTE: The sprays will be positioned so as to maintain a uniform distribution of water across the cutting face.

6. "The following ventilation requirements will be adhered to in faces where coal is not being cut, mined, or loaded:"

(a) In faces where roof bolting is to be done, the bolter must:

(i) Make a methane examination using a probe of sufficient length to test within 10 feet of the deepest penetration and 1 foot of the top before beginning.

(ii) Maintain a minimum quantity of 3,000 cubic feet a minute of air at the end of the line brattice.

(iii) Maintain the brattice to within 15 feet of the face except when installing the first row of bolts, during which time the brattice will be maintained as close as possible to the machine.

(b) All other idle faces must maintain:

(i) Perceptible air movement sufficient to limit methane concentration below 1 volume per centum.

(ii) The brattice to within 15 feet of the face except when the entry is being cleaned or the brattice line is being reconstructed.

(c) In addition to the ventilation requirements; either an approved dust collection system or water application through the drill stems type system will be used to control dust from drilling.

7. "Methane examinations as required during the mining cycle will be made within 5 feet of the deepest penetration of the face and approximately 1 foot from the roof using probes of sufficient length; except, a hand held detector may be used if the examiner does not go beyond permanent support. At all times the examiner will be under permanent support.

E. Methane Control in Outby Areas

1. The methane content in any return aircourse other than an aircourse returning the split of air from a working section (as provided in Sections 75.309 and 75.310, 30 CFR 75) shall not exceed 2.0 volume per centum. The methane content in the air in active workings shall be less than 1.0 volume per centum. If at any time the air in any active working contains 1.0 volume per centum or more of methane, changes or adjustments shall be made at once in the ventilation in the mine so that the air shall contain less than 1.0 volume per centum of methane.

2. A decision on the use of bleeder entries or systems will be made before second mining has begun with the exception of the Main West pillar section which has been granted an exemption from the bleeder system (10/13/77).

3. Whenever a working section is completed and the operator does not wish to continue to ventilate the area, or permission to ventilate the area is denied, the area shall be sealed. (See Fig. 7)

F. Section & Face Ventilation System

1. Drawing on section and face ventilation systems enclosed. (Figures 1-3B)

2. Drawing enclosed showing the construction of a belt isolation stopping. (Figure 4)

3. No air reversal into active sections will be allowed.

4. Coal shall not be permitted to accumulate at the outby end of the face equipment to the extent that ventilation of the working face is restricted.

G. Permanent Stoppings

1. All ventilating devices such as stoppings, overcasts, undercasts, and shaft partitions shall be of substantial and incombustible construction installed in a

workmanlike manner and maintained in a condition to serve the purpose for which they were intended, and any stopping leaking air excessively shall be repaired.

2. Permanent stoppings shall be erected to the third connecting crosscut outby the faces of the entries and the third crosscut will be under construction. Construction of the stopping shall be completed within two working days after the third crosscut is developed. However, when necking off a new section, four connecting crosscuts can be maintained without permanent stoppings while preparing for overcast installation.

3. Drawings of a typical permanent stopping and regulator are enclosed. (Fig. 5-6)

H. Diesel Equipment

The following requirements shall be met:

1. Complete compliance with the manufacturer's instruction and maintenance manuals.

2. The atmosphere in the operator's compartment shall be sampled daily with the engine running; and if the analysis of these samples exceeds five parts per million NO_2 or fifty parts per million CO, or both, corrective measures must be taken immediately.

3. The atmosphere returning from any working place where diesel-powered equipment is being used shall be tested at least once each day while the equipment is in operation, and if the analysis of these samples exceeds five parts per million NO_2 or fifty parts per million CO, or both, corrective measures will be taken immediately.

4. The date, time of sampling, machine identification, and the analysis obtained shall be recorded in a book maintained for this purpose.

I. Use of Auxiliary Fans and Machine-Mounted Diffusers Underground

1. The fan shall be of a permissible type, maintained in permissible condition, so located and operated to avoid any recirculation of air, and examined once every four hours when in use. The examiner shall place his initials, date, and time near the fan.

   A. Fans will be operated exhausting and shall be installed in the return air current from the place to be ventilated by the fans. The volume of positive intake air current available at the entrance to the place to be ventilated with the exhaust fan shall exceed the free discharge capacity of the fan.

2. All face ventilation systems using auxiliary fans and tubing shall be approved under the provisions of Section 303(o) of the Act. (Subsection 75.316 of the Federal Register.) All systems shall also meet the conditions set down in 75.302-4.

3. The equipment to be used is:

   Fan

   Manufacturer - Spendrup
   Model - AMF 170-50-19V
   Horsepower - 50 hp
   RPM - 3,550 RPM
   Blade Position - 20°
   Free Discharge Capacity - 29,000 cfm
   Type - Exhausting

   Tubing

   Diameter - 24"
   Type - Round

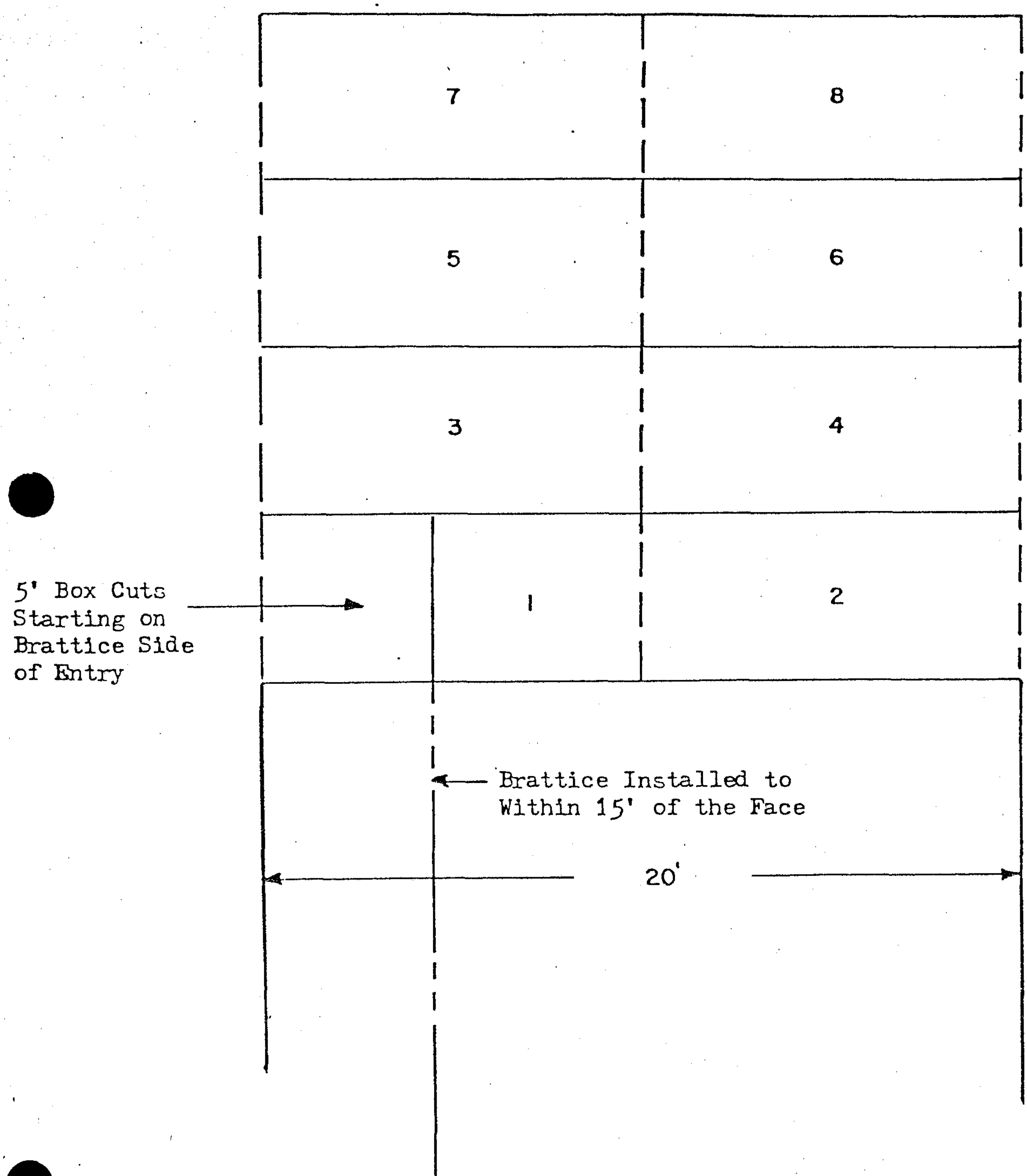
4. Ventilation layout for auxiliary fan usage is shown in Fig. 8.

J. Mine Maps

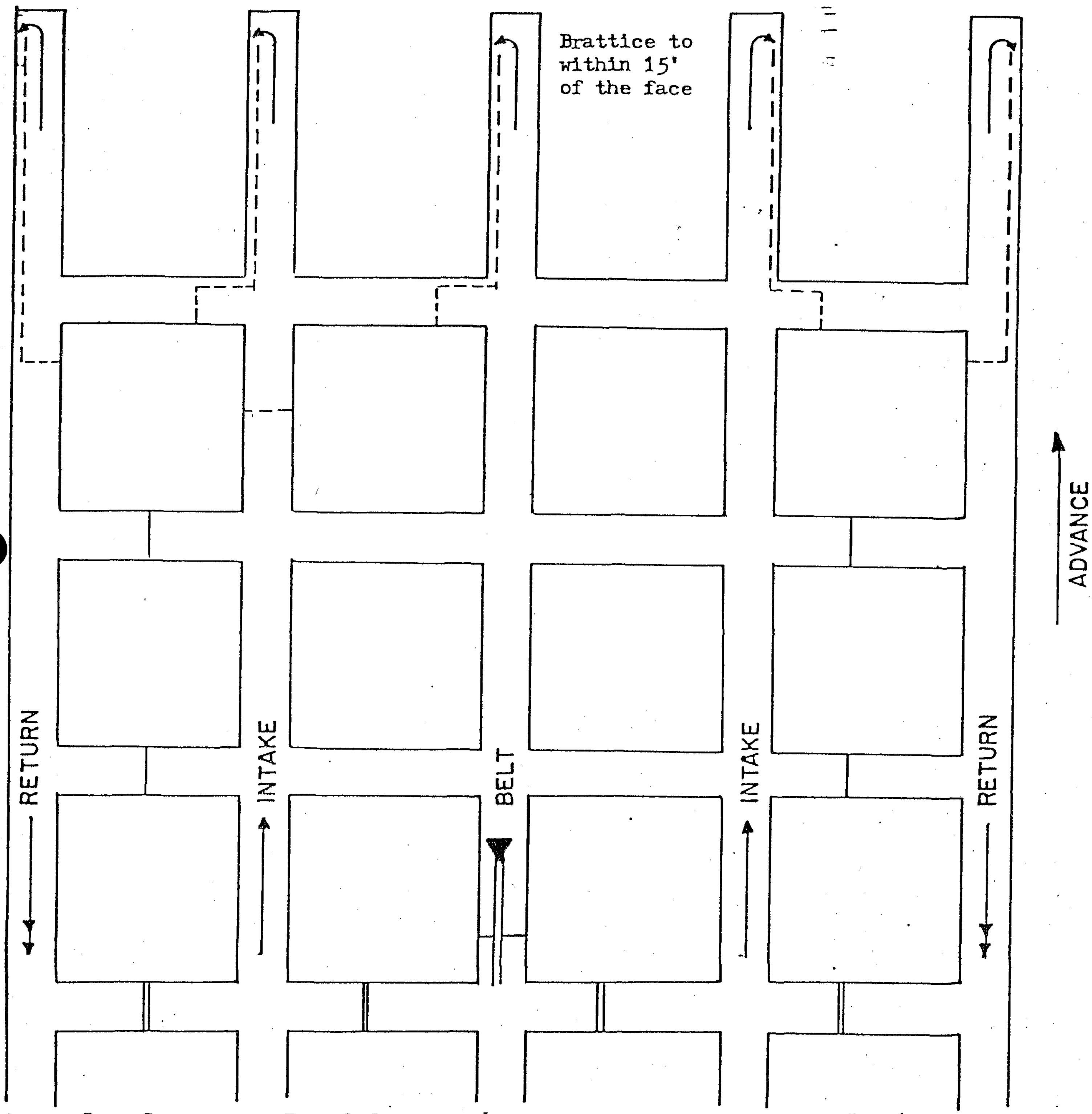
Up-to-date mine maps will be submitted every six months with the required information for approval.

VENTILATION LAYOUTS
AND ILLUSTRATIONS

FACE VENTILATION
(Figure 1)



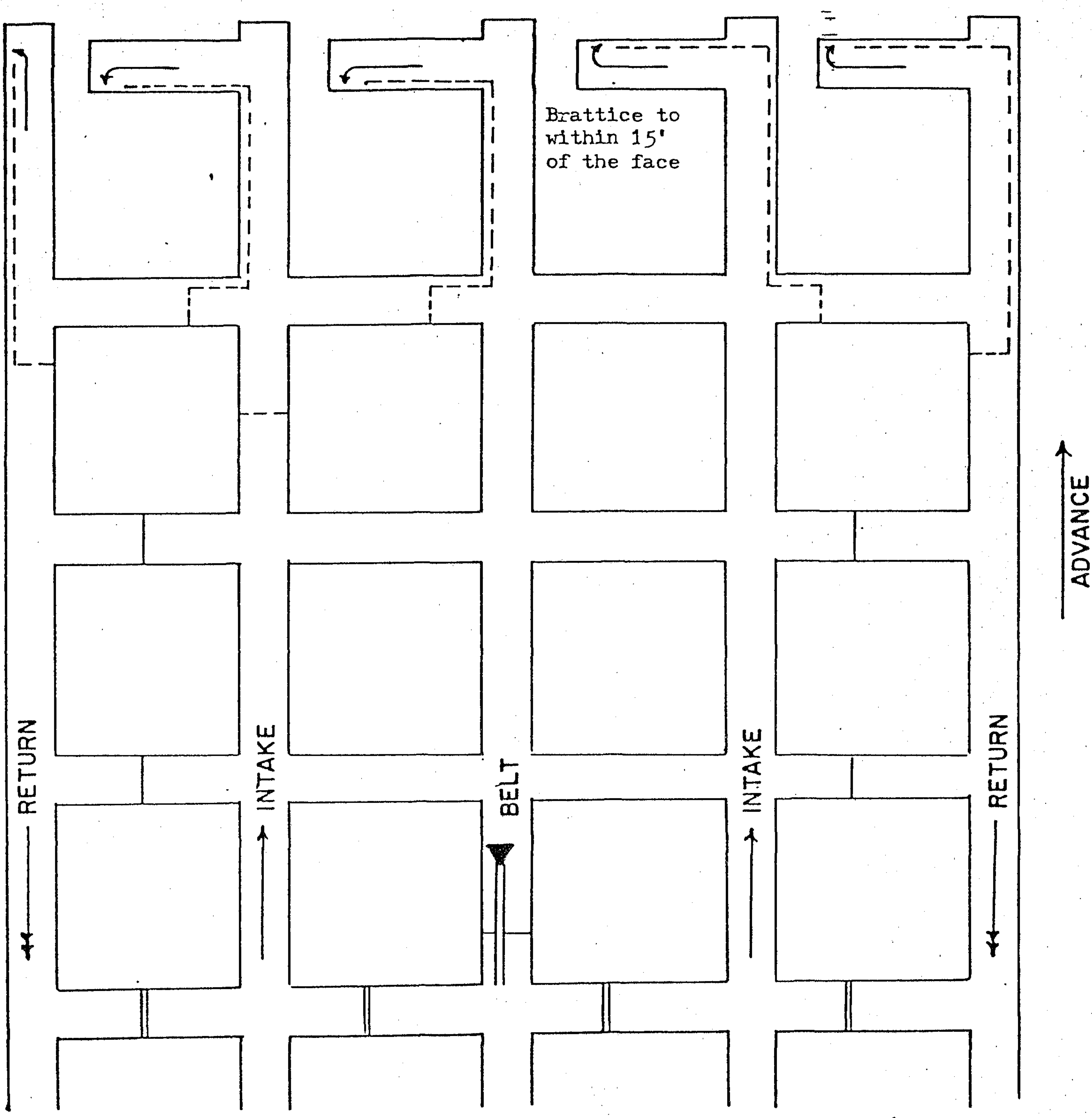
FIVE-ENTRY DEVELOPMENT
VENTILATION FOR THE STRAIGHTS
(Figure 2A)



Line Brattice or Travel Curtain ----
Temporary Stopping
Permanent Stopping

Scale - 1" = 60'

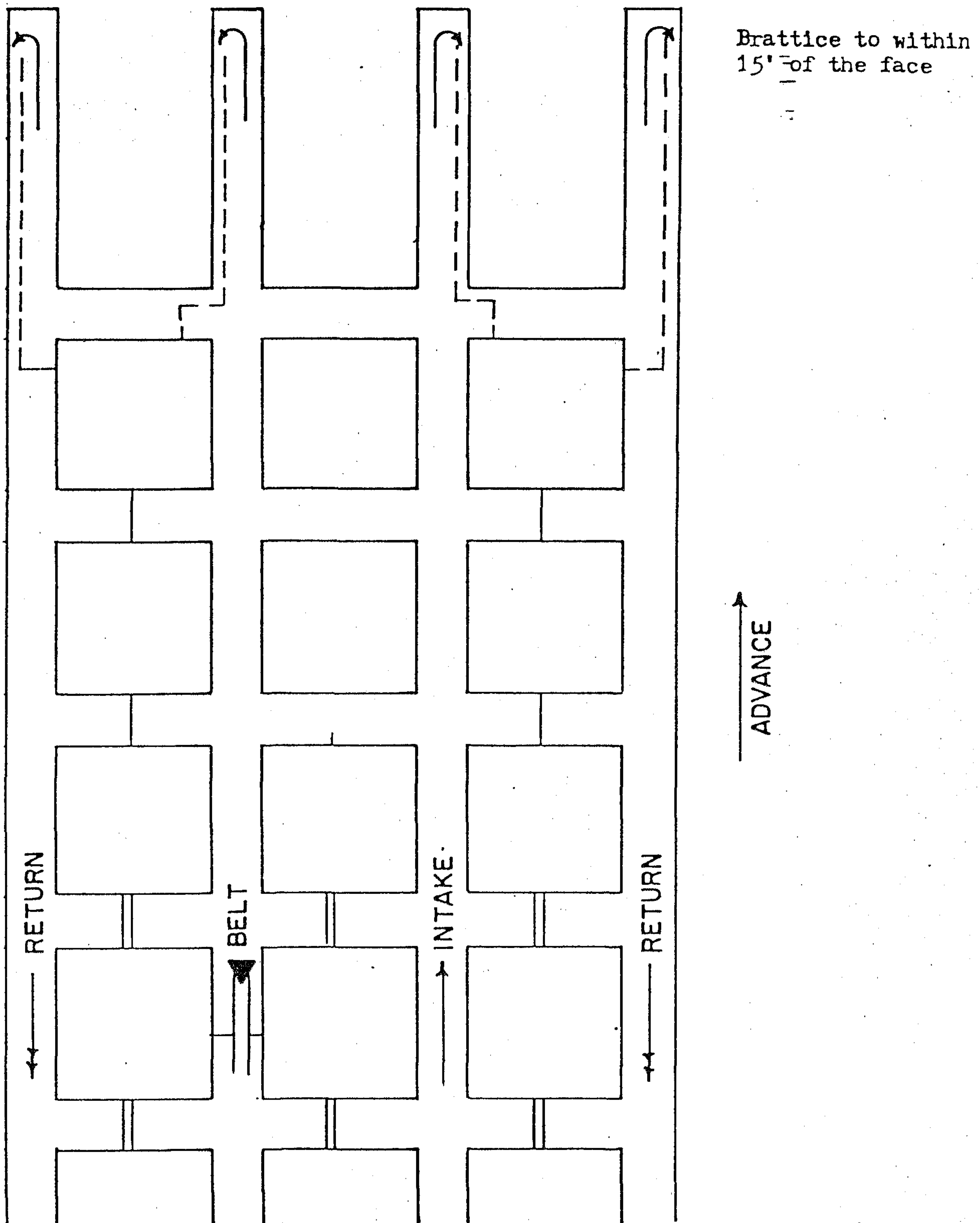
FIVE-ENTRY DEVELOPMENT
VENTILATION FOR THE CROSSCUTS
(Figure 2B)



Line Brattice or Travel Curtain ----
Temporary Stopping
Permanent Stopping

Scale - 1" = 60'

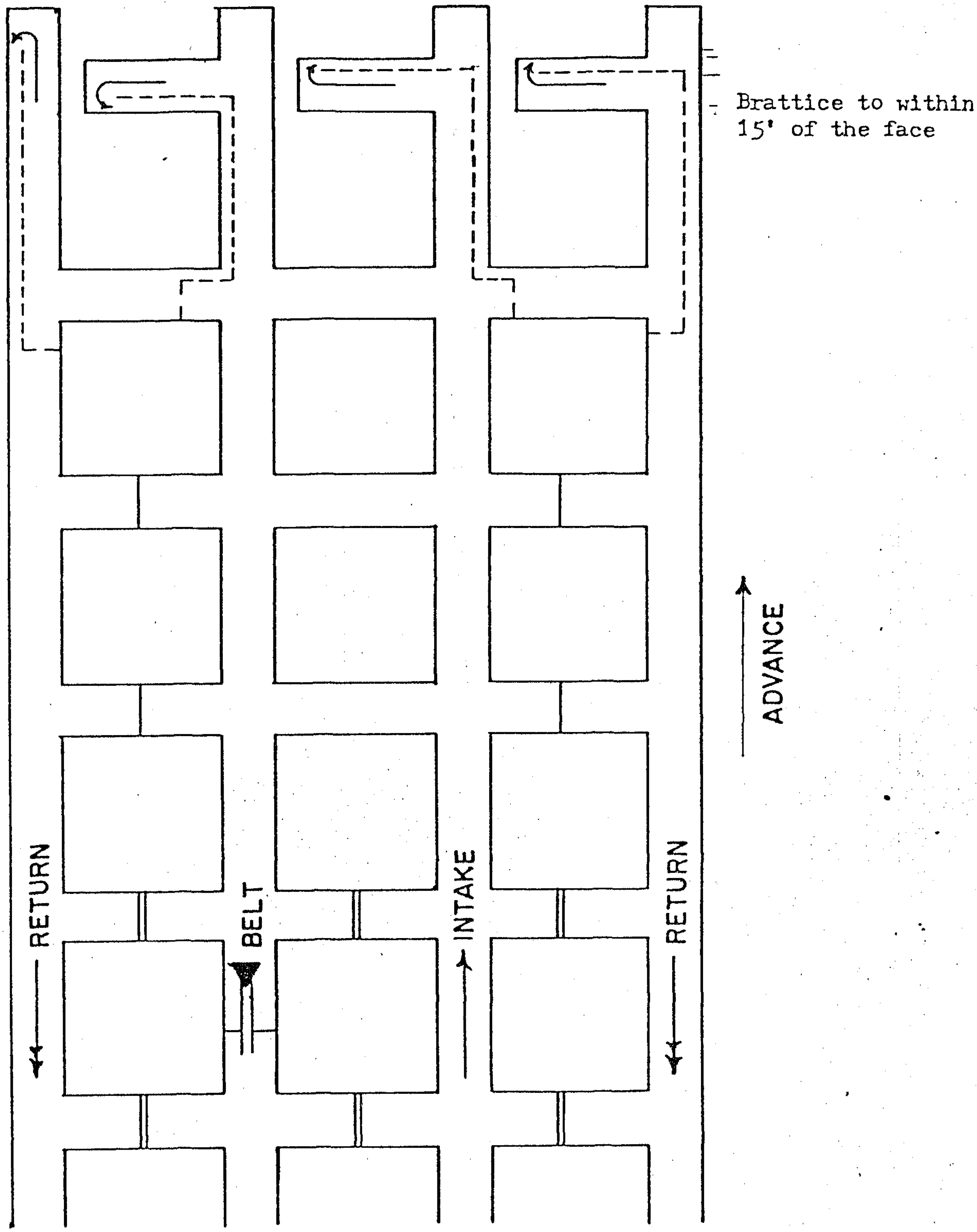
FOUR-ENTRY DEVELOPMENT
VENTILATION FOR THE STRAIGHTS
(Figure 3A)



Line Brattice or Travel Curtain ----
Temporary Stopping
Permanent Stopping

Scale - 1" = 60'

FOUR-ENTRY DEVELOPMENT
VENTILATION FOR THE CROSSCUTS
(Figure 3B)



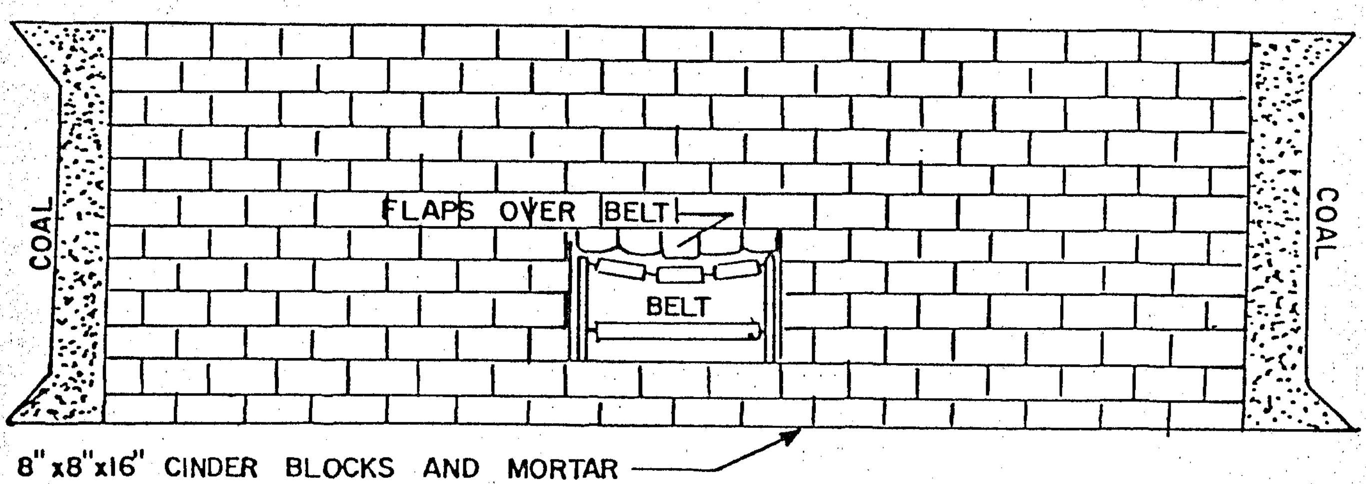
Line Brattice or Travel Curtain ----

Temporary Stopping

Permanent Stopping

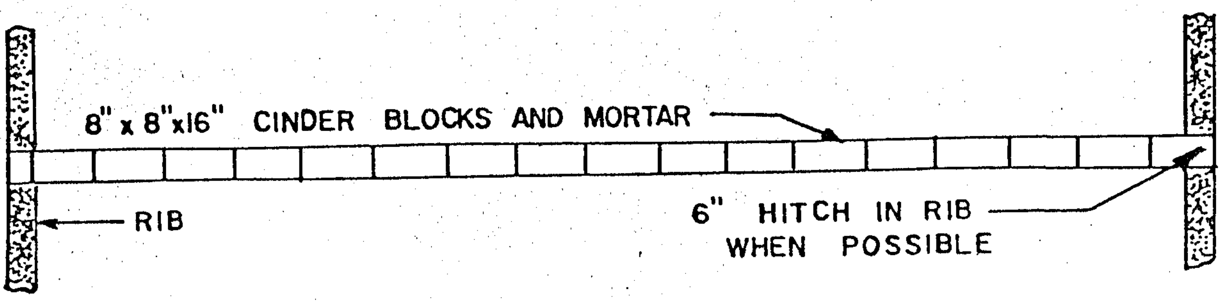
Scale - 1" = 60'

BELT ISOLATION STOPPING
(Figure 4)

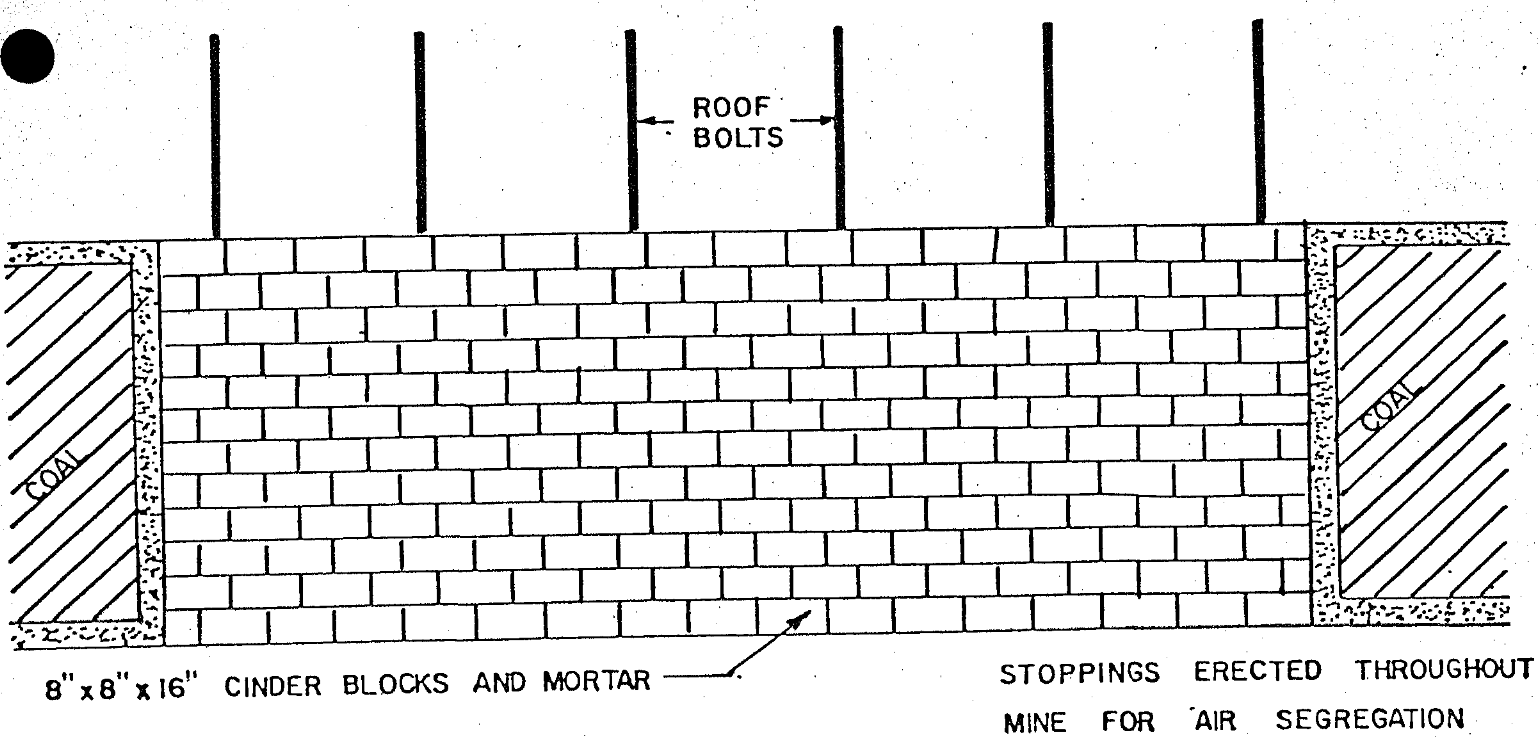


FRONT VIEW

PERMANENT STOPPING
(Figure 5)

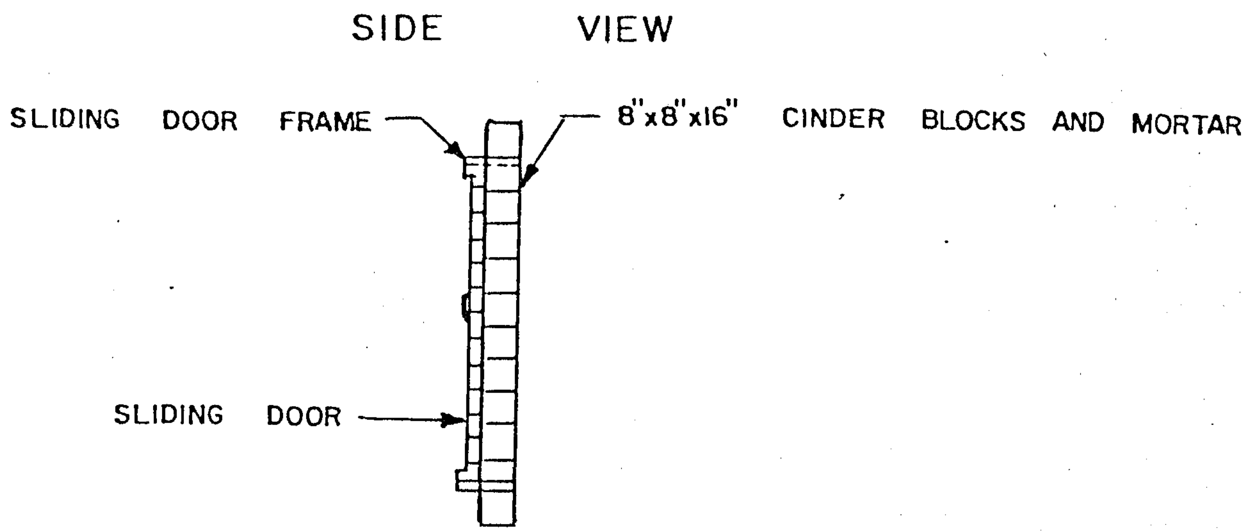


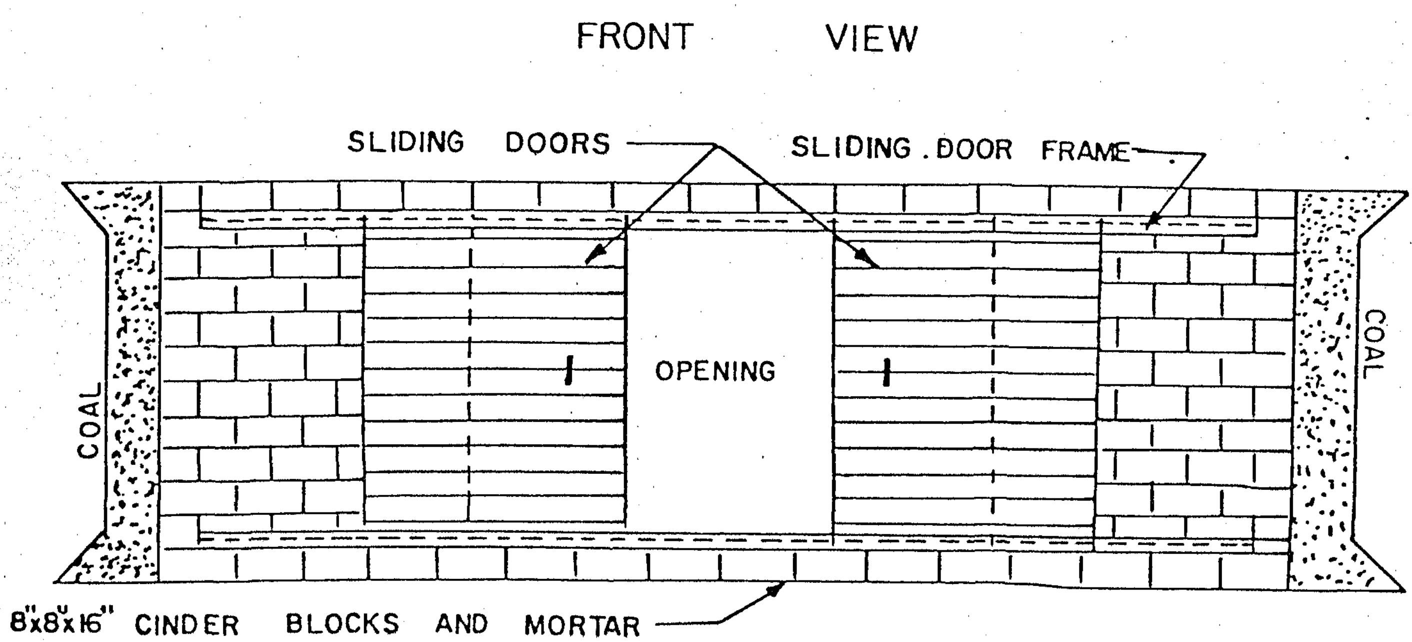
TOP VIEW



FRONT VIEW

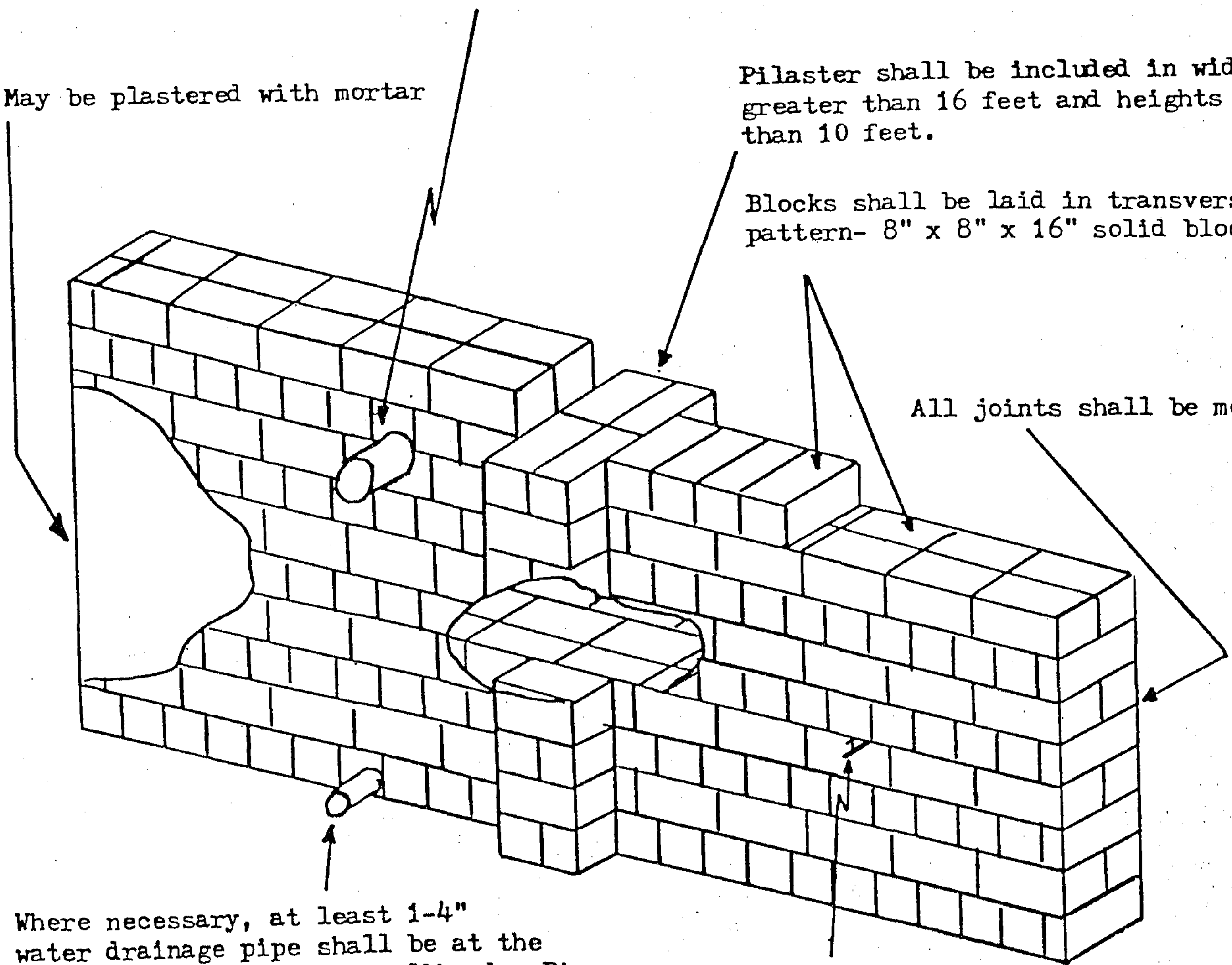
REGULATOR
(Figure 6)





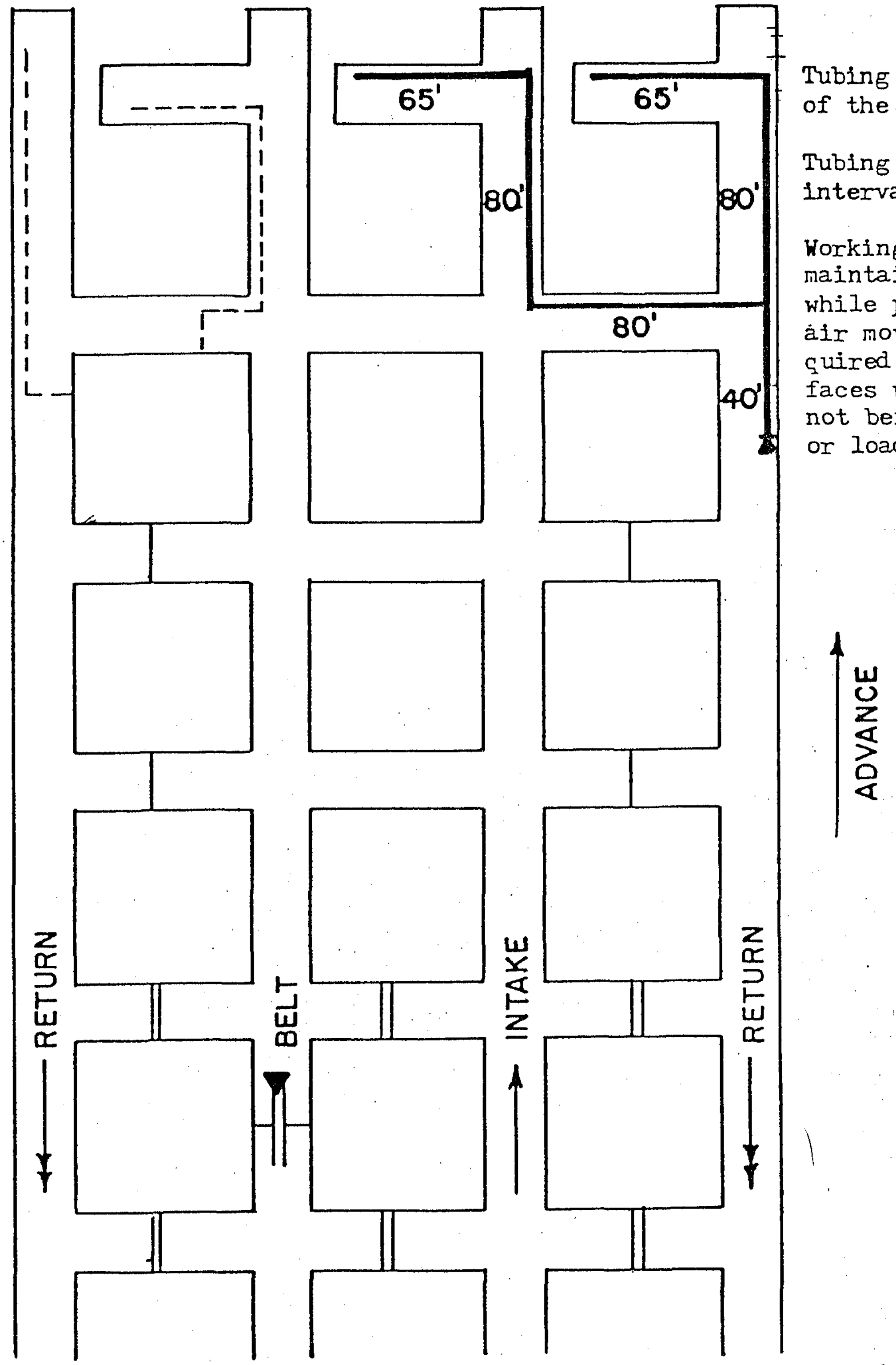
- Placed as needed in return air courses

EXPLOSION PROOF SEAL
(Figure 7)



AUXILIARY VENTILATION LAYOUT
FOR TWO ENTRIES
(Figure 8)

All other faces will be ventilated by means of the primary air current and line brattice



Tubing kept within 15' of the face

Tubing advanced in 10' intervals

Working faces shall maintain 9,000 cfm while perceptible air movement is required for all other faces where coal is not being cut, mined or loaded.

