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State of Utah
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF OIL, GAS AND MINING

Michael O. Leavitt
Governor

Ted Stewart
Executive Director

Lowell P. Braxton
Division Director

1594 West North Temple, Suite 1210
PO Box 145801
Salt Lake City, Utah 84114-5801
801-538-5340
801-359-3940 (Fax)
801-538-7223 (TDD)

March 16, 1998

David M. Arnolds
Canyon Fuel Company, LLC
555 Seventeenth Street
Denver, Colorado 80202

Re: Permit, Dugout Canyon Mine, Canyon Fuel Company, LLC., ACT/007/039, Folder #3, Carbon County, Utah

Dear Mr. Arnolds:

I am enclosing the Decision Document and conditioned permit for the Dugout Canyon Mine. Please sign both copies of the permit and return one to the Division.

Please note conditions and timeframes associated with each. Thank you for your cooperation during this permitting endeavor. If you have any questions, please call.

Sincerely,

for Lowell P. Braxton
Director

Enclosure
cc: Ken Payne
Daron Haddock
Pamela Grubaugh-Littig
Carbon County Planning (w/o enclosure)
Joe Helfrich (w/o enclosure)
Price Field Office

UTAH DIVISION OF OIL, GAS AND MINING
STATE DECISION DOCUMENT AND
TECHNICAL ANALYSIS

Canyon Fuel Company, LLC
Dugout Canyon Mine
ACT/007/039
Carbon County, Utah

March 16, 1998

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ADMINISTRATIVE OVERVIEW

Canyon Fuel Company, LLC
Dugout Canyon Mine
ACT/007/039
Carbon County, Utah

March 16, 1998

PROPOSAL

Canyon Fuel Company, LLC proposes to permit a new underground mining operation in Carbon County, Utah approximately 11 miles northeast of Wellington, Utah. The proposed permit area is located entirely on fee land and land owned by the State of Utah.

The permit area encompasses 4040 acres of which 10.4 acres are to be disturbed for the surface facilities area. Mining will initially occur in the Rock Canyon seam using standard room-and-pillar mining methods. Future mining is also projected for the Gilson seam if conditions allow. It is anticipated that the mine will produce approximately 2 million tons of coal per year.

BACKGROUND

Mining in Dugout Canyon had its beginning in 1925 when D. J. Collins hand-developed the Red Glow Mine. After that several other entities conducted small mining operations in the Canyon off and on until approximately 1965. The reserve changed hands several times when finally Sunedco acquired the reserves in the early 1980's and permitted the property in hopes of developing a 5 million ton a year coal mine. The market never materialized and the mine never was developed. The permit was not kept active and was revoked on May 19, 1987. Coastal States Energy Company acquired the properties in 1993 as part of the acquisition of Soldier Creek Coal Company.

This application was initiated by Coastal States Energy Company on March 15, 1996. Canyon Fuel Company, LLC became the applicant on December 20, 1996 when the Atlantic Richfield Companies purchased the Coastal properties. Canyon Fuel has continued to pursue the permit and will be the permittee.

ANALYSIS

The permit area consists of parts of two state coal leases, ML-42648 and ML-42649, and some fee lease (owned by Canyon Fuel) encompassing 4040 acres.

Mining will take place by standard room and pillar methods and will occur in the Rock Canyon seam. Production is anticipated to reach approximately 2 million tons per year.

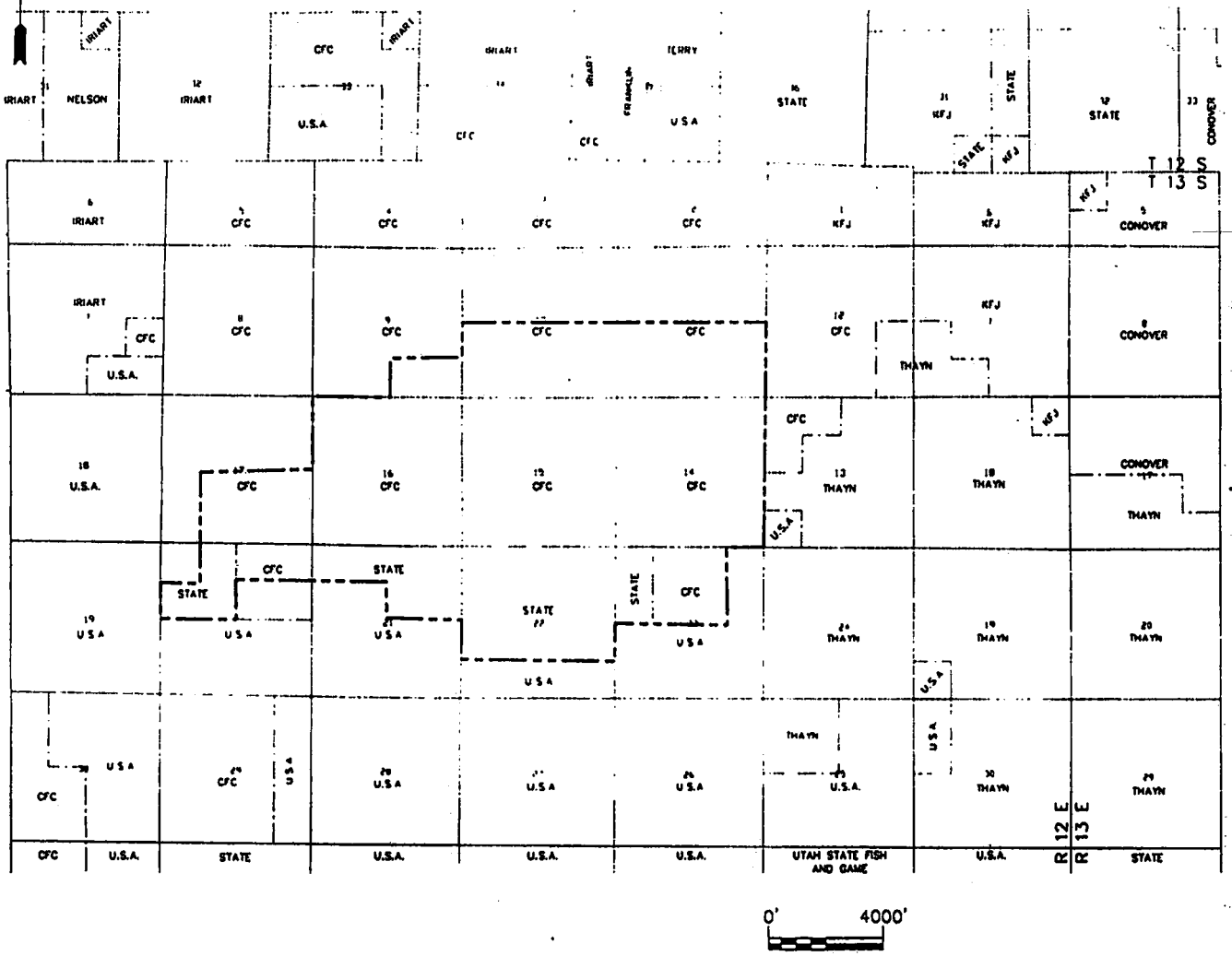
Estimated reserves in the permitted area range from 10 to 15 million tons. Canyon Fuel has identified additional reserved in adjacent federal leases that would add significantly to the life of this operation. It is anticipated that future permitting action will incorporate the federal lease into the Dugout permit, but for this permit term only state and fee properties are involved.