Line Brattice or Travel Curtain — — —
Temporary Stopping
Permanent Stopping
Exhausting Auxiliary Fan
Ventilation Tubing

Scale - 1" = 60'

Selection Sheet For Designated Areas

Mine Soldier Canyon Mine Mine ID 42-00077

Company Soldier Creek Coal Company

To Be Filled In By MSHA

Location Of Designated Area: #4 belt line at the #4 belt drive.

Position Of Sampling Instrument Within Designated Area: 15 feet down wind (with direction of airflow) from the #4 belt drive on the walkway side at the normal breathing level, but not less than one foot from the roof or rib.

Designated Area ID: 200-0

Location Of Designated Area: #8 belt line at the #8 belt drive.

Position Of Sampling Instrument Within Designated Area: 15 feet down wind (with direction of airflow) from the #8 belt drive on the walkway side at the normal breating level, but not less than one foot from the roof or rib.

Designated Area ID: 201-0

Location Of Designated Area: Main East loading point.

Position Of Sampling Instrument Within Designated Area: 15 feet down wind (with direction of airflow) from the loading point breaker on the walkway side at the normal breathing level, but not less than one foot from the roof or rib.

Designated Area ID: 202-0

Location Of Designated Area: Main North 1st East loading point.

Position Of Sampling Instrument Within Designated Area: 15 feet down wind (with direction of airflow) from the loading point breaker on the walkway side at the normal breathing level, but not less than one foot from the roof or rib.

Designated Area ID: 203-0

Location Of Designated Area: Main North 2nd East loading point.

Position Of Sampling Instrument Within Designated Area: 15 feet down wind (with direction of airflow) from the loading point breaker on the walkway side at the normal breathing level, but not less than one foot from the roof or rib.

Designated Area ID: 204-0

Selection Sheet For Designated Areas

Mine: Soldier Canyon   Mine ID: 42-00077

Company: Soldier Creek Coal Company

To Be Filled In By MSHA

Location Of Designated Area: Main haulage route to the Main East, 1st East and 2nd East sections.

Designated Area ID: 205-0

Position Of Sampling Instrument Within Designated Area: 36 inches from the operators controls on the No. 2 913 load haul dump.

Location Of Designated Area: Underground Shop

Designated Area ID: 400-0

Position Of Sampling Instrument Within Designated Area: 15 feet up wind (opposite the direction of airflow) of the point where the shop air is regulated into the return at the normal breathing level but not less than one foot from the roof or rib.

Location Of Designated Area:

Designated Area ID:

Position Of Sampling Instrument Within Designated Area:

Location Of Designated Area:

Designated Area ID:

Position Of Sampling Instrument Within Designated Area:

Location Of Designated Area:

Designated Area ID:

Position Of Sampling Instrument Within Designated Area:

U. S. Department of Labor

Mine Safety and Health Administration
P O Box 25367
Denver, Colorado 80225
Coal Mine Safety and Health
District 9

January 5, 1981

Mr. J. T. Paluso
Chief Engineer
Soldier Creek Coal Company
PO Box I
Price UT 84501

Re: Soldier Canyon Mine
I.D. No. 42-00077
Ventilation System and Methane
and Dust Control Plan

Dear Mr. Paluso:

The ventilation system and methane and dust control plan dated November 18, 1980, for the subject mine has been approved in accordance with Section 75. 316, 30 CFR 75. The plan is subject to revision at any time and shall be reviewed by the operator and MSHA at least once every six months. Before any changes are made in the approved ventilation system, they shall be submitted to and approved by the District Manager prior to implementation.

The dust sampling designated areas have been reviewed and are incorporated as a part of this plan. Attached are the identification numbers assigned to each designated area. The effective date to start sampling shall be February 1, 1981 (Feb.-March) bimonthly period.

This plan supersedes any previously approved plans and a copy of this plan shall be made available to the miners.

Sincerely yours,

for John W. Barton
District Manager

Enclosure

RECEIVED
JAN 08 1981
SC3

U. S. Department of Labor

Mine Safety and Health Administration
P O Box 25367
Denver, Colorado 80225

Coal Mine Safety and Health
District 9

December 17, 1980

M. D. Ross
Vice President
Soldier Creek Coal Company
PO Box I
Price, UT 84501

Re: Soldier Canyon Mine
I.D. No. 42-00077
Ventilation Map

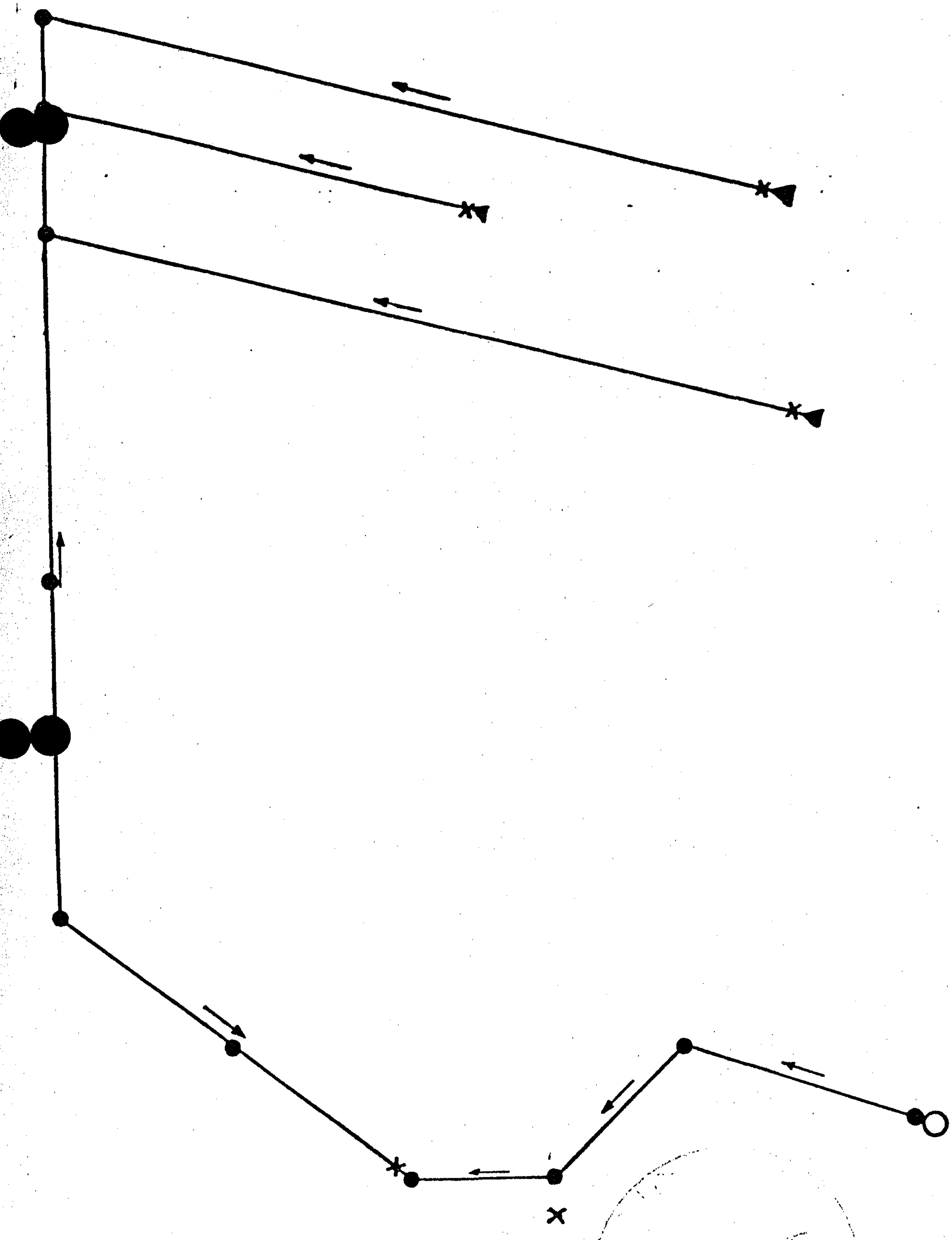
Dear Mr. Ross:

The ventilation map submitted on November 21, 1980, for the subject mine appears acceptable and will be distributed as such.

This map must be updated again in six months.

Sincerely yours,

John W. Barton
District Manager



KEY

- ○ MINE OPENING
- ● BELT TRANSFER POINT
- ● ESIGNATED AREA
- R AIR REGULATED INTO RETURN
- ▲ SECTION LOADING POINT
- ←DIRECTION OF AIR CURRENT

SOLDIER CREEK COAL CO.
SOLDIER CANYON MINE
RESPIRABLE DUST SAMPLING
FOR DESIGNATED AREAS

*indicates optional item

Soldier Canyon Mine

1—A Batch		1—B Sequence			1—C Date (yy/mm/dd)					
0	3				8	0	1	2	2	9
					yr		mo		da	
5	6	7	8	9	10	11	12	13	14	15

The following items must always be completed:

1. Mine ID	42-00077	2. District/Subdistrict	209
3. Effective Date of Action	02 (mo) 01 (da) 81 (yr)		

4. Select One Type of Entry:				
A. MMU	MMU Number	–	Des Occupation Code	
B. DA X	DA Number	203-0		
C. DWP	SA Number	–	Occupation Code	

5. Action:							
X	A. New Entry		B. Update		C. Delete		D. Confirm Delete

MMU/DA/DWP Information (complete as required)

6. MMU/DA/DWP Status						
X	A. Producing		B. Nonproducing		C. Abandoned	

Auxilliary Information								
7. Operating under Legal Proceedings*		Yes	X	No	8. Order of Withdrawal*	Yes	X	No

9. Location Description: MAIN NORTH 1ST EAST LOADING POINT

MMU Information (complete each item for new MMU entry, or complete only items to be updated)

10. Method of Mining			
	A. Longwall/Shear		H. Scoop with Cutting Machine
	B. Longwall/Plow		I. Scoop/Shoot Off Solids
	C. Continuous/Ripper		J. Conventional/Shoot Off Solid-Loading Machine
	D. Continuous/Bore		K. Hand Load/Cutting Machine
	E. Continuous/Auger		L. Hand Load/Shoot Off Solid
	F. Continuous/Shortwall		M. Hand Load/Anthracite
	G. Conventional with Cutting Machine		N. Other

11. Diesel Equipment Used*		Yes		No	12. Resin Bolts*		Yes	No

Complete for Update MMU Entry Only (when necessary)

13. New Production Tonnage				

Date

MMU/DA/DWP Status

U. S. Department of Labor
Mine Safety and Health Administration

*indicates optional item

Soldier Canyon Mine

1—A Batch		1—B Sequence			1—C Date (yy/mm/dd)					
0	3				8	0	1	2	2	9
5	6	7	8	9	10	11	12	13	14	15

(yr / mo / da)

The following items must always be completed:

1. Mine ID	42-00077	2. District/Subdistrict	209	3. Effective Date of Action: 02 (mo) 01 (da) 81 (yr)

4. Select One Type of Entry:				
A. MMU	MMU Number	–	Des Occupation Code	
B. DA X	DA Number	203–0		
C. DWP	SA Number	–	Occupation Code	

5. Action:				
	X A. New Entry	B. Update	C. Delete	D. Confirm Delete

MMU/DA/DWP Information (complete as required)

6. MMU/DA/ DWP Status	X A. Producing	B. Nonproducing	C. Abandoned
Auxilliary Information	7. Operating under Legal Proceedings*	Yes / X No	8. Order of Withdrawal* Yes / X No
9. Location Description	MAIN NORTH 1ST EAST LOADING POINT		

MMU Information (complete each item for new MMU entry, or complete only items to be updated)

10. Method of Mining			
	A. Longwall/Shear		H. Scoop with Cutting Machine
	B. Longwall/Plow		I. Scoop/Shoot Off Solids
	C. Continuous/Ripper		J. Conventional/Shoot Off Solid-Loading Machine
	D. Continuous/Bore		K. Hand Load/Cutting Machine
	E. Continuous/Auger		L. Hand Load/Shoot Off Solid
	F. Continuous/Shortwall		M. Hand Load/Anthracite
	G. Conventional with Cutting Machine		N. Other

11. Diesel Equipment Used*	Yes	No	12. Resin Bolts*	Yes / No

Complete for Update MMU Entry Only (when necessary)

13. New Production Tonnage	

Date

MSHA Form 2000-142, Oct 79 (proposed)

MMU/DA/DWP Status

U. S. Department of Labor
Mine Safety and Health Administration

*indicates optional item

Soldier Canyon Mine

1—A Batch		1—B Sequence			1—C Date (yy/mm/dd)					
0	3				8	0	1	2	2	9
5	6	7	8	9	10	11	12	13	14	15

(yr, mo, da)

The following items must always be completed:

1. Mine ID: 42-00077
2. District/Subdistrict: 209
3. Effective Date of Action: 02 (mo) 01 (da) 81 (yr)

4. Select One Type of Entry:
- A. MMU — MMU Number: ___ — Des Occupation Code: ___
- B. DA X — DA Number: 204-0
- C. DWP — SA Number: ___ — Occupation Code: ___

5. Action: X A. New Entry | B. Update | C. Delete | D. Confirm Delete

MMU/DA/DWP Information (complete as required)

6. MMU/DA/DWP Status: X A. Producing | B. Nonproducing | C. Abandoned

Auxilliary Information
7. Operating under Legal Proceedings*: Yes | X No
8. Order of Withdrawal*: Yes | X No

9. Location Description: MAIN NORTH 2ND EAST LOADING POINT

MMU Information (complete each item for new MMU entry, or complete only items to be updated)

10. Method of Mining

	A. Longwall/Shear		H. Scoop with Cutting Machine
	B. Longwall/Plow		I. Scoop/Shoot Off Solids
	C. Continuous/Ripper		J. Conventional/Shoot Off Solid-Loading Machine
	D. Continuous/Bore		K. Hand Load/Cutting Machine
	E. Continuous/Auger		L. Hand Load/Shoot Off Solid
	F. Continuous/Shortwall		M. Hand Load/Anthracite
	G. Conventional with Cutting Machine		N. Other

11. Diesel Equipment Used*: Yes | No
12. Resin Bolts*: Yes | No

Complete for Update MMU Entry Only (when necessary)

13. New Production Tonnage

Date

MMU/DA/DWP Status

U. S. Department of Labor
Mine Safety and Health Administration

*indicates optional item

Soldier Canyon Mine

1–A Batch		1–B Sequence			1–C Date (yy/mm/dd)					
0	3				8	0	1	2	2	9
					yr		mo		da	
5	6	7	8	9	10	11	12	13	14	15

The following items must always be completed:

1. Mine ID: 42-00077	2. District/Subdistrict: 209	3. Effective Date of Action: 02 (mo) 01 (da) 81 (yr)	

4. Select One Type of Entry:			
A. MMU	MMU Number: –	Des Occupation Code	
B. DA X	DA Number: 205–0		
C. DWP	SA Number: –	Occupation Code	

5. Action:				
	X A. New Entry	B. Update	C. Delete	D. Confirm Delete

MMU/DA/DWP Information (complete as required)

6. MMU/DA/DWP Status	X A. Producing	B. Nonproducing	C. Abandoned
Auxilliary Information	7. Operating under Legal Proceedings*	Yes / X No	8. Order of Withdrawal* Yes / X No
9. Location Description	MAIN HAOLAGE MAIN EAST		

MMU Information (complete each item for new MMU entry, or complete only items to be updated)

10. Method of Mining		
	A. Longwall/Shear	H. Scoop with Cutting Machine
	B. Longwall/Plow	I. Scoop/Shoot Off Solids
	C. Continuous/Ripper	J. Conventional/Shoot Off Solid-Loading Machine
	D. Continuous/Bore	K. Hand Load/Cutting Machine
	E. Continuous/Auger	L. Hand Load/Shoot Off Solid
	F. Continuous/Shortwall	M. Hand Load/Anthracite
	G. Conventional with Cutting Machine	N. Other

11. Diesel Equipment Used*	Yes	No	12. Resin Bolts*	Yes	No

Complete for Update MMU Entry Only (when necessary)

13. New Production Tonnage

Date

MSHA Form 2000-142, Oct 79 (proposed)

MMU/DA/DWP Status

U. S. Department of Labor
Mine Safety and Health Administration

*indicates optional item

Soldier Canyon Mine

1–A	1–B	1–C
Batch	Sequence	Date (yy/mm/dd)
0 3		80 12 29 (yr mo da)
5 6	7 8 9	10 11 12 13 14 15

The following items must always be completed:

1. Mine ID	42-00077	2. District/Subdistrict	2 09
3. Effective Date of Action	02 01 81 (mo da yr)		

4. Select One Type of Entry:

A. MMU	MMU Number	–	Des Occupation Code	
B. DA X	DA Number	400–0		
C. DWP	SA Number	–	Occupation Code	

5. Action: X A. New Entry ☐ B. Update ☐ C. Delete ☐ D. Confirm Delete

MMU/DA/DWP Information (complete as required)

6. MMU/DA/DWP Status: X A. Producing ☐ B. Nonproducing ☐ C. Abandoned

Auxilliary Information
7. Operating under Legal Proceedings* ☐ Yes X No
8. Order of Withdrawal* ☐ Yes X No

9. Location Description: UNDERGROUND SHOP

MMU Information (complete each item for new MMU entry, or complete only items to be updated)

10. Method of Mining

	A. Longwall/Shear		H. Scoop with Cutting Machine
	B. Longwall/Plow		I. Scoop/Shoot Off Solids
	C. Continuous/Ripper		J. Conventional/Shoot Off Solid-Loading Machine
	D. Continuous/Bore		K. Hand Load/Cutting Machine
	E. Continuous/Auger		L. Hand Load/Shoot Off Solid
	F. Continuous/Shortwall		M. Hand Load/Anthracite
	G. Conventional with Cutting Machine		N. Other

11. Diesel Equipment Used* ☐ Yes ☐ No
12. Resin Bolts* ☐ Yes ☐ No

Complete for Update MMU Entry Only (when necessary)

13. New Production Tonnage

Date

MSHA Form 2000-142, Oct 79 (proposed)

MMU/DA/DWP Status

U. S. Department of Labor
Mine Safety and Health Administration

*indicates optional item

Soldier Canyon Mine

1—A Batch	1—B Sequence	1—C Date (yy/mm/dd)
0 3		80 (yr) 12 (mo) 29 (da)
5 6	7 8 9	10 11 12 13 14 15

The following items must always be completed:

1. Mine ID	42-00077	2. District/Subdistrict	209
3. Effective Date of Action	02 (mo) 01 (da) 80 (yr)		

4. Select One Type of Entry:				
A. MMU	MMU Number	—	Des Occupation Code	
B. DA X	DA Number	200-0		
C. DWP	SA Number	—	Occupation Code	

5. Action: [X] A. New Entry [ ] B. Update [ ] C. Delete [ ] D. Confirm Delete

MMU/DA/DWP Information (complete as required)

6. MMU/DA/DWP Status: [X] A. Producing [ ] B. Nonproducing [ ] C. Abandoned

Auxilliary Information

7. Operating under Legal Proceedings*: [ ] Yes [X] No
8. Order of Withdrawal*: [ ] Yes [X] No

9. Location Description: #4 BELT LINE AT #4 BELT DRIVE

MMU Information (complete each item for new MMU entry, or complete only items to be updated)

10. Method of Mining

[ ]	A. Longwall/Shear	[ ]	H. Scoop with Cutting Machine
[ ]	B. Longwall/Plow	[ ]	I. Scoop/Shoot Off Solids
[ ]	C. Continuous/Ripper	[ ]	J. Conventional/Shoot Off Solid-Loading Machine
[ ]	D. Continuous/Bore	[ ]	K. Hand Load/Cutting Machine
[ ]	E. Continuous/Auger	[ ]	L. Hand Load/Shoot Off Solid
[ ]	F. Continuous/Shortwall	[ ]	M. Hand Load/Anthracite
[ ]	G. Conventional with Cutting Machine	[ ]	N. Other

11. Diesel Equipment Used*: [ ] Yes [ ] No
12. Resin Bolts*: [ ] Yes [ ] No

Complete for Update MMU Entry Only (when necessary)

13. New Production Tonnage

Date

MSHA Form 2000-142, Oct 79 (proposed)

MMU/DA/DWP Status

U. S. Department of Labor
Mine Safety and Health Administration

*indicates optional item

Soldier Canyon Mine

1–A Batch		1–B Sequence			1–C Date (yy/mm/dd)					
0	3				8	0	1	2	2	9
5	6	7	8	9	10	11	12	13	14	15

The following items must always be completed:

1. Mine ID: 42-00077
2. District/Subdistrict: 209.
3. Effective Date of Action: 02 (mo) 01 (da) 81 (yr)

4. Select One Type of Entry:
- A. MMU — MMU Number: — ; Des Occupation Code:
- B. DA X — DA Number: 201-0
- C. DWP — SA Number: — ; Occupation Code:

5. Action: X A. New Entry; B. Update; C. Delete; D. Confirm Delete

MMU/DA/DWP Information (complete as required)

6. MMU/DA/DWP Status: X A. Producing; B. Nonproducing; C. Abandoned

Auxilliary Information
7. Operating under Legal Proceedings*: Yes; X No
8. Order of Withdrawal*: Yes; X No

9. Location Description: #8 BELT LINE AT #8 BELT DRIVE

MMU Information (complete each item for new MMU entry, or complete only items to be updated)

10. Method of Mining
- A. Longwall/Shear
- B. Longwall/Plow
- C. Continuous/Ripper
- D. Continuous/Bore
- E. Continuous/Auger
- F. Continuous/Shortwall
- G. Conventional with Cutting Machine
- H. Scoop with Cutting Machine
- I. Scoop/Shoot Off Solids
- J. Conventional/Shoot Off Solid-Loading Machine
- K. Hand Load/Cutting Machine
- L. Hand Load/Shoot Off Solid
- M. Hand Load/Anthracite
- N. Other

11. Diesel Equipment Used*: Yes; No
12. Resin Bolts*: Yes; No

Complete for Update MMU Entry Only (when necessary)

13. New Production Tonnage:

Date

MSHA Form 2000-142, Oct 79 (proposed)

EQUIPMENT LIST

Equipment	Model
Continuous Miners	
Lee Norse	CM60H-IE-60
Lee Norse	MM455-5
Joy	12CM6-10CH
Joy	12CM6-10CH
Joy	12CM6-10CH
Roof Bolters	
Lee Norse	TD1-43
Lee Norse	TD2-43
Fletcher	DDM-13
Fletcher	DDM-13
Fletcher	DDM-13
Fletcher	DDM-13
Shuttle Cars	
Joy 1	10SC2PF-4
Joy 2	10SC27PH-1
Joy 3	10SC22-48CH-1
Joy 4	10SC2248CH-1
Joy 8	10SC2248CH-1
Joy 6	10SC22-48CH-1
Joy 9	10SC22-48CH-1
Joy 5	10SC22-48CH-1
Joy 7	10SC22-48CH-1
Joy 10	10SC22-48CH-1
Feeder Breakers	
Stamler	BF-M-3-10
Long Airdox	MFBM-48
Stamler	BF-14-3-10
Stamler	BF-14-3-10
Stamler	BF-14-3-10
Belt Drives	
Long Airdox	T-21H
Long Airdox	T-21H
Long Airdox	T-21H
Long Airdox	T-21H
Long Airdox	T-21H
Long Airdox	T-21H
Long Airdox	T-21H
Long Airdox	DT-36H
Long Airdox	DT-36H
Long Airdox	DT-36H
Long Airdox	T-21H
Long Airdox	T-21H
Long Airdox	T-21H
Long Airdox	DT-36H
Long Airdox	DT-36H

EQUIPMENT LIST
(Cont'd.)

Equipment	Model
Belt Drives (Cont'd.)	
Long Airdox	DT-36H
Long Airdox	DT-36H
Long Airdox	DT-36H
Mine Tractors	
Sien Brute (Ford)	D5011F
Ford	DU112K
Wagner	ST2BS
Swinger	200
Swinger	200
Kubota (1)	M605
Kubota (2)	M605B
Kubota (3)	M605
Kubota (4)	M605
Elma Lub Truck	544A
Elmac Personnel Carrier	P14-4
Elmac Personnel Carrier	P14-4
Elmac Personnel Carrier	P14-4
Elmac Load Haul Dump	S43EXE
Eimco Load Haul Dump	911
Eimco Load Haul Dump	911
Elmac Maint. Truck	624
Kubota	L245
Kubota	L245
Kubota	L245
Kubota	L245
Eimco Load Haul Dump	913
Eimco LHD	911
Elmac Personnel Carrier	P14-4
Eimco Load Haul Dump	911
Miller Welder	Big D-2
Rock Duster	
Eimco Load Haul Dump (7)	911
Eimco LHD (8)	913-S24
Kubota (9)	L-245
Kubota (10)	L-245
Kubota (11)	L-245
Kubota (12)	L-245
Kubota (13)	L-245
Dodge Personnel Carrier (5)	G741
Dodge Ambulance	G741
Eimco Maint. Truck	975
Huber Maintainer	M-850
Atlas Copco Air Comp.	XAS160DD
Dodge Personnel Carrier	G741

EQUIPMENT LIST
(Cont'd.)

Equipment	Model
Mine Tractors (Cont'd.)	
Eimco Load Haul Dump	913
Eimco Lub Truck	975
Jeffrey Ram Car	411H
Kubota	L-245
Kubota	L-245
Eimco Mantrip	975
Pumps	
Ingersol Rand	2GT
Ingersol Rand	2GT
Ingersol Rand Motor	A
Sunflo Pressure	P-TEJA
Worthington Transfer	
Sunflo No. 1	P28CF
Sunflo No. 2	P28CF
Sunflo No. 3	P28CF
Sunflo No. 4	P28CF
Ingersol Rand	2GT
Transformer	1000KVA
Transformer	1000KVA
Transformer	300KVA
Transformer	300KVA
Transformer	
H.V. Fused Visual Dis.	PHD
Monitor CK Dist. Box	
W.H. H.V. Vis. Disc.	AWP
Pemco Capacitor	1050KVAR
Silpak Power Supply	K-300
Silpak Transformer (Pemco Corp.)	K-1000
Silpak P.C. Switch Gear (Sec. Mon.)	VSH-1
Silpak P.C. Transformer	K-1000
Silpak P.C. Switch Gear (Sec. Mon.)	VSH-1
Ohio Brass Transformer	10309
P.C. Silpak Power Supply	K300
P.C. Silpak Power Supply	K300
P.C. Silpak Switch Gear	DVSH-2
P.C. Silpak Power Supply	K600
P.C. Silpak Power Supply	K600
P.C. Silpak Switch Gear	VSH-1
P.C. Silpak Power Supply	K300
P.C. Silpak Power Supply	K600
Caterpillar Wheel Loader	950
Caterpillar Tractor	D8H-46A
GMC Flatbed Truck	6500
GMC Tank Truck	6500
Ford Dump	LNT8000

CHAPTER IV

LAND STATUS

CHAPTER IV

LAND STATUS

4.1 SCOPE

This chapter will depict the land status of all property in the permit area.

4.2 METHODOLOGY

Data was collected from county, state and federal agencies within the last thirty days.

4.3 LAND STATUS

All information requested in this section has been compiled in table 1 or illustrated on the surface property and coal property maps.

Note - All federal land located in this area is managed by the BLM.

4.4 LAND USE

The surface of the permit area has primarily been used for the grazing of cattle and wildlife range. The steep topography, low levels of moisture, and remoteness of the land restricts development. Only approximately ten acres will ever be used for surface facilities. The remaining surface area will be protected through abstention. The mine surface facilities are located on the edge of the mine permit area, thus will minimize the distrubance on the area as a whole.

4.5 POSTMINING LAND-USE

The postmining and the pre-mining land status for the area will be identical.

4.6 SOCIOECONOMIC CONSIDERATIONS

The Carbon County area benefits greatly from the employment opportunity given by Soldier Canyon Mine.

Note land use map in appendix.

PROPERTY OWNERSHIP FOR SOLDIER CANYON LEASE AND PROPOSED LEASE

Tp. 13 S. R. 12 E

Sections 5, 8, and 17

Oil and Gas
1959 Subordination to oil and gas lease
Federal Land Bank of Berkeley to Shell Oil
and Tennessee Gas Transmission

Surface	Section	5	8	17
Eureka Energy Co.		2A-1103-4	2A-1105-2	2A-11085

Section 6

Oil and Gas
1974 ten year oil and gas lease issued to Marathon Oil
Company by B. Iriart

Surface
Bernard Iriart 2A-1104

Section 7

NE¼, NW¼, SW¼, NW¼ SE¼
Oil and Gas
1965 ten year lease issued to Paul T. Walton by B. Iriart

Surface
Bernard Iriart 2A-1105

NE¼ SE¼
Oil and Gas
1959 Subordination to oil and gas lease
Federal Land Bank of Berkeley to Shell Oil
and Tennessee Gas Transmission

Surface
Eureka Energy Co. 2A-1104A

S½ SE¼
Oil and Gas and Surface
U.S. Government

Section 18

Oil and Gas and Surface
U.S. Government

Tp. 13 S. R. 11 E.

Section 1

Oil and Gas
1974 ten year lease issued to Marathon Oil Company by B. Iriart

Surface
Bernard Iriart   2A-1079

Section 12

Oil and Gas
1965 ten year lease issued to Paul T. Walton by B. Iriart

Surface
Bernard Iriart   2A-1091

Section 13

Oil and Gas
W½
Ten year lease issued to A.A. Minerals Corporation from B. Iriart

Natural Gas Corporation of California assigned 80% of A.A. Minerals' lease

Surface
Bernard Iriart   2A-1092

E½
Oil and Gas and Surface
U.S. Government

Tp. 12 S. R. 12 E.

Section 31

Oil and Gas
Lots 1, 2, 3, E½ SW¼, NE¼ NW¼
MINERAL DEEDS

Bernard Iriart	1/16
R. W. Slemaker	5/32
Elise B. Herndon	5/8
Faudree	5/64
Assigned 83% of his to L. J. Bell	
C & K Petroleum	5/64

NE¼ NE¼
1973 ten year lease issued to Marathon Oil Company
by B. Iriart
Marathon Oil subleased 1/3 share each to Mountain Fuel
Supply and Union Oil of California

SW¼ SW¼, SE¼ NW¼, NW¼ NE¼, SE¼ NE¼, SW¼ NE¼
U.S. Government

Surface
Bernard Iriart 2A-586
W½, NE¼ NE¼

Lawrence C. Nelson 2A-587
NW¼ NE¼, SE¼ NE¼, SW¼ NE¼, SE¼

FEDERAL OIL LEASES

Tp. 13 S. R. 12 E.

Section 18

U17745 Supron Energy Corporation
Suite 1700
Campbell Center
8350 North Central Express
Dallas, Texas 75206

10 year lease Exp. 10/1/82

Tp. 13 S. R. 11 E.

Section 13

U17742 Supron Energy Corporation
10 year lease Exp. 10/1/82

Tp. 12 S. R. 12 E.

Section 31

U17938 Hawthorne Oil Company
P.O. Box 2693
Casper, Wyoming 82601

10 year lease Exp. 4/3/82

CHAPTER V

"HISTORICAL AND CULTURAL RESOURCES"

Chapter V

Historical and Cultural Resources

5.0 Table of Contents

5.1 SCOPE

This chapter serves as a negative determination of historical and cultural resources in the Soldier Canyon Mine area.

5.2 METHODOLOGY

These historical and cultural investigations were carried out by the Utah Division of State History, and visual observations were made by the Soldier Creek Coal Company.

5.3 HISTORICAL RESOURCES

5.3.1 Historical Inventory

On September 26, 1980, our office received archeological and historical information concerning the Soldier Canyon Mine lease area. This letter from the Division of State History stated, "...there are no known pre-historic or historic resources in the area of the mine plan." A copy of this letter is included at the end of this chapter.

5.3.2 History of Mining
&
5.3.3 Effects of Mining on Historical Resources

The origin of the mine dates back to 1906, when limited prospecting was done on the property. In 1935, Premium Coal Company was granted the lease on the property and mining commenced. This was a small, family-owned, non-union company which operated the mine continuously until 1972, producing approximately 1.2 million tons in its duration. In June of 1974, California

Portland Cement purchased the property and began limited production on June 15, 1976. Since that time many changes have been made to the mine and surroundings to bring it to its present stature.

The investigation mentioned previously should be sufficient in demonstrating that underground coal mining activities and surface operations at the Soldier Canyon Mine will not adversely affect any historical resources.

5.4 ARCHEOLOGICAL RESOURCES

5.4.1 Archeological Inventory & 5.4.2 Effects of Mining on Archeological Resources

No archeological resources were found in the area by the Division of State History in their investigation. Therefore, mining will produce no adverse effects on archeological resources.

5.5 PALEONTOLOGICAL RESOURCES

5.5.1 Paleontologic Resources & 5.5.2 Effects of Mining

In past mining operations there has been no evidence of paleontological resources. Therefore, no adverse effects will result from mining operations.

5.6 PUBLIC PARKS

5.6.1 Inventory of Public Facilities & 5.6.2 Effects of Mining

In a telephone conversation with the Bureau of Land Management and the Forest Service on March 13, 1981, it was determined that no public parks exist within the mine permit area. Therefore, no adverse effects will result from mining

SCOTT M. MATHESON
GOVERNOR

STATE OF UTAH
DEPARTMENT OF COMMUNITY AND
ECONOMIC DEVELOPMENT

Division of
State History
(UTAH STATE HISTORICAL SOCIETY)

MELVIN T. SMITH, DIRECTOR
307 WEST 2ND SOUTH
SALT LAKE CITY, UTAH 84101
TELEPHONE 801/533-5755

September 26, 1980

David G. Spillman
Mine Engineer
Soldier Creek Coal Company
Hidden Valley Mine
P. O. Box AS
Price, Utah 84501

Dear Mr. Spillman:

In reply to your request of September 8, 1980, a search of the cultural resource files was completed of those areas in Soldier Canyon that were requested. The search indicated that there are no known pre-historic or historic resources in the area of the mine plan.

Our office, however, is aware of some historic resources that may be located in the area of the mining plan.

If you have any questions, please contact me (801) 533-6000.

Sincerely,

Jim Dykman
Compliance Administrator

JLD:jr

CHAPTER VI

"GEOLOGY"

CHAPTER VI

Geology

6.1 SCOPE

This portion of the report examines the geology of the Soldier Canyon Mine permit area and its possible effects on mining operations.

6.2 METHODOLOGY

The data contained in this chapter is compiled from investigations conducted by Soldier Creek Coal Company, U.S.G.S. General Mining Order No. 1 as revised, and the report by Vaughn Hanson Associates of January 1980.

6.3 REGIONAL GEOLOGIC FRAMEWORK

The commercial coal seams of Soldier Canyon Mine are part of a group of sedimentary rock units known as the Book Cliffs Coalfield of Central Utah. These units, consisting largely of sandstones, shales, carbonaceous shales, calcareous shale and coal beds were laid down as broad shallow sea deposits during late Mesozoic Era (Upper Cretaceous). The Blackhawk member of these formations contains the three commercial coal beds and varies from 600 to 1100 feet in thickness.

The following geological summary is taken from Monograph No. 3, Utah Geological and Mineralogical Survey.

Blackhawk Formation

"By virtue of the coal it bears, this formation is the most important unit in the coal field. The best analysis of the unit originates with Young (1955, p. 183-186) and many of his findings are reiterated here. In his discussion he includes the Spring Canyon Tongue, here carried with the Star Point Sandstone, with the Blackhawk. With this tongue he includes six prominent littoral marine sandstone tongues with several minor ones projecting eastward into the Mancos Shale. These sandstone tongues in their eastward extension grade into shale and thus lose their identity (figures 7 and 8). The interval between each tongue consists of lagoonal deposits of sandstone, shale and coal. The top sandstone ledge below the lagoonal deposits is invariably bleached white. The six members from the highest to the lowest include: Desert, Grassy, Sunnyside, Kenilworth, Aberdeen and Spring Canyon members.

These members can be subdivided only where the littoral sandstone tongues are present and each is limited in extent. As a general rule the lower members are more easily identifiable to the west and the upper members are more easily identifiable to the east.

The lowest member, the Spring Canyon, consists of 60 to 100 feet of coal-bearing shales and sandstones. The coal beds in the member thin out eastward and are replaced by two massive off-shore bar sandstones near Helper, which mark the east limits of coal-producing swamps in that sequence. The next member, the Aberdeen, consists of 88 feet of sandstone topped by 100 feet of shale, sandstone and coal near Kenilworth. The Aberdeen Sandstone first appears in the west part of the field and may be recognizable in the Gordon Creek area of the Wasatch Plateau field. It extends eastward to Dugout Canyon, a few miles east of Soldier Canyon where it grades into the Mancos. The coal beds replaced by five bar sandstones between Kenilworth and Coal Creek Canyon that are consequently replaced by Mancos-like shale. The Kenilworth Member has a lower sandstone which reaches a maximum of 85 feet thick and disappears eastward near Sunnyside. The coal-bearing beds become important near the west end of the field, thicken and extend eastward only to thin east of Cordingly Canyon. Farther eastward the beds grade into Mancos-like shale and eventually become a part of that formation. Thin coal is recognized as far east as the Beckwith Plateau. Four minable beds are known in the Kenilworth Member. The interval of sand, shale and coal reaches a maximum thickness of 160 feet.

The next member, the Sunnyside, has its sandstone bed reaching a maximum of 50 feet at Pace Canyon. It first appears near Kenilworth, extends eastward by splitting into two tongues and finally gives way to the Mancos near Horse Canyon. The lagoonal rocks are relatively thin, 25 feet, which are replaced east of Sunnyside. These beds contain two important coal beds, however. The Grassy Member is 110 feet thick near the Grassy siding of the D&RGW Railroad 6 miles north of Woodside. The lower sandstone, 60 feet thick, first appears at Sunnyside but grades into the Mancos on the east side of the Green River Canyon. Only a few thin coal beds are present in the upper 50 feet. The final member first appears near the Desert siding of D&RGW Railroad 12 miles south of Woodside at the south end of the coal field. The sandstone reaches a maximum of 70 feet and gives way to the Mancos eastward at Saleratus Canyon east of the Green River. The entire Blackhawk finally disappears in that direction. Fifty feet of coal-bearing rocks present at Desert thin rapidly eastward. At Green River the overlying Castlegate Sandstone rests directly on the sandstone beds of the Desert Member. The lagoonal beds contain many thin, unminable lenses of coal. Young's beds are not easily recognizable south of Sunnyside and Fisher's subdivisions are more easily recognized. The Kenilworth is a lower sandstone, followed by a middle shale. The Sunnyside cliff-forming sandstone (middle sandstone) follows with its coal beds near the top. The lagoonal sequence that follows, including thicker sandstone beds, is called the upper shale of Beckwith zone.

In the Castlegate area the Blackhawk ranges from 900 to 1,300 feet thick; the upper members are not definable. Better coal beds are assembled in the lower 500 feet because the coals are best developed above the thick sandstone members. In the Soldier Canyon and Sunnyside areas the Blackhawk has thinned to

500 to 1,000 feet of rock and to the south it thins farther. Near the south end of the Beckwith Plateau 170 to 475 feet of Sunnyside Grassy and Desert members are underlain by 100 to 260 feet of Mancos-like shale, followed by a littoral sandstone tongue 150 to 170 feet thick. This lower tongue (Kenilworth Sandstone) quickly disappears east of Green River.

Each sandstone tongue is usually medium-grained yellow-gray sandstone, bleached white at the top. Most are thick-bedded to massive at the top and gradually become more thin-bedded near the bottom. Near their eastward terminus they become finer grained, eventually reverting to siltstone and finally into Mancos shale. The lagoonal sandstones are medium to fine-grained, yellow-gray to brown, shaley to thick-bedded. The shales contain varying amounts of carbonaceous matter which determines their color. The coal beds are more fully discussed in the Coal Seams section.

The Book Cliffs coal field conveniently subdivides into four. The Castlegate area is the west part of the field extends easterly from the Wasatch Plateau Boundary (North Gordon fault zone) to the line dividing R. 10 and 11 E. The Soldier Canyon area extends from the east Castlegate boundary to a line dividing R. 12 and 13 E., or just east of Dugout Canyon. Sunnyside bed is well developed from Rock Canyon southward to Williams Draw. The Woodside area entails the land from Williams Draw to the mouth of Gray Canyon or the boundary with the Sego coal field.

The lower Sunnyside bed is the most important of the field. It has the greatest aerial extent, has had the greatest production and can produce a metallurgical coke. Other beds include the following (listed from top to bottom with respect to stratigraphic position):

Coal Bed or Zone	Area of Importance
Beckwith Zone	Woodside
Upper Sunnyside Bed	Sunnyside
Lower Sunnyside Bed	Sunnyside
Rock Canyon Bed	Soldier Canyon & Sunnyside
Fish Creek Bed	Soldier Canyon
Gilson Bed	Soldier Canyon
Kenilworth	Castlegate
Castlegate Zone	Castlegate
Spring Canyon Zone	Castlegate.

In summary, the Spring Canyon beds are minable west of Price River Canyon, the Castlegate has minable seams throughout the Castlegate area (except locally) and the Kenilworth is best developed between Price River and Deadman Canyon. The Gilson Seam is the only one of importance between Deadman and Coal Canyons. Farther east it thins out at Soldier Canyon to a point a little southeast of Rock Canyon. The Fish Creek bed probably achieves minable thickness between Dugout and Soldier Canyons in the Soldier Canyon area. The Upper Sunnyside is considered an upper split of the Lower Sunnyside and is locally developed in the Sunnyside area, most notably between Whitmore and Horse Canyons. The Beckwith Zone, present only in the Woodside area, containes coal beds that are highly lenticular and often split. Only locally do beds exceed 4 feet thick.

As alluded to in previous discussions, the Mancos sea retreated gradually during Upper Cretaceous time twoard the east. The marine environment was replaced by nearshore marine, beach, lagoonal and finally continental surroundings as time progressed. Older coal beds are in the west part of the field and younger ones to the east. The ancient coasts are thought to have been aligned approximately north-south, as indeed they were except locally. The costs reflect the structural tendencies of the time. Gross' (1961), in an isopach map of the Blackhawk Formation, shows a major irregularity which undoubtedly helped shape the present configuration of the Book Cliffs. His isopachous lines are north-south in the area south of Sunnyside, but swing east-west to the northwest. The thickest section of Blackhawk is known for oil-well data 14 miles north of Sunnyside. This may indicate an embayment which would affect any northward projection of coal pinch-out lines and may extend the thicker coal seam as known in the Sunnyside area toward the northwest as verified by a drill hole near the head of Soldier Canyon.

The coal beds exposed on the Wellington NE quadrangle are shown in their stratigraphic positions below:

	Feet
Castlegate Sandstone	
Coal beds above Upper Sunnyside	0-3
Upper Sunnyside Bed	0-6
Total interval above Lower Sunnyside to base of Castlegate Sandstone	175-250
Lower Sunnyside Bed	1-9
Interval	55-180
Rock Canyon Bed	1-9
Interval	50

	Feet
Gilson Bed	1-13
Interval	50

The lowermost Kenilworth bed probably averages 2 feet thick over the entire quadrangle and is consistent. According to Clark (1928, p. 49).

The Kenilworth bed is generally overlain by shale or sandy shale, with a sandstone about 5 to 10 feet above the coal, but in some places sandstone rests directly on coal . . . The coal rests on a massive sandstone from 100 to 125 feet thick or is separated from it by a few inches to a few feet of shale or sandy shale. . . It appears to be the only coal not seriously reduced in thickness or affected in character in the vicinity of Soldier Creek. . . There is a considerable area in secs. 29, 30, 31, and 32, T. 13S, R. 13 E., where the Kenilworth bed is probably thin or absent . . .

The Gilson bed is probably the most valuable on the quadrangle but is variable in thickness (drawing 3). To the west near Soldier Canyon it is lenticular and badly split. East of Sec. 20, T. 13 S., R. 12 E. the bed does not thin to less than 3 feet. Much of the coal is seriously burned at the outcrop and has probably ruined the coal within 200 feet of the outcrop. The zone of burning is usually less where outcrops cross stream channels.

The Fish Creek bed, thought to be a split of the Rock Canyon bed above, achieves its best development in Fish Creek Canyon. The average thickness of the bed is 3 feet 3 inches and locally it thickens to more than 4 feet. In local areas the bed should be minable.

Clark (1928 p. 51) notes this bed is of good thickness throughout a considerable area on the north where it is under deeper cover.

System	Series	Stratigraphic unit	Thickness (feet)	Description
Tertiary	Eocene	Green River Formation	–	Greenish gray and white claystone and shale, also contains fin grained and thin-bedded sandstone. Shales often dark brow containing carbonaceous matter. Full thickness not exposed.
	Paleocene	Colton Formation (Wasatch Formation)	300-2,000	Colton consists of brown to dark red lenticular sandstone, shal and siltstone, thins westwardly and considered a tongue of th Wasatch.
		Wasatch Formation	3,000	Wasatch predominantly sandstone with interbedded red and gree shales with basal conglomerate. Found in east part of field an equivalent to Colton and Flagstaff in west.
		Flagstaff Limestone (Wasatch Formation)	0- 500	Flagstaff mainly light gray and cream colored limestones, variegated shale, and fine-grained, reddish brown, calcareous sandstone.
		North Horn Formation *MINOR COAL*	350-2,500	Gray to gray green calcareous and silty shale, tan to yellow-gray fine-grained sandstone and minor conglomerate. Unit thickens to west.
	Danian			
Cretaceous	Maestrichthian	Tuscher Formation	0- 200	Light gray to cream-white friable massive sandstone and subordinate buff to gray shale that exhibits light greenish cast. Contains minor conglomerate and probably represents lower part of North Horn, only present in east part of field.
		Mesaverde Group: Price River Formation *MINOR COAL*	500-1,500	Yellow-gray to white, medium-grained sandstone and shaley sandstone with gray to olive green shale. Contains carbonaceous shale with minor coal and thickens along east edge of field.
	Campanian	Mesaverde Group: Castlegate Sandstone *MINOR COAL*	100- 500	White to gray, fine- to medium-grained, argillaceous massive resistant sandstone thinning eastwardly with subordinate shale. Carbonaceous east of Horse Canyon but coal is thin and lignitic.
		Mesaverde Group: Blackhawk Formation *MAJOR COAL SEAMS*	600-1,100	Cyclical littoral and lagoonal deposits with six major cycles. Littoral deposits mainly thick-bedded to massive cliff-forming yellow-gray fine- to medium-grained sandstone, individual beds separated by gray shale. Lagoonal facies consist of thin- to thick-bedded yellow-gray sandstones, shaley sandstones, shale and coal. Coal beds form basis of Book Cliffs coal field. Unit thins eastward grading into the Mancos Shale.
		Mesaverde Group: Star Point Sandstone	0- 580	Yellow-gray massive medium- to fine-grained littoral sandstone tongues projecting easterly separated by gray marine shale tongues projecting westerly.
		Mancos Shale: Masuk Tongue	4,300-5,050	Gray marine shale, locally heavily charged with carbonaceous material, slightly calcareous and gypsiferous, nonresistant forming flat desert surfaces and rounded hills and badlands. Separated mainly to the west into tongues by westward projecting littoral sandstone which eventually grade into shale. Sandstones are fine- to medium-grained, yellow-gray to tan and medium-bedded to massive and cliff forming.
	Santonian	Mancos Shale: Emery Sandstone		
	Coniacian	Mancos Shale: Garley Canyon Sandstone		
		Mancos Shale: Blue Gate Shale		
	Turonian	Mancos Shale: Ferron Sandstone *MINOR COAL*		
		Mancos Shale: Tununk Shale		
	Cenomanian	Dakota Sandstone	2- 126	Heterogeneous sandstone, conglomerate and shale, thin resistant cuesta former.

Generalized section of rock formations, Book Cliffs coal field.

The Rock Canyon bed is valuable on the Wellington NE quadrangle. It is irregular in thickness with occasional shaley partings. In one bench the thickness ranges from 3.5 to nearly 3 feet. The thickness over much of the quadrangle averages 5 feet. Most of the surface exposures are burned.

The Lower Sunnyside coal is mostly thin in outcrop and marginal to the 4-foot limit. It rests on the Sunnyside Sandstone which is easily traced. Much of the bed, however, has been burned along the outcrop. The average thickness is 2.4 feet in surface exposures. All beds, including the Upper Sunnyside, are thin and no sections show 4 feet of clear coal. Along the east map edge the Upper Sunnyside thickens to 6 feet but is split by partings.

Subsurface Information

Subsurface data from drill hole and mines are summarized below (Table 60):

Table 60. Drill hole and mine subsurface data, Wellington NE Quadrangle.

	Average Thickness (Feet)		
	Gilson	Rock Canyon	Lower Sunnyside
Kaiser Leases (east map margin)	7.0	5.4	4
Kennecott (Pace to Dugout Canyon)	11.0	8.0	-
Island Creek 22-13S-12E	8.7	8.0	-
21-13S-12E	5.4	6.8	3.8
17-13S-12E	2.0	3.0	-
Drill Hole 32-12S-12E	9.4	9.0	9.6
Soldier Canyon Mine	4.8	12.0	3.0

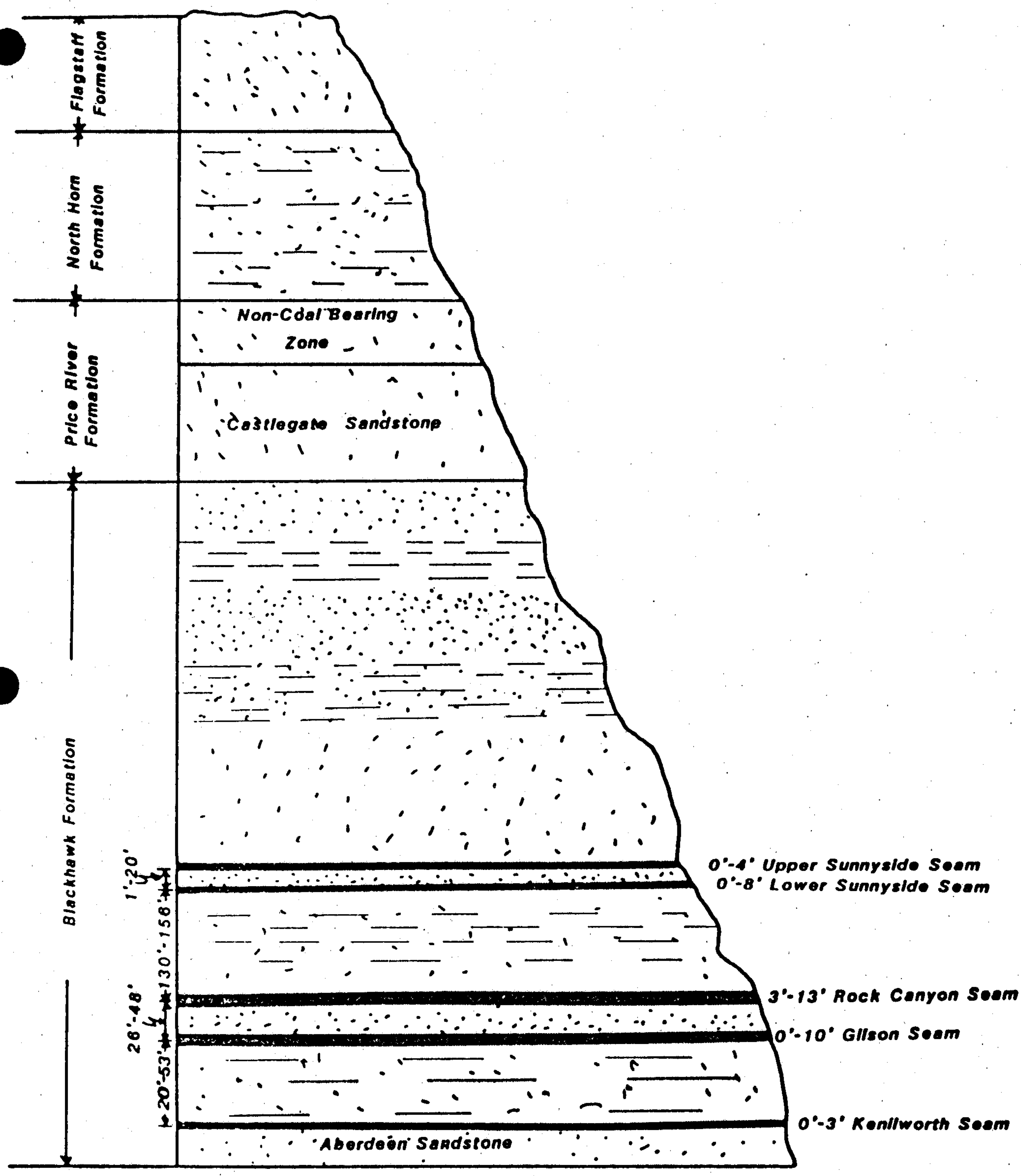
The three 9-foot seams in north Soldier Creek may indicate a thickening trend to the north.

6.4 GEOLOGY OF PROJECT VICINITY

6.4.1 Stratigraphy

6.4.2 Structure

See Figure 1 in this chapter



(Fig. 1) Generalized columnar section of the Soldier Canyon Mine lease area (Doelling, 1972 and Pollastro, 1980).

6.5 GEOLOGY OF COAL BED AND ADJACENT UNITS

6.5.1 Exploration and Drilling

See Drawing No's. 1, 2, and 3, and Figure 2.

6.5.2 Stratigraphy

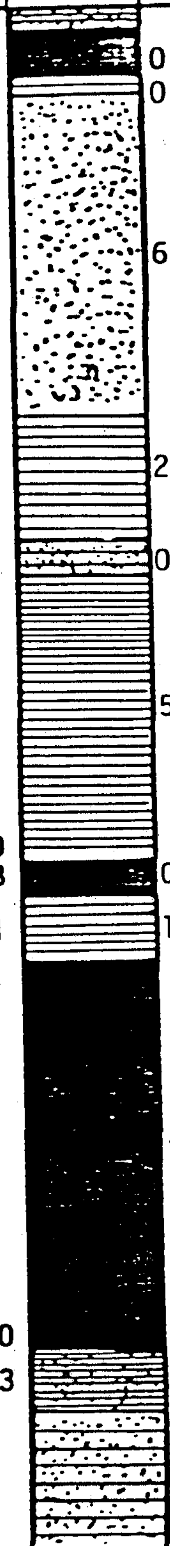
See Drawing No's. 1, 2, and 3.

6.5.3 Structure

See Drawing No's. 1, 2, and 3.

6.5.4 Detailed Columns of Interest and Cross-Sections

See Drawing No's. 1, 2, and 3.



DEPTH (feet)	Thickness	LITHOLOGIC DESCRIPTION
768.9		
769.3		Sandy Shale--Very Dense, No Fractures
770.2	0.9	Coal
770.5	0.3	Shale
	6.5	Sandstone--Fine Grained, Dense
777.0		
	2.5	Shale--Black, Highly Fractured
779.5		
780.2	0.7	Sandstone Interbedded With Shale
	5.8	Shale--Black, Solid
786.0		
786.8	0.8	Coal (Upper Split)
788.1	1.3	Shale
	7.9	Coal (Lower Split)
796.0		
797.3	1.3	Shale With Sandy Material
		Sandstone Interbedded With Shale

REVISIONS

NO.	DATE	BY
1		
2		
3		

Soldier Creek Coal Company

SOLDIER CANYON MINE

SCALE:

TITLE: RP2--Sunnyside Seam--Lithology

DRAWING NO. 1 of 3

DRAWN BY: ACP | DATE: 5/15/80 | CHECKED: | DATE: | APPROVED: | DATE:

DEPTH (feet)			LITHOLOGIC DESCRIPTION
908.9			
910.8		1.9	Sandstone With Carbon Material--Dark Gray
922.0		11.2	Sandstone With Interbedded Shale
934.3		12.3	Coal (Rock Canyon)
935.2		0.90	Boney Coal
			Shale, High Carbon Matte

REVISIONS		
NO.	DATE	BY
1		
2		
3		

Soldier Creek Coal Company

SOLDIER CANYON MINE

SCALE:

TITLE: RP2--Rock Canyon--Lithology

DRAWING NO. 2 of 3

DRAWN BY	DATE	CHECKED	DATE	APPROVED	DATE
ACP	5/15/80				

DEPTH (feet)		LITHOLOGIC DESCRIPTION
970.0		
	9.5	Sandstone And Shale Interbedded--Thin Layers Of Carbon Material
		Shale
979.5		Fine Grained Sandstone And Shale Interbedded
980.0		Coal
980.8	0.3	Sandstone And Shale
981.3	0.2	Coal
981.7		Sandstone And Shale
	6.3 (Total)	Coal (Gilson)
984.9	0.2	Rockband
988.0	0.1	Boney
	2.4	Sandy Shale--Solid, No Fracture
990.4		
		Sandstone And Shale Interbedded

REVISIONS		
NO	DATE	BY
1		
2		
3		

Soldier Creek Coal Company

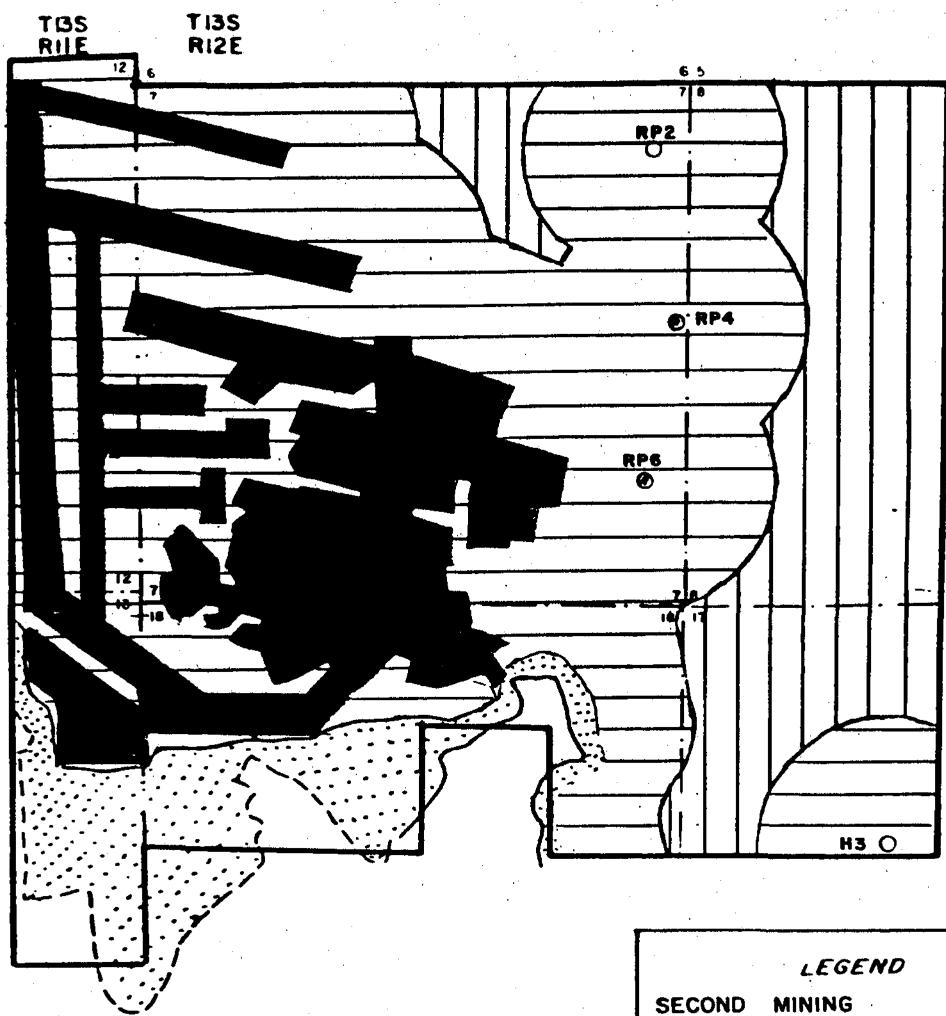
SOLDIER CANYON MINE

SCALE:

TITLE: RP2--Gilson Seam--Lithology

DRAWING NO: 3 of 3

DRAWN BY: ACP | DATE: 5/15/80 | CHECKED: | DATE: | APPROVED: | DATE:



RESERVE BASE	ACRES	AVERAGE THICKNESS	TONS
MEASURED	1,201.20	9.75	17,667,377
INDICATED	334.44	9.22	5,550,053
INFERRED			

LEGEND

- SECOND MINING
- INFERRED OUTCROP
- EXPOSED OUTCROP
- SECTION LINE
- BURNED COAL
- MEASURED RESERVES
- INDICATED RESERVES
- INFERRED RESERVES

1000' 0' 1000' 2000'

1"=2000'

ROCK CANYON SEAM	CARBON COUNTY, UTAH	1711.26 ACRES

REVISIONS

NO.	DATE	BY
1		
3		

LESSEE

CALIFORNIA PORTLAND CEMENT

SOLDIER CREEK COAL COMPANY

SOLDIER CANYON MINE

NAME

TITLE: COAL RESERVE BASE MAP

LEASE NO. SL-051279-063188

POS. MINING ENG. *DATE* *CHECKED* *DATE* *APPROVED* *DATE*

(Fig. 2)

6.5.5 Coal Reserves

This portion of Chapter VI is drawn from U.S.G.S General Mining Order No. 1, as revised.

SUNNYSIDE SEAM

The Sunnyside Seam is the uppermost seam located on the lease. It overlies the Rock Canyon Seam with bed separation ranging from 127 feet (RP2) to 163 feet (RP6). There have been no analysis performed on the Sunnyside coal from our property. Bed thickness used for the reserve calculations came from drill hole data (RP2, 4, 6) and outcrop information.

The seam is minable only on the northern third of the property. The basic criteria used for minability being thickness, with coal under 4 feet being discarded. The Recoverable Reserves were based on the proposed mine plan for the Rock Canyon Seam and columnized workings projected to the Sunnyside Seam. All work is to be room and pillar development and retreat with continuous miners. First mining was projected to extract 45% with second mining areas planned to take 80% overall. The only restricted mining areas being a subsidence barrier under the road and creek where only first mining will be conducted and property barriers where mining is prohibited.

ROCK CANYON SEAM

The Rock Canyon Seam is the middle member of the three minable seams located on the lease. Operations are now being conducted in this seam where approximately 3.4 million tons have been extracted to date. The quality of the coal on an "as received" basis is:

Moisture	6.00%
Ash	12.00%
Volatile	35.50%
Fixed Carbon	46.50%
	100.00%
BTU/lb	11,500
Sulphur	0.50%

Note: Based on 100 plus analyses

Seam thickness used for reserve calculations resulted from drill hole data (RP2, 4, 6, H3), old workings, and outcrop information.

The seam is minable over the entire property except where it thins down to 3 feet in the H3 drill hole. It is the most important seam of the three and the projected mine plan for the Rock Canyon governs all mining on the lease. All development in this seam will also be room and pillar mining with the same extraction percentages being applied. Due to extensive development by the previous owners, second mining will be restricted and in some areas prohibited. Also, the protection of the road and Soldier Creek will be provided by conducting only first mining.

GILSON SEAM

The Gilson Seam is the lowermost seam within the lease and underlies the Rock Canyon Seam with bed separation ranging from 26 feet (RP4) to 48 feet (RP2). As with the Sunnyside, the quality of the Gilson coal has not been analyzed on our property. Reserve calculation criteria for height of coal came from drill hole data (RP2, 4, 6) and outcrop information.

The Gilson Seam appears to be minable over 40% of the lease area. The limiting criteria for mining again being 4 feet of height. The Recoverable Reserves were also based on columnized workings in reference to the Rock Canyon mine plan with the same extraction ratios. Restricted areas for mining in the Gilson include: subsidence barrier for the road and creek, property barriers, and selected areas in the old workings.

6.5.6.1 Reserve Calculations

SUMMARY OF TONNAGES

Seam	Classification	Area (A)	Average Thickness (Feet)	Tonnage	
Sunnyside	Coal Reserve Base				
	Measured	456.84	3.69	3,035,658	
	Indicated	850.78	3.50	5,363,552	
	Inferred	202.00	2.30	836,280	
		1,509.62	3.40	9,235,490	
	Minable Reserve Base				
	Measured	162.17	6.07	1,771,956	
	Indicated	265.69	5.31	2,540,960	
		427.86	5.60	4,312,916	
	Recoverable Reserves				
	Measured	155.76	5.99	1,147,118	
	Indicated	246.53	5.23	1,806,067	
		402.29	5.53	2,953,185	
Rock Canyon	Coal Reserve Base				
	Measured	1,201.20	9.75	17,667,377	(17,089,746)
	Indicated	334.44	9.22	5,550,053	(5,550,053)
		1,535.64	9.63	23,217,430	(22,639,799)
	Minable Reserve Base				
	Measured	1,150.00	10.05	17,390,897	(16,813,266)
	Indicated	334.44	9.22	5,550,053	(5,550,053)
		1,484.44	9.86	22,940,950	(22,363,319)
	Recoverable Reserves				
	Measured	979.92	10.13	11,467,861	(10,890,230)
	Indicated	310.05	9.13	4,075,007	(4,075,007)
		1,289.97	9.89	15,542,868	14,965,237

* The Figures in parentheses represent tonnage revisions which account for tons mined from June 1980 to March 1981. These figures are only approximate.

SUMMARY OF TONNAGES

Seam	Classification	Area (A)	Average Thickness (Feet)	Tonnage
Gilson	Coal Reserve Base			
	Measured	407.27	5.35	3,921,608
	Indicated	913.03	4.98	8,186,045
	Inferred	370.60	3.50	2,334,780
		1,690.90	4.75	14,442,433
	Minable Reserve Base			
	Measured	280.89	6.18	3,125,414
	Indicated	497.20	6.22	5,566,386
		778.09	6.21	8,691,800
	Recoverable Reserves			
	Measured	274.49	6.17	1,919,494
	Indicated	471.15	6.20	3,899,746
		745.64	6.19	5,819,240

6.5.5.2 Coal Quality and Characteristics

See Figure 3.

6.5.6 Adjacent Units

At present the Soldier Canyon Mine is conducting mining operations in the Rock Canyon Seam only. Above the seam a bed of sandstone with interbedded shale and a sandstone layer with carbon material above this are found.

Below the Rock Canyon Seam a layer of boney coal is found directly underneath the seam. Below the boney coal, a layer of shale is located.

6.5.6.1 Rock Characteristics

Rock samples have been taken and will be sent to Ford Laboratory for testing. These results when received will be forwarded to your agency.

6.6 GEOLOGIC EFFECTS OF MINING

6.6.1 Mining Hazards

The geological hazards to surface operations are minimal; to underground operations the hazards are greater, comprising roof falls, methane seepages and water flooding. Precautions taken in the course of mining are aimed at minimizing such underground hazards.

Tests of coal cores from each seam by the U.S. Geological and the Utah Geological and Mineralogical Survey during

SOLDIER CREEK COAL COMPANY
ANALYSIS SHEET

GENERAL

Seam:	Rock Canyon
Location:	Soldier Canyon, Carbon County, Utah
Shipping Point:	Banning, Utah
Origin Railroad:	D & RGW

PROXIMATE ANALYSIS	As Received	Air Dried	Dry Basis
Moisture	7.00%	4.10%	%
Ash	11.20%	11.54%	12.00%
Volatile	35.30%	36.39%	37.94%
Fixed Carbon	46.50%	47.97%	50.06%
	100.00%	100.00%	100.00%
Btu/lb.	11,500	11,890	12,428
Sulphur	0.60%	0.61%	0.63%

ULITIMATE ANALYSIS	Dry Basis
Carbon	71.84%
Hydrogen	5.23%
Nitrogen	1.39%
Chlorine	Trace 0.02%
Sulphur	0.59%
Ash	8.33%
Oxygen (by difference)	12.60%

SULPHUR FORMS	
Pyritic Sulphur	.07%
Organic Sulphur	.53%

ASH MINERAL ANALYSIS	
SO_3 Sulphur Trioxide	3.89%
Al_2O_3 Alumina	18.77%
CaO Lime	6.07%
Fe_2O_3 Ferric Oxide	2.14%
K_2O Potassium Oxide	.27%
Na_2O Sodium Oxide	.63%
P_2O_5 Phosphorous Pentoxide	.14%
MgO Magnesia	1.40%
SiO_2 Silica	65.00%
TiO_2 Titania	.92%
Undetermined	.77%
	100.00%

ASH FUSION TEMP.	Reducing	Oxidizing
Initial Deformation	2340°F	2400°F
Softening (H=W)	2460°F	2540°F
Softening (H=½W)	2540°F	2610°F
Fluid	2660°F	2740°F
Free Swelling Index	2	
T-250 Temperature	2810°F	
Hardgrove Grindability Index	45	
Silica Value	87	

PLASTIC PROPERTIES OF COAL GIESELER PLASTOMETER	
Maximum Fluidity, D.D.P.M.*	2
Initial Softening Temperature, (1 DDPM) oC	416
Maximum Fluid Temperature, oC	421
Solidification Temperature, oC	454
Temperature Range, oC	38

*1 Dial Division Per Minute at 40 Gram Inches Torque

7/30/80

(Fig. 3)

1975 disclosed the presence of methane gas in each seam. Adequate ventilation is planned to mitigate any methane hazard.

<u>Subsidence</u>: Types and patterns of subsidence depend on mine geometry, strengths of rocks, thickness and configuration of overburden and the methods and percent extraction of coal.

The minable coal deposits of the Rock Canyon and Gilson seams extend from the outcrops over a distance of 20,000 feet to a depth of 3,000 feet. The uppermost Sunnyside seam does not become minable until a depth of 1,200 feet is reached.

There is a risk of subsidence when mining coal under the sharp and steep scarp of the Book Cliffs. Sloughing has occurred under such conditions at both Kaiser and U.S. Steel to the east. Such sloughing is the result of subsidence attributable to mining too much coal near the outcrops.

About 200 feet above the coal seams is the massive Castlegate sandstone, 200 feet thick. This strong sandstone member will resist subsidence. Subsidence will occur possibly at a rate that might be expressed in inches per year rather than feet per year. Subsidence will not be uniform.

Soldier Canyon Mine plans call for the columnization of workings on the three seams so far as any multiple seam mining occurs.

The land-use areas are outside the Book Cliffs scarp and there are no landslide hazards. Similarly, all operations on these areas are surface operations and subsidence is not a hazard as it is in the underground operations. A possible hazard is that of flooding during and after a major storm. This hazard is not considered severe as the maximum recorded rainfall at Price is 1.24" in 24 hours.

6.6.2 Surface Hazards

The geologic hazards to surface operations will be minimal. There are no buildings or surface structures that lie above the coal-bearing formations within the lease boundaries or the additional affected surrounding areas. Adequate protection barriers will be left unmined in the coal seams to protect Soldier Creek and the gas supply line that runs along Soldier Creek. All surface springs will be located and monitored for quality and flow.

6.6.3 Impacts of Mining

See 6.6.1 and 6.6.2.

6.7 INFORMATION SOURCES

Soldier Creek Coal Company investigations and private studies.

U.S.G.S.

General Mining Order No. 1

Vaughn Hanson Associates

January 1980

CHAPTER VII

"HYDROLOGY"

CHAPTER VII

Hydrology

7.1 GROUNDWATER HYDROLOGY

The information for this section is contained in the following reports.

7.1.0 Scope
&
7.1.1 Methodology

The Hydrology of the Soldier Canyon Mine permit area has been researched by Vaughn Hansen Associates. Combined with this hydrological study the Vaughn Hansen Associates study established an approved run-off control plan for the Soldier Canyon Mine. These reports and pertinent correspondence with different government agencies are located in this chapter.

It should be noted that Soldier Canyon Mine purchases all of its culinary water and all waste water is treated and then pumped into the mine. Mine water is later discharged under an approved N.P.D.S. discharge plan.

7.2 SURFACE WATER HYDROLOGY
&
7.3 ALLUVIAL VALLEY FLOOR DETERMINATION

The information for these sections is contained in the following reports.

Scott M. Matheson
Governor

James O. Mason, M.D., Dr.P.H.
Executive Director
801-533-6111

DIVISIONS

Community Health Services
Environmental Health
Family Health Services
Health Care Financing and Standards

OFFICES

Administrative Services
Health Planning and Policy Development
Medical Examiner
State Health Laboratory

STATE OF UTAH
DEPARTMENT OF HEALTH
DIVISION OF ENVIRONMENTAL HEALTH
150 West North Temple, P.O. Box 2500, Salt Lake City, Utah 84110

James D. Clise, Director
Room 426 801-533-6121

(801) 533-6146

September 12, 1979

Soldier Creek Coal Mine
P.O. Box 1
Price, Utah 84501

RE: Sedimentation Basins

Gentlemen:

We have reviewed the plans and engineer's report for the Soldier Creek Coal Company surface runoff sedimentation basin. Figures 7, 8, 21 and the Vaughn Hansen Associate's Soldier Canyon Mine Runoff Control Plan were reviewed.

As a result of our review, the plans for the Soldier Canyon Mine sedimentation basin are approved and a construction permit as constituted by this letter is hereby issued.

The pond is to provide 1.8 acre feet settling volume for the mine disturbed area runoff from a ten-year 24-hour 2.1 inch rainfall. This pond is to have a dewatering outlet located 5.7 feet above the bottom and a minimum of three feet above the maximum sediment level. An emergency spillway pipe will also be provided at an outlet level of ten feet.

Issuance of this construction permit is not an approval of resulting effluent quality. Should the effluent not meet state or federal standards, you must provide the necessary additional treatment.

We also request that you sample and submit a monthly report of twice weekly effluent analyses for BOD, TSS, Total Coliform and Fecal Coliform of the treated sanitary wastewater used in the mine for dust suppression. The wastewater effluent must meet the Standards as indicated in section 1.4.6 of the enclosed Wastewater Disposal Regulations. Please contact this office if you have any questions regarding this matter.

Sincerely,

UTAH WATER POLLUTION COMMITTEE

Calvin K. Sudweeks
Executive Secretary

RECEIVED
SEP 13 1979
SC3

cc: Oil, Gas and Mining
EPA/Salt Lake City
Southeast 208

SM:lp

Soldier Creek Coal Co
Copy.

United States Department of the Interior
OFFICE OF SURFACE MINING
Reclamation and Enforcement
POST OFFICE BLDG. RM. 270
1823 STOUT STREET
DENVER, COLORADO 80202

OFFICE OF THE REGIONAL DIRECTOR

7 SEP 1979

Mr. Ron Daniels
Staff Assistant
Division of Oil, Gas, and
Mining
Department of Natural Resources
1588 West North Temple
Salt Lake City, Utah 84116

Reference: Runoff Control Plans, Soldier Creek Coal,
Soldier Canyon Mine ACT/007/018

Dear Mr. Daniels:

We are hereby providing approval of the runoff control plan as proposed by Soldier Creek Coal for the Soldier Canyon Mine. Due to the rugged topography and the desire to disturb the minimal amount of surface lands, the location of the proposed sediment pond will be acceptable. This approval is subject to approval and any additional stipulations provided by the Geological Survey or the Bureau of Land Management.

This plan was submitted in correspondence to OSM from Mr. Suchoski of your staff on July 20, 1979. It was enjoyable to review such a well presented and thought out sediment control plan as submitted by Soldier Creek Coal.

Copies of this letter are enclosed for transmittal to the applicant by your office.

Sincerely,

DONALD A. CRANE

Enclosure

cc: Howard, BLM (1)
Feldmiller, USGS (2)
Daniels, UT-NS (2)
BLM District, Moab (1)
Moffit, USGS (1)

RECEIVED
SEP 19 1979
SC³

SCOTT M. MATHESON
Governor

GORDON E. HARMSTON
Executive Director,
NATURAL RESOURCES

CLEON B. FEIGHT
Director

STATE OF UTAH
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF OIL, GAS, AND MINING
1588 West North Temple
Salt Lake City, Utah 84116
(801) 533-5771

November 23, 1979

Mr. Carl Pollastro
Mine Engineer
Soldier Creek Coal Company
P.O. Box I
Price, Utah 84501

RE: Runoff Plans Approval
Soldier Canyon Mine
Soldier Creek Coal Company
Carbon County, Utah
ACT/007/018

Dear Carl:

The Division staff has completed its review of the Runoff Control Plan for the Soldier Canyon Mine prepared by Vaughn Hansen Associates.

Approval of the plans is hereby issued. Copies of the approvals from the Division of Water Rights, the Department of Health and the Office of Surface Mining are enclosed for your records.

The only concern expressed by the Division is with the revegetation seed mix. The plans specify the use of Range-type Alfalfa, the Division would recommend the use of Ladak, Nomad or Rambler Alfalfa.

If there are any questions, please contact the Division.

Sincerely,

Thomas J. Suchoski

THOMAS J. SUCHOSKI
RECLAMATION HYDROLOGIST

Enclosure: Approval Letters (3)

cc: Don Crane, O.S.M., Region V

TJS/te

STATE OF UTAH
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF WATER RIGHTS
200 EMPIRE BUILDING
231 EAST 400 SOUTH
SALT LAKE CITY, UTAH 84111
(801) 533-6071

DEE C. HANSEN
STATE ENGINEER

EARL M. STAKER
DEPUTY

DIRECTING ENGINEERS
HAROLD D. DONALDSON
DONALD C. NORSETH
STANLEY GREEN
ROBERT L. MORGAN

August 7, 1979

Soldier Creek Coal Co.
Soldier Creek Mine
P.O. Box 1
Price, UT 84501

Re: Runoff Control Plan

Gentlemen:

We have completed a review of the data submitted July 30, 1979 concerning the above mentioned project. It is our opinion that the proposed dam does not present a threat to life or property and therefore approval by the State Engineer of construction is not necessary.

We would request that the office be supplied with the final plan if it differs from that submitted.

Sincerely,

Robert L. Morgan
Dam Safety Engineer

RLM/mj

cc: Division of Oil, Gas & Mining
Vaughn Hansen Associates
Price Area Office

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION VIII
1860 LINCOLN STREET
DENVER, COLORADO 80203

RECEIVED
JUL 30 1979
SC³

APPLICANT:
Mr. A.C. Pallastro
Chief Mining Engineer
Soldier Creek Coal Co.
P.O. Box "I"
Price, Utah 84501

FACILITY:

Soldier Creek Coal Company

Receipt of your application is hereby acknowledged.

The application has been assigned the following serial number:

UT-0023680

Please refer to this number in future correspondence.

Prior to the issuance of a permit, representatives of this Agency will contact you and advise you of the effluent limitations which will be included in your permit. If you have any questions, please write to this office or call (303) 837-3874.

Sincerely yours,

Roger E. Frenette, Chief
Permits Administration and Compliance Branch
Enforcement Division

cc: Utah State Department of Health

Mrs. Catherine V. Chachas
State Engineer

SOLDIER CANYON MINE

RUNOFF CONTROL PLAN

Prepared for

SOLDIER CREEK COAL COMPANY

Price, Utah

By

VAUGHN HANSEN ASSOCIATES

Salt Lake City, Utah

July 1979

TABLE OF CONTENTS

Certified: Vaughn E. Hansen

Vaughn E. Hansen
Registered Professional Engineer
State of Utah No. 1298

LIST OF FIGURES

LIST OF FIGURE (cont)

LIST OF TABLES

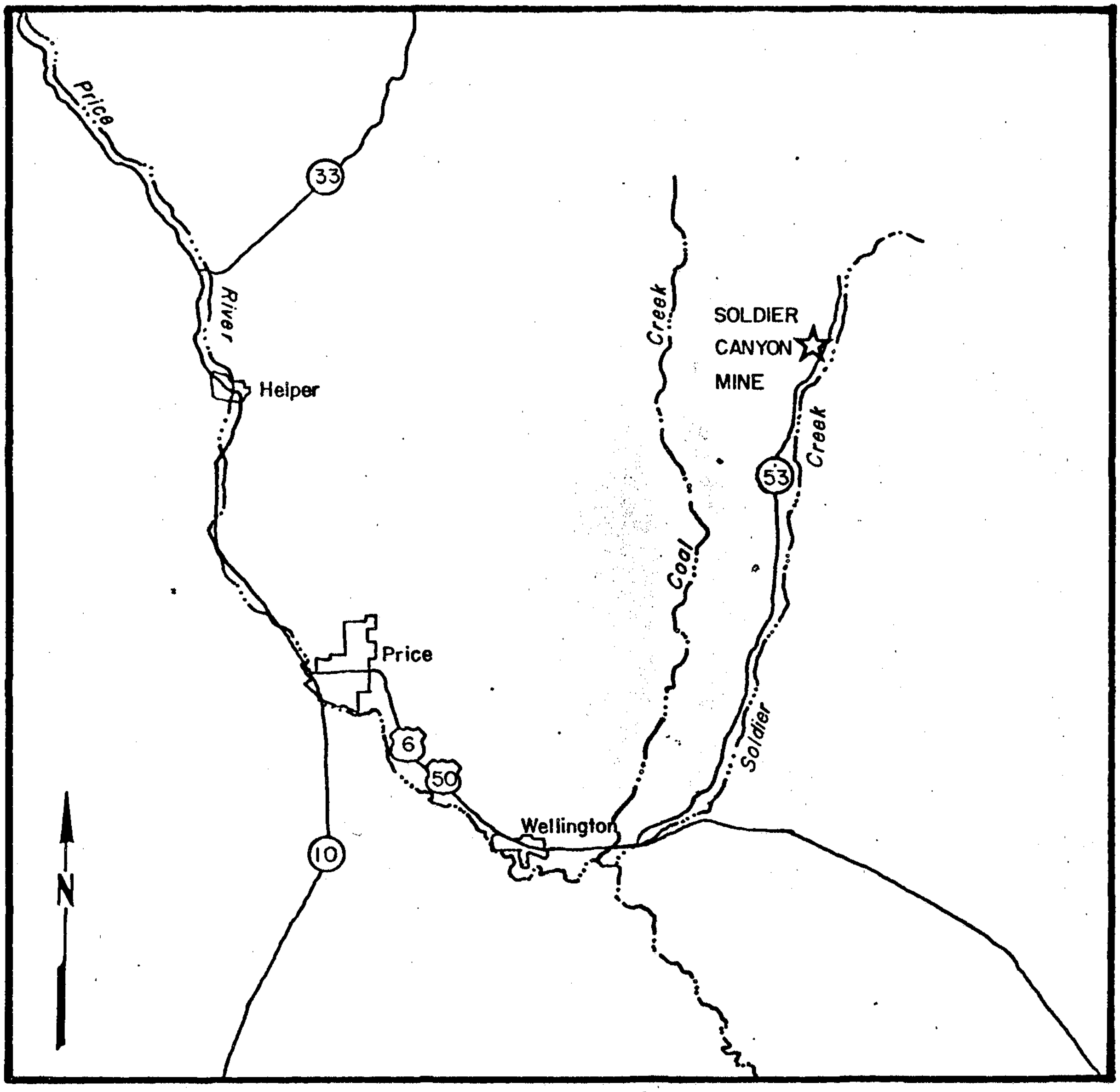
SOLDIER CANYON MINE

RUNOFF CONTROL PLAN

INTRODUCTION

Recent regulations promulgated by the U.S. Office of Surface Mining Reclamation and Enforcement (OSM) require that water which flows across areas disturbed by coal mining pass through a sediment control device. In accordance with this mandate, Soldier Creek Coal Company recently constructed a temporary sedimentation pond below their Soldier Canyon Mine facilities near Price, Utah (see attached figure 1). Plans were then initiated to design the pond to meet OSM requirements and serve as a long term structure. The firm of Vaughn Hansen Associates was retained to provide the following:

1. Assessment of the adequacy of existing and proposed runoff conveyance structures (ditches and culverts) leading into the pond area for passing the design storm peak flows;
2. Hydrographs of Soldier Creek resulting from the 10-year, 24-hour and 25-year, 6-hour storms, with flow depths in relation to the sedimentation pond;
3. Hydrographs of flows entering the proposed pond resulting from the 10-year, 24-hour and 25-year, 6-hour storms;
4. Pond sediment storage requirements;
5. Pond design, suitable for construction;
6. Sediment disposal plans;
7. Temporary and final reclamation and revegetation plans for the sediment pond; and
8. Pond discharge monitoring plan and a copy of the NPDES discharge permit application, if required.



Scale 1: 250,000

Location of the Soldier Canyon Mine.

Prior to the final preparation of this report, appropriate information presented herein was discussed not only with coal company representatives but also the agencies involved with regulations concerning the pond construction and operation. Informal discussions were held with the Utah Division of Oil, Gas, and Mining (Tom Suchoski and Mike Thompson), the Utah Division of Water Rights (Bob Morgan), and the Utah Division of Health (Steve McNeal).

METHODS

The runoff volume resulting from a particular rainfall depth was determined using the runoff curve number technique, as defined by the U.S. Soil Conservation Service (1972). According to the curve number methodology, the algebraic and hydrologic relations between storm rainfall, soil moisture storage, and runoff can be expressed by the equations

$$Q = \frac{(P-0.2S)^2}{P+0.8S} \qquad (1)$$

and

$$CN = \frac{1000}{10+S} \qquad (2)$$

where Q is the direct runoff volume, in inches; P is the storm reainfall depth, in inches; S is a watershed storage factor, in inches, defined as the maximum possible difference between P and Q; and CN is a dimensionless expression of S referred to as the curve number. Curve number values were chosen using information supplied by the U.S. Soil Conservation Service (1972), Hawkins (1973), and personal hydrologic judgement following field observations. Values of P were obtained for selected durations and return periods from Richardson (1971), as reported for the Soldier Summit, Utah station (See Table 1).

Estimates of the peak discharge to be expected from various precipitation events were made using the dimensionless hydrograph method illustrated in Figure 1 which was developed by the U.S. Soil Conservation Service (1972). In this figure, D is the duration of excess rainfall; T_c is the time of concentration, T_p is the time of peak; T_r is the time of recession; T_b is the time of base, with all time units in hours; and q_p is the peak discharge, in cubic feet per second. Five separate hydrograph families have been developed by the U.S. Soil Conservation

Table 1. Estimated precipitation depths, in inches, for various return periods and durations at Soldier Summit, Utah (from Richardson, 1971).