The surface facilities area is located on 10.4 acres within the Canyon Fuel Fee property. It will be accessed from the Dugout Canyon Road a Class B public road which is under the jurisdiction of Carbon County. Surface facilities will be commensurate with those needed to handle approximately 2 million tons of coal per year and will consist of buildings, utilities, tanks, conveyors, stockpiles, equipment areas, and all necessary sediment control structures. In order to facilitate the surface operations and to provide protection to Dugout Creek during the mining operation, much of the creek through the disturbed area will be placed in a culvert. A stream alteration permit for this action has been obtained from the Division of Water Rights.

RECOMMENDATION

This recommendation is based on the complete permit application package (PAP), the Technical Analysis (TA) conducted by the Division, the Cumulative Hydrologic Impact Assessment CHIA also prepared by the Division, and the administrative record. Canyon Fuel Company, LLC has demonstrated that mining within the permit boundary can be done in conformance with the Surface Mining Control and Reclamation Act, and the corresponding Utah Act and performance standards. The 510 (C) report on the Applicant Violator System for this mine has an issue recommendation.

It is recommended that approval be given for the Dugout Canyon mine with conditions as outlined in the Technical Analysis and summarized as Attachment A to the Permit.



LEGEND

THAYN =	MILTON AND ARDITH THAYN TRUST
U.S.A. =	UNITED STATES OF AMERICA
STATE =	STATE OF UTAH
CFC=	CANYON FUEL COMPANY, LLC
CONOVER =	GEORGE AND ALICE CONOVER ETAL
KFJ =	KFJ RANCH PARTNERSHIP
IRIART =	LOUISE L. IRIART TRUST
TERRY =	TERRY L. AND ANITA M. FREDRICKSON AND JACK B. AND REGINA MANCHESTER
FRANKLIN =	FRANKLIN G. BURTON PR. OF HATTIE OLSEN EST. AND LARUE LAYNE ETAL
NELSON =	NEWEL H. AND MADGE NELSON
	PERMIT AREA BOUNDARY

FIGURE 1–1. SURFACE OWNERSHIP

EarthFax

PERMITTING CHRONOLOGY

Canyon Fuel Company, LLC
Dugout Canyon Mine
ACT/007/039
Carbon County, Utah

March 16, 1998

March 15, 1996	Soldier Creek Coal Company submits the permit application package for the proposed Dugout Canyon Mine.
March 22, 1996	SHPO concurs with the report's recommendation that No Historic Properties will be impacted with the development of the Dugout Canyon Mine.
May 8, 1996	The Division sent letters to the applicant, Soldier Creek Coal Company, documenting that the application was not complete with a description of the deficiencies.
September 5, 1996	Soldier Creek Coal Company and the Division and the consultant meet to discuss administrative completeness concerns. Draft Technical Analysis (TA) is prepared.
September 23, 1996	The application was determined complete. Due to an oversight, this action was not published at this time.
December 20, 1996	The application is transferred from Soldier Creek Coal Company to Canyon Fuel Company, LLC.
May 21, 1997	Canyon Fuel Company, LLC responds to the Technical Analysis.
August 1, 1997	Division sends revised Technical Analysis.
September 9, 1997	Response from Canyon Fuel Company, LLC for the August 1, 1997 TA deficiencies.
October 6, 1997	Meeting with the Division and Canyon Fuel Company, LLC representatives outlines remaining deficiencies.