RETURN PERIOD (years)	DURATION 5 Min	10 Min	15 Min	30 Min	1 Hr	2 Hr	3 Hr	6 Hr	12 Hr	24 Hr
1	.21	.32	.41	.57	.72	.77	.81	.93	1.03	1.14
2	.23	.36	.45	.62	.79	.86	.93	1.10	1.25	1.41
5	.26	.40	.50	.70	.88	.99	1.09	1.34	1.57	1.80
10	.28	.43	.55	.76	.96	1.09	1.21	1.52	1.79	2.08
25	.30	.47	.59	.82	1.04	1.21	1.36	1.76	2.11	2.48
50	.33	.51	.64	.89	1.13	1.32	1.50	1.96	2.37	2.79
100	.36	.55	.70	.97	1.23	1.44	1.65	2.16	2.62	3.09

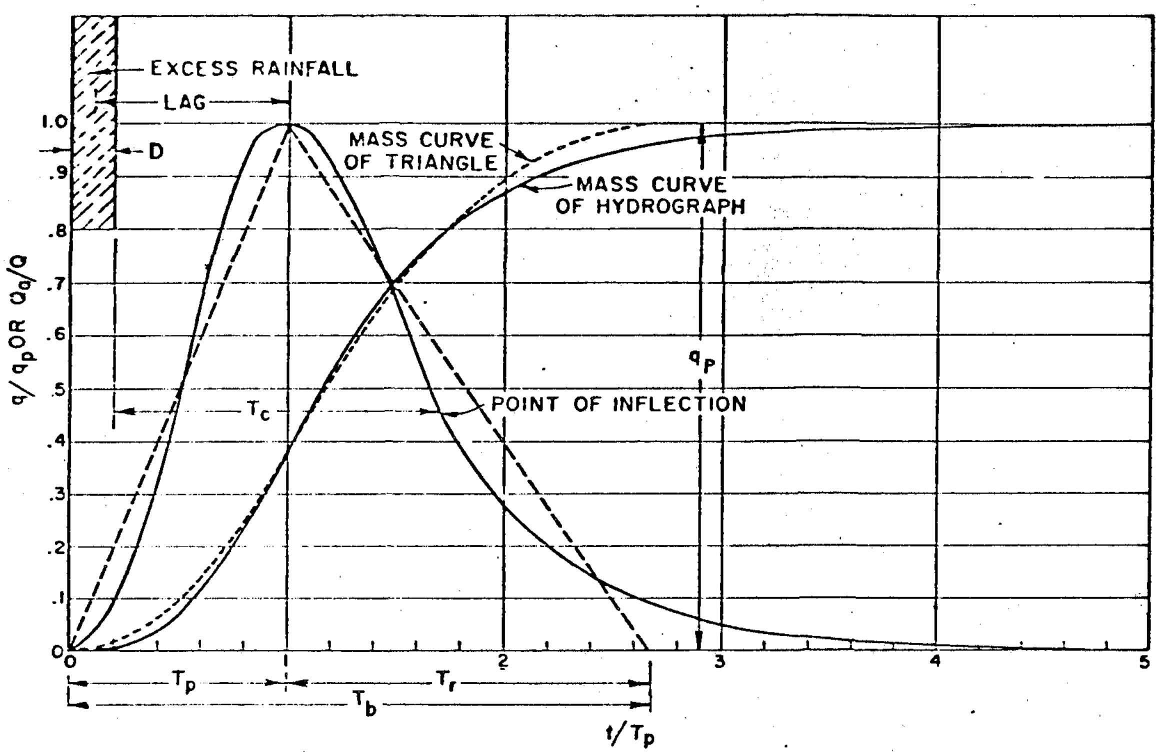


Figure 1. Dimensionless curvilinear unit hydrograph and equivalent triangular hydrograph (from U.S. Soil Conservation Service, 1972).

Service (1972), with the selection of the family of curves to be used based on the curve number and rainfall depth as given in Figure 2. According to the dimensionless hydrograph method, one discharge and two time constants are determined from empirical equations and storm distributions. The constans are multiplied by increments of discharge and time from the dimensionless hydrograph to obtain the plotting points of the synthetic hydrograph. Hydrographs from various heterogeneous upstream areas contributing to the same structure (sedimentation pond or culvert) were determined separately for this investigation and added to obtain a composite hydrograph and peak discharge. Because individual hydrographs were not routed through conveyance structures or the proposed pond (see Figure 3), the synthetic peak is considered to be a conservative estimate.

The discharge constant used in the dimensionless hydrograph method is determined according to the equation

$$q = \frac{484\ A\ Q}{T_p} \qquad (3)$$

where q is the peak discharge constant, in cubic feet per second; A is the drainage area, in square miles; Q is the runoff volume, in inches (as determined by equation 1); T_p is the time elapsed from the beginning of runoff to the hydrograph peak, in hours; and 484 is a constant. T_p is assumed to be a function of watershed lag, which is determined according to the equation

$$L = \frac{(\ell^{0.8})\quad (S + 1)^{0.7}}{1900\ Y^{0.5}} \qquad (4)$$

where L is the watershed lag, in hours; ℓ is the hydraulic length, or the length of the mainstream to the farthest divide, in feet; S is as previously defined; and Y is the average watershed slope, in percent. Values of Y were obtained by measuring the lengths (in feet) of selected contour lines within the drainage boundary, multiplying by the selected conrour interval (in feet), dividing by

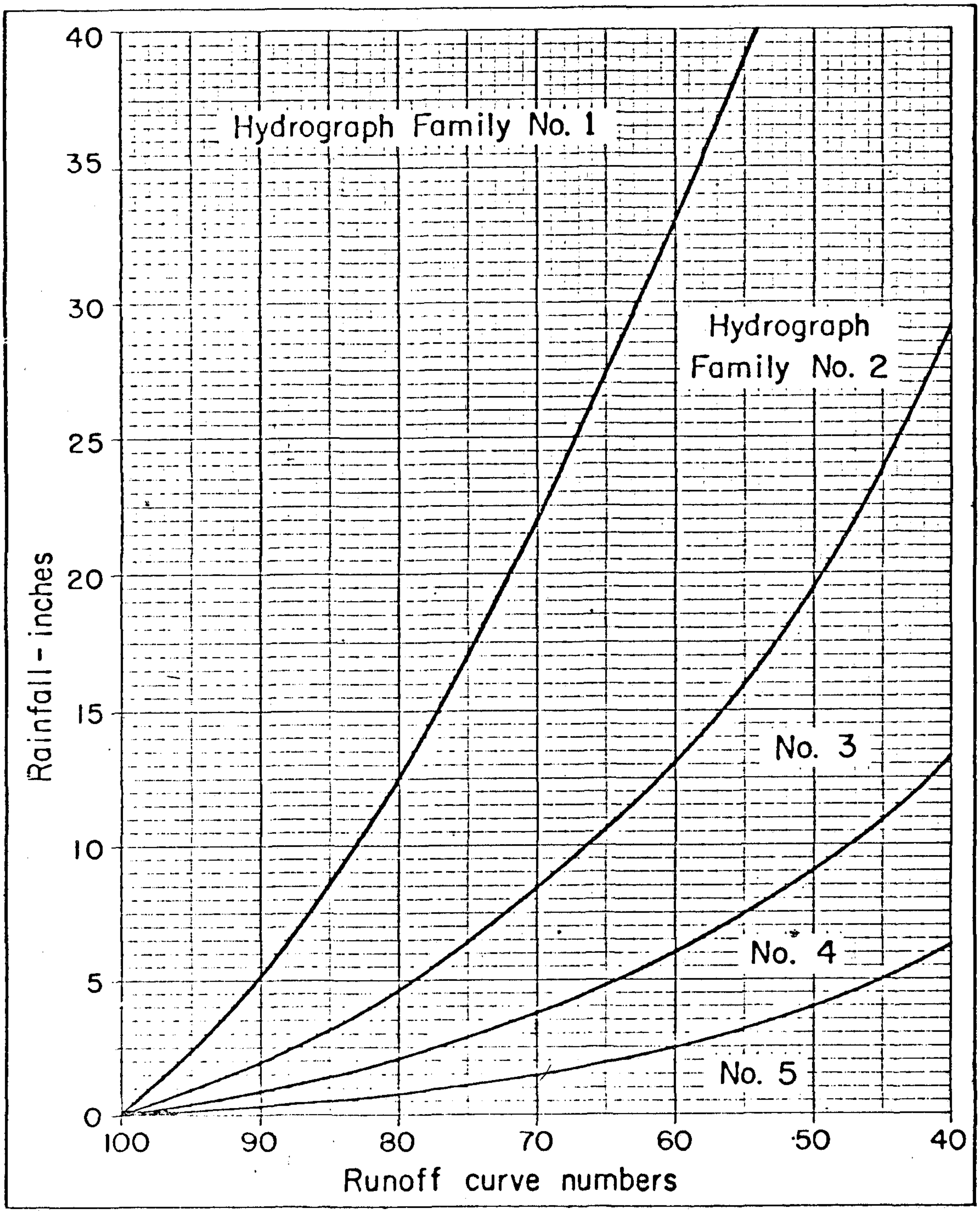


Figure 2. Chart for selecting a hydrograph family for a given rainfall and runoff curve number (from U.S. Soil Conservation Service, 1972).

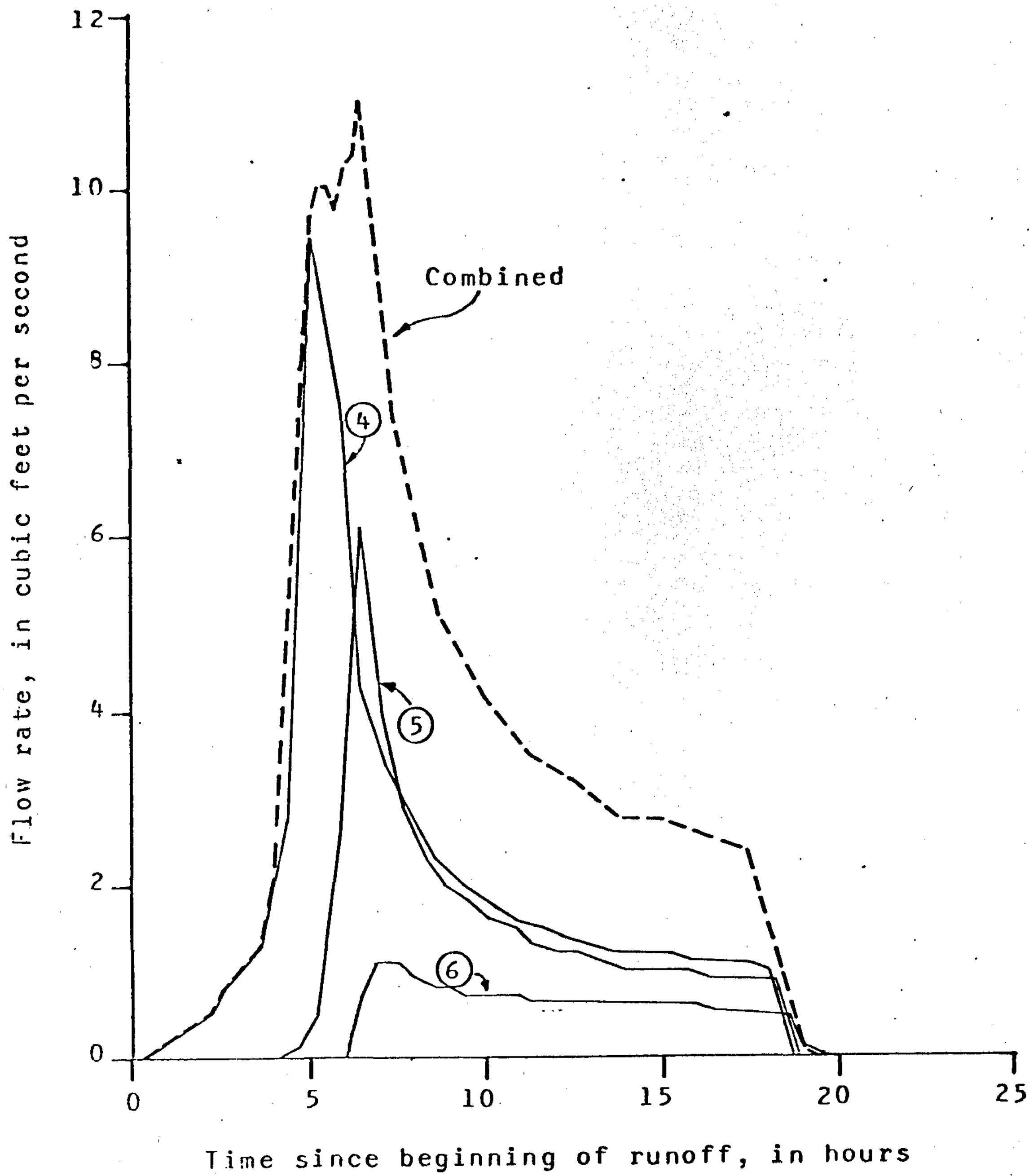


Figure 3. Sample individual and composite hydrographs of a complex watershed.

the drainage area (in square feet), and multiplying by 100. The hydraulic length was taken from an appropriate topographic map while S was determined from equation 2 once the runoff curve number had been estimated.

According to the U.S. Soil Conservation Service (1972), the watershed lag is equal to 0.6 T_c and the time to peak is equal to 0.7 T_c. Combining these two expressions it can be seen that

$$T_p = 1.17L \tag{5}$$

where both variables are as previously defined.

The two time constants utilized in the dimensionless hydrograph method are T_p (derived according to equation 5) and T_o or D, the duration of excess rainfall. This latter value was determined using the theoretical Type II storm distribution shown in Figure 4 for 24-hour storms and the design distribution shown in Figure 5 for 6-hour storms. According to the curve number method, sufficient precipitation must fall to satisfy initial watershed abstractions before runoff will begin. This depth of rainfall is taken as 0.2S (U.S. Soil Conservation Service, 1972), where S is as previously defined. Dividing 0.2S by the total storm depth results in a ratio which can be found on the ordinate of either Figure 4 or 5, depending upon the storm duration. The corresponding time on the abscissa of the appropriate figure is the theoretical time from the beginning of rainfall to the beginning of runoff. Subtracting this value from the storm duration results in T_o. Thus, if the runoff curve number for a particular watershed near the Soldier Canyon Mine is 75, S = 3.33 and 0.2S = 0.67. The duration of excess rainfall for the 10-year, 24-hour storm is found by dividing 0.67 by 2.08, entering Figure 4 with the resulting ratio (0.32) and reading

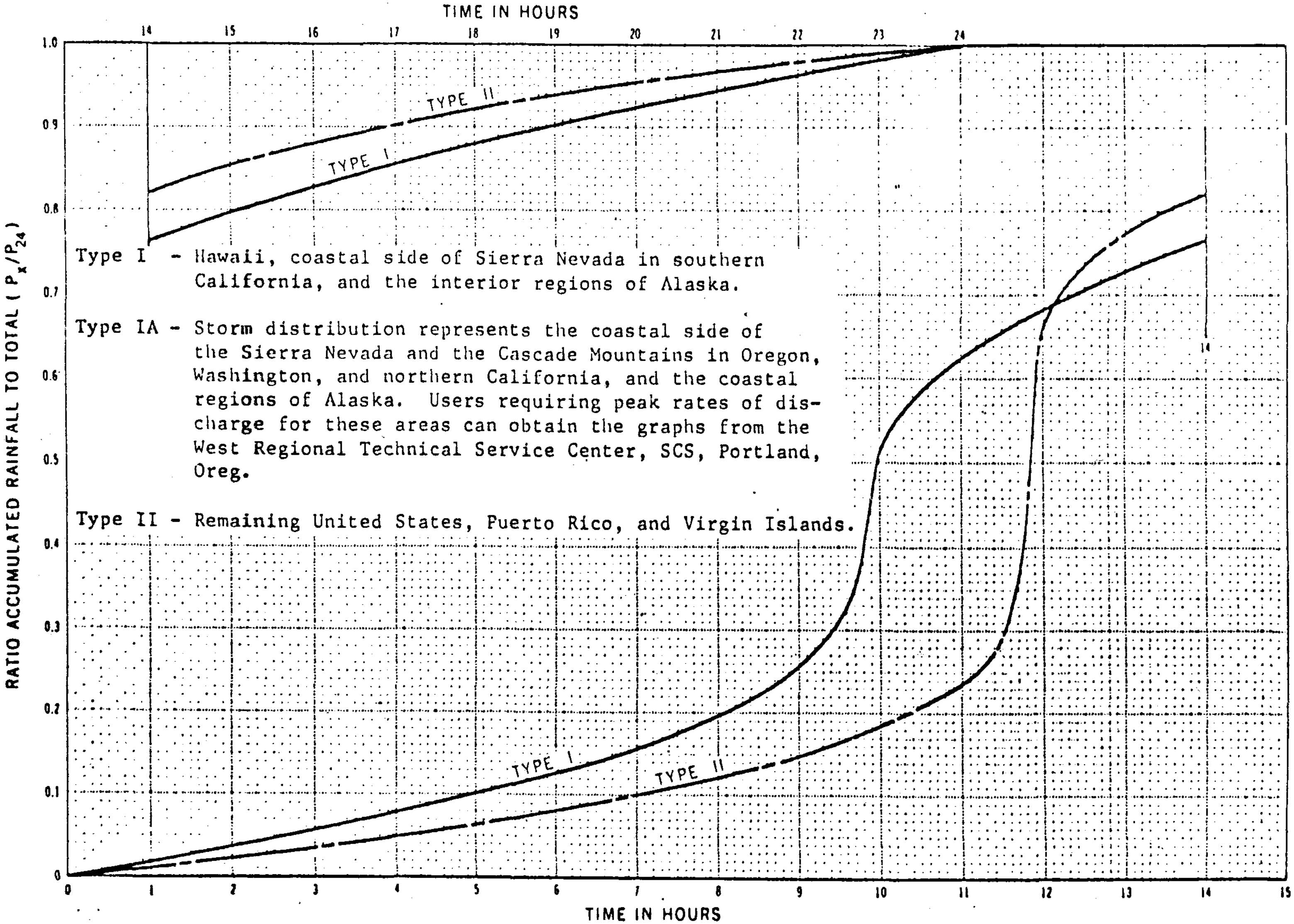


Figure 4. Twenty-four-hour rainfall distributions (from Kent, 1973).

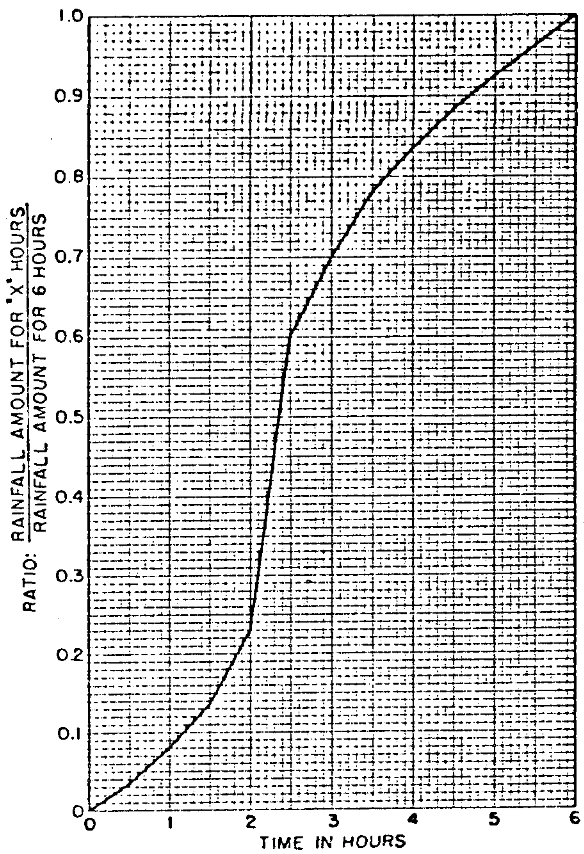


Figure 5. Six-hour design rainfall distribution (from U.S. Soil Conservation Service, 1972).

the corresponding storm duration during which no runoff occurs from the Type II storm curve (11.6 hours). Substracting this value from 24 results in an excess rainfall duration of 12.4 hours. A similar method is followed for the 6-hour storm.

Following the determination of a given peak discharge, design sizes for culverts used for ephemeral runoff diversions and conveyance were determined using methods derived by the U.S. Bureau of Public Roads as presented by the U.S. Soil Conservation Service (1972) and illustrated in Figure 6. Inlet control was assumed in all cases.

Open channel flow capacities have been determined using the Manning equation. According to this method,

$$V = \frac{1.486}{n} R^{0.67} S^{0.50} \tag{6}$$

where V is the velocity, in feet per second; n is the Manning roughness coefficient; R is the hydraulic radius, in feet, defined as the area divided by the wetted perimeter; and S is the hydraulic slope, in feet per foot. Estimates of the roughness coefficient were derived according to methods developed by the U.S. Soil Conservation Service (1956) and compared with tabular information presented by Posey (1950). The velocity obtained by equation 6 was converted to a flow rate using the continuity equation, which states that

$$q = AV \tag{7}$$

where q is the discharge, in cubic feet per second; A is the cross-sectional area of flow, in square feet; and V is the velocity, in feet per second.

The stage-discharge relation of the corrugated metal riser and conduit used for the pond spillway was determined by methods outlined by Mynear and Haan (1977),

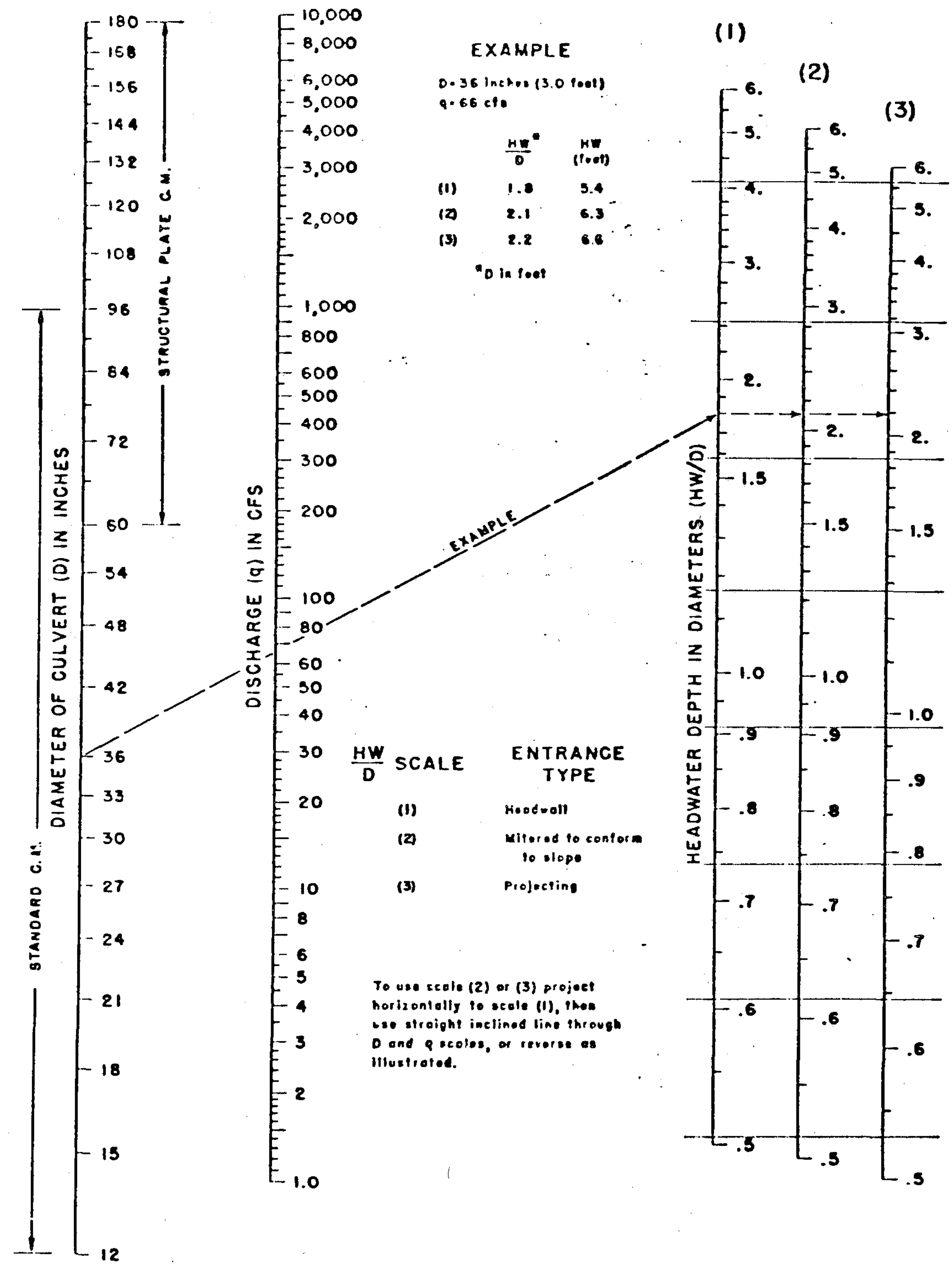


Figure 6. Headwater depth for corrugated metal pipe culverts with inlet control (U.S. Soil Conservation Service, 1972).

who state that the discharge of the spillway is calculated as the smallest of the possible flows due to weir flow, orifice flow, or pipe flow at any stage. The coefficients suggested by Mynear and Haan (1977) were used in the appropriate equations.

Weir flow is determined by the equation

$$q = CLH^{3/2} \tag{8}$$

where q is a previously defined; C is a coefficient determined by entrance conditions (3.2 in this case); L is the length of the weir crest, in feet, or the circumference of the riser; and H is the head of water above the riser inlet.

Orifice flow occurs when the flow is restricted by the opening and can be determined as

$$q = CA\ (2gH)^{1/2} \tag{9}$$

where q is as previously defined; C is a coefficient dependant upon the orifice geometry (0.6 in this case); A is the cross sectional area of the opening, in square feet; g is the gravitational constant (32.2 feet per second squared); and H is the head above the orifice inlet, in feet. The orifices considered are the riser inlet and the inlet of the conduit leading from the riser through the pond embankment.

Pipe flow occurs when the friction of the pipe controls the flow. According to Mynear and Haan (1977), this flow type can be described by

$$q = \frac{A\ (2gH)^{1/2}}{(1 + K_e + K_b + K_c\ L)^{1/2}} \tag{10}$$

where q, A, g, and H are as previously defined; K_e is an entrance loss coefficient (0.5 in this case); K_b is a correction factor for energy loss in bends (0.0 in this case); K_c is a friction factor; and L is the pipe length, in feet. K_c can be determined by the equation

$$K_c = \frac{5087\ n^2}{d^{4/3}} \tag{11}$$

where n is Manning's roughness coefficient and d is the inside diameter of the pipe, in inches.

In determining the capacity of the existing conveyance structures, it was necessary to consider not only the desing flow but also the sediment load associated with that flow. The sediment yield resulting from an individual storm was determined using a modified form of the Universal Soil Loss Equation as developed by Williams (1975). According to this method

$$S = 95\ (Q \cdot q_p)^{0.56} \cdot K \cdot LS \cdot C \cdot P \tag{12}$$

where S is the sediment yield, in tons; Q is the runoff volume, in acre-feet; q_p is the peak flow rate, in cubic feet per second; K is the soil erodibility factor; LS is the slope length and gradient factor; C is the cropping management factor; and P is the erosion control practice factor.

The slope length and gradient factor (LS) was digitized for this investigation according to methods outlined by Clyde et al. (1978) which state that

$$LS = \left(\frac{650 + 450s + 65s^2}{10,000 + s^2}\right) \left(\frac{\ell}{72.6}\right) \tag{13}$$

where s is the slope steepness, in percent; ℓ is the slope length, in feet; and m is an exponent dependant upon slope steepness (0.6 in this case). The slope length (ℓ) was determined according to the equation (Williams and Berndt, 1972)

$$\ell = \frac{0.5\ A}{L_c} \tag{14}$$

where A is the drainage area, in aquare feet, and L_c is the total length of channels in the watershed, in feet.

The sediment transport capacity of the conveyance structures was determined using the similitude principles outlined by Colemen et al.(1975). This technique relies on the use of a sediment transport similitude number which is defined according to the equation

$$A_L = \frac{\rho_s - \rho_w}{\rho_w} \cdot \frac{L}{\rho_s\ g\ Y\ V} \tag{15}$$

where A_L is the sediment transport similitude number; ρ_s and ρ_w are the sediment and water densities, respectively, in slugs per cubic foot (equal to 5.14 and 1.95, respectively); g is the gravitational constant (32.2 feet per second squared); Y is the flow depth, in feet; and V is the mean flow velocity, in feet per second.

This similitude term has been found to correlate with the Froude number,

$$F = \frac{V}{(gY)^{1/2}} \tag{16}$$

and the boundary condition similitude number,

$$D = \frac{g^{1/3}\ d_{50}}{\nu^{2/3}} \tag{17}$$

where d_{50} is the median particle diameter of the sediment, in feet, and ν is the kinematic viscosity of the water in the channel, in square feet per second. Values of A_L as a function of F and D can be taken from Table 2.

Table 2. Values of A_L for values of F and D (from Coleman et al., 1975)

Value of F	Value of D										
	2	3	4	5	6	7	8	9	10	11	12
0.2	5.0×10^{-4}	9.0×10^{-6}	2.7×10^{-6}	1.3×10^{-6}	9.2×10^{-7}	9.9×10^{-7}	9.2×10^{-7}	1.5×10^{-6}	....	....	....
.3	7.4×10^{-4}	2.4×10^{-4}	8.5×10^{-5}	3.8×10^{-5}	2.7×10^{-5}	2.4×10^{-5}	3.2×10^{-5}	8.5×10^{-5}	1.0×10^{-4}	7.6×10^{-5}	....
.4	1.2×10^{-3}	6.8×10^{-4}	4.2×10^{-4}	2.8×10^{-4}	2.2×10^{-4}	2.1×10^{-4}	3.6×10^{-4}	6.5×10^{-4}	6.7×10^{-4}	5.1×10^{-4}	3.2×10^{-4}
.5	1.5×10^{-3}	9.6×10^{-4}	6.4×10^{-5}	5.0×10^{-4}	4.4×10^{-4}	5.1×10^{-4}	8.9×10^{-4}	1.1×10^{-3}	1.1×10^{-3}	8.7×10^{-4}	6.6×10^{-4}
.6	2.1×10^{-3}	1.4×10^{-3}	9.2×10^{-5}	7.5×10^{-4}	6.5×10^{-4}	1.0×10^{-3}	1.4×10^{-3}	1.5×10^{-3}	1.4×10^{-3}	1.1×10^{-3}	9.4×10^{-4}
.7	3.2×10^{-3}	1.9×10^{-3}	1.3×10^{-3}	1.0×10^{-3}	9.8×10^{-4}	1.4×10^{-3}	1.7×10^{-3}	1.8×10^{-3}	1.7×10^{-3}	1.5×10^{-3}	1.2×10^{-3}
.8	5.2×10^{-3}	3.0×10^{-3}	2.0×10^{-3}	1.5×10^{-3}	1.4×10^{-3}	1.7×10^{-3}	2.1×10^{-3}	2.2×10^{-3}	2.1×10^{-3}	1.8×10^{-3}	1.6×10^{-3}
.9	9.0×10^{-3}	5.4×10^{-3}	3.3×10^{-3}	2.4×10^{-3}	2.0×10^{-3}	2.1×10^{-3}	2.5×10^{-3}	2.5×10^{-3}	2.4×10^{-3}	2.3×10^{-3}	2.0×10^{-3}
1.0	1.6×10^{-2}	1.0×10^{-2}	6.0×10^{-3}	4.0×10^{-3}	2.9×10^{-3}	2.6×10^{-3}	3.0×10^{-3}	3.0×10^{-3}	2.8×10^{-3}	2.6×10^{-3}	2.4×10^{-3}
1.1	....	....	1.3×10^{-2}	6.7×10^{-3}	4.2×10^{-3}	3.6×10^{-3}	3.7×10^{-3}	3.6×10^{-3}	3.5×10^{-3}	3.3×10^{-3}	3.0×10^{-3}
1.2	....	....	2.8×10^{-2}	1.2×10^{-2}	6.5×10^{-3}	5.0×10^{-3}	4.7×10^{-3}	4.5×10^{-3}	4.3×10^{-3}	4.0×10^{-3}	3.8×10^{-3}
1.3	....	....	....	....	....	7.3×10^{-3}	6.3×10^{-3}	5.7×10^{-3}	5.4×10^{-3}	5.0×10^{-3}	4.9×10^{-3}
1.4	....	....	....	....	....	1.1×10^{-2}	8.4×10^{-3}	7.4×10^{-3}	6.8×10^{-3}	6.5×10^{-3}	6.5×10^{-3}
1.5	....	....	....	....	....	1.8×10^{-2}	1.2×10^{-2}	1.0×10^{-2}	9.0×10^{-3}	8.8×10^{-3}	8.8×10^{-3}

The basic equation of sediment transport is derived from equation 15 and states that

$$L = A_L \frac{\rho_s \ \rho_w}{\rho_s - \rho_w} gYV \tag{18}$$

or

$$L = 3.12 \ A_L gYV \tag{19}$$

if the appropriate density values are inserted.

RESULTS AND DISCUSSION

Conveyance Structure Adequacy

The existing system used to convey runoff water through the yard towards the temporary sedimentation pond consists of 24-inch corrugated metal culverts, grate covered concrete ditches (18-inches by 18-inches), berms, and cobble-stone lined open channels (see Figure 7). The system captures and conveys water not only from the yard area but also a 128-acre undistrubed watershed to the west of the yard. The structures appear adequate for conveying runoff water generated within the yard but were investigated for their adequacy in conveying the runoff water and sediment generated in the large, undisturbed drainage area (watershed No. 2). The 25-year, 6-hour storm runoff was used for this analysis.

The drainage boundary and characteristics of watershed No. 2 are shown in Figure 8. These characteristics were utilized in the appropriate equations of the dimensionless hydrograph technique to derive the hydrograph resulting from the 25-year, 6-hour storm (see Appendix A). The resulting peak flow is 16.0 cubic feet per second with a runoff volume of 2.87 acre-feet.

The modified Universal Soil Loss Equation described by equation 12 was used to predict the sediment load resulting from the 25-year, 6-hour storm runoff. The discharge values have been noted. These and the remaining factors and their use rational are found in Table 3. In determining the value of the slope length and gradient factor (LS), the near vertical sandstone cliffs in the drainage area (see Figure 8) were ignored because of their presumed insignificant contribution to the sediment load. The cropping management

Table 3. Sediment yield from watershed No. 2 resulting from the 25-year, 6-hour storm runoff event.

Equation: $S = 95\,(Q \cdot q_p)^{0.56} \cdot K \cdot LS \cdot C \cdot P$

Variable	Description	Value	Derivation Reference
Q	Runoff volume, in AF	2.87	Text of report
q_p	Peak runoff rate, in cfs	16.0	Text of report
K	Soil erodibility factor	0.15	Clyde et al., 1978 Field observations - high sand, low clay, low organic matter Meeuwig, 1971
L	Slope length (390 feet)	58.2 (L and S combined)	Williams and Berndt, 1972 Clyde et al., 1978
S	Slope gradient (64.6%)		
C	Cropping management factor	0.013	Wischmeier, 1975
P	Erosion control practice factor	1.0	U.S. Soil Conservation Service, 1977
S	Event soil loss, in tons	91.9	Williams, 1975

factor (C) was determined following field observations of a canopy cover of 25 percent consisting of pinyon pine, juniper, and brush and a good ground cover of 80 percent consisting of grasses and rock. The computed sediment yield converts to an average concentration of 32.0 tons per acre-foot or 23,550 mg/1, which is reasonable for a high intensity thunderstorm-type rainfall event in this area. The yield compares favorably with sediment data reported by Williams et al. (1969) for adjacent sites in Coal Canyon and Horse Canyon.

According to equation 19, the sediment transport capacity is directly proportional to the flow velocity, which is in turn directly proportional to the hydraulic radius and the hydraulic slope and inversely proportional to the roughness (see equation 6). The critical point in the conveyance system occurs where the concrete ditches come to a perpendicular intersection. At this point, the velocity approaches zero and the bulk of the sandy sediment load is dropped, resulting in channel overflow and maintenance problems. However, for ease of computation, the critical section in the system was assumed to exist in the concrete ditch to the south of the shop. At this point, the channel slope is 1.4 percent and the roughness coefficient is equal to 0.013.

In determining the kinematic viscosity of the water, it was assumed that the event of concern would occur as a result of a summer thunderstorm. The temperature of the discharging water was assumed to equal 17°C, based on two water temperature measurements in Soldier Creek near the mine in August 1978. Thus, the kinematic viscosity was determined to be 1.148×10^{-5} square feet per second (see Flammer and Jeppson, 1975). The other variable associated with the boundary condition similitude number (the median particle diameter of the sediment) was set equal to 1.31 x 10^{-3} foot (0.40 mm) based on field observations in the channel above the upper culvert inlet.

Table 4 gives the results of computations used to determine the sediment transport capacity of the critical section. The data are summarized in Figure 9. This figure was used to determine the sediment transport capacity graph of the 25-year, 6-hour storm runoff event at the critical section (see Figure 10). It was thus determined that the ditch has the capacity of transporting 56.1 tons of sediment, which is 35.8 tons <u>less</u> than the storm sediment yield. Assuming a bulk sediment density of 82 pound per cubic foot, at least 870 cubic feet of sediment will be dropped in the system during the design storm. More may drop because of conditions at the T-section of the ditches.

In order to avoid this, it is suggested that the drainage from the majority of watershed No. 2 (labled watershed No. 1) be diverted to bypass the yard and proposed sedimentation pond and flow directly into Soldier Creek. Following discussions with the Utah Division of Oil, Gas, and Mining, the 50-year, 6-hour storm, with its resulting peak runoff rate of 20.2 cubic feet per second (see Appendix A), was chosen for design purposes. The bypass culvert should be installed with a headwall at the inlet end to increase the hydraulic efficiency and minimize erosion. Ideally, the culvert should discharge directly into Soldier Creek. If this is not possible, a downspout or appropriately lined channel (riprap, old conveyor belting, etc.) should be provided below the culvert outlet to convey the water away from steep slopes and reduce erosion potential.

Using Figure 6, a 30-inch corrugated metal culvert will adequately pass the design storm runoff without a head of water at the inlet (i.e. HW/D = 1.0).

Table 4. Results of sediment transport capacity computations for critical section in yard drainage system.

Y (ft)	Z (ft)	A (ft^2)	V (ft/s)	q (cfs)	F	T (^oF)	d_{50} (ft)	D	A_L	L (lb/s/ft)	G (lb/s)	G (tons/d)
0.10	1.5	0.15	2.68	0.40	1.49	63	1.31×10^{-3}	8.07	11.5×10^{-3}	0.31	0.46	19.1
0.20	1.5	0.30	3.95	1.19	1.56	63	1.31×10^{-3}	8.07	16.1×10^{-3}	1.28	1.92	82.8
0.40	1.5	0.60	5.53	3.32	1.54	63	1.31×10^{-3}	8.07	14.7×10^{-3}	3.27	4.91	212.1
0.70	1.5	1.05	6.87	7.22	1.45	63	1.31×10^{-3}	8.07	10.1×10^{-3}	4.88	7.32	316.2
1.00	1.5	1.50	7.78	11.54	1.37	63	1.31×10^{-3}	8.07	7.71×10^{-3}	6.03	9.04	390.5
1.50	1.5	2.22	8.52	19.18	1.23	63	1.31×10^{-3}	8.07	5.16×10^{-3}	6.63	9.94	429.3

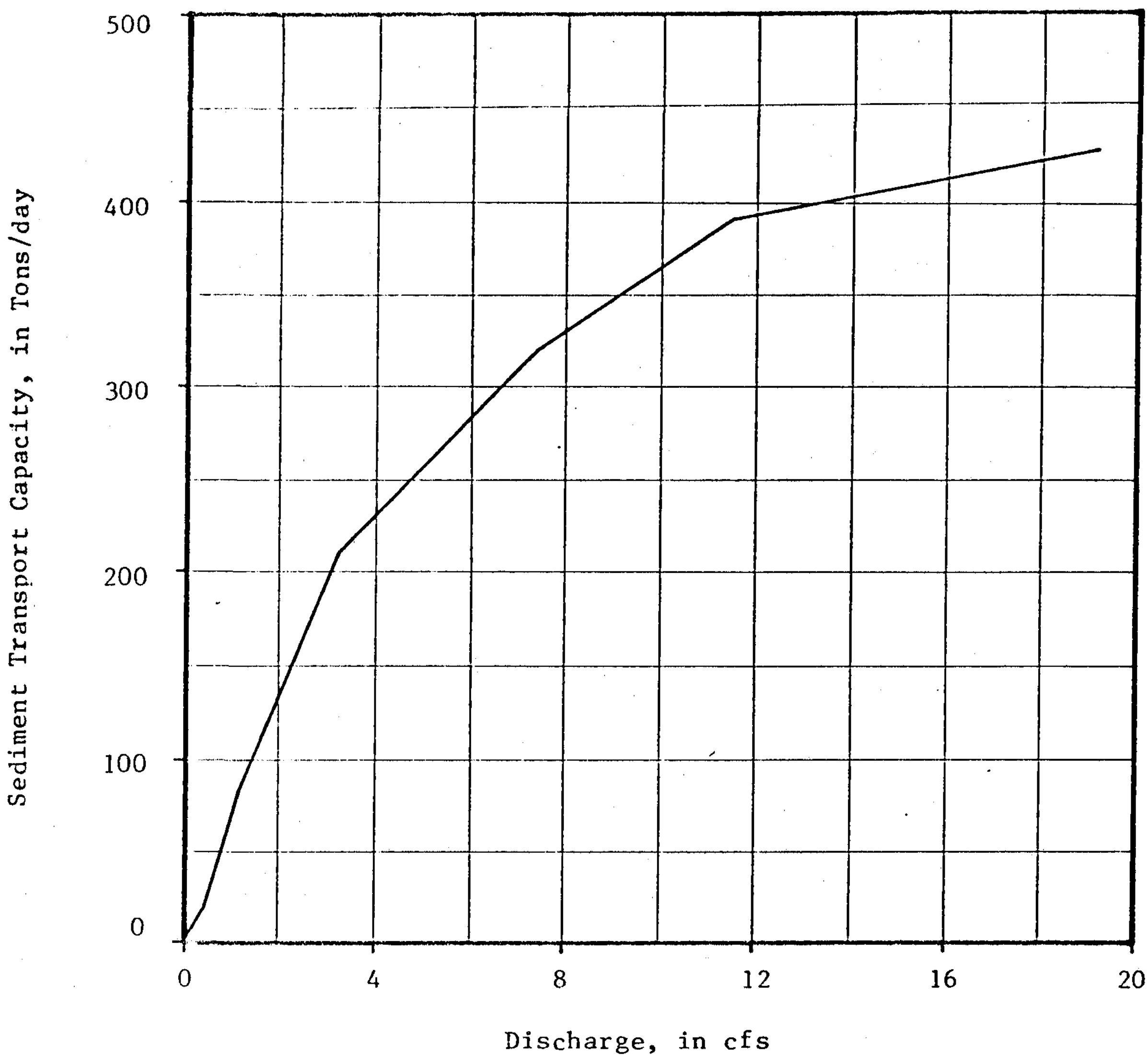


Figure 9. Sediment transport capacity of critical section in yard drainage system.

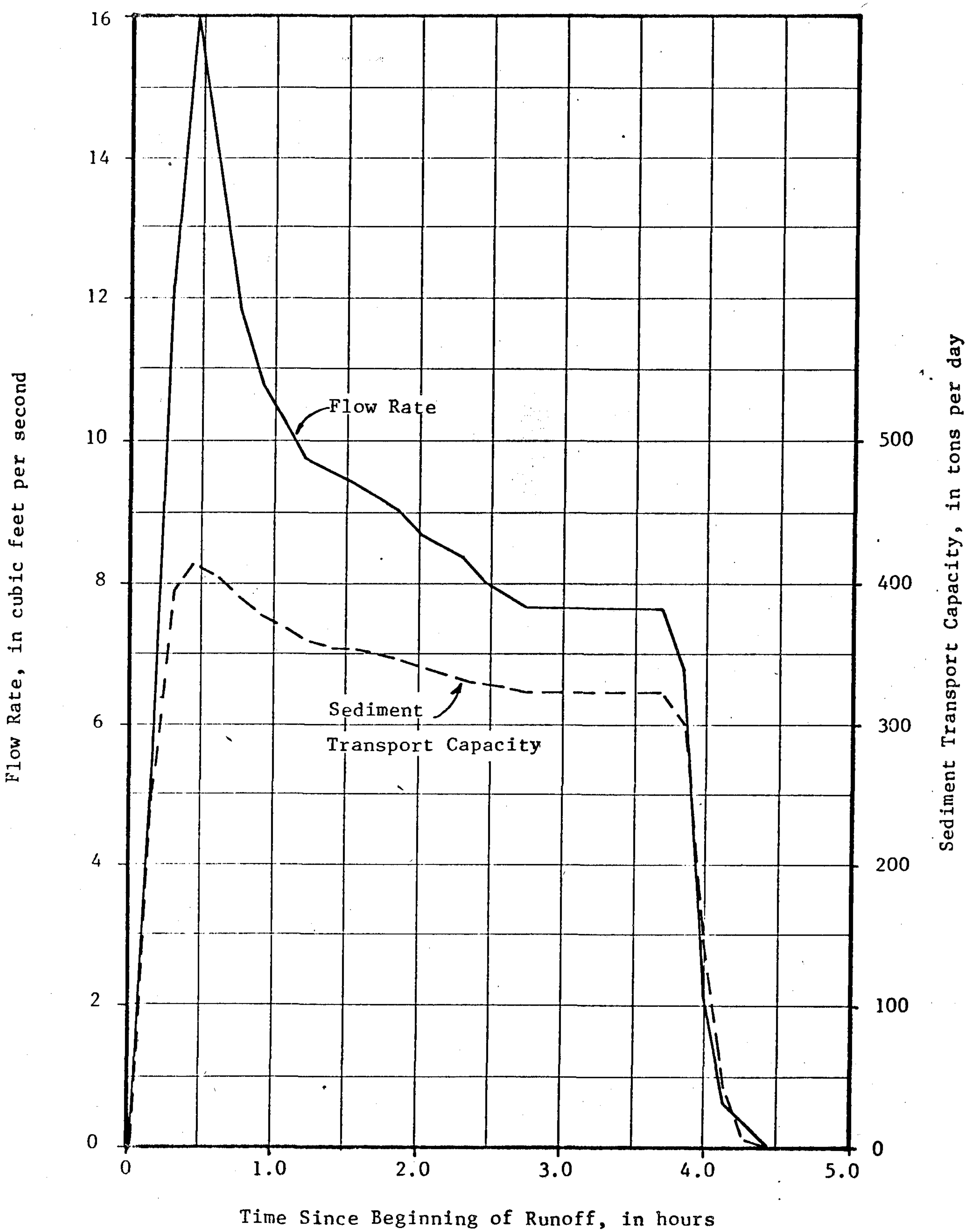


Figure 10. Flow and sediment transport capacity graphs of 25-year, 6-hour storm runoff from watershed No. 2 at the critical conveyance system section.

By keeping the slope on this culvert greater than about 5 percent, the bypass should also adequately convey the design flow sediment load. The culvert can be placed either down the center of the yard (adjacent to the existing 24-inch culvert) or along the bench above the mine portals bordering the southwest edge of the yard, past the substation and adjacent retaining wall and down to the stream. More culvert would be required for this latter route but problems are not encountered with existing conveyance structures and yard traffic, which will be the case if the former route is selected.

The bypass is necessary not only to avoid sediment problems in the existing conveyance system but also because a suitable pond site does not exist to adequately contain the runoff from both the yard and watershed No. 1. Approximately 3.7 times the storage space would be needed for the sediment pond if the bypass was not installed. As is implied in subsequent sections, this space is not available without a large, undertermined expense.

Figure 11 gives the stage-discharge curve for the critical section in the existing conveyance system. Subsequent sections of this report show that the peak discharge during the 25-year, 6-hour storm at this point is expected to be about 3.3 cubic feet per second, which corresponds with a depth of 0.4 foot. Because at least a portion of the yard area will likely be paved in the near future, no excess sediment load likely will be transported and dropped by this flow. Thus, with the upper bypass, the conveyance system is considered adequate. Future computations will assume that the bypass has been installed.

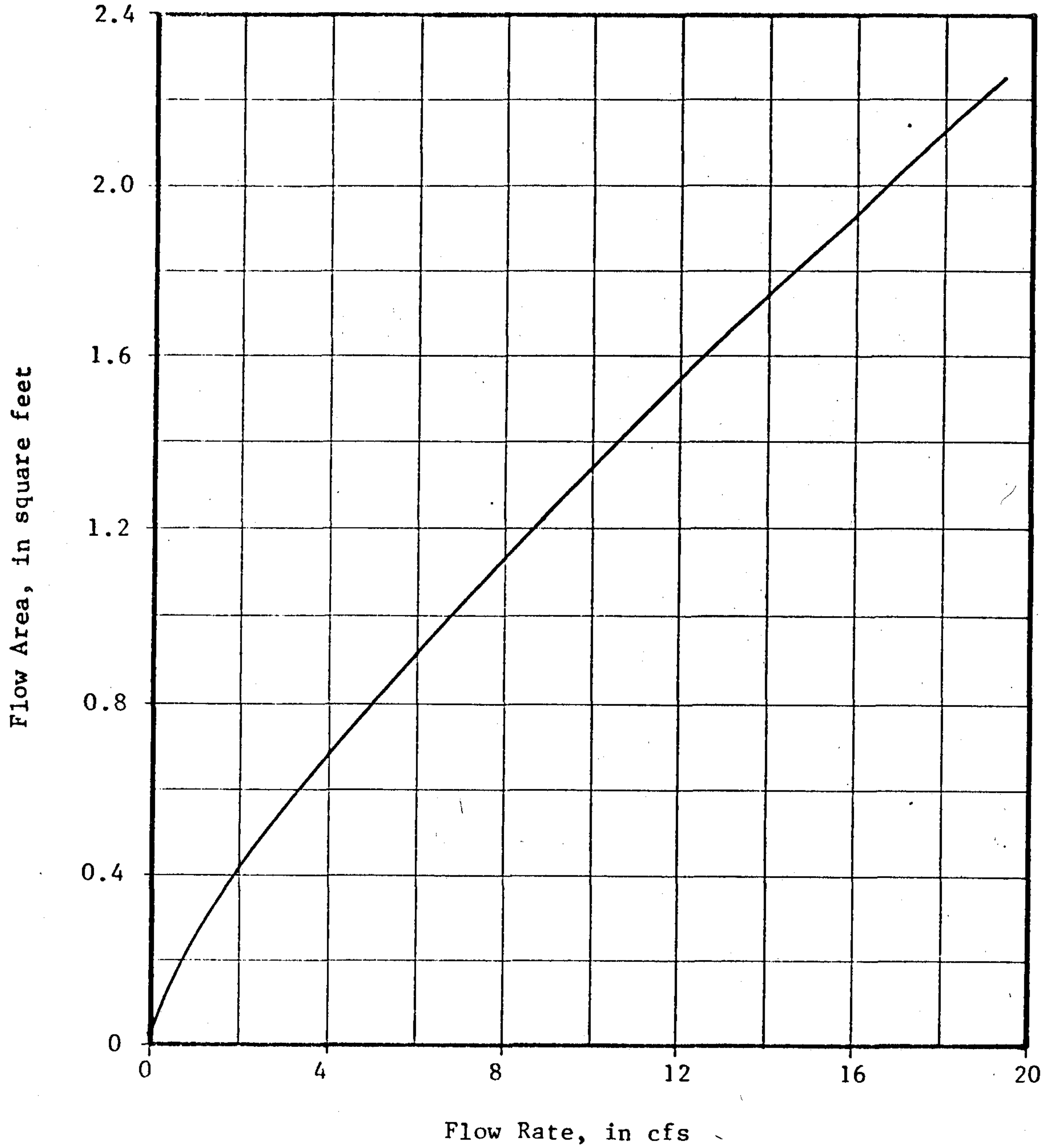


Figure 11. Stage-discharge curve of critical section in existing runoff conveyance system.

Soldier Creek Hydrographs

The flow of Soldier Creek adjacent to the sedimentation pond site were determined using the drainage basin characteristics shown in Figure 12 and the SCS dimensionless hydrograph technique. Because summer flows in Soldier Creek are relatively low (about one-third of a cubic foot per second), the computed direct runoff hydrograph was assumed to equal the total hydrograph.

Appendix B contains the tabulated hydrographs of Soldier Creek flows resulting from the 10-year, 24-hour and 25-year, 6-hour storms. These are portrayed graphically in Figures 13 and 14, respectively.

Channel cross-sections of Soldier Creek were surveyed adjacent to the middle of the sedimentation pond site and immediately below the pond site in order to determine the impact of the Soldier Creek storm flows on the pond. Manning's equation was used to determine the flow depth at the cross-sections during the design storms. Determination of the roughness coefficients based on methods of the U.S. Soil Conservation Service (1956) is summarized in Table 5. The resulting stage-discharge relations can be found in Figures 15 and 16.

Figures 17 and 18 show the upper and lower channel cross-section, respectively, together with the flow depths during the 10-year, 24-hour and 25-year, 6-hour storms. In each case the flow is entirely contained within the channel and will, therefore, not impinge upon the improved sedimentation pond.

Pond Inflow Hydrographs

The drainage basin characteristics of areas contributing to the sedimentation pond site are shown in Figure 19. These values were inserted into the appropriate

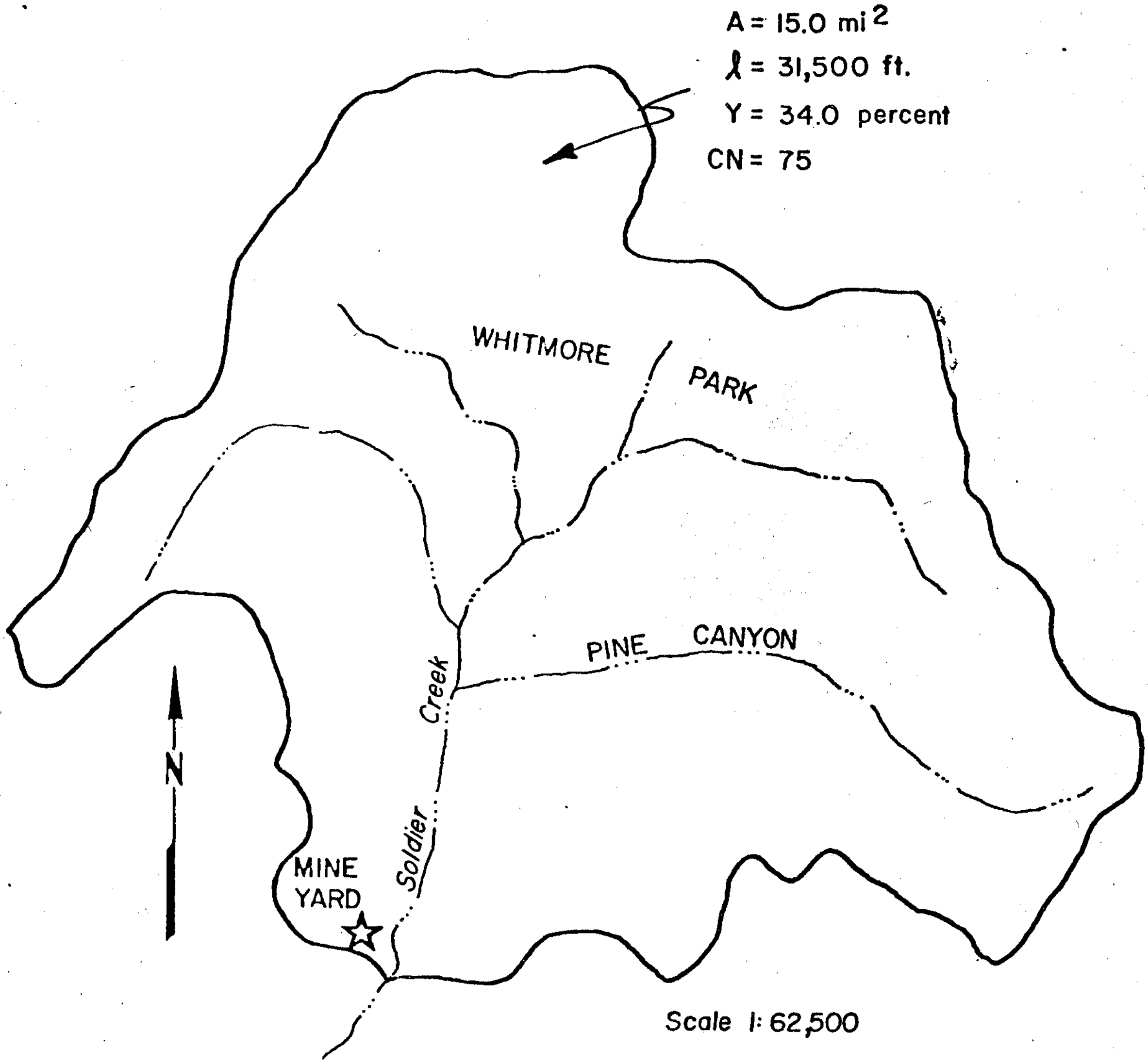


Figure 12. Drainage basin characterists of the Soldier Creek watershed above the Soldier Canyon Mine.

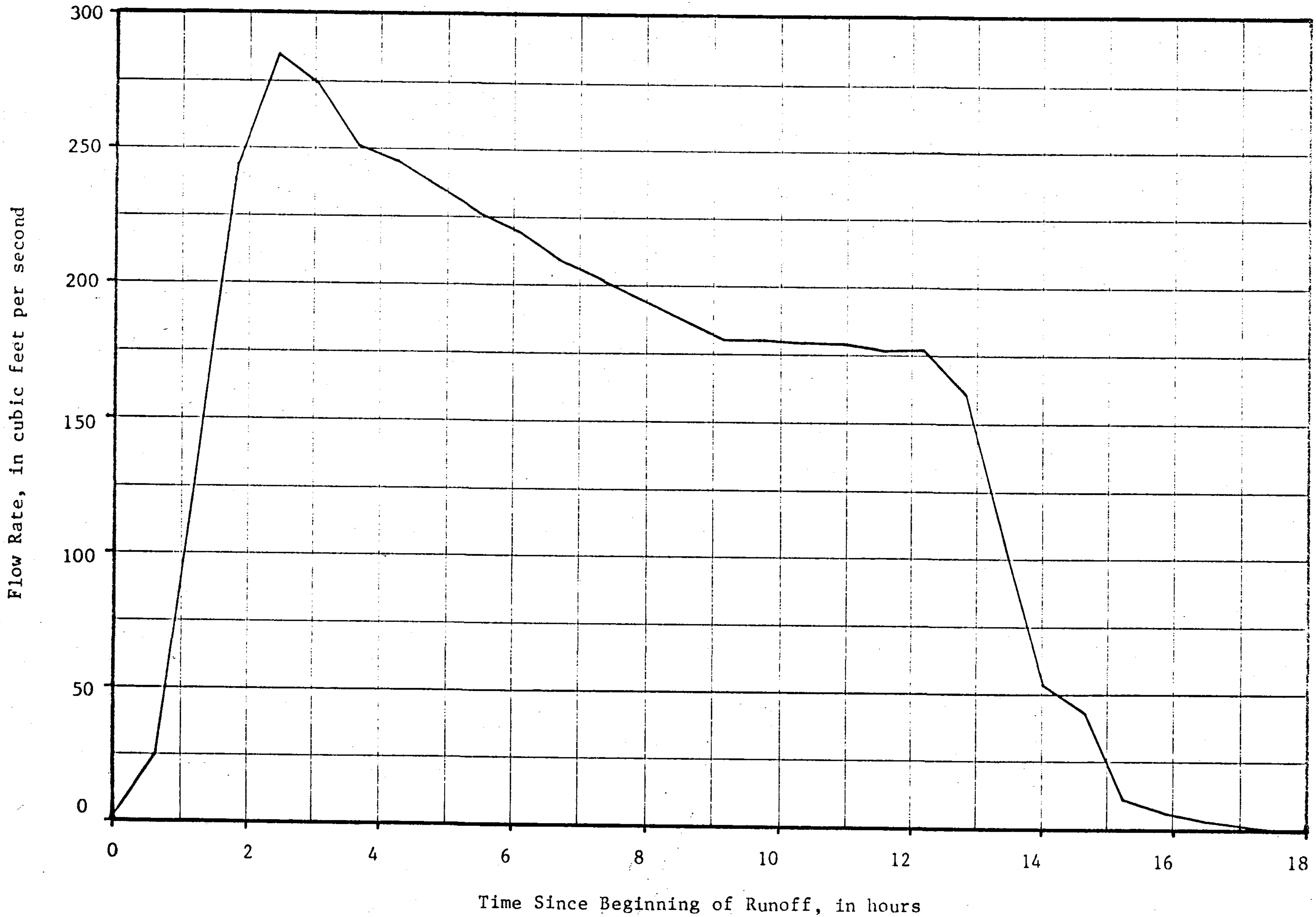


Figure 13. Hydrograph resulting from the 10-year, 24-hour storm in the upper Soldier Creek watershed.

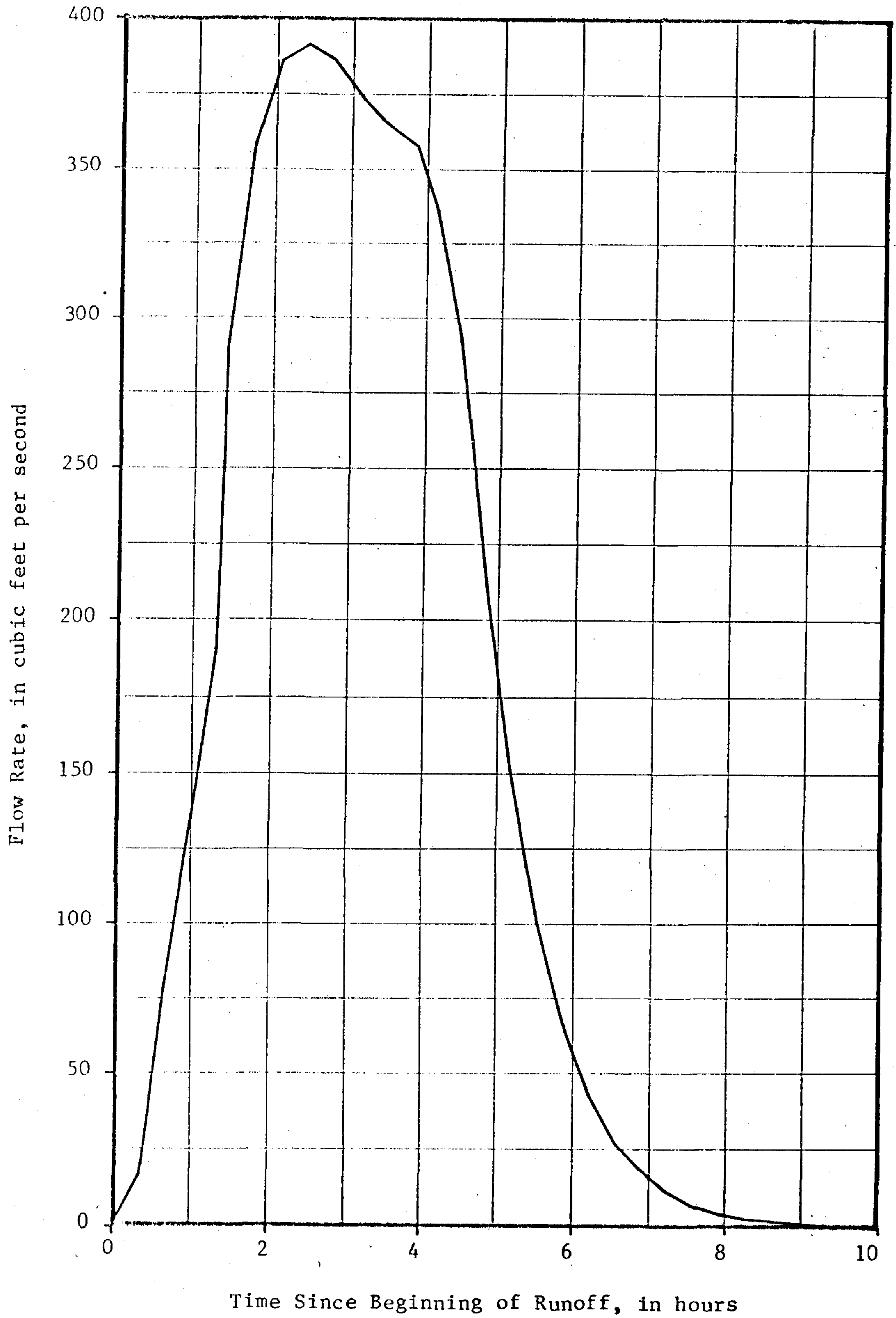


Figure 14. Hydrograph resulting from the 25-year, 6-hour storm in the upper Soldier Creek watershed.

Table 5. Computation of Manning's roughness coefficient adjacent to the sedimentation pond site.

Step	Remarks	Modifying Value
	Upper Section	
1	Channel in coarse gravel	0.028
2	Moderately sloughed side slopes	0.010
3	No significant shape changes	0.000
4	Large boulders in channel	0.025
5	No obstruction vegetation	0.000
6	No meander effect	0.000
7	Total estimated n	0.063

Step	Remarks	Modifying Value
	Lower Section	
1	Channel in coarse gravel	0.028
2	Slightly sloughed side slopes	0.005
3	Major shape change upstream	0.010
4	Logs and boulders in channel	0.025
5	No obstructing vegetation	0.000
6	No meander effect	0.000
7	Total estimated n	0.068

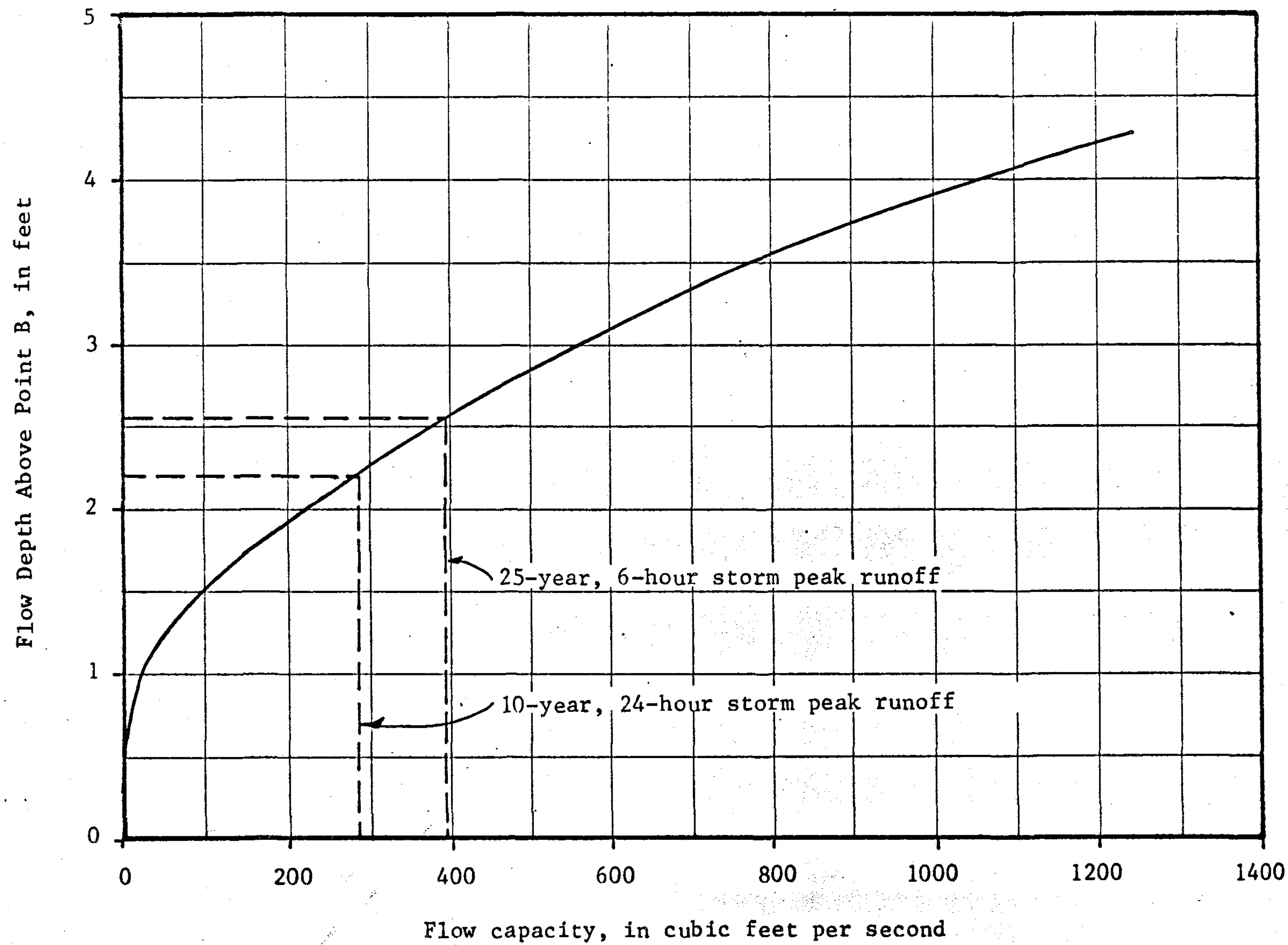


Figure 15, Stage-discharge curve of Soldier Creek adjacent to the middle of the sedimentation pond site (upper section).

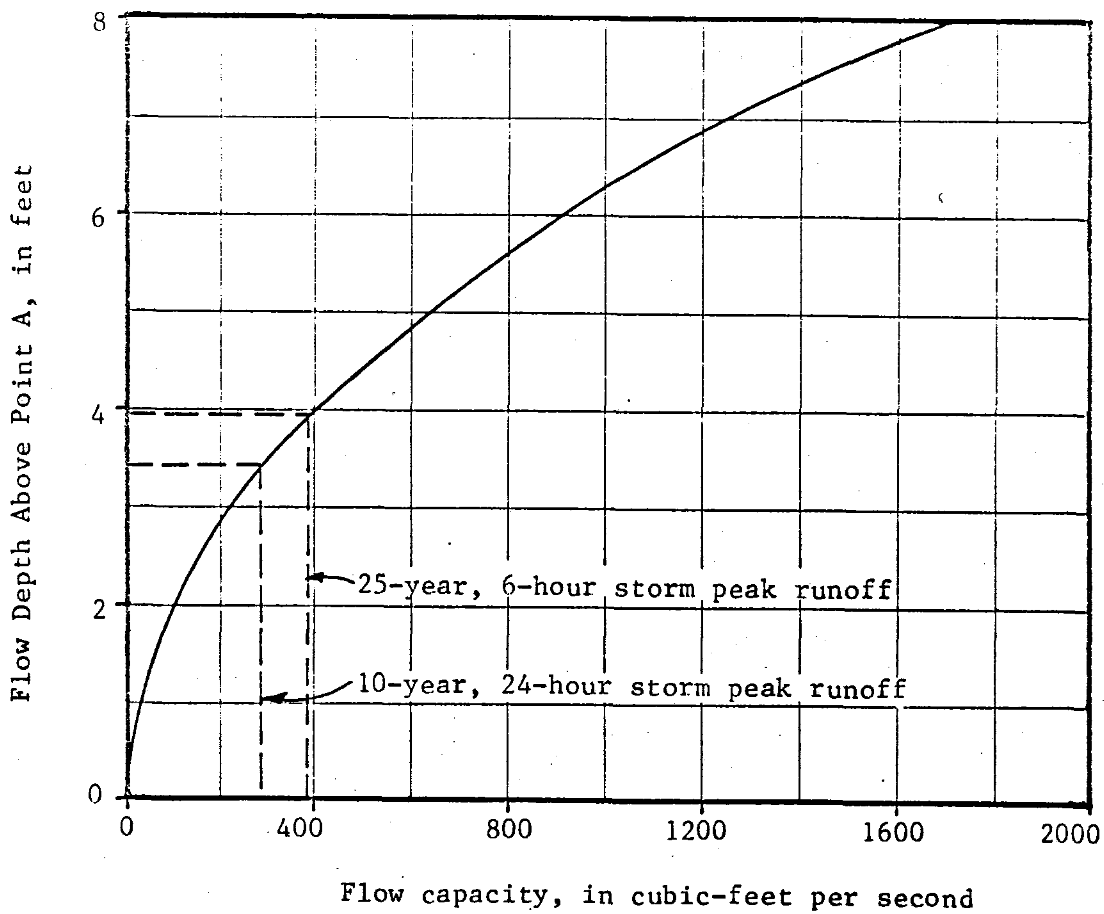


Figure 16. Stage-discharge curve of Soldier Creek immediately below the sedimentation pond site (lower section).

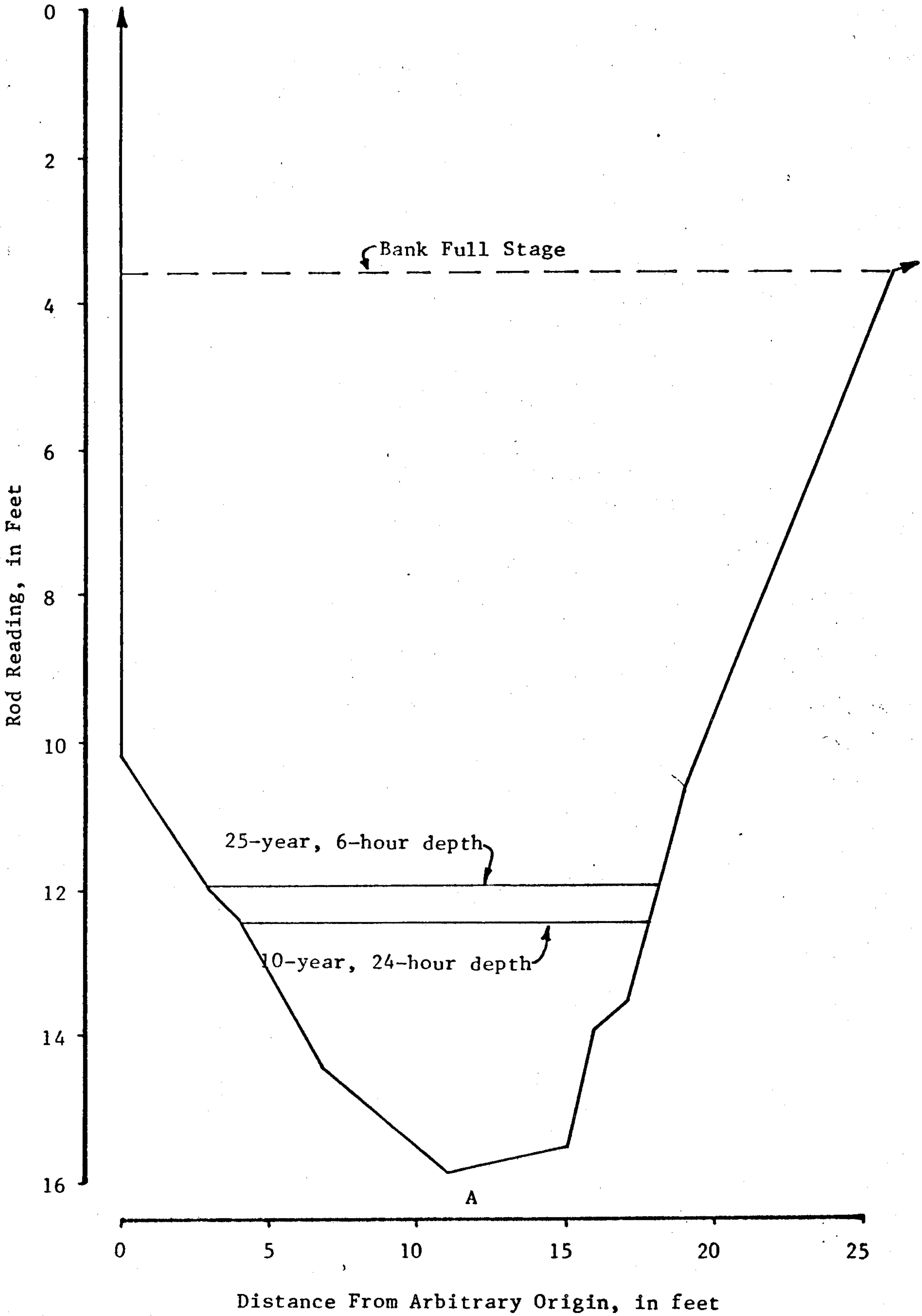


Figure 17. Channel cross-section of Soldier Creek at upper section with peak flow depths resulting from the 10-year, 24-hour and 25-year, 6-hour storms.

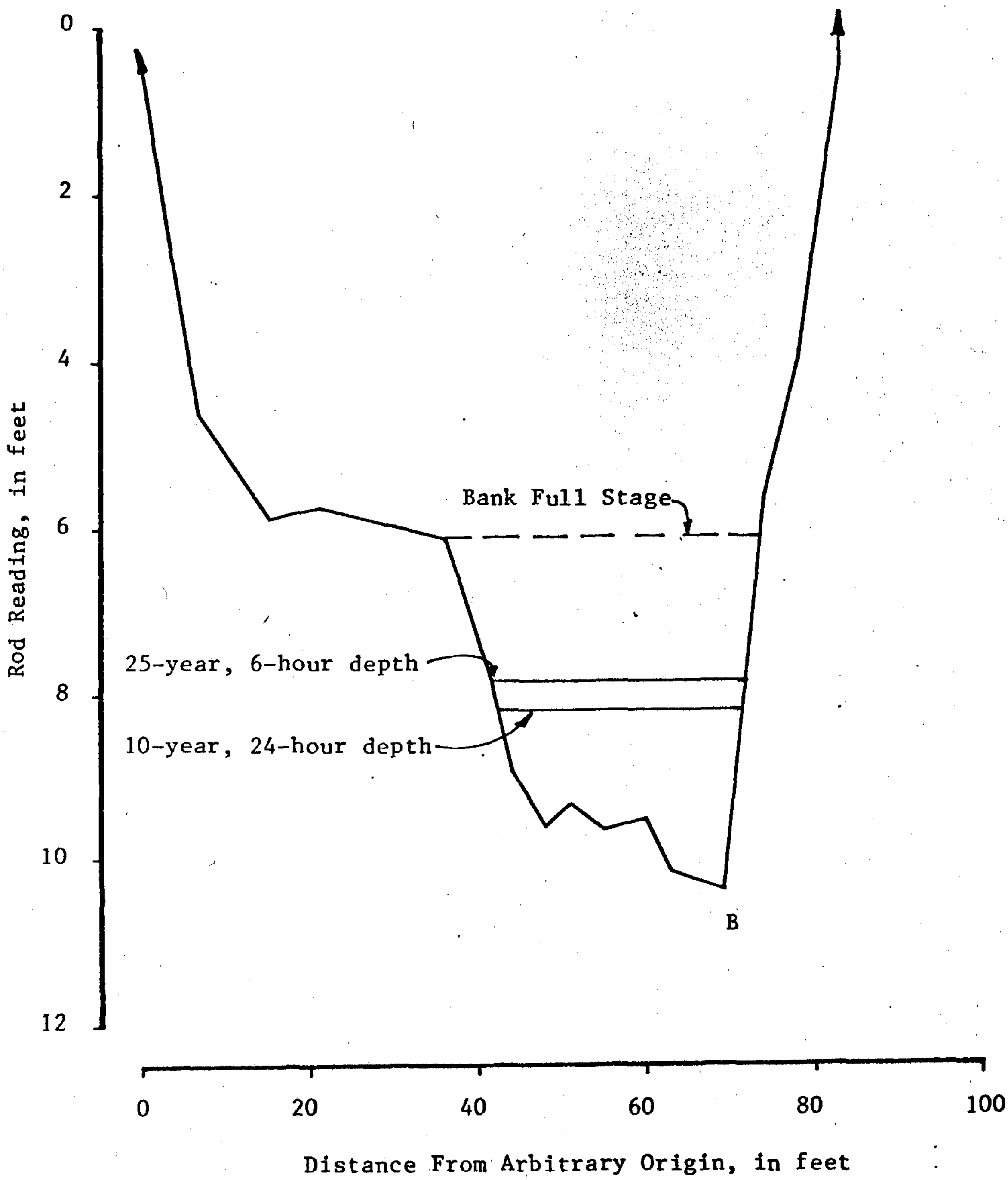


Figure 18. Channel cross-section of Soldier Creek at lower section with peak flow depth resulting from the 10-year, 24-hour and 25-year, 6-hour storms.

equations to obtain the hydrographs of the inflow from the yard and adjacent areas to the pond resulting from the 10-year, 24-hour and 25-year, 6-hour storms (see Appendix C). The individual hydrographs and their composites are given in Figure 20. As has been noted, the individual hydrographs were not routed through the conveyance system. The composite hydrographs are, therefore, a conservative estimate of the expected hydrographs.

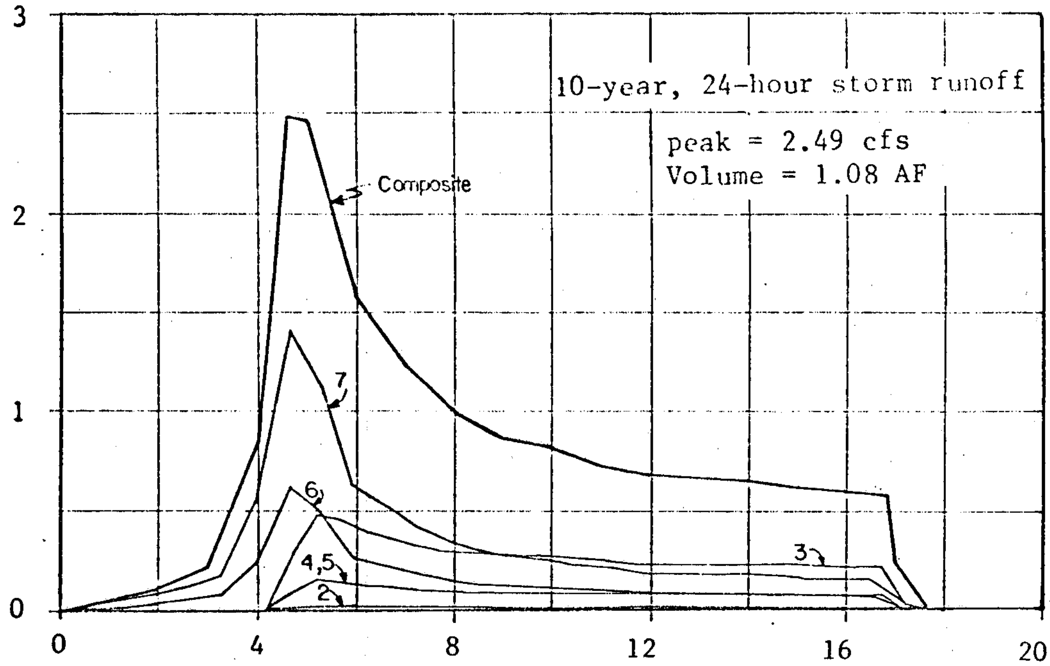
Pond Sediment Storage Requirements

State and Federal regulations require that sedimentation ponds be designed to provide sufficient storage space for the accumulated sediment volume inflow for the life of the pond or 0.1 acre-foot per acre of upstream disturbed area. For ease of computation, the latter criteria was selected for pond design. Thus, with 6.0 acres of disturbed area within the upstream drainage area, the pond will contain a sediment storage pool with a volume of 0.6 acre-feet.

Pond Design

The improved sedimentation pond can be adequately located at the site of the existing pond. However, because this location is within 100 feet of a perennial stream, a variance is requested by this document from the Utah Division of Oil, Gas, and Mining to allow the pond to be located within a regulated buffer zone. The variance is requested on the following grounds:

1. No other suitable location exists for the pond without incurring an unnecessarily large expense;
2. The main stream channel of Soldier Creek will not be affected by the pond location;



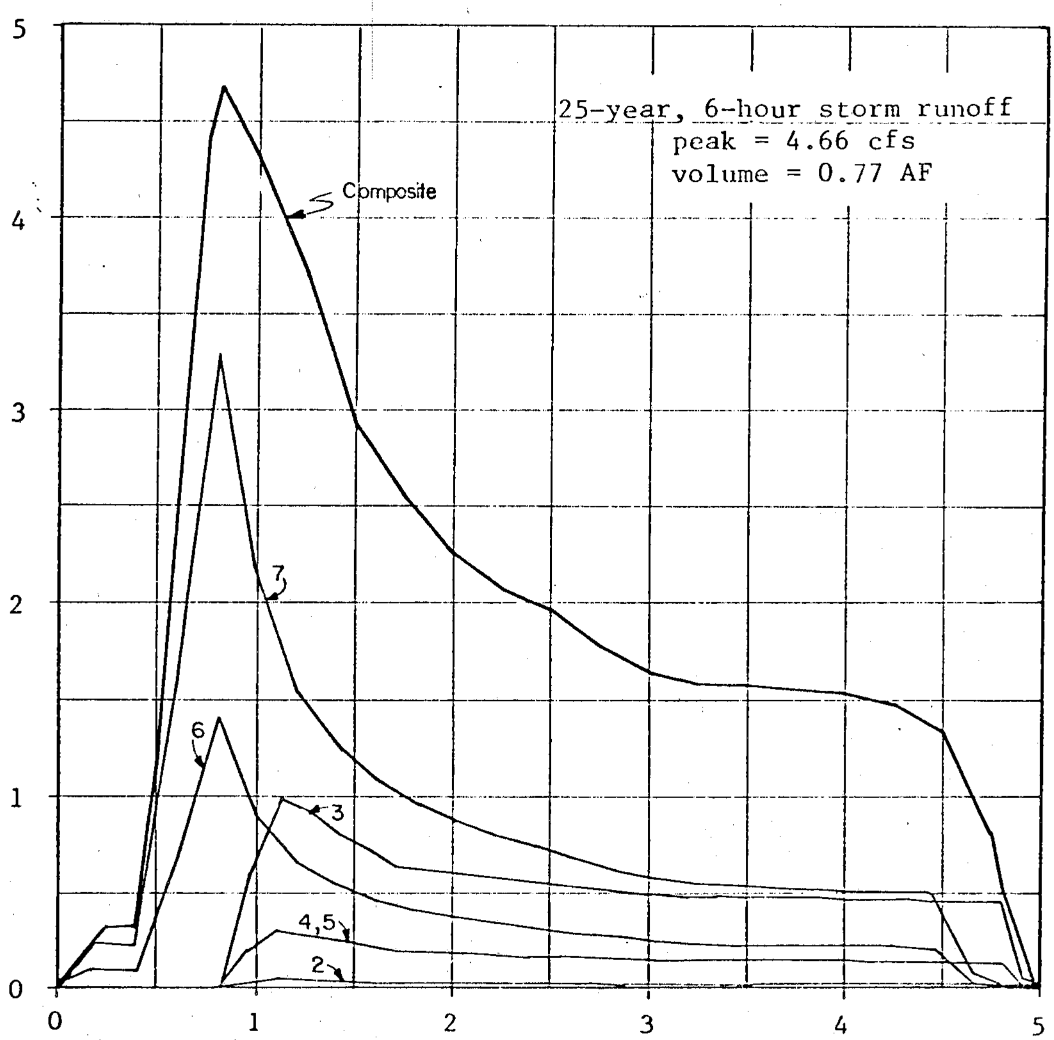


Figure 20. Individual and composite hydrographs of sedimentation pond inflow resulting from the 10-year, 24-hour and 25-year, 6-hour storms.

3. The pond embankment will not be affected by flood flows in Soldier Creek with magnitudes less than the 25-year, 6-hour storm peak discharge (see Figure 17 and 18);
4. The flood plain portion of the channel upon which the pond will be built will be restored to its approximate original contour after the pond is removed; and
5. The pond will not degrade the quality of water in Soldier Creek but rather result in an improvement because of the retention of sediment which would have normally entered the stream (whether or not the upstream area had been disturbed).

Prior to pond construction, the area below the top of the proposed embankment should be cleared of all brush and other organic matter. The embankment foundation should also be scarified. The sediment which has collected in the pond to date should be removed and disposed of as outlined in a subsequent section prior to earthwork within the existing pond area. The foundation area currently has a slope of approximately five percent which is adequate for construction.

Field observations indicated that the soil material at the pond site is composed of a clayey sand (unified soil classification symbol SC). The U.S. Bureau of Reclamation (1974) has indicated that this soil is impervious when compacted, has good to fair shear strength and low compressibility when compacted and saturated, and provides good workability as a construction material. These characteristics indicated that the material is excellent for use in embankments and will, therefore, be used in pond construction.