October 28, 1997	State and Institutional Trust Lands Administration (SITLA) concurs with the proposed uses of the surface so long as coal lease ML-42648 remains in good standing.
October 30, November 6, 13, and 20 1997	Publication of this permitting action, intent to develop Dugout Canyon Mine, is published in the Sun Advocate.
November 13, 1997	Submittal from Canyon Fuel Company, LLC responds to deficiencies outlined in meeting on October 6, 1997.
November 28, 1997	A "concern" letter from Mr. Milton Thayn of Price, Utah is received about the permitting of this mine.
December 10, 1997	Division responds to Mr. Thayn's concerns. No further comments from Mr. Thayn.
January 6, 1998	Division sends Canyon Fuel Company, LLC a "punch list" of all of the remaining deficiencies.
February 4, 1998	Response to the "punch list" from Canyon Fuel Company, LLC.
February 27, 1998	Meeting at the Division with representatives of Canyon Fuel Company, LLC, BLM, SITLA and Water Rights.
March 3, 1998	Reclamation bond is determined to be $1,260,000.
March 13, 1998	Reclamation bond is posted with the Division
March 16, 1998	TA and CHIA completed.
March 16, 1998	Decision Document completed and Permit issued.

MINE PLAN INFORMATION

Mine Name: Dugout Canyon Mine State ID: ACT/007/039

Permittee: Canyon Fuel Company, LLC County: Carbon

Controlled By: ARCO Coal Contact Person(s): David Arnolds
Telephone: (801) 637-6360 Position: President
New/Existing: Both Mining Method: Room and Pillar

Federal Lease No(s).: None
Legal Description(s): _____

State Lease No(s).: ML-42648; ML-42649
Legal Description(s): **ML-42648:** T.13S., R12E., Sec 10: S1/2, Sec 11: S1/2, Sec 14 and 15: All, Sec. 17: E1/2SW1/4, SE1/4, NE1/4, Sec 20: E1/2NW1/4, SW1/4NW1/4, N1/2NW1/4, Sec 21: N1/2NW1/4, NE1/4, Sec 22: N1/2, N1/2S1/2, Sec 23: W1/2 NW1/4; **ML-42649:** T.13S., R.12E., Sec. 9 S1/2SE1/4

Other Leases (identify): Canyon Fuel Fee
Description(s): T.13S., R12E, Sec 16: All, Sec 23: E1/2NW1/4, W1/2NE1/4

Ownership Data:

Surface Resources (acres):	Existing Permit Area	Proposed Permit Area	Total Life Of Mine Area
Federal	0	0	0
State	0	920	920
Private	0	3120	3120
Other			
TOTAL	0	4040	4040

Coal Ownership (acres):

Federal	0	0	0
State	0	3240	3240
Private	0	800	800

Other			
TOTAL	0	4040	4040

Mine Plan Information
Dugout Canyon Mine
Page 2

Disturbed Acres	0	10.4	10.4
Minable Coal (tons)			
Federal			
Non- Federal	0	10-15 million	10-15 million
TOTAL	0	10-15 million	10-15million*

Recoverable Reserve Data	Name	Thickness	Depth
Seam	Rock Canyon	6' - 10'	600' - 2400'

Mine Life: 1998-2008 *
Average Annual Production: 2 Million Tons
Date Projected Annual Rate Reached: 2000

* While not included in this permit term, Canyon Fuel has indicated its intent to add additional permit area and coal reserves (federal) to the Dugout Canyon Permit in the future. This would extend the life of the mine to beyond the year 2025.

FINDINGS

Canyon Fuel Company, LLC
Dugout Canyon Mine
ACT/007/039
Carbon County, Utah

March 16, 1998

1. The permit application for the extraction of coal and the associated surface facilities for the Dugout Canyon Mine is accurate and complete and all requirements of the Surface Mining Control and Reclamation Act, and the approved Utah State Program (the "Act") are in compliance. See Technical Analysis dated March 12, 1998 (R645-300-133.100)

2. The applicant proposes acceptable practices for the reclamation of disturbed lands. The Division has determined that reclamation, as required by the Act can be feasibly accomplished following the approved plan with the attached permit stipulations. (R645-300-133.710)

3. An assessment of the probable cumulative impacts of all anticipated coal mining and reclamation activities in the general area on the hydrologic balance has been conducted by the Division and no significant impacts were identified. See CHIA dated March 12, 1998. The Mining and Reclamation Plan (MRP) proposed under the revised application has been designed to prevent damage to the hydrologic balance in the permit area and in associated off-site area (R645-300-133.400 and UCA 40-10-11 (2)(c)).

4. The proposed lands to be included within the permit area are:

    a. Not included within an area designated unsuitable for underground coal mining operation (R645-300-133.220);

    b. not within an area under study for designated land unsuitable for underground coal mining operations (R645-300-133.210);

    c. not on any lands subject to the prohibitions or limitation of 30 CFR 761.11 {a} (national parks, etc), 761.11 {f} (public buildings, etc.) and 761.11 {g} (cemeteries);

    d. not within 100 feet of a public road except at the location where the public road accesses the property(R645-300-133.220); and

    e. not within 300 feet of any occupied dwelling (R645-300-133.220).

5. The operation would not affect the continued existence of any threatened or endangered species or result in the destruction or adverse modification of their critical habitats as determined under the Endangered Species Act of 1973. (16 USC 1531 et seq.) (R645-300-133.500)

6. The Division's issuance of a permit is in compliance with the National Historic Preservation Act and implementing regulations (36 CFR 800). See letter from State Historic Preservation Office, dated March 22, 1996. (R645-300-133.600)

7. The applicant has the legal right to enter and complete mining activities in the Permit area through State coal leases issued by the State of Utah (See Leases in Appendix A-1,. (R645-300-133.300)

8. A 510 (c) report has been run on the Applicant Violator System (AVS), which shows that: prior violations of applicable laws and regulations have been corrected; neither Canyon Fuel Company, LLC or any affiliated company, are delinquent in payment of fees for the Abandoned Mine Reclamation Fund; and the applicant does not control and has not controlled mining operations with demonstrated pattern of willful violations of the Act of such nature, duration, and with such resulting irreparable damage to the environment as to indicate an intent not to comply with the provisions of the Act (A 510 (c) report was run on March 11, 1998, see memo to file dated March 11, 1998). (R645-300-133.730)

9. Underground mining operations to be performed under the permit will not be inconsistent with other operations anticipated to be performed in areas adjacent to the proposed permit area.

10. The applicant has posted a surety bond for the Dugout Canyon Mine in the amount of $1,260,000. (R645-300-134)

11. No lands designated as prime farmlands or alluvial valley floors occur on the permit area. (R645-302-313.100 and R645-302-321.100)

12. The proposed postmining land-use of the permit area is the same as the pre-mining land use and has been approved by the Division and the surface land management agency.

13. The Division has made all specific approvals required by the Act, the Cooperative Agreement, and the Federal Lands Program.

14. All procedures for public participation required by the Act, and the approved Utah State Program are in compliance. The public advertisement was noticed on October 30, November 6, 13, 20, 1997. (R645-300-120)

15. No existing structures will be used in conjunction with this mine. (R645-300-133.720)

Permit Supervisor

Permit Supervisor

Associate Director of Mining

Director

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State of Utah
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF OIL, GAS AND MINING

Michael O. Leavitt
Governor

Ted Stewart
Executive Director

James W. Carter
Division Director

355 West North Temple
3 Triad Center, Suite 350
Salt Lake City, Utah 84180-1203
801-538-5340
801-359-3940 (Fax)
801-538-5319 (TDD)

Jikepro07

December 20, 1996

David M. Arnolds
Canyon Fuel Company, LLC
555 Seventeenth Street
Denver, Colorado 80202

Re: Approval for Transfer of Permit Application and Transfer of Exploration Permit, Soldier Creek Coal Company to Canyon Fuel Company, LLC, Dugout Canyon Mine, PRO/007/039, Folder #3, Carbon County, Utah

Dear Mr. Arnolds:

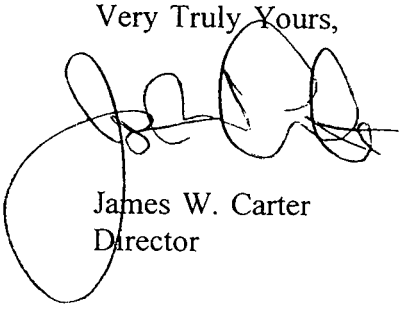
The Division has found that Canyon Fuel Company, LLC has met all requirements for a transfer of a permit application as required under R645-303-300. Therefore, the request for transfer of the permit application and transfer of the associated exploration permit for the proposed Dugout Canyon Mine is hereby approved. The application transfer will be effective upon the closing of the Purchase and Sale Agreement between The Coastal Corporation, Coastal Coal Company, Inc., Atlantic Richfield Company, and Itochu Corporation.

The only permit associated with this transfer is for exploration at the site. No mining permit is associated with this action. However, Canyon Fuel Company, LLC will now be responsible for compliance with the terms and requirements of the application including all existing commitments and obligations relating to the Dugout Canyon Mine application transferred from Soldier Creek Coal Company including the exploration permit.

You should now proceed to amend your Permit Application Package (PAP) to reflect the changes. Appropriate replacement pages, including but not limited to the list of corporate officers, legal financial information, surface and coal ownership maps, lease ownership descriptions, and a variety of other pertinent information should all be updated and submitted

for insertion to the PAP. Please submit 3 copies of the revised PAP information within 120 days for distribution and processing. If you have any questions, please call Daron Haddock, Permit Supervisor at 539-5325.

Very Truly Yours,



James W. Carter
Director

enclosures
cc: James Fulton OSM,
Clay Parr, Kimball, Parr, Waddoups, Brown & Gee
Mary Ann Wright
D. Haddock
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FINDINGS

Canyon Fuel Company, LLC
Transfer of Permit Application
Dugout Canyon Mine
PRO/007/039

December 20, 1996

Upon closing of the Purchase and Sale Agreement between the Coastal Corporation, Coastal Coal Company, Inc., Atlantic Richfield Company, and Itochu Corporation, Canyon Fuel Company, LLC will be responsible for the permit application previously submitted by Soldier Creek Coal Company and determined to be administratively complete on September 23, 1996.

Canyon Fuel Company, LLC has submitted a replacement performance bond sufficient to cover reclamation costs for an exploration project previously conduceted in the permit area. After this transfer has been effected, Canyon Fuel Company, LLC will be responsible for the entire area which was under an exploration permit by Soldier Creek Coal Company and will assume all liability for compliance with terms and conditions of the exploration permit and any orders, stipulations or conditions associated with that permit.