Pond design details are outlined in Figure 21. Using the method of average end areas (Davis and Foote, 1940) the stage-capacity curve shown in Figure 22 was

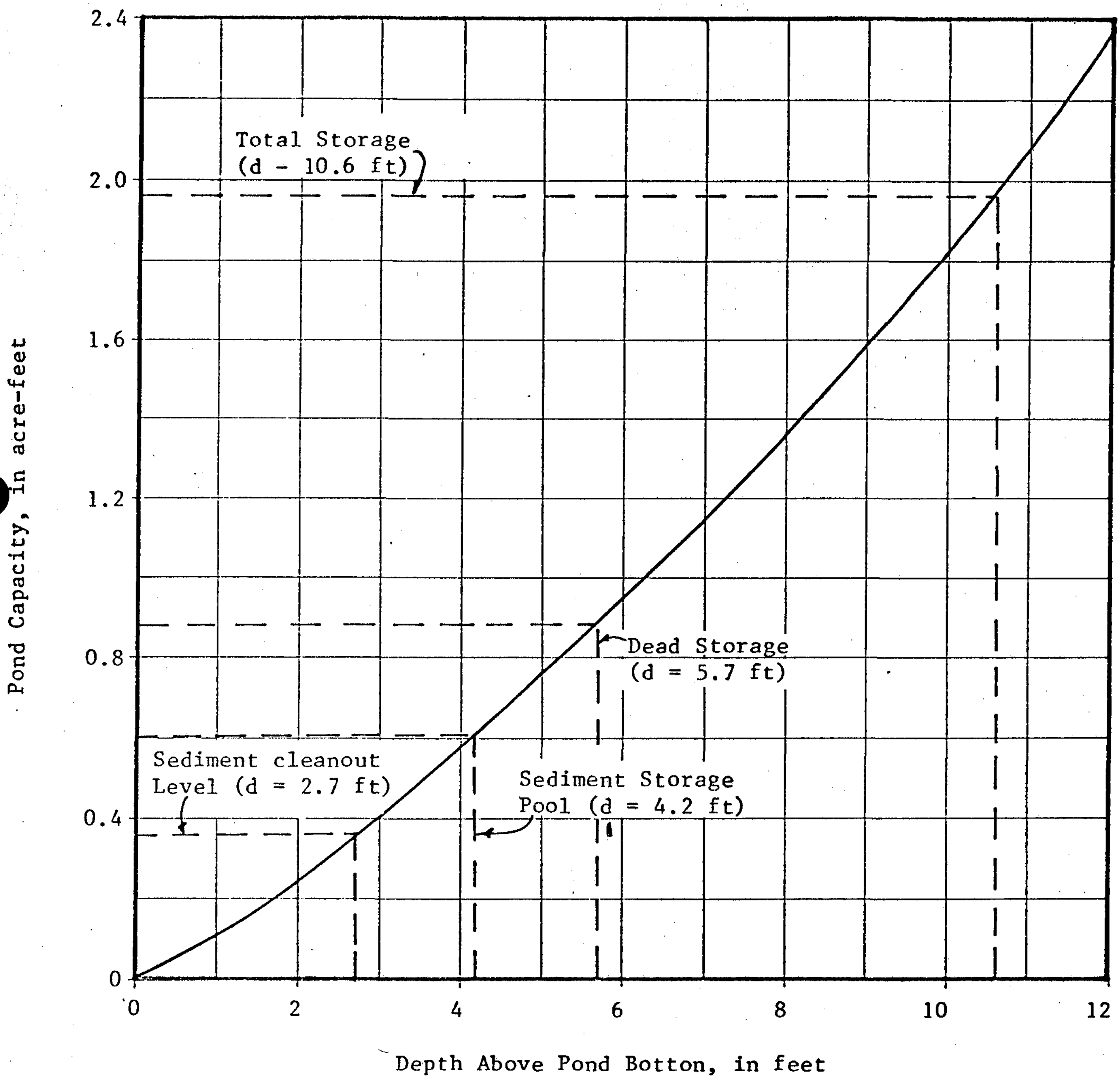


Figure 22. Stage-capacity curve of the proposed sedimentation pond.

developed. As this figure indicates, the pond will consist of a sediment storage pool (0.6 acre-foot), a dead pool, and a runoff control pool (equal to the inflow volume resulting from the 10-year, 24-hour storm). The Utah Division of Oil, Gas, and Mining requests that a dewatering device be placed in the pond to draw the pond level down to the bottom of the runoff control pool in anticipation of a future event before the water in the pond has evaporated or seeped out. This dewatering device must be placed above the top of the sediment storage pool. However, the Utah Division of Health requires that no dewatering device be placed within three feet of the top of the sediment cleanout level. Thus, a dead storage pool has been created in order to meet the requirements of both agencies.

The proposed principal and emergency spillway system consists of a corrugated metal riser and conduit, with an anti-vortex device, trash rack, and anti-seep collars. Utilizing equations 8 through 11, an 18-inch riser and conduit were found to adequately pass the peak flow resulting from the 25-year, 6-hour storm with a head above the riser inlet of 0.46 foot (see Figure 23). For design purposes, a head of 0.5 foot was assumed.

The total embankment height was obtained by adding the stage at full storage capacity (10.6 feet), the head of water over the spillway under design flow conditions (0.5 foot), the required freeboard height (1.0 foot) and a 5 percent settlement allowance (0.6 foot). This resulted in a design embankment height of 12.7 feet. The embankment top width was determined using the regulatory criteria that the top width not be less than the quotient of (H + 35)/5 where H is the height of the embankment, in feet, as measured from the upstream toe. The resulting top width was calcualted as 9.5 feet.

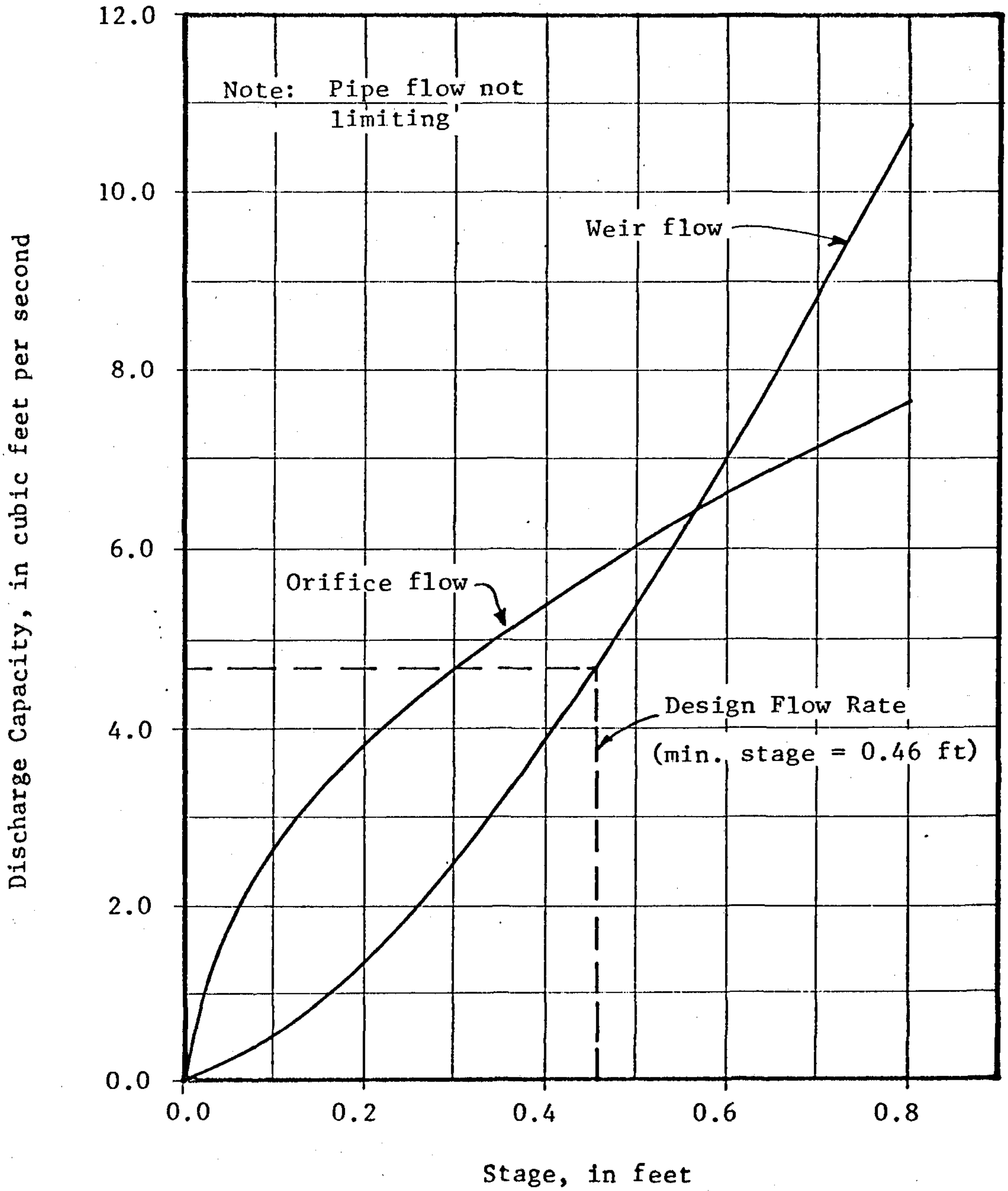


Figure 23. Stage-discharge curves for 18-inch spillway riser and conduit.

Embankment slopes have been designed to equal lv:2.5h for both upstream and downstream faces, based on the requirement that the combined side slopes of the settled embankment not be less than lv:5h, with neither slope steeper than lv:2h. Slopes within the pond other than the embankment will either be left untouched (i.e. the steep slope on the west side of the pond) or graded to lv:lh in those areas where the material is basically left in place.

Both the spillway and dewatering device should be constructed of similar materials, with the dewatering device also consisting of an 18-inch corrugated metal riser and conduit, anti-vortex device, trash rack, and anti-seep collars. The anti-vortex hood will also act as a skimming device by not allowing water to be pulled directly from the surface of the pond. A water control gate should be located in a 48-inch diameter corrugated metal manhole within the pond embankment to allow efficient water release (see Figure 24). The use of a manhole is necessitated by the facts that:

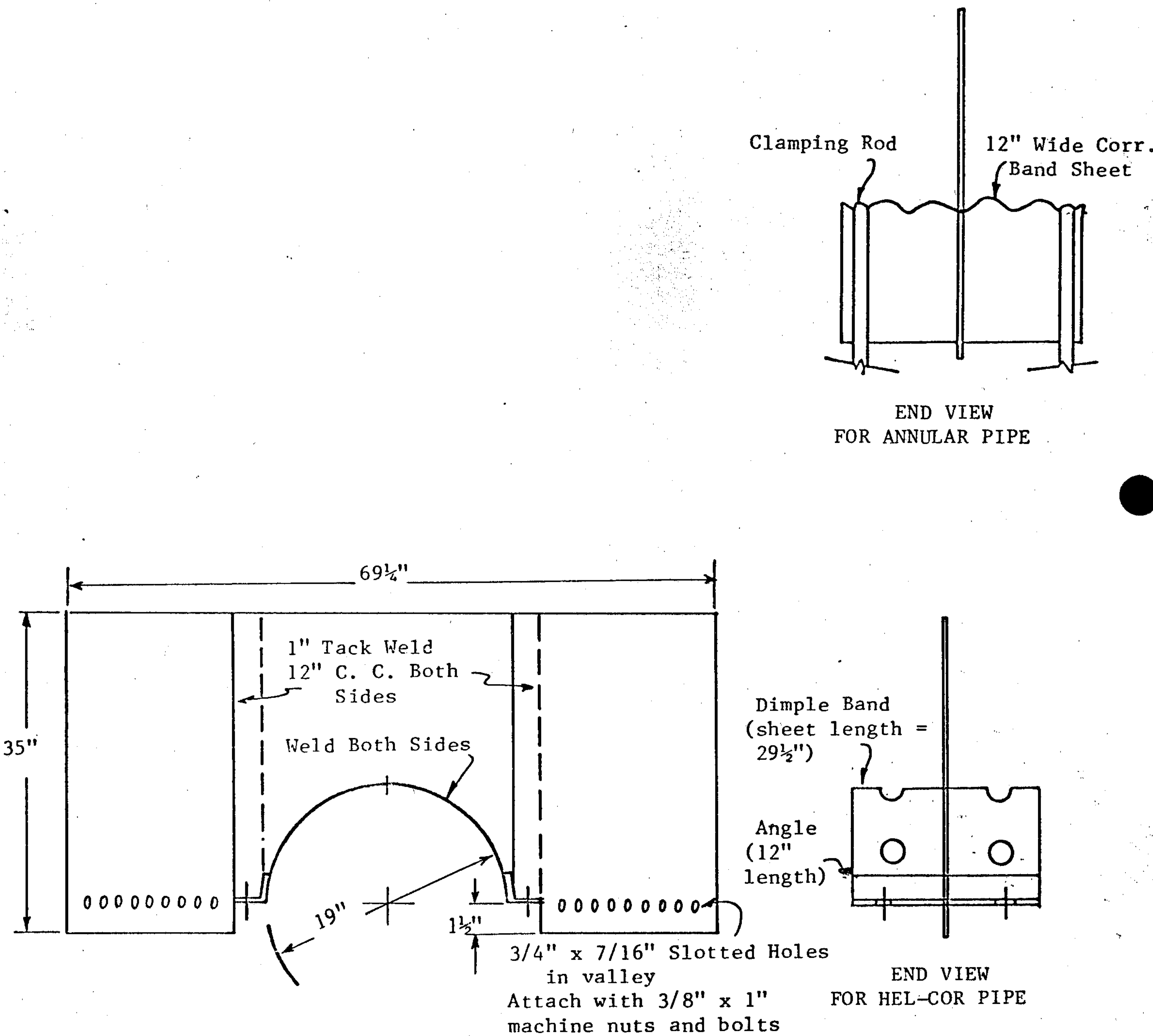
1. The water control gate must be installed at the inlet end of a culvert, utilizing the water pressure at this point to seat the seal;
2. The presence of the anti-vortex hood (as required by the Utah Division of Oil, Gas, and Mining) does not allow the gate to be placed at the extreme inlet;
3. Gates are apparently not available which can be attached between two culverts in a watertight manner; and
4. It is desireable to allow access to the control gate for maintenance purposes.

The control gate lift mechanism can be located either above the manhole cover or within the manhole, with access being easier by the former (and suggested) method.

In either case, the operating device should be locked and the key kept in the possession of one individual in order to satisfy the desires of the Utah Division of Health. Access to the gate for maintenance can be made via a ladder or rebar rungs which have bedn welded to the manhole side.

Sufficient space must be available in the pond to completely detain the runoff resulting from the 10-year, 24-hour storm. At the same time, sufficient settling time must be allowed in order to meet applicable effluent standards in the discharged water. It is, therefore, suggested that water in the pond be released through the dewatering device after 14 days, unless there is a good probability of occurrence of a runoff producing storm prior to that time under which condition the water should be released before storm occurrence. This will allow sufficient time for all but the fine clay and colloidal particles to settle (U.S. Environmental Protection Agency, 1976).

Anti-seep collars have been proposed based on suggestions by the Utah Division of Water Rights (personal communication) and methods outlined by the U.S. Environmental Protection Agency (1976). These methods indicate that, in order to increase the seepage length by 10 percent, two collars with a width of 5.8 feet can be installed with a maximum spacing of 29.4 feet. ARMCO standardly manufactures a 16 gage corrugated metal anti-seep collar for 18-inch corrugated metal pipe with a width of 69.25 inches which would be adequate (see Figure 25). The corrugations should be installed vertically with a continuous weld. It must be specified whether annularly or helically corrugated pipe is used for the conduit when ordering the collars.



ONE HALF SHOWN - OTHER HALF IDENTICAL

Figure 25. ARMCO corrugated metal anti-seep collar.

Riprap should be placed in the inlet channel and below both outlet conduits of the pond in order to disipate energy and reduce erosion potential. Searcy (1967) indicates that riprap with a median diameter of 6 inches should be adequate in both cases and is, therefore, suggested for use.

All connections (joints, seals, etc.) must be watertight in order to prevent structural failure and soil piping. Several types of watertight corrugated metal pipe are available but they must be requested as such. Particular attention should be paid to welded joints (riser and conduit connections, conduit and manhole connections, etc.).

The embankment fill material should be placed in 6- to 8-inch thick continuous layers over the entire length of the fill and machine compacted. Material immediately around the conduits leading through the embankment should be hand compacted to prevent damage by machinery.

Sediment Disposal Plans

Federal and State regulations require that sediment which has accumulated in the pond be removed when 60 percent of the design sediment storage volume has been filled. The point at which cleanout becomes necessary can be marked with paint on the spillway riser following the construction of the pond. The sediment can be assumed to settle uniformly over the basin (based on observations of the existing temporary pond).

Adequate sediment disposal areas are nearly non-existant at the mine site because of slope and access problems. A disposal site with a surface area of 2500 square feet (50 feet by 50 feet) and a depth of slightly over 6 feet will provide enough volume to contain the sediment which has accumulated to the cleanout level. Such a site could be located in the northwest corner of the yard. Because a portion of the yard will be paved in the future and the flow from watershed No. 2 will presumably be diverted, the sediment inflow to the pond should be small. It is reasonable to expect that the accumulated sediment in the pond may never reach the cleanout level during the life of the pond.

<u>Pond Reclamation</u>

Federal and State regulations require that areas disturbed by pond construction be stablized with an effective vegetative cover as soon as possible after disturbance. This cover should be composed of native and other plants which are adaptable to the site and provide soil stability.

The U.S. Bureau of Land Management (1978) indicates that the Soldier Canyon Mine is located in Pinyon-Juniper Woodland and Mountain Shrub vegetation communities. Because a mixture of plant types has proven to be more effective than single species in restoring disturbed areas (Plummer et al., 1968), the grasses given in Table 6 have been chosen for temporary reclamation. Plant attributes in this table were taken from Plummer et al. (1968) while the seeding rate was suggested by the U.S. Soil Conservation Service (1975). A mixture has been chosen to provide rapid growth species, sod forming species, and species which are compatible with other plants. All are native or compatible to the area (U.S. Bureau of Land Management, 1978). All disturbed areas should be seeded with the exception of the interior of the pond below the dewatering device level. Seeding should ideally be done in the late fall, just before the first heavy snowfall of the year (Plummer et al., 1968), following the disturbance. Prior to seeding, two tons of straw per acre of disturbed area should be spread over the

Table 6. Suggested plant species for revegetation of areas disturbed by pond construction.

Species	Attribute Rating*: Initial Establishment	Growth Rate	Final Establishment	Natural Spread	Soil Stability	Species compatibility	Planting Rate, in pounds/acre
Beardless bluebunch Wheatgrass (Agropyron spictum inerme)	4	3	4	5	3	4	4
Mountain brome (Bromus carinatus)	5	5	3	4	4	5	4
Range-type alfalfa (Medicago sative)	5	5	4	2	4	5	4
Western (bluestem) Wheatgrass (Agropyron Smithii)	3	3	5	4	5	4	4
Southern smooth brome (Bromus inermis)	3	4	5	5	5	3	4
				TOTAL			20

* 1 = very poor
2 = poor
3 = fair
4 = good
5 = very good

area and crimped twice into the soil with a roto tiller to aid in moisture retention and provide soil stability (U.S. Soil Conservation Service, 1975). The seed mixture can then be broadcast onto the area either by hand or through the use of a cyclone seeder.

Final reclamation of the pond can be undertaken after the upstream disturbed area has been reclaimed and the upstream revegetation effort has been labled as successful. Thus, permission must be received from the Utah Division of Oil, Gas, and Mining and the Utah Division of Health before the pond can be removed. If a significant amount of coal has been trapped in the pond, the accumulated sediment should be removed and disposed of as outlined previously prior to reclamation. Otherwise, the pond can be reclaimed with the sediment in place if soil tests (SAR and pH) indicate that the sediment is non-toxic.

The structures associated with the pond (including the culvert leading from the yard area to the pond) should be removed and the pond regarded to its approximate original contour. The entire area (including the pond access road) should then be revegetated using the mixture, planting rates, and methods previously described for temporary reclamation. Because the area occupied by the proposed imporved sedimentation pond is currently vegetated almost entirely with grasses, the mixture contained in Table 6 is considered adequate.

NPDES Application and Pond Monitoring Plan

A copy of the NPDES application has been included in Appendix D. This form was obtained from the U.S. Environmental Protection Agency (Denver) and the original should be sent back to them along with a $10.00 filing fee, as noted in the Appendix.

Upon approval of the NPDES permit application, the U.S. Environmental Protection Agency will specify a monitoring program, which should be followed. State and Federal coal mining regulations also require that discharge be monitored for total suspended solids, pH, total iron, and total manganese. If any of these parameters are not requested by the EPA as part of the NPDES permit, they should be included in the monitoring plan.

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APPENDIX A

Selected Runoff Hydrograph Computations From Undisturbed Area West of Mine Yard

HYDROGRAPH COMPUTATION FORM

STREAM AND STATION Soldier Creek Coal Co. - Watershed # 1

REMARKS 50-year, 6-hour storm runoff

DR. AREA 0.20 SQ. MI. T_c 0.21 HR. RUNOFF CONDITION NO. II

RUNOFF CURVE NO. 75 . STORM DISTRIB CURVE — . HYDRO. FAM. NO. 4

STORM DURATION 6 HR. RAINFALL: POINT 1.96 IN. AREAL 1.96 IN.

Q 0.362 IN. COMPUTED T_p 0.15 HR. T_o 3.9 HR.

(T_o/T_p): COMPUTED 26.0 : USED 25 . REVISED T_p 0.16

$q_p = \frac{484\ A}{\text{REV. } T_p}$ = 605.0 CFS. Qq_p = 219.0 CFS.

t(COLUMN) = (t/T_p) REV. T_p q(COLUMN) = $(qc/q_p)\ Qq_p$

LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS
1	0.00	0.00	21	3.06	9.64	41		
2	0.15	5.48	22	3.21	9.64	42		
3	0.31	15.33	23	3.37	9.64	43		
4	0.46	20.15	24	3.52	9.64	44		
5	0.61	17.96	25	3.67	9.64	45		
6	0.77	14.89	26	3.83	8.54	46		
7	0.92	13.58	27	3.98	2.63	47		
8	1.07	12.92	28	4.13	0.88	48		
9	1.22	12.26	29	4.28	0.22	49		
10	1.38	12.05	30	4.44	0.00	50		
11	1.53	11.83	31			51		
12	1.68	11.61	32			52		
13	1.84	11.39	33			53		
14	1.99	10.95	34			54		
15	2.14	10.73	35			55		
16	2.30	10.29	36			56		
17	2.45	10.07	37			57		
18	2.60	9.86	38			58		
19	2.75	9.64	39			59		
20	2.91	9.64	40			60		

HYDROGRAPH COMPUTATION FORM

STREAM AND STATION Soldier Creek Coal Co. – Watershed #2 (w/o Bypass)

REMARKS 25-year, 6-hour storm

DR. AREA 0.20 SQ. MI. T_c 0.22 HR. RUNOFF CONDITION NO. II

RUNOFF CURVE NO. 75 . STORM DISTRIB. CURVE – . HYDRO. FAM. NO. 4

STORM DURATION 6 HR. RAINFALL: POINT 1.76 IN. AREAL 1.76 IN.

Q 0.270 IN. COMPUTED T_p 0.15 HR. T_o 3.8 HR.

(T_o/T_p): COMPUTED 25.3 : USED 25 . REVISED T_p 0.15

$q_p = \frac{484\ A}{\text{REV. } T_p}$ = 645.2 CFS. Qq_p = 174.2 CFS.

t (COLUMN) = (t/T_p) REV. T_p q (COLUMN) = $(q_c/q_p)\ Qq_p$

LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS
1	0.00	0.00	21	3.06	7.66	41		
2	0.15	4.36	22	3.21	7.66	42		
3	0.31	12.19	23	3.37	7.66	43		
4	0.46	16.03	24	3.52	7.66	44		
5	0.61	14.39	25	3.67	7.66	45		
6	0.77	11.95	26	3.83	6.79	46		
7	0.92	10.50	27	3.98	7.04	47		
8	1.07	10.28	28	4.13	0.70	48		
9	1.22	9.76	29	4.29	0.17	49		
10	1.38	9.58	30	4.44	0.00	50		
11	1.53	9.41	31			51		
12	1.69	9.23	32			52		
13	1.84	9.06	33			53		
14	[illegible]	8.71	34			54		
15	2.14	8.54	35			55		
16	2.30	8.19	36			56		
17	2.45	8.01	37			57		
18	2.60	7.24	38			58		
19	2.75	7.66	39			59		
20	2.91	7.66	40			60		

APPENDIX B

10-year, 24-hour and 25-year, 6-hour Storm Runoff Hydrograph Computations of Soldier Creek Adjacent to the Proposed Sedimentation Pond

HYDROGRAPH COMPUTATION FORM

STREAM AND STATION Soldier Creek near sedimentation pond

REMARKS 10-year, 24-hour storm

DR. AREA 15.00 SQ. MI. T_c 1.92 HR. RUNOFF CONDITION NO. II

RUNOFF CURVE NO. 70. STORM DISTRIB. CURVE —. HYDRO. FAM. NO. 4

STORM DURATION 24 HR. RAINFALL: POINT 2.08 IN. AREAL 2.08 IN.

Q 0.271 IN. COMPUTED T_p 1.34 HR. T_o 12.2 HR.

(T_o/T_p): COMPUTED 9.10 : USED 10. REVISED T_p 1.22

$q_p = \frac{484\ A}{\text{REV. } T_p}$ = 5950.8 CFS. Qq_p = 1612.7 CFS.

t (COLUMN) = (t/T_p) REV. T_p q (COLUMN) = $(q_c/q_p)\ Qq_p$

LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS
1	0.0	0.0	21	[illegible]	177.40	41		
2	[illegible]	[illegible]	22	[illegible]	[illegible]	42		
3	[illegible]	[illegible]	23	[illegible]	[illegible]	43		
4	[illegible]	[illegible]	24	[illegible]	[illegible]	44		
5	[illegible]	[illegible]	25	[illegible]	[illegible]	45		
6	[illegible]	[illegible]	26	[illegible]	[illegible]	46		
7	[illegible]	[illegible]	27	[illegible]	[illegible]	47		
8	[illegible]	[illegible]	28	[illegible]	[illegible]	48		
9	[illegible]	[illegible]	29	[illegible]	[illegible]	49		
10	[illegible]	[illegible]	30	[illegible]	0.0	50		
11	[illegible]	[illegible]	31			51		
12	[illegible]	[illegible]	32			52		
13	[illegible]	[illegible]	33			53		
14	[illegible]	[illegible]	34			54		
15	[illegible]	[illegible]	35			55		
16	[illegible]	[illegible]	36			56		
17	[illegible]	[illegible]	37			57		
18	[illegible]	[illegible]	38			58		
19	[illegible]	[illegible]	39			59		
20	[illegible]	[illegible]	40			60		

HYDROGRAPH COMPUTATION FORM

STREAM AND STATION Soldier Creek near sedimentation pond

REMARKS 25-year, 6-hour storm

DR. AREA 15.00 SQ. MI. T_c 1.92 HR. RUNOFF CONDITION NO. II

RUNOFF CURVE NO. 70 . STORM DISTRIB. CURVE — . HYDRO. FAM. NO. 4

STORM DURATION 6 HR. RAINFALL: POINT 1.76 IN. AREAL 1.76 IN.

Q 0.157 IN. COMPUTED T_p 1.34 HR. T_o 3.7 HR.

(T_o/T_p): COMPUTED 2.8 : USED 3 . REVISED T_p 1.23

$$q_p = \frac{484\ A}{\text{REV. } T_p} = 5902.4 \text{ CFS.} \qquad Qq_p = 926.7 \text{ CFS.}$$

$$t\text{(COLUMN)} = (t/T_p)\ \text{REV. } T_p \qquad q\text{(COLUMN)} = (qc/q_p)\ Qq_p$$

LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS
1	0.0	0.0	21	[illegible]	18.53	41		
2	[illegible]	[illegible]	22	[illegible]	12.05	42		
3	[illegible]	[illegible]	23	7.58	7.41	43		
4	[illegible]	[illegible]	24	[illegible]	[illegible]	44		
5	[illegible]	[illegible]	25	[illegible]	[illegible]	45		
6	[illegible]	[illegible]	26	[illegible]	[illegible]	46		
7	[illegible]	[illegible]	27	[illegible]	[illegible]	47		
8	[illegible]	[illegible]	28	[illegible]	0.0	48		
9	[illegible]	[illegible]	29	[illegible]	0.0	49		
10	[illegible]	[illegible]	30			50		
11	[illegible]	[illegible]	31			51		
12	[illegible]	[illegible]	32			52		
13	[illegible]	[illegible]	33			53		
14	[illegible]	[illegible]	34			54		
15	[illegible]	[illegible]	35			55		
16	[illegible]	[illegible]	36			56		
17	[illegible]	[illegible]	37			57		
18	[illegible]	[illegible]	38			58		
19	[illegible]	[illegible]	39			59		
20	[illegible]	[illegible]	40			60		

APPENDIX C

10-year, 24-hour and 25-year, 6-hour Storm Runoff Hydrograph Computations of Inflow To The Proposed Sedimentation Pond.

HYDROGRAPH COMPUTATION FORM

STREAM AND STATION Soldier Creek Coal Co. - Watershed #2 (w/ Bypass)

REMARKS 10-year, 24-hour storm runoff

DR. AREA 0.0006 SQ. MI. T_c 0.03 HR. RUNOFF CONDITION NO. II

RUNOFF CURVE NO. 75. STORM DISTRIB CURVE —. HYDRO. FAM. NO. 4

STORM DURATION 24 HR. RAINFALL: POINT 2.08 IN. AREAL 2.08 IN.

Q 0.421 IN. COMPUTED T_p 0.02 HR. T_o 12.4 HR.

(T_o/T_p): COMPUTED 620.0 : USED 50 . REVISED T_p 0.25

$q_p = \frac{484\ A}{\text{REV. } T_p}$ = 1.2 CFS. Qq_p = 0.5 CFS.

$t\text{(COLUMN)} = (t/T_p)\ \text{REV. } T_p$ $q\text{(COLUMN)} = (qc/q_p)\ Qq_p$

LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS
1	0.00	0.00	21	10.00	.001	41		
2	0.50	0.01	22	10.50	0.01	42		
3	1.00	0.02	23	11.00	0.01	43		
4	1.50	0.02	24	11.50	0.01	44		
5	2.00	0.02	25	12.00	0.01	45		
6	2.50	0.02	26	12.50	0.01	46		
7	3.00	0.02	27	13.00	0.001	47		
8	3.50	0.01	28	13.50	0.00	48		
9	4.00	0.01	29			49		
10	4.50	0.01	30			50		
11	5.00	0.01	31			51		
12	5.50	0.01	32			52		
13	6.00	0.01	33			53		
14	6.50	0.01	34			54		
15	7.00	0.01	35			55		
16	7.50	0.01	36			56		
17	8.00	0.01	37			57		
18	8.50	0.01	38			58		
19	9.00	0.01	39			59		
20	9.50	0.01	40			60		

HYDROGRAPH COMPUTATION FORM

STREAM AND STATION Soldier Creek Coal Co. – Watershed #3

REMARKS 10-year, 24-hour storm

DR. AREA 0.013 SQ. MI. T_c 0.08 HR. RUNOFF CONDITION NO. II

RUNOFF CURVE NO. 75. STORM DISTRIB. CURVE —. HYDRO. FAM. NO. 4

STORM DURATION 24 HR. RAINFALL: POINT 2.08 IN. AREAL 2.08 IN.

Q 0.421 IN. COMPUTED T_p 0.05 HR. T_o 12.4 HR.

(T_o/T_p): COMPUTED 248.0: USED 50. REVISED T_p 0.25

$q_p = \frac{484\ A}{\text{REV. } T_p}$ = 25.2 CFS. Qq_p = 10.6 CFS.

t (COLUMN) = (t/T_p) REV. T_p q (COLUMN) = $(qc/q_p)\ Qq_p$

LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS
1	0.00	0.00	21	10.00	0.24	41		
2	0.50	0.29	22	10.50	0.24	42		
3	1.00	0.44	23	11.00	0.23	43		
4	1.50	0.46	24	11.50	0.23	44		
5	2.00	0.40	25	12.00	0.23	45		
6	2.50	0.36	26	12.50	0.23	46		
7	3.00	0.33	27	13.00	0.03	47		
8	3.50	0.31	28	13.50	0.00	48		
9	4.00	0.30	29			49		
10	4.50	0.29	30			50		
11	5.00	0.28	31			51		
12	5.50	0.27	32			52		
13	6.00	0.27	33			53		
14	6.50	0.26	34			54		
15	7.00	0.25	35			55		
16	7.50	0.24	36			56		
17	8.00	0.24	37			57		
18	8.50	0.24	38			58		
19	9.00	0.24	39			59		
20	9.50	0.24	40			60		

HYDROGRAPH COMPUTATION FORM

STREAM AND STATION Soldier Creek Coal Co. - Watershed #4

REMARKS 10-year, 24-hour storm

DR. AREA 0.004 SQ. MI. T_c 0.04 HR. RUNOFF CONDITION NO. II

RUNOFF CURVE NO. 75. STORM DISTRIB. CURVE –. HYDRO. FAM. NO. 4

STORM DURATION 24 HR. RAINFALL: POINT 2.08 IN. AREAL 2.08 IN.

Q 0.421 IN. COMPUTED T_p 0.03 HR. T_o 12.4 HR.

(T_o/T_p): COMPUTED 413.3 : USED 50. REVISED T_p 0.25

$q_p = \frac{484\ A}{\text{REV. } T_p}$ = 7.7 CFS. Qq_p = 3.3 CFS.

$t\text{(COLUMN)} = (t/T_p)\ \text{REV. } T_p$ $q\text{(COLUMN)} = (q_c/q_p)\ Qq_p$

LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS
1	0.00	0.00	21	10.00	0.07	41		
2	0.50	0.04	22	10.50	0.07	42		
3	1.00	0.15	23	11.00	0.07	43		
4	1.50	0.14	24	11.50	0.07	44		
5	2.00	0.12	25	12.00	0.07	45		
6	2.50	0.11	26	12.50	0.07	46		
7	3.00	0.10	27	13.00	0.01	47		
8	3.50	0.10	28	13.50	0.00	48		
9	4.00	0.09	29			49		
10	4.50	0.09	30			50		
11	5.00	0.09	31			51		
12	5.50	0.09	32			52		
13	6.00	0.08	33			53		
14	6.50	0.08	34			54		
15	7.00	0.08	35			55		
16	7.50	0.08	36			56		
17	8.00	0.08	37			57		
18	8.50	0.07	38			58		
19	9.00	0.07	39			59		
20	9.50	0.07	40			60		

HYDROGRAPH COMPUTATION FORM

STREAM AND STATION Soldier Creek Coal Co. - Watershed #5

REMARKS 10-year, 24-hour storm

DR. AREA 0.005 SQ. MI. T_c 0.05 HR. RUNOFF CONDITION NO. II

RUNOFF CURVE NO. 75 . STORM DISTRIB. CURVE — . HYDRO. FAM. NO. 4

STORM DURATION 24 HR. RAINFALL: POINT 2.08 IN. AREAL 2.08 IN.

Q 0.421 IN. COMPUTED T_p 0.03 HR. T_o 12.4 HR.

(T_o/T_p): COMPUTED 413.3 : USED 50 . REVISED T_p 0.25

$q_p = \frac{484\ A}{\text{REV. } T_p}$ = 7.7 CFS. Qq_p = 3.3 CFS.

$t\,(\text{COLUMN}) = (t/T_p)\ \text{REV. } T_p$ $q\,(\text{COLUMN}) = (qc/q_p)\ Qq_p$

LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS
1	0.00	0.00	21	10.00	0.07	41		
2	0.50	0.09	22	10.50	0.07	42		
3	1.00	0.15	23	11.00	0.07	43		
4	1.50	0.14	24	11.50	0.07	44		
5	2.00	0.12	25	12.00	0.07	45		
6	2.50	0.11	26	12.50	0.07	46		
7	3.00	0.10	27	13.00	0.01	47		
8	3.50	0.10	28	13.50	0.00	48		
9	4.00	0.09	29			49		
10	4.50	0.09	30			50		
11	5.00	0.09	31			51		
12	5.50	0.09	32			52		
13	6.00	0.08	33			53		
14	6.50	0.08	34			54		
15	7.00	0.08	35			55		
16	7.50	0.08	36			56		
17	8.00	0.07	37			57		
18	8.50	0.07	38			58		
19	9.00	0.07	39			59		
20	9.50	0.07	40			60		

HYDROGRAPH COMPUTATION FORM

STREAM AND STATION Soldier Creek Coal Co. - Watershed #6

REMARKS 10-year, 24-hour storm.

DR. AREA 0.003 SQ. MI. T_c 0.12 HR. RUNOFF CONDITION NO. II

RUNOFF CURVE NO. 90 . STORM DISTRIB. CURVE — . HYDRO. FAM. NO. 2

STORM DURATION 24 HR. RAINFALL: POINT 2.08 IN. AREAL 2.08 IN.

Q 1.163 IN. COMPUTED T_p 0.08 HR. T_o 16.6 HR.

(T_o/T_p): COMPUTED 207.5 : USED 75 . REVISED T_p 0.22

$q_p = \frac{484\ A}{\text{REV. } T_p} =$ 6.6 CFS. $Qq_p =$ 7.7 CFS.

$t\text{(COLUMN)} = (t/T_p)\ \text{REV. } T_p$ $q\text{(COLUMN)} = (q_c/q_p)\ Qq_p$

LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS
1	0.00	0.00	21	13.20	0.08	41		
2	0.66	0.01	22	13.86	0.08	42		
3	1.32	0.02	23	14.52	0.07	43		
4	1.98	0.03	24	15.18	0.07	44		
5	2.64	0.05	25	15.84	0.07	45		
6	3.30	0.09	26	16.50	0.07	46		
7	3.96	0.22	27	17.16	0.00	47		
8	4.62	0.61	28	17.82	0.00	48		
9	5.28	0.28	29			49		
10	5.94	0.27	30			50		
11	6.60	0.22	31			51		
12	7.26	0.18	32			52		
13	7.92	0.15	33			53		
14	8.58	0.15	34			54		
15	9.24	0.12	35			55		
16	9.90	0.11	36			56		
17	10.56	0.10	37			57		
18	11.22	0.09	38			58		
19	11.88	0.08	39			59		
20	12.54	0.08	40			60		

HYDROGRAPH COMPUTATION FORM

STREAM AND STATION Soldier Creek Coal Co. – Watershed #7

REMARKS 10-year, 24-hour storm

DR. AREA 0.007 SQ. MI. T_c 0.15 HR. RUNOFF CONDITION NO. II

RUNOFF CURVE NO. 90 . STORM DISTRIB. CURVE — . HYDRO. FAM. NO. 2

STORM DURATION 24 HR. RAINFALL: POINT 2.08 IN. AREAL 2.08 IN.

Q 1.163 IN. COMPUTED T_p 0.10 HR. T_o 16.6 HR.

(T_o/T_p): COMPUTED 166.0 : USED 75 . REVISED T_p 0.22

$q_p = \frac{484\ A}{\text{REV. } T_p}$ = 15.4 CFS. Qq_p = 17.9 CFS.

$t\text{(COLUMN)} = (t/T_p)\ \text{REV. } T_p$ $q\text{(COLUMN)} = (qc/q_p)\ Qq_p$

LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS
1	0.00	0.00	21	13.20	0.18	41		
2	0.66	0.02	22	13.86	0.18	42		
3	1.32	0.05	23	14.52	0.17	43		
4	1.98	0.08	24	15.18	0.16	44		
5	2.64	0.12	25	15.84	0.16	45		
6	3.30	0.19	26	16.50	0.15	46		
7	3.96	0.55	27	17.16	0.01	47		
8	4.62	1.21	28	17.82	0.00	48		
9	5.28	1.12	29			49		
10	5.94	0.64	30			50		
11	6.60	0.51	31			51		
12	7.26	0.42	32			52		
13	7.92	0.35	33			53		
14	8.58	0.30	34			54		
15	9.24	0.27	35			55		
16	9.90	0.25	36			56		
17	10.56	0.23	37			57		
18	11.22	0.21	38			58		
19	11.88	[illegible]	39			59		
20	12.54	0.19	40			60		

HYDROGRAPH COMPUTATION FORM

STREAM AND STATION Soldier Creek Coal Co. – Watershed #2 (w/ Bypass)

REMARKS 25-yr, 6-hour storm runoff

DR. AREA 0.0006 SQ. MI. T_c 0.03 HR. RUNOFF CONDITION NO. II

RUNOFF CURVE NO. 75. STORM DISTRIB CURVE —. HYDRO. FAM. NO. 4

STORM DURATION 6 HR. RAINFALL: POINT 1.76 IN. AREAL 1.76 IN.

Q 0.270 IN. COMPUTED T_p 0.02 HR. T_o 3.8 HR.

(T_o/T_p): COMPUTED 190.0 : USED 50 . REVISED T_p 0.08

$q_p = \frac{484\ A}{\text{REV. } T_p}$ = 3.6 CFS. Qq_p = 1.0 CFS.

$t\text{(COLUMN)} = (t/T_p)\ \text{REV. } T_p$ $q\text{(COLUMN)} = (q_c/q_p)\ Qq_p$

LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS
1	0.00	0.00	21	3.20	0.02	41		
2	0.16	0.03	22	3.36	0.02	42		
3	0.32	0.05	23	3.52	0.02	43		
4	0.48	0.04	24	3.68	0.02	44		
5	0.64	0.04	25	3.84	0.02	45		
6	0.80	0.03	26	4.00	0.02	46		
7	0.96	0.03	27	4.16	0.002	47		
8	1.12	0.03	28	4.32	0.00	48		
9	1.28	0.03	29			49		
10	1.44	0.03	30			50		
11	1.60	0.03	31			51		
12	1.76	0.03	32			52		
13	1.92	0.03	33			53		
14	2.08	0.02	34			54		
15	2.24	0.02	35			55		
16	2.40	0.02	36			56		
17	2.56	0.02	37			57		
18	2.72	0.02	38			58		
19	2.88	0.02	39			59		
20	3.04	0.02	40			60		

HYDROGRAPH COMPUTATION FORM

STREAM AND STATION Soldier Creek Coal Co. - Watershed #3

REMARKS 25-year, 6-hour storm

DR. AREA 0.013 SQ. MI. T_c 0.08 HR. RUNOFF CONDITION NO. II

RUNOFF CURVE NO. 75. STORM DISTRIB. CURVE —. HYDRO. FAM. NO. 4

STORM DURATION 6 HR. RAINFALL: POINT 1.76 IN. AREAL 1.76 IN.

Q 0.270 IN. COMPUTED T_p 0.05 HR. T_o 3.8 HR.