The following findings specifically apply to the transfer application.

1. DOGM's records and the results of a 510{c} clearance check, show that neither Coastal States Energy Company, Canyon Fuel Company, LLC or any affiliates control or have controlled coal mining and reclamation operations with a demonstrated pattern of willful violations of the Act of such nature and duration and with such resulting irreparable damage to the environment as to indicate an intent not to comply with the Act. At the present time, affiliates of the Coastal Corporation and of the Atlantic Richfield Company do control coal mining operations that have outstanding enforcement issues, however, all of the issues have been, or are in the process of being corrected through the appropriate legal process, as required by R645-300-132. (Coastal entities involved in outstanding forfeiture litigation will remain with Coastal and are not part of this transfer process.)

2. The State of Utah, DOGM has determined that the transfer of permit application is accurate and complete, and complies with the requirements of R645-300-133.100.

3. Coastal States Energy Company and Affiliates of Canyon Fuel Company, LLC have paid all reclamation fees from previous and existing coal mining and reclamation operations as required by 30 CFR part 870. (R645-300-133.730)

4. Procedures for public participation have complied with requirements of the Act and the Utah State Program. Notice was published in the Sun Advocate on November 19, 1996 as required by R645-303-322. No comments were received.

5. The applicant has obtained a performance bond equivalent to the bonding requirements of the existing exploration permit, in the amount of $30,000. (R645-303-342)

Permit Coordinator

Permit Supervisor

Associate Director, Mining

Director

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007/039 #2

LAW OFFICES OF
KIMBALL, PARR, WADDOUPS, BROWN & GEE
A PROFESSIONAL CORPORATION
SUITE 1300
185 SOUTH STATE STREET
POST OFFICE BOX 11019
SALT LAKE CITY, UTAH 84147-0019
TELEPHONE (801) 532-7840
TELECOPIER (801) 532-7750

JOHN M. BURKE

December 20, 1996

HAND DELIVERED

Daron Haddock, Permit Supervisor
Division of Oil, Gas, and Mining
1594 West North Temple, Suite 1210
Box 145801
Salt Lake City, Utah 84114-5801

Re: Replacement Bond for Dugout Mine Exploration Permit No. U07064

Dear Daron:

Please find enclosed herewith Bond No. U8006249, which is submitted to replace the bond for the Dugout Mine Exploration Permit No. U0706 4.

Please advise if I can be of any further assistance.

Very truly yours,

John M. Burke

JMB:wm

Bond No. U8006249

Exhibit "B" - BONDING AGREEMENT
SURETY BOND

Permit Number: U07064

SURETY BOND
(NON-FEDERAL COAL)
-ooOOoo-

THIS SURETY BOND entered into by and between the undersigned PERMITTEE, and SURETY, hereby jointly and severally bind ourselves, our heirs, administrators, executors, successors and assigns unto the State of Utah, Division of Oil, Gas and Mining (DIVISION) in the penal sum of ($30,000.00) (Surety Bond Amount) for the timely performance of reclamation responsibilities of the surface disturbance described in Exhibit "A" of this Reclamation Agreement.

This SURETY BOND will remain in effect until all of the PERMITTEE's reclamation obligations have been met and released by the DIVISION and is conditioned upon regulations, the approved permit and the Division.

The SURETY will not cancel this bond at any time for any reason, including non-payment of premium or bankruptcy of the Principal during the period of liability.

The SURETY and their successors and assigns, agree to guarantee the obligation and to indemnify, defend and hold harmless the DIVISION from any and all expenses which the DIVISION may sustain as a result of the PERMITTEE's failure to comply with the condition(s) of the reclamation obligation.

The SURETY will give prompt notice to the PERMITTEE and to the DIVISION of any notice received or action alleging the insolvency or bankruptcy of the SURETY, or alleging any violations or regulatory requirements which could result in suspension or revocation of the SURETY's license.

Terms for release or adjustment of this BOND are as written and agreed to by the DIVISION and the PERMITTEE in the RECLAMATION AGREEMENT incorporated by reference herein, to which this SURETY AGREEMENT has been attached as Exhibit "B".

Exhibit "B" - BONDING AGREEMENT
SURETY BOND

IN WITNESS WHEREOF, the PERMITTEE has hereunto set its signature and seal this _____ day of December, 1996.

CANYON FUEL COMPANY, LLC

By: _____

Title: C.F.O.

IN WITNESS WHEREOF, the SURETY has hereto set its signature and seal this 20th day of December, 1996.

UNITED PACIFIC INSURANCE COMPANY

By: Cassie J. Berrisford

Title: Cassie J. Berrisford, Attorney-in-Fact

ACCEPTED BY THE STATE OF UTAH:

_____

Director - Division of Oil, Gas and Mining

NOTE: An Affidavit of Qualification must be completed and attached to this form for each authorized agent or officer. Where one signs by virtue of Power of Attorney for a company, such Power of Attorney must be filed with this agreement. If the PERMITTEE is a corporation, the Agreement shall be executed by its duly authorized officer.

AFFIDAVIT OF QUALIFICATION
SURETY COMPANY
—oo0Oo—

I, Cassie J. Berrisford, being first duly sworn under oath, deposes and says that he/she is the (officer or agent) agent of United Pacific Insurance Company; and that he/she is duly authorized to execute and deliver the foregoing obligations; and that said SURETY COMPANY is authorized to execute the same and has complied in all respects with the laws of Utah in reference to becoming sole surety upon bonds, undertakings and obligations herein.

Cassie J. Berrisford
(Surety Company Officer)

Attorney-in-Fact
(Position)

Subscribed and sworn to before me this 20th day of December 1996.

Notary Public

My Commission Expires: April 6, 1997

Attest:

STATE OF California)
COUNTY OF Los Angeles ss:

VICTORIA VOORHEES
COMM. #987753
Notary Public — California
LOS ANGELES COUNTY
My Comm. Expires APR 6,1997

CALIFORNIA ALL-PURPOSE ACKNOWLEDGMENT

State of California

County of Los Angeles

On December 20, 1996 (DATE) before me, Victoria Voorhees, Notary Public (NAME, TITLE OF OFFICER - E.G., "JANE DOE, NOTARY PUBLIC")

personally appeared Cassie J. Berrisford (NAME(S) OF SIGNER(S))

☒ personally know to me - OR - ☐ proved to me on the basic of satisfactory evidence to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

VICTORIA VOORHEES
COMM. #987753
Notary Public — California
LOS ANGELES COUNTY
My Comm. Expires APR 6,1997

WITNESS my hand and official seal.

Victoria Voorhees
SIGNATURE OF NOTARY

OPTIONAL

Though the data below is not required by law, it may prove valuable to persons relying on the document and could prevent fradulent reattachment of this form.

CAPACITY CLAIMED BY SIGNER

☐ INDIVIDUAL
☐ CORPORATE OFFICER

_____
TITLE(S)

☐ PARTNER(S) ☐ LIMITED ☐ GENERAL
☐ ATTORNEY-IN-FACT
☐ TRUSTEE(S)
☐ GUARDIAN/CONSERVATOR
☐ OTHER: _____

SIGNER IS REPRESENTING:
NAME OF PERSON(S) OR ENTITY(IES)

DESCRIPTION OF ATTACHED DOCUMENT

_____
TITLE OR TYPE OF DOCUMENT

_____
NUMBER OF PAGES

_____
DATE OF DOCUMENT

_____
SIGNER(S) OTHER THAN NAMED ABOVE

krm (10/95)

THE FACE OF THIS DOCUMENT HAS A COLORED BACKGROUND ON WHITE PAPER

RELIANCE SURETY COMPANY
UNITED PACIFIC INSURANCE COMPANY

RELIANCE INSURANCE COMPANY
RELIANCE NATIONAL INDEMNITY COMPANY

ADMINISTRATIVE OFFICE, PHILADELPHIA, PENNSYLVANIA

POWER OF ATTORNEY

KNOW ALL MEN BY THESE PRESENTS, that RELIANCE SURETY COMPANY is a corporation duly organized under the laws of the State of Delaware, and that RELIANCE INSURANCE COMPANY and UNITED PACIFIC INSURANCE COMPANY, are corporations duly organized under the laws of the Commonwealth of Pennsylvania and that RELIANCE NATIONAL INDEMNITY COMPANY is a corporation duly organized under the laws of the State of Wisconsin (herein collectively called "the Companies") and that the Companies by virtue of signature and seals do hereby make, constitute and appoint **Cassie J. Berrisford, of Los Angeles, California** their true and lawful Attorney(s)-in-Fact, to make, execute, seal and deliver for and on their behalf, and as their act and deed **any and all bonds and undertakings of suretyship** and to bind the Companies thereby as fully and to the same extent as if such bonds and undertakings and other writings obligatory in the nature thereof were signed by an Executive Officer of the Companies and sealed and attested by one other of such officers, and hereby ratifies and confirms all that their said Attorney(s)-in-Fact may do in pursuance hereof.

This Power of Attorney is granted under and by the authority of Article VII of the By-Laws of RELIANCE SURETY COMPANY, RELIANCE INSURANCE COMPANY, UNITED PACIFIC INSURANCE COMPANY, and RELIANCE NATIONAL INDEMNITY COMPANY which provisions are now in full force and effect, reading as follows:

ARTICLE VII - EXECUTION OF BONDS AND UNDERTAKINGS

1. The Board of Directors, the President, the Chairman of the Board, any Senior Vice President, any Vice President or Assistant Vice President or other officer designated by the Board of Directors shall have power and authority to (a) appoint Attorney(s)-in-Fact and to authorize them to execute on behalf of the Company, bonds and undertakings, recognizances, contracts of indemnity and other writings obligatory in the nature thereof, and (b) to remove any such Attorney(s)-in-Fact at any time and revoke the power and authority given to them.

2. Attorney(s)-in-Fact shall have power and authority, subject to the terms and limitations of the Power of Attorney issued to them, to execute deliver on behalf of the Company, bonds and undertakings, recognizances, contracts of indemnity and other writings obligatory in the nature thereof. The corporate seal is not necessary for the validity of any bonds and undertakings, recognizances, contracts of indemnity and other writings obligatory in the nature thereof.

3. Attorney(s)-in-Fact shall have power and authority to execute affidavits required to be attached to bonds, recognizances, contracts of indemnity or other conditional or obligatory undertakings and they shall also have power and authority to certify the financial statement of the Company and to copies of the By-Laws of the Company or any article or section thereof.

This Power of Attorney is signed and sealed by facsimile under and by authority of the following resolution adopted by the Executive and Finance Committees of the Boards of Directors of Reliance Insurance Company, United Pacific Insurance Company and Reliance National Indemnity Company by Unanimous Consent dated as of February 28, 1994 and by the Executive and Financial Committee of the Board of Directors of Reliance Surety Company by Unanimous Consent dated as of March 31, 1994.