(T_o/T_p): COMPUTED 76.0 : USED 50 . REVISED T_p 0.08

$q_p = \frac{484\ A}{\text{REV. } T_p}$ = 78.7 CFS. Qq_p = 21.2 CFS.

t(COLUMN) = (t/T_p) REV. T_p q(COLUMN) = $(qc/q_p)\ Qq_p$

LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS
1	0.00	0.00	21	3.20	0.47	41		
2	0.16	0.59	22	3.36	0.47	42		
3	0.32	0.98	23	3.52	0.47	43		
4	0.48	0.92	24	3.68	0.46	44		
5	0.64	0.90	25	3.84	0.46	45		
6	0.80	0.71	26	4.00	0.46	46		
7	0.96	0.65	27	4.16	0.86	47		
8	1.12	0.62	28	4.32	0.80	48		
9	1.28	0.60	29			49		
10	1.44	0.58	30			50		
11	1.60	0.56	31			51		
12	1.76	0.55	32			52		
13	1.92	0.53	33			53		
14	2.08	0.51	34			54		
15	2.24	0.50	35			55		
16	2.40	0.50	36			56		
17	2.56	0.49	37			57		
18	2.72	[illegible]	38			58		
19	2.88	0.49	39			59		
20	3.04	0.48	40			60		

HYDROGRAPH COMPUTATION FORM

STREAM AND STATION Soldier Creek Coal Co. – Watershed #4

REMARKS 25-year, 6-hour storm

DR. AREA 0.004 SQ. MI. T_c 0.04 HR. RUNOFF CONDITION NO. II

RUNOFF CURVE NO. 75 . STORM DISTRIB. CURVE — . HYDRO. FAM. NO. 4

STORM DURATION 6 HR. RAINFALL: POINT 1.76 IN. AREAL 1.76 IN.

Q 0.270 IN. COMPUTED T_p 0.03 HR. T_o 3.8 HR.

(T_o/T_p): COMPUTED 126.7 : USED 50 . REVISED T_p 0.08

$q_p = \frac{484\ A}{REV.\ T_p}$ = 24.2 CFS. Qq_p = 6.5 CFS.

t(COLUMN) = (t/T_p) REV. T_p q(COLUMN) = $(q_c/q_p)\ Qq_p$

LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS
1	0.00	0.00	21	3.20	0.15	41		
2	0.16	0.18	22	3.36	0.14	42		
3	0.32	0.30	23	3.52	0.14	43		
4	0.48	0.28	24	3.68	0.14	44		
5	0.64	0.25	25	3.84	0.14	45		
6	0.84	0.22	26	4.00	0.14	46		
7	0.96	0.20	27	4.16	0.07	47		
8	1.12	0.19	28	4.32	0.00	48		
9	1.28	0.18	29			49		
10	1.44	0.18	30			50		
11	1.60	0.17	31			51		
12	1.76	0.17	32			52		
13	1.92	0.16	33			53		
14	2.08	0.16	34			54		
15	2.24	0.15	35			55		
16	2.40	0.15	36			56		
17	2.56	0.15	37			57		
18	2.72	0.15	38			58		
19	2.88	0.15	39			59		
20	3.04	0.15	40			60		

HYDROGRAPH COMPUTATION FORM

STREAM AND STATION Soldier Creek Coal Co. – Watershed #5

REMARKS 25-year, 6-hour storm

DR. AREA 0.004 SQ. MI. T_c 0.05 HR. RUNOFF CONDITION NO. II

RUNOFF CURVE NO. 75 . STORM DISTRIB. CURVE — . HYDRO. FAM. NO. 4

STORM DURATION 6 HR. RAINFALL: POINT 1.76 IN. AREAL 1.76 IN.

Q 0.270 IN. COMPUTED T_p 0.03 HR. T_o 3.8 HR.

(T_o/T_p): COMPUTED 126.7 : USED 50 . REVISED T_p 0.08

$q_p = \frac{484\ A}{\text{REV. } T_p} =$ 24.2 CFS. $Qq_p =$ 6.5 CFS.

$t\text{(COLUMN)} = (t/T_p)\ \text{REV. } T_p$ $q\text{(COLUMN)} = (qc/q_p)\ Qq_p$

LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS
1	0.00	0.00	21	3.20	0.15	41		
2	0.16	0.18	22	3.36	0.14	42		
3	0.32	0.30	23	3.52	0.14	43		
4	0.48	0.28	24	3.68	0.14	44		
5	0.64	0.25	25	3.84	0.14	45		
6	0.80	0.22	26	4.00	0.14	46		
7	0.96	0.20	27	4.16	0.02	47		
8	1.12	0.19	28	4.32	0.00	48		
9	1.28	0.18	29			49		
10	1.44	0.18	30			50		
11	1.60	0.17	31			51		
12	1.76	0.17	32			52		
13	1.92	0.16	33			53		
14	2.08	0.16	34			54		
15	2.24	0.15	35			55		
16	2.40	0.15	36			56		
17	2.56	0.15	37			57		
18	2.72	0.15	38			58		
19	2.88	0.15	39			59		
20	3.04	0.15	40			60		

HYDROGRAPH COMPUTATION FORM

STREAM AND STATION Soldier Creek Coal Co. – Watershed #6

REMARKS 25-year, 6-hour storm

DR. AREA 0.024 SQ. MI. T_c 0.12 HR. RUNOFF CONDITION NO. II

RUNOFF CURVE NO. 90. STORM DISTRIB CURVE —. HYDRO. FAM. NO. 3

STORM DURATION 6 HR. RAINFALL: POINT 1.76 IN. AREAL 1.76 IN.

Q 0.893 IN. COMPUTED T_p 0.08 HR. T_o 4.6 HR.

(T_o/T_p): COMPUTED 57.5 : USED 50. REVISED T_p 0.09

$q_p = \frac{484\ A}{\text{REV. } T_p}$ = 16.1 CFS. Qq_p = 14.4 CFS.

$t\text{(COLUMN)} = (t/T_p)\ \text{REV. } T_p$ $q\text{(COLUMN)} = (q_c/q_p)\ Qq_p$

LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS
1	0.00	0.01	21	4.05	0.22	41		
2	0.20	0.10	22	4.25	0.22	42		
3	0.41	0.10	23	4.46	0.21	43		
4	0.61	0.69	24	4.66	0.04	44		
5	0.81	1.20	25	4.86	0.00	45		
6	1.01	0.92	26			46		
7	1.22	0.63	27			47		
8	1.42	0.54	28			48		
9	1.62	0.46	29			49		
10	1.82	0.41	30			50		
11	2.02	0.37	31			51		
12	2.23	0.34	32			52		
13	2.43	0.32	33			53		
14	2.64	0.29	34			54		
15	2.84	0.27	35			55		
16	3.04	0.25	36			56		
17	3.24	0.24	37			57		
18	3.44	0.23	38			58		
19	3.65	0.23	39			59		
20	3.85	0.22	40			60		

HYDROGRAPH COMPUTATION FORM

STREAM AND STATION Soldier Creek Coal Co. - Watershed #7

REMARKS 25-year, 6-hour storm

DR. AREA 0.007 SQ. MI. T_c 0.15 HR. RUNOFF CONDITION NO. II

RUNOFF CURVE NO. 90 . STORM DISTRIB. CURVE — . HYDRO. FAM. NO. 3

STORM DURATION 6 HR. RAINFALL: POINT 1.76 IN. AREAL 1.76 IN.

Q 0.893 IN. COMPUTED T_p 0.10 HR. T_o 4.6 HR.

(T_o/T_p): COMPUTED 46 : USED 50 . REVISED T_p 0.09

$q_p = \frac{484\ A}{\text{REV. } T_p} =$ 37.6 CFS. $Qq_p =$ 33.6 CFS.

t (COLUMN) = (t/T_p) REV. T_p q (COLUMN) = $(q_c/q_p)\ Qq_p$

LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS	LINE NO.	t HOURS	q CFS
1	0.00	0.03	21	4.05	0.51	41		
2	0.20	0.24	22	4.25	0.50	42		
3	0.41	0.84	23	4.46	0.49	43		
4	0.61	1.59	24	4.66	0.09	44		
5	0.81	2.27	25	4.86	0.00	45		
6	1.01	2.16	26			46		
7	1.22	1.55	27			47		
8	1.42	1.26	28			48		
9	1.62	1.04	29			49		
10	1.82	0.96	30			50		
11	2.03	0.87	31			51		
12	2.23	0.80	32			52		
13	2.43	0.72	33			53		
14	2.64	0.68	34			54		
15	2.84	0.62	35			55		
16	3.04	0.59	36			56		
17	3.24	0.55	37			57		
18	3.44	0.54	38			58		
19	3.65	0.53	39			59		
20	3.85	0.52	40			60		

APPENDIX D

Copy of NPDES

Permit Application

Form Approved
OMB No. 158-R0096

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM
APPLICATION FOR PERMIT TO DISCHARGE - SHORT FORM C

FOR AGENCY USE

APPLICATION NUMBER		
DATE RECEIVED		
YEAR	MO.	DAY

To be filed only by persons engaged in manufacturing and mining

Do not attempt to complete this form before reading accompanying instructions

Please print or type

1. Name, address, location, and telephone number of facility producing discharge
   - A. Name Soldier Creek Coal Company
   - B. Mailing address
     1. Street address Post Office Box "I"
     2. City Price
     3. State Utah
     4. County Carbon
     5. ZIP 84501
   - C. Location:
     1. Street Highway 53 (Soldier Creek Canyon)
     2. City
     3. County Carbon
     4. State Utah
   - D. Telephone No. 801 (Area Code) 637-6360

2. SIC [| | |] (Leave blank)

3. Number of employees 120

If all your waste is discharged into a publicly owned waste treatment facility and to the best of your knowledge you are not required to obtain a discharge permit, proceed to item 4. Otherwise proceed directly to item 5.

4. If you meet the condition stated above, check here ☐ and supply the information asked for below. After completing these items, please complete the date, title, and signature blocks below and return this form to the proper reviewing office without completing the remainder of the form.
   - A. Name of organization responsible for receiving waste
   - B. Facility receiving waste:
     1. Name
     2. Street address
     3. City
     4. County
     5. State
     6. ZIP

5. ☒ Principal product, ☐ raw material (Check one) Coal from underground mine

6. Principal process Underground mining using room and pillar process

7. Maximum amount of principal product produced or raw material consumed per (Check one)

Basis	Amount 1-99 (1)	100-199 (2)	200-499 (3)	500-999 (4)	1000-4999 (5)	5000-9999 (6)	10,000-49,999 (7)	50,000 or more (8)
A. Day								
B. Month								
C. Year								x

8. Maximum amount of principal product produced or raw material consumed, reported in item 7, above, is measured in (Check one):

A. ☐ pounds B. ☒ tons C. ☐ barrels D. ☐ bushels E. ☐ square feet

F. ☐ gallons G. ☐ pieces or units H. ☐ other, specify ______________

9. (a) Check here if discharge occurs all year ☐, or

(b) Check the month(s) discharge occurs: Discharge will occur intermittently as a direct result of snowmelt and stormwater runoff.

1. ☐ January 2. ☐ February 3. ☐ March 4. ☒ April 5. ☐ May 6. ☐ June

7. ☐ July 8. ☒ August 9. ☐ September 10. ☐ October 11. ☐ November 12. ☐ December

(c) Check how many days per week: 1. ☒ 1 2. ☐ 2-3 3. ☐ 4-5 4. ☐ 6-7

10. Types of waste water discharged to surface waters only (check as applicable)

Discharge per operating day	Flow, gallons per operating day					Volume treated before discharging (percent)				
	0.1-999 (1)	1000-4999 (2)	5000-9999 (3)	10,000-49,999 (4)	50,000- or more (5)	None (6)	0.1-29.9 (7)	30-64.9 (8)	65-94.9 (9)	95-100 (10)
A. Sanitary, daily average										
B. Cooling water, etc. daily average										
C. Stormwater runoff, daily average				x						x
D. Maximum per operating day for total discharge (all types)				x		All water will enter and be discharged from a sedimentation pond.				

11. If any of the three types of waste identified in item 10, either treated or untreated, are discharged to places other than surface waters, check below as applicable.

Waste water is discharged to:	Average flow, gallons per operating day				
	0.1-999 (1)	1000-4999 (2)	5000-9999 (3)	10,000-49,999 (4)	50,000 or more (5)
A. Municipal sewer system					
B. Underground well					
C. Septic tank					
D. Evaporation lagoon or pond					
E. Other, specify		NOT APPLICABLE			

12. Number of separate discharge points: A. ☐ 1 B. ☒ 2-3 C. ☐ 4-5 D. ☐ 6 or more

13. Name of receiving water or waters Soldier Creek — Spillway and dewatering device (only one ~~in operation at any one time~~)

14. Does your discharge contain or is it possible for your discharge to contain one or more of the following substances added as a result of your operations, activities, or processes: ammonia, cyanide, aluminum, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, zinc, phenols, oil and grease, and chlorine (residual). A. ☒ yes B. ☐ no

I certify that I am familiar with the information contained in the application and that to the best of my knowledge and belief such information is true, complete, and accurate.

Printed Name of Person Signing ______________ Title ______________

Date Application Signed ______________ Signature of Applicant ______________

18 U.S.C. Section 1001 provides that:
Whoever, in any matter within the jurisdiction of any department or agency of the United States knowingly and wilfully falsifies, conceals, or covers up by any trick, scheme, or device a material fact, or makes any false, fictitious, or fraudulent statements or representations; or makes or uses any false writing or document knowing same to contain any false, fictitious, or fraudulent statement or entry, shall be fined not more than $10,000 or imprisoned not more than 5 years, or both.

GENERAL INSTRUCTIONS

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM APPLICATION FOR PERMIT TO DISCHARGE (SHORT FORM)

The Federal Water Pollution Control Act, as amended by Public Law 92-500 enacted October 18, 1972, prohibits any person from discharging pollutants into a waterway from a point source (see definitions below), unless his discharge is authorized by a permit issued either by the U.S. Environmental Protection Agency or by an approved State Agency. (See "Procedures for Filing".)

REQUIREMENTS

If you have a discharge or discharges, such as that described in the first paragraph of these instructions, you must complete one of the following forms to apply for a discharge permit. The forms differ by types of discharges as indicated below:

Short Form A - Municipal Wastewater Dischargers
Short Form B - Agriculture
Short Form C - Manufacturing Establishments and Mining
Short Form D - Services, Wholesale and Retail Trade, and All Other Commercial Establishments, Including Vessels, Not Engaged in Manufacturing or Agriculture

If your business or activity involves production of both raw products and ready-for-market products you may be required to complete two of the above forms. For example, if you produce a raw product such as milk and, on the same site, process the raw milk into cheese, you must complete Form B - Agriculture, and Form C - Manufacturing and Mining.

If the discharge is from a Federal Facility's treatment plant receiving more than 50% domestic waste (based on the dry weather flow rate) complete Form A.

If the discharge is from a sewage treatment process which is not from a municipal, agricultural, or industrial facility (e.g., housing subdivision, school) complete and submit Form D.

EXCLUSIONS

You are not required to obtain a permit for the following types of waste discharges:

(1) Sewage discharged from vessels (e.g., ships); or

(2) "Water, gas, and other materials injected into a well to facilitate production of oil or gas, or water derived in association with oil or gas production and disposed of in a well" where authorized by the State in which the well is located; or

(3) Dredged or fill material; or

(4) Discharges from properly functioning marine engines; or

(5) Those discharges conveyed directly to a publicly or privately owned waste treatment facility (however, discharges originating from publicly or privately owned waste treatment facilities are not excluded) ; or

Note: Municipal and manufacturing dischargers that believe they are exempt due to Item 5, are requested to complete certain items and return the form (see "Procedures for Filing").

(6) Most discharges from separate storm sewers. Discharges from storm sewers which receive industrial, municipal, and/or agricultural wastes or which are considered by EPA or a State to be significant contributors to pollution are not excluded.

PROCEDURES FOR FILING

Copies of all forms are available at State water pollution control agencies and at all Environmental Protection Agency Regional Offices (see attached table).

Data submitted on these forms are to be used as a basis for issuing discharge permits. Depending on the adequacy and nature of the data submitted, you may be called upon for additional information before a permit is granted.

If you have any questions as to whether or not you need a permit under this program contact your State water pollution control agency or the nearest Regional Office of the U.S. Environmental Protection Agency. A list of EPA Regional Offices is in the attached table.

Complete the appropriate form(s) for your operation, being sure that each item is considered and the required data submitted. Check the items which most nearly apply to you and your operation. If an item does not apply, please enter in the appropriate place "Not Applicable" or "NA" to show that the item was given consideration. Most of the items on the form require the checking of one or more of several possible answers.

If the application is to be sent to the Environmental Protection Agency, there is an application fee of $10. This fee, in the form of a check or money order made payable to the Environmental Protection Agency, should be mailed with the original of the application form to the EPA Regional Office having jurisdiction over the State in which the discharge is located.

If the State in which the discharge is located has a Federally-approved permit program, the application should instead be sent to the State agency administering the program; you will be informed as to the amount of the application fee, if any, and the address to which the application and fee should be sent.

Agencies and instrumentalities of Federal, State or local governments will not be required to pay an application fee.

Applications pertaining to "existing" discharges, i.e., those which were in operation on or before October 18, 1972, must be filed with the EPA Regional Office or approved State agency by April 16, 1973. The exception is that anyone who applied to the Corps of Engineers for a discharge permit under the Refuse Act of 1899 need not reapply for a permit for the same discharge, unless it is substantially changed in nature, volume or frequency; application must also be made for any other discharges not covered by the Refuse Act.

Applications for "new" discharges beginning between October 18, 1972, and on or before July 15, 1973, must apply at least 60 days before the date the discharge is due to begin, unless a delay is granted by the approved State agency or by EPA.

Applications for "new" discharges beginning on or after July 16, 1973, must apply at least 180 days before the date the discharge is due to begin, unless a delay is granted by the approved State agency or by EPA.

SIGNATURE ON APPLICATION

The person who signs the application form will often be the applicant himself; when another person signs on behalf of the applicant, his title or relationship to the applicant should be shown in the space provided. In all cases, the person signing the form should be authorized to do so by the applicant. An application submitted by a corporation must be signed by a principal executive officer of at least the level of vice president or his duly authorized representative, if such representative is responsible for the overall operation of the facility from which the discharge(s) described in the form originate. In the case of a partnership or a sole proprietorship, the application must be signed by a general partner or the proprietor, respectively. In the case of a municipal, State, Federal or other public facility, the application must be signed by either a principal executive officer, ranking elected official or other duly authorized employee.

USE OF INFORMATION

All information contained in this application will, upon request, be made available to the public for inspection and copying. A separate sheet entitled "Confidential Answers" must be used to set out information which is considered by the applicant to constitute trade secrets. The information must clearly indicate the item number to which it applies. Confidential treatment can be considered only for that information for which a specific written request of confidentiality has been made on the attached sheet. However, in no event will identification of the contents, volume, and frequency of a discharge be recognized as confidential or privileged information, except in certain cases involving the national security.

DEFINITIONS

1. A "person" is an individual, partnership, corporation, association, State, municipiality, commission, other political subdivision of a State, and any interstate body.

2. A "pollutant" includes solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt, and industrial, municipal and agricultural waste discharged into water.

3. A "point source" is any discernible, confined and discrete conveyance including but not limited to a pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft from which pollutants are or may be discharged.

4. A "discharge of pollutant" or a "discharge of pollutants" means any addition of any pollutant to the waters of the United States from any point source; any addition of any pollutant to the waters of the contiguous zone or the ocean from any point source other than a vessel or other floating craft.

5. A "discharge" when used without qualification includes a "discharge of pollutant" and a "discharge of pollutants." (See above.)

6. The term "municipality" means a city, town, borough, county, parish, district, association, or other public body created by or pursuant to State law and having jurisdiction over disposal of sewage, industrial wastes, or other wastes, or an Indian tribe or an authorized Indian tribal organization, or a designated and approved areawide waste treatment management agency.

SHORT FORM C - SPECIFIC INSTRUCTIONS

MANUFACTURING AND MINING

Item 1. Provide the official, legal name of the facility and the address where the facility is located. If the mailing address is different from the location, supply this information in remarks.

Item 2. Leave this line blank. The SIC code will be supplied by the reviewing office.

Item 3. Specify the average number of employees working in the facility.

Item 4. Complete this item and mail this form without filing fee only if all of your waste is discharged to a publicly owned treatment facility.

Item 5. List the principal products produced at this location or the raw material consumed, whichever one will give a better measure of the over-all volume of production in conjunction with the number and units provided in item 7. Where several similar articles are produced, use a broader term which will include all or most of the specific ones (e.g., "costume jewelry" to designate the production of bracelets, earrings, and pins).

Item 6. Name the process using the raw materials or used for producing the principal product specified in item 5.

Item 7. The maximum amount of principal product produced or raw material consumed may be calculated on a daily, monthly, or yearly basis, whichever is more convenient. Check appropriate boxes to indicate basis used (lines A-C), and amount produced or consumed (box 1-8).

Item 8. Check one box to indicate the units in which the measure of production was reported (item 6). If box H is checked, enter units in the space provided.

Item 9. If you discharge wastes all year, check the box provided in (a). Otherwise, check the box beside the month(s) listed and (b) to show when wastes are usually discharged. Also, check one box under (c) to show how many days out of the week the wastes are discharged.

Item 10. This item applies to wastes ultimately discharged to surface waters only (e.g., a lake, stream, creek, ocean, etc.). Types of discharged waste water are classified in the table as follows:

A. "Sanitary" - Consisting only of used water from restrooms, toilets, showers, and similar sanitary or comfort facilities.

B. "Noncontact Cooling Water, Condensed Steam, etc." - Water used for cooling steam generation, etc., which does not come in contact with the product, intermediates, and/or raw materials.

C. "Process Water" - Water used directly in the manufacturing process, which comes in contact with the product, intermediates, or raw materials.

For each type of waste discharged, check one box (1-5) to show the average (annual) flow per operating day (lines A-C). This average should be based only on the number of actual days during the past year the discharge is occurring and not the entire calendar year. For example, 300,000 gallons of cooling water is discharged in the course of a year. This discharge occurs for 100 days of that year. The average daily flow is 300,000/100=3,000 gallons (box B-2 should be checked) and not 300,000/365=820 gallons.

If pretreatment (such as lagooning, ponding, chemical addition, aeration, etc.) before discharging the wastes is practiced check the appropriate box (6-10) under the heading "Amount Treated Before Discharging, Percent" (lines A-C). If no treatment is used, check the box labeled "None".

On line D, check the box (1-5) to indicate the maximum combined flow (of all types of discharges together) observed for any one day in the last full year of operation. For new facilities, this should reflect the best engineering estimates.

Item 11. Check the appropriate box(es) to indicate daily average flow of waste, if these wastes are discharged ultimately to places other than surface waters. If a box on line E is checked write in the place of discharge in the space provided.

Item 12. Check the box beside the number(s) to show the number of separate discharge points. A separate discharge point is defined as an easily identifiable completely or partly enclosed container or channel through which the waste is discharged into a body of water; for example, a pipe, ditch, culvert, refuse container, barge, boat, etc.

Item 13. Give the name of the waterway into which all or a major portion of the waste water is discharged. Whenever possible, use the name of the waterway as shown on published maps. If the discharge is into an unnamed tributary, give the name of the water body fed by the tributary and identify as tributary to (name of water body).

Item 14. If any of the listed substances are used in your processes or are likely to enter your discharge as a result of your activities or operations, you should check the box marked yes. If any of the listed substances are present in your discharge only because such substances are present in your intake waters (including drinking waters), you should check the box marked no.

I.	Regional Administrator, Region I, Environmental Protection Agency, John F. Kennedy Federal Bldg., Room 2303, Boston, Mass.02203. ATTENTION: Permits Branch. (617)-223-7210	Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont.
II.	Regional Administrator, Region II, Environmental Protection Agency, 26 Federal Plaza, Room 908 New York, NY 10007. ATTENTION: Permits Branch. (212)-264-9895	New Jersey, New York, Virgin Islands, Puerto Rico.
III.	Regional Administrator, Region III, Environmental Protection Agency, Curtis Bldg., 6th and Walnut Sts., Philadelphia, PA. 19106. ATTENTION: Permits Branch (215)-597-9966	Delaware, District of Columbia, Maryland, Pennsylvania, Virginia, West Virginia
IV.	Regional Administrator Region IV, Environmental Protection Agency, 1421 Peachtree St. NE., Atlanta, GA 30309. ATTENTION: Permits Branch. (404)-526-3971	Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee.
V.	Regional Administrator Region V, Environmental Protection Agency, 1 North Wacker Dr., Chicago, IL 60606. ATTENTION: Permits Branch. (312)-353-1476	Illinois, Indiana, Michigan, Minnesota, Ohio, Wisconsin.
VI.	Regional Administrator Region VI, Environmental Protection Agency, 1600 Patterson St., Suite 1100, Dallas, TX 75201. ATTENTION: Permits Branch. (214)-749-1983	Arkansas, Louisiana, New Mexico, Oklahoma, Texas.
VII.	Regional Administrator Region VII, Environmental Protection Agency, 1735 Baltimore Ave., Kansas City, MO 64108. ATTENTION: Permits Branch. (816)-374-5955	Iowa, Kansas, Missouri, Nebraska
VIII.	Regional Administrator Region VIII, Environmental Protection Agency, 1860 Lincoln St., Suite 900, Denver, CO 80203. ATTENTION: Permits Branch. (303)-837-4901	Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming.
IX.	Regional Administrator Region IX, Environmental Protection Agency, 100 California St., San Francisco, CA 94111. ATTENTION: Permits Branch. (415)-556-3450	Arizona, California Hawaii, Nevada, Guam, American Samoa.
X.	Regional Administrator Region X, Environmental Protection Agency, 1200 6th Ave., Seattle, WA 98101. ATTENTION: Permits Branch. (206)-442-1213	Alaska, Idaho, Oregon, Washington.

HYDROLOGIC INVENTORY OF THE SOLDIER CANYON MINE LEASE AND ADJACENT AREAS, CARBON COUNTY, UTAH

Prepared for

SOLDIER CREEK COAL COMPANY

Price, Utah

By

VAUGHN HANSEN ASSOCIATES

Salt Lake City, Utah

January, 1980

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HYDROLOGIC INVENTORY OF
THE SOLDIER CANYON MINE LEASE AND ADJACENT AREAS
CARBON COUNTY, UTAH

INTRODUCTION

Regulations, established by the U.S. Office of Surface Mining Reclamation and Enforcement (OSM) (Volume 44, Number 50 of the Federal Register, dated Tuesday, March 13, 1979), require that water monitoring programs be established to monitor the hydrologic impacts to areas affected by underground coal mining activities and to protect the hydrologic balance of such areas. As a result, a hydrologic investigation has been conducted on the 1707 acre lease area owned by Soldier Creek Coal Company. The lease area is located north and east of Price, Utah in the Book Cliffs (see Figure 1). The purpose of this report is to describe the existing hydrologic conditions of the lease area and to propose a program to predict and monitor the impacts from mining.

This report contains a description of the hydrologic environment; a description of the surface water hydrologic system of the Soldier Canyon Mine lease and adjacent areas, with the during and the post-mining monitoring program; and a description of the groundwater hydrologic system and associated monitoring program.

Vaughn Hansen Associates of Salt Lake City has been responsible for the collection and interpretation of hydrologic data. Water quality

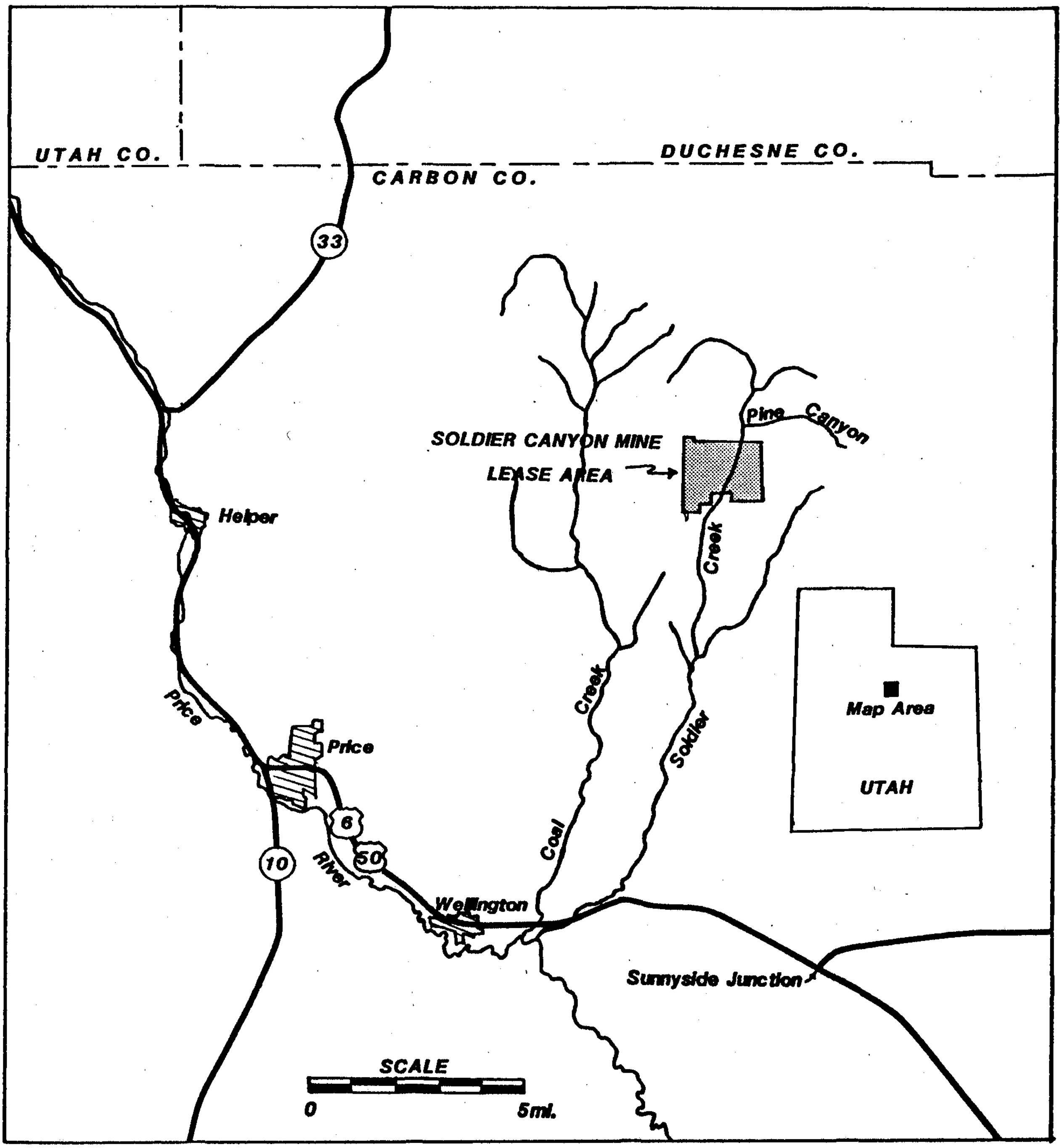

Figure 1. Location of the Soldier Canyon Mine lease area.

samples have been analyzed by Ford Chemical Laboratory, Inc. of Salt Lake City, Utah. Hydrologic data were gathered from September to October of 1979, and the methodologies used to collect and analyze the data are described in the appropriate sections of this report.

HYDROLOGIC ENVIRONMENT

Geology, soils, climate and vegetation are variables that influence the hydrologic response of an area. These variables, as they pertain to the hydrologic environment of the Soldier Canyon Mine lease area, are described in the following sections of this report.

Geology

The Soldier Canyon Mine lease area is located within the Book Cliffs coal field, which extends from the Utah-Colorado state line to Castlegate, Utah. The general dip of the strata in the vicinity of the lease area is to the north and east at approximately 11 percent (6 degrees) (Doelling, 1972). The strike of the strata coincides in general with the trend of the cliffs (Spieker, 1925).

Geologic formations exposed within the lease area are the Blackhawk and Price River formations of the Mesaverde Group and the North Horn and Flagstaff formations of the Wasatch Formation (see Figures 2 and 3).

Blackhawk Formation. The Blackhawk Formation, which directly overlies the Mancos Shale in the vicinity of the Soldier Canyon Mine (Doelling, 1972), is the middle and coal bearing unit of the Mesaverde Group. The Blackhawk consists of a basal sandstone (the Aberdeen Sandstone), overlain by massive beds of gray to buff sandstone with alternating beds of sandy shale, shale, and coal (Clark, 1928). In the vicinity of the Soldier Canyon Mine lease area, the Blackhawk Formation ranges in thickness from

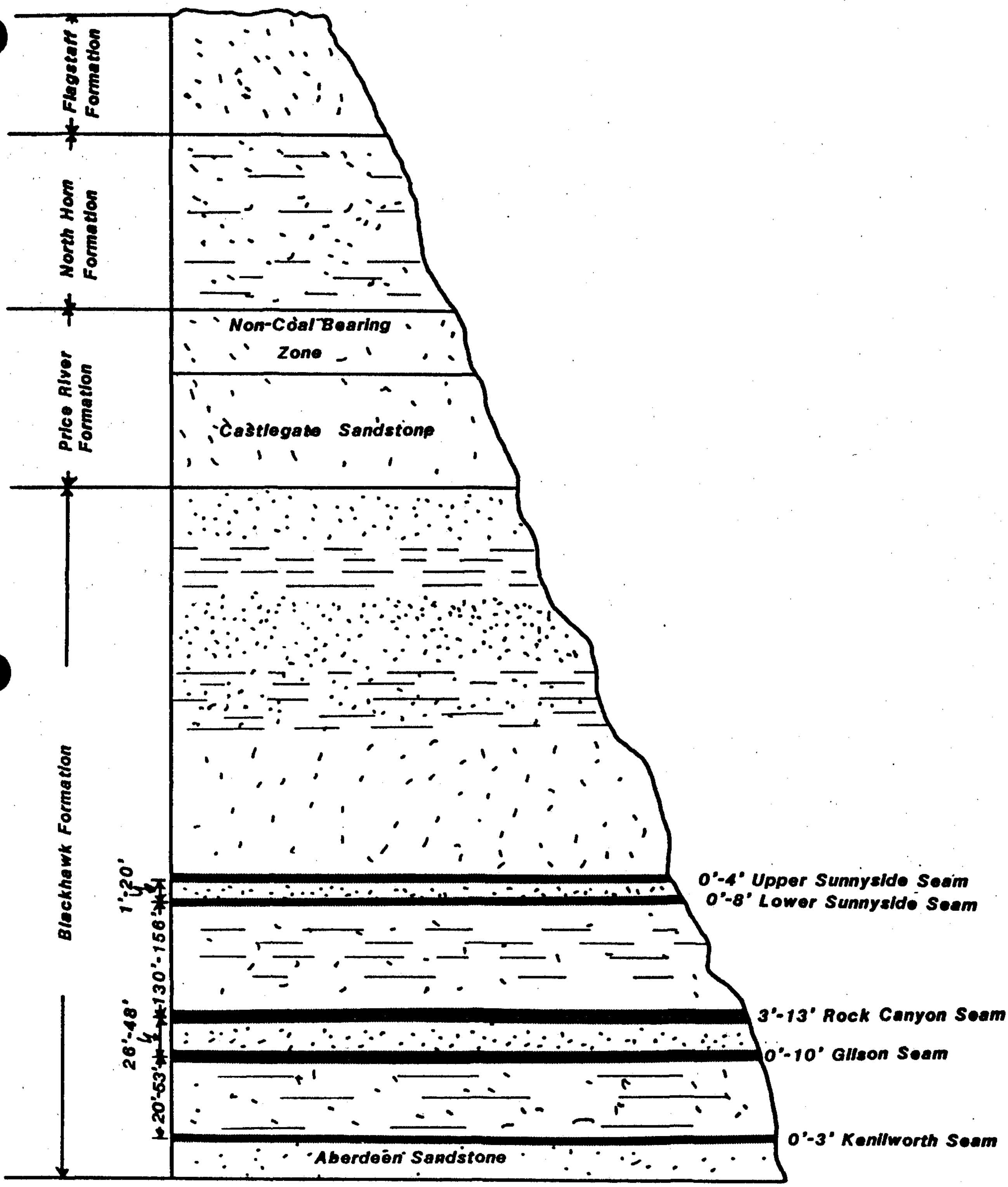

Figure 3. Generalized columnar section of the Soldier Canyon Mine lease area (Doelling, 1972 and Pollastro, 1980).

950 feet to 1050 feet (Doelling, 1972).

According to Clark (1928, p. 19):

> The coal bearing part of the Blackhawk Formation consists of massive beds of gray to buff sandstone, alternating with smaller amounts of sandy shale, shale and coal beds. The sandstone is composed larely of semirounded quartz grains cemented by carbonate of lime and is reasonably well consolidated but not greatly indurated except some of the fine-grained and highly calcareous beds. The shale, as a rule, is more or less sandy and adjacent to the coal beds usually contains some carbonaceous material. The coal beds have been extensively burned at the surface, and the associated rocks are greatly altered in character and composition. At many places where coal beds have burned, the rocks overlying them have fused, and everywhere they are predominantly red instead of gray and buff, their original colors.
>
> The dominant feature of the coal-bearing part of the Blackhawk Formation consists of the massive, cliff-forming beds of sandstone, which lie beneath many of the principal coal beds. Some of these sandstone beds are exposed for 20 to 30 miles in east-west extent.

The presence of shale layers in the Blackhawk Formation acts as an effective barrier to the vertical movement of water within the formation. Therefore, water penetrating into the Blackhawk probably percolates downward until it encounters a shale layer, which then causes horizontal movement to the surface or to another sandstone finger within the formation.

Price River Formation. Overlying the Blackhawk Formation is the Price River Formation; composed of a massive basal sandstone, referred to as the Castlegate Sandstone, and the non coal-bearing beds overlying the Castlegate (Clark, 1928).

The Castlegate Sandstone consists of massive, fine- to medium-grained sandstone beds (Doelling, 1972) which are gray to buff and composed mainly of semirounded grains of quartz (Clark, 1928). The basal portion of the Castlegate is a transition zone from sandy shale to sandstone and in many areas shale and sandy shale are encountered near the top of the sandstone bed (Clark, 1928). The Castlegate Sandstone is approximately 225 feet thick near the Soldier Canyon Mine (Doelling, 1972).

The non coal-bearing portion of the Price River Formation consists of two or more thick beds of sandstone, interbedded with thin-bedded shale and sandy shale (Clark, 1928). The sandstone layers are massive, white to gray beds, consisting of semi-angular grains of quartz. The shales are predominantly gray in color with occasional traces of olive-green shales in certain areas (Doelling, 1972). In the vicinity of the Soldier Canyon Mine, the non coal-bearing portion of the Price River Formation is approximately 150 feet thick (Doelling, 1972).

North Horn Formation. The North Horn Formation, the lower-most member of the Wasatch Formation, consists of a series of shale, sandstone, minor conglomerate and freshwater limestone. The shales vary from yellow to gray or gray-green in color and are usually calcareous and silty (Doelling, 1972; Clark, 1928). The sandstones are tan to yellow-gray, fine to coarse-grained conglomerate sandstones with interbedded highly colored sandy shale (Clark, 1928). Limestone increases near the upper portion of the member (Doelling, 1972). Near the Soldier Canyon Mine, the North Horn appears to be 250 to 500 feet thick.

Flagstaff Limestone Formation. The Flagstaff Limestone Formation consists of thin-bedded limestones, shales and sandstones (Doelling, 1972). The varicolored shales are interbedded with lacustrine and microcrystalline limestone. The sandstones are fine- to medium-grained, reddish-brown, and generally less plentiful then the other constituents (Doelling, 1972).

Faults. There are not major faults within or adjacent to the Soldier Canyon Mine lease area. According to Pollastro (1980), no faults have been encountered in mining coal from the Soldier Canyon Mine.

Soils

Wilson et al. (1975) classify soils within the lease area as Badland-Rock Land Association. Badland consists of shale or interbedded sandstone and shale, while the rock land consists of bare rock outcrop with some shallow and very shallow soils over bedrock (Wilson, et al., 1975). Shallow soils are found on benches and mesas where the topography is rolling.

Runoff is classified by Wilson et al. as rapid to very rapid with very high sediment production.

Climate

The general climate of the Soldier Canyon Mine lease area is characterized by moderate amounts of precipitation, high potential evapotranspiration, low temperatures, and relatively short growing seasons.

Temperature is both spacially and seasonally variable, being strongly influenced by elevation (U.S. Geological Survey, 1979). Temperatures vary in January from a mean minimum of 6°F to a mean maximum of 32°F; whereas July temperatures vary from a mean minimum of 53°F to a mean maximum of 84°F (Jeppsen et al., 1968). The average frost free season for the lease area is 60 days (Jeppsen et al., 1968).

Precipitation is affected by altitude and topography in the area of the Soldier Canyon Mine. Jeppsen et al., 1968, indicate that the normal annual precipitation of the lease area is 14 inches with 8 inches occurring as snow from October to April and 6 inches occurring as rainfall between May and September.

The annual potential evapotranspiration of the lease area is approximately 22 inches. Due to the fact that annual potential evapotranspiration exceeds normal annual precipitation, the lease area at the Soldier Canyon Mine is not considered to be an important water source.

Vegetation

A wide variety of vegetative communities are encountered within the lease area at the Soldier Canyon Mine, resulting from the varied topography, aspect, and elevation found therein.

The lease area is covered with Pinyon-Juniper, Mountain Shrub, Sagebrush-Grass, Conifer-Aspen (Bentley et al., 1978), and Ponderosa Pine vegetative communities (U.S. Geological Survey, 1979). The Sagebrush-Grass and Mountain Shrub communities fringe and intermix with the other communities throughout the lease area.

SURFACE WATER HYDROLOGY

Regional Surface Hydrologic System

The Soldier Canyon Mine lease area is situated in the Book Cliffs near the headwaters of the Price River Basin. The entire lease area drains toward Soldier Creek, a perennial tributary of the Price River.

Snowmelt is the major source of water for the perennial streams of the Price River Basin. Ephemeral streams are abundant in the basin, existing primarily at lower elevations where potential evapotranspiration exceeds precipitation.

Water use upstream from Castle Valley (the monoclinal valley containing most of the agricultural land noted in Figure 4) is primarily for stockwatering and industrial purposes (coal mining and electrical power generation). Within Castle Valley, agriculture and power production utilize nearly all of the inflowing water (Mundorff, 1972), with minimum flows in the gaged streams and rivers in the basin occasionally reaching zero. Storage reservoirs are common at higher elevations. Transbasin diversions occur throughout the area.