"Resolved that the signatures of such directors and officers and the seal of the Company may be affixed to any such Power of Attorney or any certificates relating thereto by facsimile,and any such Power of Attorney or certificate bearing such facsimile signatures or facsimile seal shall be valid and binding upon the Company and any such Power so executed and certified by facsimile signatures and facsimile seal shall be valid and binding upon the Company, in the future with respect to any bond or undertaking to which it is attached."

IN WITNESS WHEREOF, the Companies have caused these presents to be signed and their corporate seals to be hereto affixed, this **July 19, 1996.**

RELIANCE SURETY COMPANY
RELIANCE INSURANCE COMPANY
UNITED PACIFIC INSURANCE COMPANY
RELIANCE NATIONAL INDEMNITY COMPANY

Mark W. Alsup

STATE OF Washington }
COUNTY OF King } ss.

On this, **July 19, 1996**, before me, Janet Blankley, personally appeared **Mark W. Alsup**, who acknowledged himself to be the Vice President of the Reliance Surety Company, and the Vice President of Reliance Insurance Company, United Pacific Insurance Company, and Reliance National Indemnity Company and that as such, being authorized to do so, executed the foregoing instrument for the purpose therein contained by signing the name of the corporation by himself as its duly authorized officer.

In witness whereof, I hereunto set my hand and official seal.

JANET D BLANKLEY NOTARY PUBLIC STATE OF WASHINGTON 12-29-97

Janet D. Blankley

Notary Public in and for the State of Washington
Residing at Puyallup

I, **Robyn Layng**, Assistant Secretary of RELIANCE SURETY COMPANY, RELIANCE INSURANCE COMPANY, UNITED PACIFIC INSURANCE COMPANY, and RELIANCE NATIONAL INDEMNITY COMPANY do hereby certify that the above and foregoing is a true and correct copy of the Power of Attorney executed by said Companies, which is still in full force and effect.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed the seals of said Companies this 20th day of December 19 96.

Assistant Secretary

THE BACK OF THIS DOCUMENT CONTAINS AN ARTIFICIAL WATERMARK - HOLD AT AN ANGLE TO VIEW

Non-FEDERAL
March 16, 1998

STATE OF UTAH
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF OIL, GAS AND MINING
1594 West North Temple
Box 145801
Salt Lake City, Utah 84114-5801
(801) 538-5289

This permit, ACT/007/039, is issued for the state of Utah by the Utah Division of Oil, Gas and Mining (DOGM) to:

Canyon Fuel Company, LLC
6955 South Union Park Center, Suite 540
Midvale, Utah 84047
(801) 596-7111

for the Dugout Canyon Mine. Canyon Fuel Company, LLC is the lessee of state and fee-owned property. A performance bond is filed with the DOGM in the amount of $1,260,000.00, payable to the state of Utah, Division of Oil, Gas and Mining. DOGM must receive a copy of this permit signed and dated by the permittee.

Sec. 1 STATUTES AND REGULATIONS - This permit is issued pursuant to the Utah Coal Mining and Reclamation Act of 1979, Utah Code Annotated (UCA) 40-10-1 et seq, hereafter referred to as the Act.

Sec. 2 PERMIT AREA - The permittee is authorized to conduct underground coal mining activities on the following described lands within the permit area at the Dugout Canyon Mine situated in the state of Utah, Carbon County, and located:

Parts of State leases ML 42648 & ML42649 as described below:

T. 13 S., R. 12 E., SLBM, Utah
Section 9: S1/2SE1/4
Section 10: S1/2
Section 11: S1/2
Sections 14 and 15: All
Section 17: E1/2SW1/4; SE1/4
Section 20: E1/2NW1/4; SW1/4NW1/4; N1/2NE1/4
Section 21: N1/2NW1/4; NE1/4
Section 22: N1/2; N1/2S1/2
Section 23: W1/2NW1/4

Fee land owned by Canyon Fuel Company, LLC (800 acres) as described below:

T. 13 S., R. 12 E., SLBM, Utah
Section 16: All
Section 23: E1/2NW1/4; W1/2NE1/4

This legal description is for the permit area of the Dugout Canyon Mine included in the mining and reclamation plan. The permittee is authorized to conduct underground coal mining and reclamation activities on the foregoing described property subject to the conditions of the leases, including all conditions and all other applicable conditions, laws and regulations.

Sec. 3 COMPLIANCE - The permittee will comply with the terms and conditions of the permit, all applicable performance standards and requirements of the State Program.

Sec. 4 PERMIT TERM - This permit becomes effective on March 16,1998 and expires on March 16, 2003.

Sec. 5 ASSIGNMENT OF PERMIT RIGHTS - The permit rights may not be transferred, assigned or sold without the approval of the Director, DOGM. Transfer, assignment or sale of permit rights must be done in accordance with applicable regulations, including but not limited to 30 CFR 740.13(e) and R645-303.

Sec. 6 RIGHT OF ENTRY - The permittee shall allow the authorized representative of the DOGM, including but not limited to inspectors, and representatives of OSMRE, without advance notice or a search warrant, upon presentation of appropriate credentials, and without delay to:

A. have the rights of entry provided for in 30 CFR 840.12, R645-400-110, 30 CFR 842.13 and R645-400-220; and,
B. be accompanied by private persons for the purpose of conducting an inspection in accordance with R645-400-100 and 30 CFR 842, when the inspection is in response to an alleged violation reported by the private person.