In general, the chemical quality of water in the headwaters of the Price River Basin is excellent, with this watershed providing most of the domestic water needs of the people below. However, this quality rapidly deteriorates downstream as the streams cross shale formations (particularly the Mancos Shale in and adjacent to Castle Valley) and

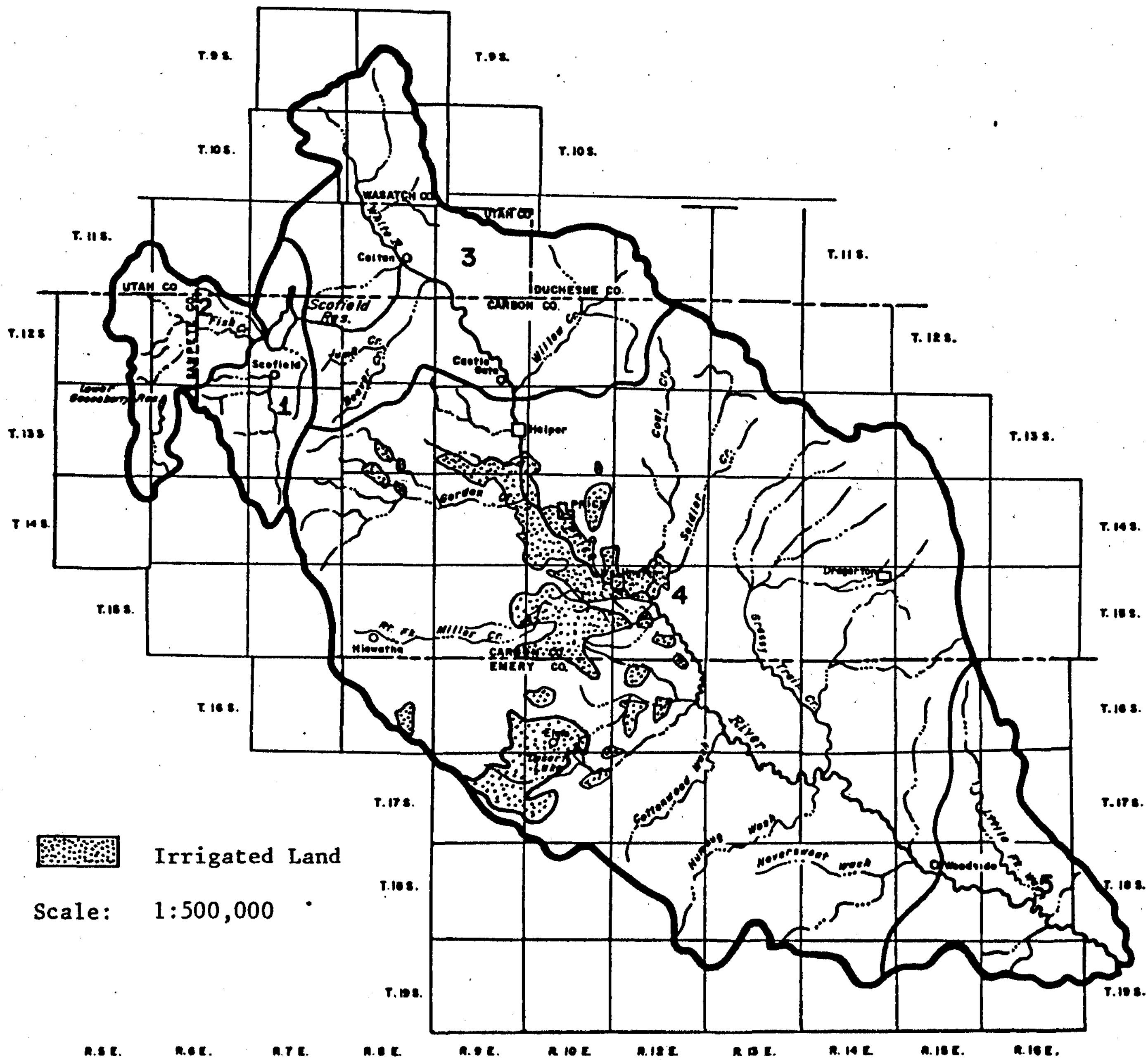

Figure 4. Price River Basin. (Adapted from the Utah Division of Water Resources, 1975.)

receive irrigation return flows from lands situated on Mancos-derived soils (Price and Waddell, 1973). Within the Price River Basin, for example, Mundorff (1972) reports that the Price River and its tributaries generally have a dissolved solids concentration of less than 400 milligrams per liter upstream from Helper. The water in this area is of a calcium bicarbonate type. Between this point and the confluence with Miller Creek, most of the flows originate on or traverse Mancos shales. Much of the flow is derived from irrigation return flows. The Price River at Wellington, which is near the center of the basin, has an average dissolved solids content of about 1700 milligrams per liter and is of a mixed chemical type (calcium-magnesium-sodium-sulfate). At Woodside, which is about 22 miles upstream from the confluence of the Price River with the Green River, the weighted average dissolved solids content has generally been between 2000 and 4000 milligrams per liter, with the water type being strongly sodium sulfate.

Sediment yield from the upper portion of the basin is probably neglible (Mundorff, 1972). According to the U.S. Soil Conservation Service (1975), erosion rates in the Price and San Rafael River Basin vary from 0.1 to 3.0 acre-feet per square mile per year. The bulk of the sediment yielded each year at the mouth of the Price River comes from limited areas covered with highly erodable shales (Mundorff, 1972).

Drainage Basin Characteristics

The lease area of the Soldier Canyon Mine is part of the Soldier Creek perennial watershed. Stream channels from the lease area flow in all directions except north.

Topography in the area is rugged, with elevations varying from 6600 feet to approximately 8300 feet above sea level. Slopes vary from vertical cliffs to less than 2 percent (1.2 degrees) along the ridges. The dominant aspect of the Soldier Canyon Mine lease area is to the south and east on the west side of Soldier Creek and to the south and west on the east side of Soldier Creek.

Water sources within or adjacent to the lease area at the Soldier Canyon Mine are a few springs and streams, which will be discussed in subsequent sections of this report. There are no major water bodies located within or adjacent to the lease area.

Rainfall-runoff relationships for the Soldier Canyon Mine lease area were determined from the runoff curve number technique as defined by the U.S. Soil Conservation Service (1972). According to the curve number technique, the algebraic and hydrologic relationship between storm rainfall, soil moisture storage, and runoff can be expressed by the following equations:

$$Q = \frac{(P-0.2S)^2}{P+0.8S} \qquad (1)$$

and

$$CN = \frac{1000}{10+S} \qquad (2)$$

where Q is the direct runoff depth in inches, P is the storm rainfall depth in inches, S is a watershed storage factor, in inches, defined originally as the maximum possible difference between P and Q, and CN is a dimensionless expression of S referred to as the curve number.

Hawkins (1973) indicates that runoff curve numbers tend to vary inversely with precipitation depth in forested mountain watersheds. In the vicinity of the Soldier Canyon Mine lease area the exact relationship between runoff curve numbers and precipitation depth is undetermined. Therefore, an average curve number of 75 was determined for the lease area based upon vegetative type, hydrologic soil grouping, and ground cover density (as outlined by the U.S. Soil Conservation Service, 1972).

Equation (1) is based upon the assumption that $I_a = 0.2S$, where I_a is the initial abstraction from storm rainfall, defined as the rainfall which must fall before runoff begins (i.e. to satisfy interception, evaporation, and soil-water storage). Therefore, determination of runoff from equation (1) is valid only when $P \geq I_a$ or $P \geq 0.2S$. Below this point, no runoff can occur. Based on the average curve number of 75 for the lease area and equation (2), I_a is equal to 0.67 inches. Figure 5 illustrates the rainfall-runoff relationship for the lease area.

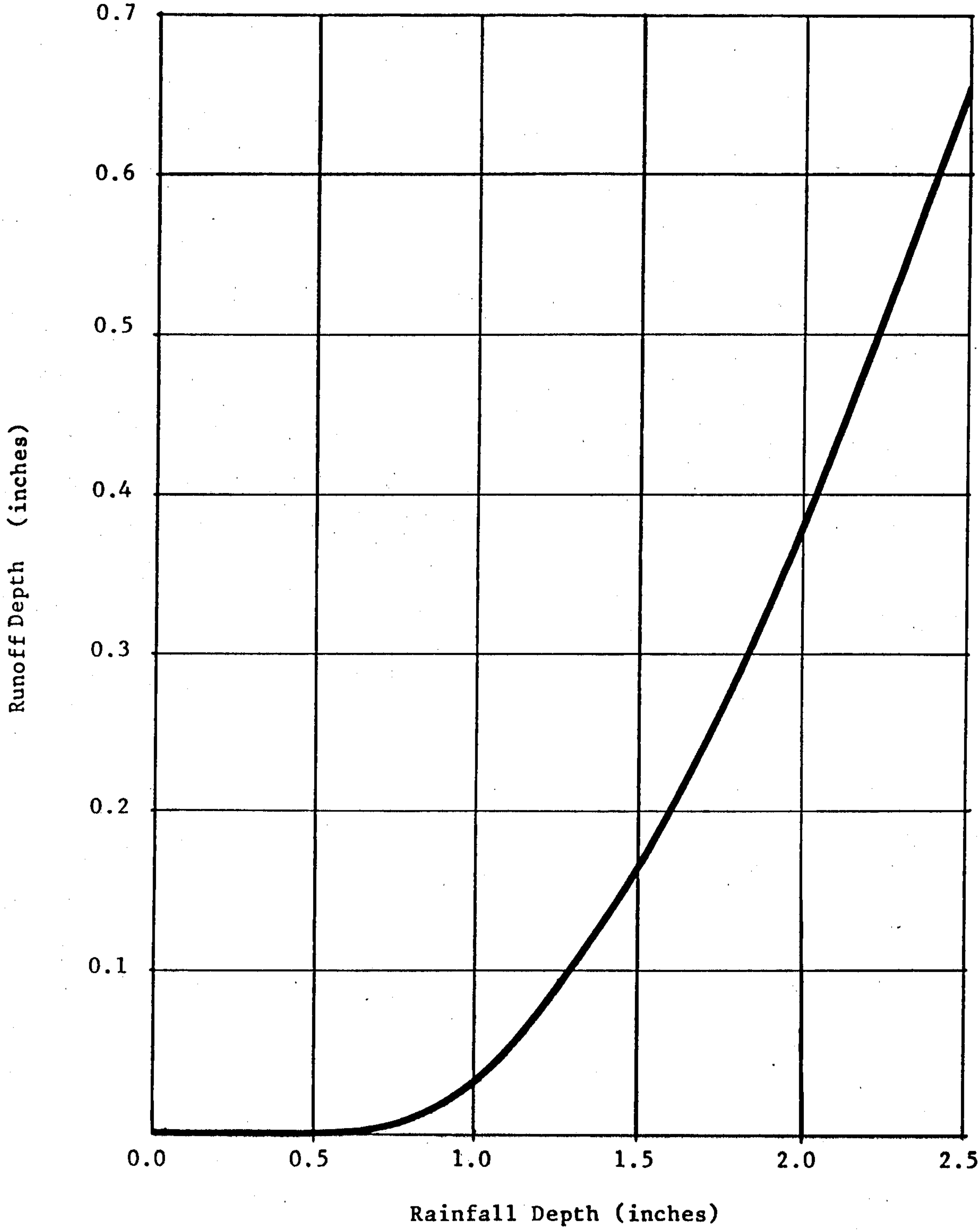

Figure 5. Runoff Depth versus rainfall depth for the Soldier Canyon Mine lease area.

Flow Characteristics

According to Jeppson et al. (1968), the mean annual water yield for the Soldier Canyon Mine lease area is approximately 1.0 inch. Two additional hydrologic methods were used to estimate the mean annual water yield to increase the confidence level of the estimate. The first, "Grunsky's Rule", was originally developed by Grunsky (1908) and later adapted by Sellars (1965). According to Grunsky, the average annual water yield can be determined from

$$Q = \alpha P^2 \quad (\text{for } P \geq 1/2\alpha)) \tag{3}$$

and

$$A = P - 1/(4\alpha) \quad (\text{for } P \leq 1/(2\alpha)) \tag{4}$$

where Q is the mean annual water yield in inches, P is the normal annual precipitation in inches, and α is a runoff coefficient in inches^{-1}. Alpha (α) for the lease area was estimated to be 0.009 inches^{-1} from guidelines set forth by Hawkins (1976). In accordance with equations (3) and (4), $1/(2\alpha)$ equals 55.6 which is greater than the normal annual precipitation of 14 inches determined from Jeppson et al. (1968). Therefore, equation (3) is applicable to the lease area and, according to Grunsky's Rule, the mean annual water yield from the lease area is 0.0 inches.

The second method used in estimating the mean annual water yield is known as Ol'deKop's formula (Sellars, 1965). The mean annual water yield is determined from

$$Q = P - E_o \tanh \frac{P}{E_o} \tag{5}$$

where Q and P are as previously defined and E_o is the annual potential evapotranspiration in inches. As indicated in the climatic section of this report, the mean annual precipitation and annual potential evapotranspiration for the lease area are 14 and 22 inches respectively. As estimated from Ol'deKop's formula, the mean annual water yield from the lease area is 1.6 inches. Therefore, estimates of the mean annual water yield from both Ol'deKop's and Grunsky's formulas compare favorably with the estimate from the Hydrologic Atlas of Utah prepared by Jeppson et al. (1968) which is assumed to be the true estimate.

Monthly flows for Soldier Creek were computed as the percentage of annual flow for the year 1978 to determine the seasonal distribution of flows for perennial streams in the vicinity of the lease area. The results are presented in Figure 6. The distribution of flows, as depicted in Figure 6, is typical of high mountain regions in the west, in which most of the streamflow occurs from March through June as a result of snowmelt.

As mentioned previously, all of the lease area drains toward Soldier Creek. The U.S. Geological Survey has established a gaging station on Soldier Creek just below the Soldier Canyon Mine and has obtained periodic measurements of discharge and water quality from July through November. Eureka Energy Company also maintains a gaging station upstream from the mine near the junction of Soldier Creek with the tributary from Pine Canyon. Data is available from both gaging stations since 1978. Based upon the

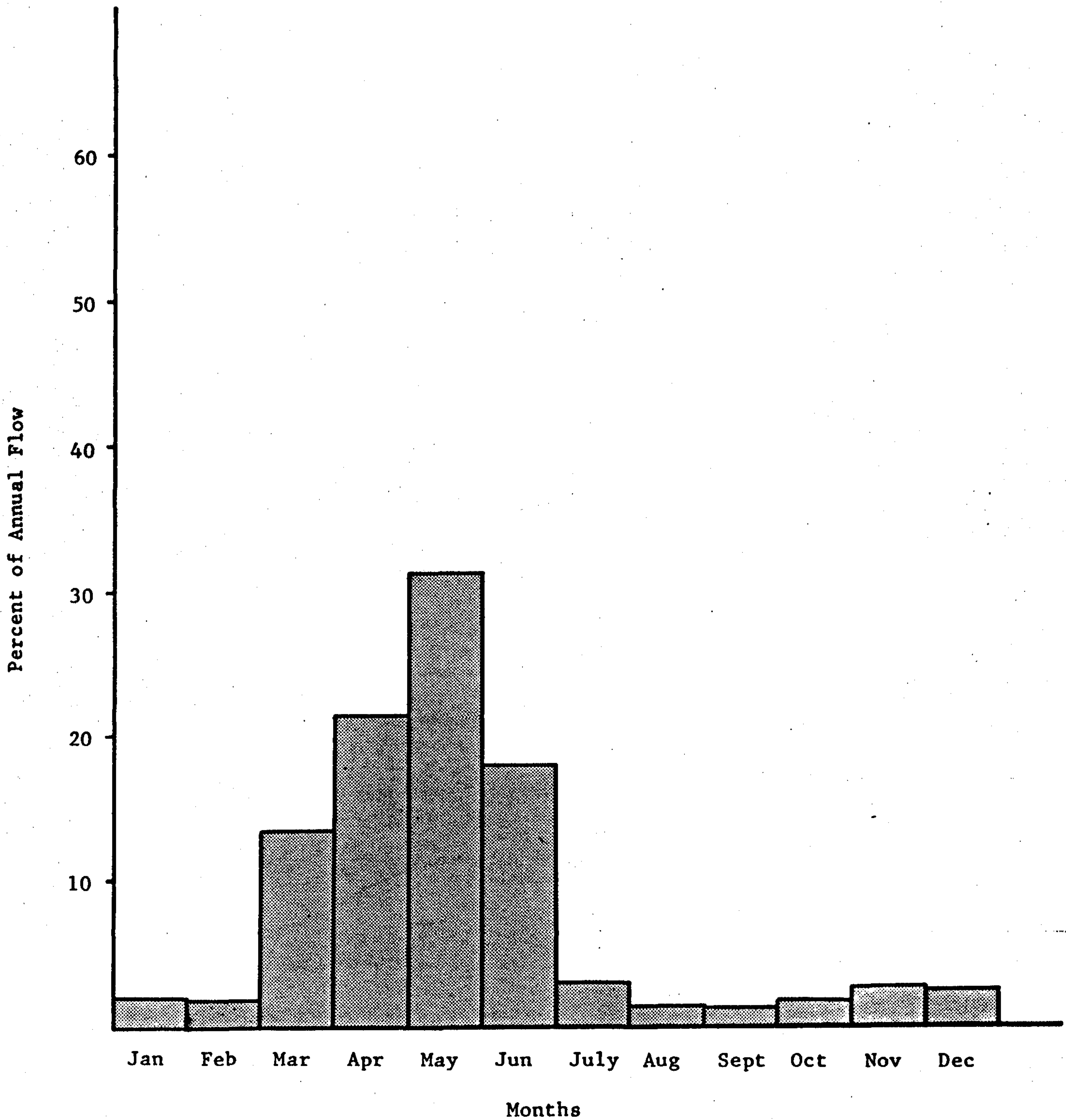

Figure 6. Monthly distribution of flows for Soldier Creek, near the Soldier Canyon Mine, for the year 1978.

periodic measurements of these two sites since 1978, the maximum measured flow of Soldier Creek is 19.0 cubic feet per second and the minimum measured flow is 0.1 cubic feet per second. Peak discharges in Soldier Creek are expected to be much higher than these periodic measurements. Summer thunderstorms, common in this area, would produce flows well in excess to these measured values.

Estimates of peak flow recurrence intervals for Soldier Creek near the Soldier Canyon Mine were prepared by Vaughn Hansen Associates (July, 1979). Peak flow estimates were determined from the runoff curve number and unit hydrograph technique as defined by the U.S. Soil Conservation Service (1972). According to Vaughn Hansen Associates (July, 1979) the estimated peak discharge of Soldier Creek from the 10-year, 24-hour event is 285 cubic feet per second, and the peak discharge from the 25-year, 6-hour event is 391 cubic feet per second.

Surface Water Quality

Surface water quality data were collected during the fall period of analysis (September-October, 1979) from two sites on Soldier Creek (18-1 and 18-2) within the Soldier Canyon Mine lease area (see Figure 7). These stations were located to obtain data from Soldier Creek both above and below existing surface facilities of the Soldier Canyon Mine. Additional water quality data were obtained from unpublished data of the U.S. Geological Survey and Eureka Energy Company of Salt Lake City, Utah, for two gaging stations on Soldier Creek. The USGS gaging station is located immediately downstream from the Soldier Canyon Mine and the Eureka Energy Company gaging station is located upstream from the mine, below the confluence of Soldier Creek and its Pine Canyon tributary.

Water quality samples collected by Vaughn Hansen Associates were analyzed according to the schedule of parameters listed in Table 1. Attachment A summarizes the analytical methods used in both the field and laboratory and Attachment B contains the results of the chemical analyses of surface water samples collected within the lease area during the study period. Field analyses were completed at the time of sample collection, and samples were preserved for laboratory analysis according to the methods outlined by the American Public Health Association et al. (1976).

Table 1. Comprehensive water quality analytical schedule.

Field Measurements	Laboratory Measurements	
Discharge	Acidity (as $CaCO_3$)	Magnesium
pH	Alkalinity (as $CaCO_3$)	Manganese, Total
Specific Conductance	Arsenic, Total	Mercury, Total
Temperature, Air	Barium, Total	Nitrate (NO_3 as N)
Temperature, Water	Bicarbonate	Oil and Grease
	Boron, Total	Phenol
	Cadmium, Total	Phosphate (PO_4 as P) Ortho
	Calcium	Potassium
	Chloride	Selenium, Total
	Chromium, Total	Silver, Total
	Copper, Total	Sodium
	Fluoride	Sulfate
	Iron, Total	Suspended Solids
	Iron, Dissolved	Total Dissolved Solids
	Lead, Total	Zinc, Total

Where data were available, seasonal variations in water quality as indexed by major cations and anions were determined and are illustrated in Figure 7. Total dissolved solids concentrations were lowest during the months of April through June when flows were highest. This inverse relationship is caused by a dilution effect from snowmelt in the early spring and runoff period. Later in the year as flow decreases and the majority of flow is derived from groundwater, this diluting effect is less pronounced, resulting in increased total dissolved solids concentrations. Total dissolved solids concentrations for Soldier Creek were relatively high for a mountain stream, ranging from 374 milligrams per liter during the high flow season to 860 milligrams per liter during the low flow season in the vicinity of the lease area.

From the data gathered during the fall period of analysis and other previously mentioned sources, suspended solids concentrations of Soldier Creek were found to vary from 1.0 to 1,644 milligrams per liter. All suspended solids concentrations measured during the summer and fall seasons of the year were less than 17 milligrams per liter. The only suspended solids concentration to exceed 17 milligrams per liter (1,644 mg/l) was measured in April during the snowmelt runoff period. Suspended solids concentrations are generally higher during the snowmelt runoff period than during the portion of the year when baseflow conditions exists. During the runoff period it is not uncommon for suspended solids concentrations in Soldier Creek to naturally and significantly exceed the federal coal mining effluent standard of 45 milligrams per liter (see OSM regulation section 817.42).

The hydrogen ion activity (pH) of Soldier Creek was found to vary in the vicinity of the lease area from 7.4 to 8.7 units. The basic condition of Soldier Creek is probably due to the high concentration of bicarbonates (American Public Health Association et al., 1976). Most natural waters are buffered to some extent by reactions involving dissolved carbon dioxide species, with the most effective buffering action from these species being within the range from 6.0 to 8.5 pH units. Therefore, the relatively constant and basic pH coupled with low acidity and high alkalinity concentrations, indicates that waters in the area are not significantly influenced by pollution (Hem, 1970).

Data gathered by Vaughn Hansen Associates during the fall period of analysis (September - October, 1979), data from Eureka Energy Company, and data obtained from the USGS indicate that both total and dissolved iron concentrations are somewhat related to flowrate, with higher concentrations occurring during the snowmelt runoff period when suspended sediment concentrations are high and with lower concentrations occurring during baseflow conditions. Data from Eureka Energy Company and data obtained during the fall study period indicate that dissolved iron concentrations in Soldier Creek have varied from less than 0.01 milligrams per liter to 0.385 milligrams per liter, with the higher concentrations occurring in April and May during the snowmelt runoff period and the lower concentrations occurring during summer and fall baseflow conditions.

With the exception of data gathered during the fall period of analysis, data was not available to compare total iron with dissolved iron concentrations. From the fall period of analysis, dissolved iron concentrations were approximately one-tenth to one-twentieth of the concurrent total iron concentrations, with the dissolved and total iron concentrations varying from less than 0.01 to 0.02 and 0.19 to 0.37 milligrams per liter, respectively.

Total manganese concentrations were low in Soldier Creek, varying from 0.009 to 0.119 milligrams per liter. No distinct seasonal variation in manganese concentrations can be determined.

The Utah Division of Health has classified the waters within the Soldier Canyon Mine lease area as 3C (protected for non-game fish and other aquatic life) and 4 (protected for agricultural uses including irrigation of crops and stockwatering). Tables 2 and 3 contain the numerical water quality standards applicable to these various classifications. Few exceedances of these chemical standards were noted from data gathered during the baseline study and other previously noted sources. Most of the chemical standards in Tables 2 and 3 are for dissolved rather than total constituents, while most of the various water quality parameters analyzed during the fall period were analyzed for the total rather than the dissolved form of the constituents. With the exception of cyanide, phenol, copper, barium and zinc; all of the total constituents were well within the limits established for the dissolved constituents in the chemical standards of Tables 2 and 3.

Table 2. Utah Division of Health numerical standards for water in the State.

Constitutent	CLASSES											
	Domestic Source			Recreation & Aesthetics		Aquatic Wildlife				Agri-culture	Indus-try	Special
	1A	1B	1C	2A	2B	3A	3B	3C	3D	4	5	6
Bacteriolocical (No./100 ml)								STANDARDS WILL BE DETERMINED ON A CASE-BY-CASE BASIS (see Table 3)			STANDARDS WILL BE DETERMINED ON A CASE-BY-CASE BASIS	STANDARDS WILL BE DETERMINED ON A CASE-BY-CASE BASIS
(30-day Geometric Mean)												
Maximum Total Coliforms	1	50	5,000	1,000	5,000	*	*		*	*		
Maximum Fecal Coliforms	*	*	2,000	200	2,000	*	*		*	*		
Physical												
Total Dissolved Gasses	*	*	*	*	*	(b)	(b)		*	*		
Minimum DO (mg/l) (a)	*	*	5.5	5.5	5.5	6.0	5.5		5.5	*		
Maximum Temperature	*	*	*	*	*	20°C	27°C		*	*		
Maximum Temp. Change	*	*	*	*	*	2°C	4°C		*	*		
pH	6.5-9.0	6.5-9.0	6.5-9.0	6.5-9.0	6.5-9.0	6.5-9.0	6.5-9.0		6.5-9.0	6.5-9.0		
Turbidity increase (c)	*	*	*	10 NTU	10 NTU	10 NTU	10 NTU		15 NTU	*		
Chemical (Maximum mg/l)												
Arsenic, dissolved	.05	.05	.05	*	*	*	*		*	.1		
Barium, dissolved	1	1	1	*	*	*	*		*	*		
Cadmium, dissolved	.010	.010	.010	*	*	.0004(d)	.004(d)		*	.01		
Chromium, dissolved	.05	.05	.05	*	*	.10	.10		.10	.10		
Copper, dissolved	*	*	*	*	*	.01	.01		*	.2		
Cyanide	*	*	*	*	*	.005	.005		*	*		
Iron, dissolved	*	*	*	*	*	1.0	1.0		1.0	*		
Lead, dissolved	.05	.05	.05	*	*	.05	.05		*	.1		
Mercury, total	.002	.002	.002	*	*	.00005	.00005		.00005	*		
Phenol	*	*	*	*	*	.01	.01		*	*		
Selenium, dissolved	.01	.01	.01	*	*	.05	.05		*	.05		
Silver, dissolved	.05	.05	.05	*	*	.01	.01		*	*		
Zinc, dissolved	*	*	*	*	*	.05	.05		*	*		
NH_3 as N (un-ionized)	*	*	*	*	*	.02	.02		*	*		
Chlorine	*	*	*	*	*	.002	.01		*	*		
Fluoride, dissolved (e)	1.4-2.4	1.4-2.4	1.4-2.4	*	*	*	*		*	*		
NO_3 as N	10	10	10									
Boron, dissolved	*	*	*	*	*	*	*		*	.75		
H_2S	*	*	*	*	*	.002	.002		*	*		
TDS (f)	*	*	*	*	*	*	*		*	1200		
Radiological (Maximum pCi/l)												
Gross Alpha	15	15	15	*	*	15(g)	15(g)		15(g)	15(g)		
Radium 226, 228 combined	5	5	5	*	*	*	*		*	*		
Strontium 90	8	8	8	*	*	*	*		*	*		
Tritium	20,000	20,000	20,000	*	*	*	*		*	*		
Pesticides (Maximum ug/l)												
Endrin	.2	.2	.2	*	*	.004	.004		.004	*		
Lindane	4	4	4	*	*	.01	.01		.01	*		
Methoxychlor	100	100	100	*	*	.03	.03		.03	*		
Toxaphene	5	5	5	*	*	.005	.005		.005	*		
2, 4-D	100	100	100	*	*	*	*		*	*		
2, 4, 5-TP	10	10	10	*	*	*	*		*	*		
Pollution Indicators (g)												
Gross Beta (pCi/l)	50	50	50	*	*	50	50		50	50		
BOD (mg/l)	*	*	5	5	5	5	5		5	5		
NO_3 as N (mg/l)				4	4	4	4		*	*		
PO_4 as P (mg/l)(h)	*	*	*	.05	.05	.05	.05		*	*		

* Insufficient evidence to warrant the establishment of numerical standard. Limits assigned on case-by-case basis.

(a) These limits are not applicable to lower water levels in deep impoundments.

(b) Not to exceed 110% of saturation.

(c) For Classes 2A, 2B, 3A, and 3B at background levels of 100 NTUs or greater, a 10% increase limit will be used instead of the numeric values listed. For Class 3D at background levels of 150 NTUs or greater, a 10% increase limit will be used instead of the numeric value listed. Short term variances may be considered on a case-by-case basis.

(d) Limit shall be increased threefold if $CaCO_3$ hardness in water exceeds 150 mg/l.

(e) Maximum concentration varies according to the daily maximum mean air temperature.

Temp. °C	mg/l
12.0 and below	2.4
12.1 to 14.6	2.2
14.7 to 17.6	2.0
17.7 to 21.4	1.8
21.5 to 26.2	1.6
26.3 to 32.5	1.4

(f) Total dissolved solids (TDS) limit may be adjusted on a case-by-case basis.

(g) Investigations should be conducted to develop more information where these pollution indicator levels are exceeded.

(h) PO_4 as P(mg/l) limit for lakes and reservoirs shall be .025.

Table 3. Numerical standards for class 3C water use (see Table 2).

Physical	
Minimum D.O. (mg/1)	5
Maximum Temperature	27°C
Maximum Temperature Change	4°C
pH	6.5-9.0
Turbidity Increase (NTU)	15****
Chemical (Maximum Mg/1)	
Cadmium, dissolved	0.004
Chromium, dissolved	0.1
Copper, dissolved	0.01
Cyanide	0.005
Iron, dissolved	1.0
Lead, dissolved	0.05
Mercury, total	0.0005
Phenol	0.01
Selenium, dissolved	0.05
Silver, dissolved	0.01
Zinc, dissolved	0.05
Chlorine	0.2
H_2S	0.02
Radiological (Maximum pCi/1)	
Gross Alpha	15
Gross Beta	30
Pesticides (Maximum mg/1	
Endrin	0.004
Lindane	0.01
Methoxychlor	0.03
Toxaphene	0.005
Pollution Indicators* **	
BOD (mg/1)	5.0
NO_3 as N (mg/1)	4.0

***Investigations should be conducted to develop more information where these pollution indicator levels are exceeded.

****At background levels of 150 NTU's or greater, a 10% increase limit will be used instead of the numeric values. Short term variances may be considered on a case-by-case basis.

Phenol concentrations of Soldier Creek were found to exceed state standards for Class 3C waters (0.01 milligrams per liter) in only one sample. At Station 18-1, immediately upstream from the Soldier Canyon Mine surface facilities, a phenol concentration of 0.026 milligrams per liter was measured. The occurrence of phenolic compounds in surface waters is generally considered an indicator of waste products, however the U.S. Environmental Protection Agency indicates that phenolic compounds also arise from naturally occurring organic sources. Therefore, the breakdown of organic residue in the area (both plant and animal) may be the source of phenol occurrences.

Cyanide concentrations were found to exceed state standards for Class 3C waters (0.005 milligrams per liter) in only one sample. The cyanide concentration of a sample collected by Eureka Energy Company, upstream from the Soldier Canyon Mine near the confluence of Soldier Creek with the Pine Canyon tributary, was measured at 0.02 milligrams per liter. The reason for the occurrence of cyanide in this one sample is not known since the appearance of cyanide is generally associated with industrial waste (Hem, 1970).

Concentrations of barium, copper, and zinc slightly exceeded state standards for Class 3C (0.01 mg/l dissolved copper and 0.05 mg/l dissolved zinc) and Class 4 waters (0.1 mg/l dissolved barium) in one or two samples collected by Eureka Energy Company at station E-22. In one sample, the dissolved barium concentration was measured at 0.14 milligrams per liter. In two samples the dissolved copper concentration was measured at 0.012 milligrams per liter, and in one sample the dissolved zinc concentration was measured at 0.061 milligrams per liter.

Sediment Yield

Estimates of the average annual sediment yield to be expected from the mine lease area were made using the PSIAC method (Pacific Southwest Inter-Agency Committee, 1968) and the Universal Soil Loss Equation (U.S. Soil Conservation Service, 1977; Clyde et al., 1978). Tables 4 and 5 contain the parameter estimates and sediment yield computation results of the respective methods. Using a sediment delivery ratio of 24 percent (based on Renfro, 1975), the average annual sediment yield predicted by the Universal Soil Loss Equation is 1.0 ton per acre. This converts to 0.37 acre-feet per square mile if a sediment unit weight of 80 pounds per cubic foot is assumed (see Flaxman, 1975). This compares favorably with the estimate made by the PSIAC method, considering the accuracy of the methods. The sediment delivery ratio estimate probably accounts for a majority of the difference.

Assuming an average from the two methods of 0.39 acre-feet per square mile, the Soldier Canyon Mine lease area yields a yearly average of 1.04 acre-feet of sediment to the Price River Basin. Although no published sediment yield data are available for the upland areas of the basin, this is undoubtedly only a small portion of the total amount of sediment yielded from the mountainous areas of the Price River Basin.

Table 4. Average annual sediment yield estimate of Soldier Canyon Mine lease area using the PSIAC method.

Factor	Description	Rating
Surface Geology	Sandstones and interbedded shales and sandstones, moderately fractured.	6
Soils	High percentage of rock fragments.	0
Climate	Precipitation primarily as snow.	0
Runoff	High peak flows per unit area.	0
Topography	Steep upland slopes, high relief and little flood plain development.	10
Ground Cover	Area mostly protected by vegetation.	-5
Land Use	Ordinary road construction, less than 50% intensively grazed.	0
Upland Erosion	About 25% of area characterized by landslide erosion.	10
Channel Erosion	Moderate flow depths, occasional bank erosion.	10
	Total	46

Sediment Yield (from Figure 8) = 0.41 AF/mi^2/yr.

Table 5. Average annual sediment estimate of the Soldier Canyon Mine lease area using the Universal Soil Loss Equation.

Equation: A = RKLSCP

Variable		
R	Rainfall factor	16
K	Soil erodability factor	0.20
L	Slope length factor (1000 ft.)	LS = 95
S	Slope gradient factor (61%)	
C	Cropping management factor	0.013
P	Erosion control practice factor	1.0
A	Estimated soil loss (tons/acre/year)	3.95

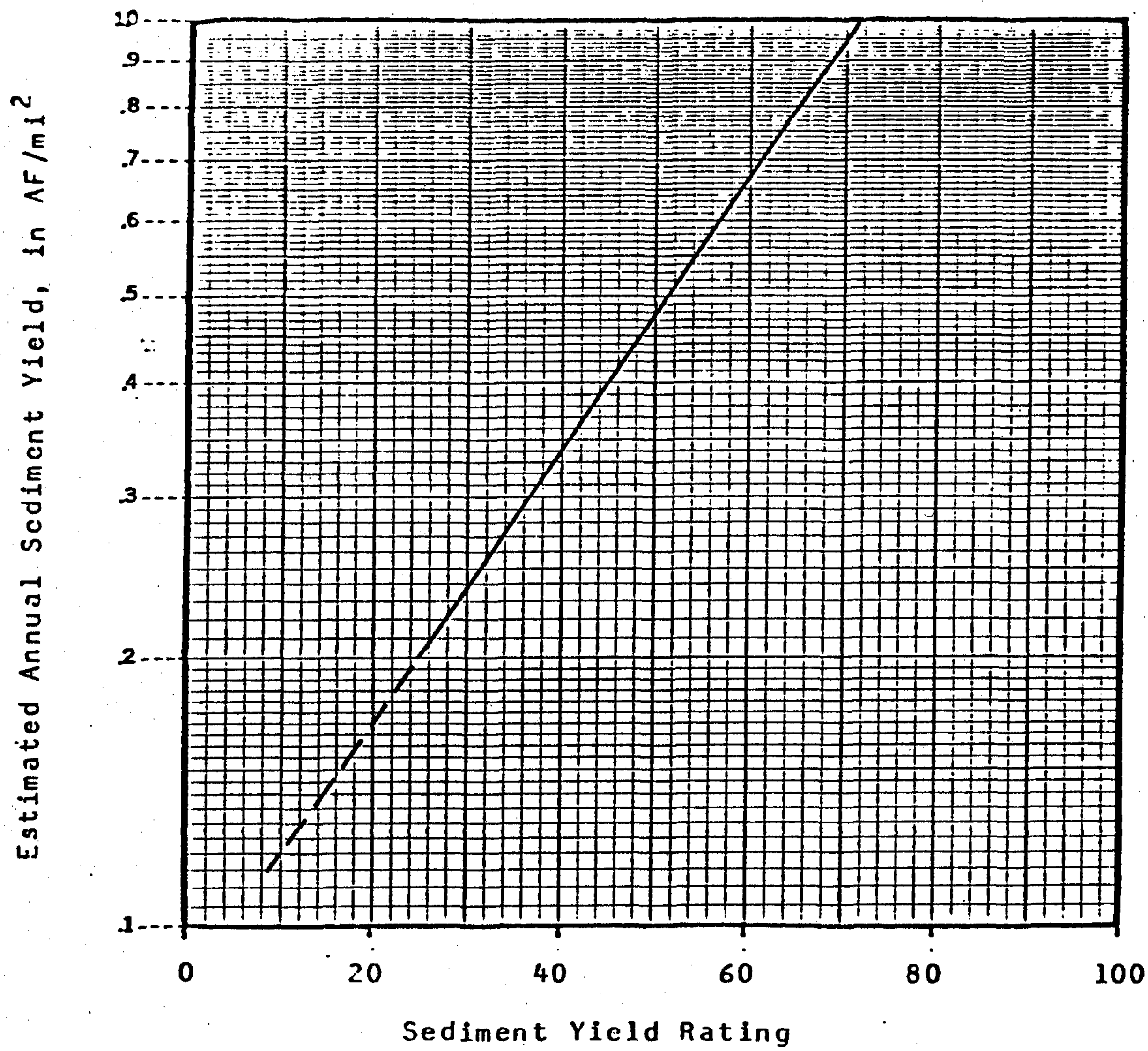

Figure 8. Sediment yield as determined by the PSIAC method (adapted from Shown, 1970).

Surface Water Monitoring Program

An ongoing hydrologic monitoring program will be conducted at the stations shown in Figure 9. Stations 18-1 and 18-2 were selected to monitor the impacts of surface drainage from the surface mine facilities. Station E-22 was selected upstream from the Soldier Canyon Mine lease area to monitor any impacts on the surface hydrologic system from underground mining activities.

Samples will be collected from all surface water stations shown on Figure 9 annually and analyzed as outlined in the comprehensive schedule given in Table 1 (or an approved abbreviated schedule) with the exception of orthophosphates and cyanide. Total phosphate will be analyzed in place of orthophosphate because state standards are based upon the total form. Cyanide will be added to the comprehensive schedule due to the appearance of background cyanide concentrations in a sample collection from Soldier Creek by Eureka Energy Company as previously discussed in this section. These samples will be collected during the month of August each year to allow sufficient time prior to snowfall to collect additional data if the laboratory results show unique, unexpected conditions. Samples will be analyzed according to Attachment A and preserved as previously outlined.

In addition to the annual comprehensive sampling in August, surface water samples will be gathered and analyzed on a quarterly basis (November, February, and May) throughout the period of mine operation. These samples will be analyzed in accordance with the parameters listed in the abbreviated schedule of Table 6.

The derivation of Table 6 was based on the need to clarify background conditions and future impacts. Because of the relatively high chemical quality of waters in the Soldier Canyon Mine lease area, as determined by the inventory, suspended solids has been included in the abbreviated schedule as the single most important impact indicator. Phenol and cyanide are included because of the background concentrations found previously. Total dissolved solids, specific conductance, temperature, and the major cations and anions are included as indexes of major change. Total iron, total manganese, and pH determinations are required by OSM regulations. Certain parameters of Table 6 may be dropped or the frequency of sampling altered with the concurrence of the regulatory agency if subsequent data justifies such an alteration.

Surface water monitoring will continue on a quarterly basis (August, November, February, and May) during post-mining operations until the reclamation effort is approved by the regulatory agency. Post-mining samples will be analyzed in accordance with the abbreviated water quality

Table 6. Abbreviated water quality analytical schedule.

Field Measurements	Laboratory Measurements	
Discharge	Bicarbonate	Phenol
pH	Calcium	Potassium
Specific Conductance	Chloride	Sodium
Temperature, Air	Cyanide	Sulfate
Temperature, Water	Iron, Total	Suspended Solids
	Magnesium	Total Dissolved Solids
	Manganese, Total	

analytical schedule with the exception of the August sample, which will be analyzed for the parameters as listed in Table 1 (or an approved abbreviated schedule).

An NPDES discharge permit has already been acquired by Soldier Creek Coal Company for discharge from surface mine facilities. Monitoring of all discharges will be conducted in accordance with this permit.

As required, water quality data collected from surface water monitoring stations will be submitted to the regulatory authority (Utah Division of Oil, Gas, and Mining). Such reports will normally be submitted within 60 to 90 days of the end of each quarter, depending upon the speed of the laboratory analyses.

GROUNDWATER HYDROLOGY

Regional Groundwater Hydrologic System

The principal factor controlling the occurrence and availability of groundwater in any area is geology. As noted by Price and Waddell (1972), nearly all of the region surrounding the Soldier Canyon Mine lease area is underlain by rocks of continental and marine origin, consisting predominately of interbedded sandstones and shales. Although some of the sandstones in the region serve as the principle water bearing strata, their ability to yield water for extended periods of time is largely controlled by the fact that the sandstone beds are relatively impermeable and by the existence of the impermeable interbedded shale layers, which prevent the downward movement of a significant amount of water.

According to the U.S. Geological Survey (1979), groundwater in the region exists under water table, artesian, and perched conditions. Water table conditions exist primarily in shallow alluvial deposits along larger perennial streams and in relatively flat lying sedimentary rocks. Artesian conditions exist at greater depths where a confining layer overlies a more permeable member. However, pressures are generally not sufficient to produce flowing wells. Perched or impeded conditions exist where the confining layer lies beneath the water bearing strata.

The Book Cliffs, where the Soldier Canyon Mine is located, and the adjacent Wasatch Plateau act as recharge areas for regional groundwater systems (Price and Arnow, 1974). Only a small portion of the annual precipitation, probably much less than five percent, recharges the groundwater supply (Price and Arnow, 1974; U.S. Geological Survey 1979). The depth of water infiltrating through the surface to saturated beds is small due to the presence of the relatively impermeable shale layers near the surface over much of the area and to the potential evapotranspiration being greater than the rainfall.

Price and Arnow (1974) indicate that properly constructed wells in the Price River Basin would have only limited yields (normally less than 50 gallons per minute). Wells immediately adjacent to the Soldier Canyon Mine lease area could normally be expected to yield less than 10 gallons per minute (Price and Wadell, 1973). Increased yields could possibly be expected from wells penetrating highly fractured sandstones.

Rocks in the mountainous areas near the Soldier Canyon Mine generally have low specific yields (0.2 to 0.7 percent) and low hydraulic conductivities (Price and Waddell, 1973). The volume of recoverable water in the area is small, averaging less than 600 acre-feet per square mile in the upper 100 feet of saturated rock (Price and Arnow, 1974).

The quality of groundwater in the Price River Basin deteriorates with distance downstream much the same as surface water. Dissolved solids concentrations in ground water range from less than 500 milligrams per liter near the Soldier Canyon Mine lease area to 3000 milligrams per liter near the confluence of the Price River with the Green River (Price and Waddell, 1973). This increase in dissolved solids concentration is the result of increased contact of water and rock as travel distance increases, with saline shales contributing a major portion of the dissolved constituents.

Characteristics of Seeps and Springs

All springs and seeps were sampled within and adjacent to the Soldier Canyon Mine lease area during September, 1979 to obtain an index of ground-water hydrologic conditions in the area. Discharge and water temperature measurements were made and a water quality sample was collected and analyzed for the comprehensive list of parameters in Table 1. Results of the field investigation and chemical analyses are illustrated in Figure 10.

Only three springs were found within or adjacent to the lease area, two of which were located outside of the lease boundary. All three of the springs were located near the base of a dominant sandstone formation. Both springs S8-1 and S31-1 issue near the interface between the Flagstaff and North Horn formations and spring S7-1 issues at the contact between the Castlegate Sandstone and non coal-bearing portion of the Price River Formation. As mentioned previously, all three of these formations consist of a series of shale and sandstone layers with both the Flagstaff and North Horn formations containing beds of limestone. Shale layers act as impeding members to deep percolation, forcing at least a portion of the water that percolates through the soil mantle to move somewhat horizontally to be discharged at the surface as spring water.

The three springs encountered near the Soldier Canyon Mine were located at higher elevations with recharge zones suspected to be the small areas of the nearby flats located along adjacent ridges. Flows from the springs were low during the inventory, ranging from less than one gallon per minute to two gallons per minute. Due to the localized nature of the springs, flows are expected to be higher during the snowmelt runoff period and are expected to be quite sensitive to the amount of precipitation received during any given year.

As illustrated on Figure 10, the groundwater, as indexed by springs in the lease area, is of a strong calcium bicarbonate type with high sulphate concentrations measured at spring S7-1. Total dissolved solids concentrations varied from 386 to 969 milligrams per liter. These relatively high concentrations are probably due to the prolonged contact of the water with the shale layers of the Flagstaff, North Horn, and Price River formations. Shales tend to contain an abundance of soluble minerals and allow more surface contact to water flowing through them than would be expected in coarse-textured rocks (Bently et al., 1978).

All three of the springs located during the hydrologic inventory of the lease area were selected for continued water quality and quantity monitoring. Although springs S8-1 and S31-1 are located outside of the lease area and potential area of impact from underground mining activities, they were selected for continued monitoring as an index to background conditions.