Sec. 7 SCOPE OF OPERATIONS - The permittee shall conduct underground coal mining activities only on those lands specifically designated as within the permit area on the maps submitted in the mining and reclamation plan and permit application and approved for the term of the permit and which are subject to the performance bond.

Sec. 8 ENVIRONMENTAL IMPACTS - The permittee shall minimize any adverse impact to the environment or public health and safety through but not limited to:

A. accelerated monitoring to determine the nature and extent of noncompliance and the

results of the noncompliance;

B. immediate implementation of measures necessary to comply; and

C. warning, as soon as possible after learning of such noncompliance, any person whose health and safety is in imminent danger due to the noncompliance.

Sec. 9 DISPOSAL OF POLLUTANTS - The permittee shall dispose of solids, sludge, filter backwash or pollutants in the course of treatment or control of waters or emissions to the air in the manner required by the approved Utah State Program and the Federal Lands Program which prevents violation of any applicable state or federal law.

Sec. 10 CONDUCT OF OPERATIONS - The permittee shall conduct its operations:

A. in accordance with the terms of the permit to prevent significant, imminent environmental harm to the health and safety of the public; and

B. utilizing methods specified as conditions of the permit by DOGM in approving alternative methods of compliance with the performance standards of the Act, the approved Utah State Program and the Federal Lands Program.

Sec. 11 EXISTING STRUCTURES - As applicable, the permittee will comply with R645-301 and R645-302 for compliance, modification, or abandonment of existing structures.

Sec. 12 RECLAMATION FEE PAYMENT - The permittee shall pay all reclamation fees required by 30 CFR part 870 for coal produced under the permit, for sale, transfer or use.

Sec. 13 AUTHORIZED AGENT - The permittee shall provide the names, addresses and telephone numbers of persons responsible for operations under the permit to whom notices and orders are to be delivered.

Sec. 14 COMPLIANCE WITH OTHER LAWS - The permittee shall comply with the provisions of the Water Pollution Control Act (33 USC 1151 et seq,) and the Clean Air Act (42 USC 7401 et seq), UCA 26-11-1 et seq, and UCA 26-13-1 et seq.

Sec. 15 PERMIT RENEWAL - Upon expiration, this permit may be renewed for areas within the boundaries of the existing permit in accordance with the Act, the approved Utah State Program and the Federal Lands Program.

Sec. 16 CULTURAL RESOURCES - If during the course of mining operations, previously

unidentified cultural resources are discovered, the permittee shall ensure that the site(s) is not disturbed and shall notify DOGM. DOGM, after coordination with OSMRE, shall inform the permittee of necessary actions required. The permittee shall implement the mitigation measures required by DOGM within the time frame specified by DOGM.

Sec. 17 APPEALS - The permittee shall have the right to appeal as provided for under R645-300.

Sec. 18 SPECIAL CONDITIONS - There are special conditions associated with this permitting action as described in Attachment A.

The above conditions (Secs. 1-18) are also imposed upon the permittee's agents and employees. The failure or refusal of any of these persons to comply with these conditions shall be deemed a failure of the permittee to comply with the terms of this permit and the lease. The permittee shall require his agents, contractors and subcontractors involved in activities concerning this permit to include these conditions in the contracts between and among them. These conditions may be revised or amended, in writing, by the mutual consent of DOGM and the permittee at any time to adjust to changed conditions or to correct an oversight. DOGM may amend these conditions at any time without the consent of the permittee in order to make them consistent with any new federal or state statutes and any new regulations.

THE STATE OF UTAH

By: James P Bruff

Date: 3/16/98

I certify that I have read, understand and accept the requirements of this permit and any special conditions attached.

_____

Authorized Representative of the Permittee

Date: _____

ATTACHMENT A

By accepting this permit the Canyon Fuel Company, LLC (permittee) has committed to comply with the requirements of the following permit conditions, as specified, and in accordance with the requirements of:

1. **R645-301-131.100,** Prior to operation of the main mine fan, an agreement regarding fan noise will be reached between Canyon Fuel Company, LLC and Milton Thayn. An agreement regarding surveying and fencing property boundaries will also be reached.

2. **R645-301-232.100, R645-301-232.720 and R645-301-331,** until borrow soil is needed for reclamation, or will be disturbed for approved mining activities, it needs to be left in place, undisturbed, and under established natural vegetation.

3. **R645-301-358,** prior to any site disturbing activities an on the ground nest survey must be conducted for all raptors and bird species of special interest by a qualified person.

4. **R645-301-330,** no construction nor any other site disturbing activities may occur within the permit area until after April 15, 1998.

5. **R645-301-331,** cheatgrass control must be instigated at the Soldier Canyon topsoil stockpile prior to any growth medium from Dugout Canyon being brought on site. The cheatgrass control must continue until control is obtained.

6. **R645-301-534.130.** Before road construction the Applicant must demonstrate that the embankment in and around cross section Z-Z' has a safety factor of at least 1.3 for saturated soils.

7. **R645-301-533.700,** prior to construction the Applicant will give the Division the detailed specifications for the sediment pond.

8. **R645-301-521.140,** Prior to mining, the Applicant needs to supply the Division with a detailed mine map similar to those submitted to MSHA.

9. **R645-301-356,** the productivity of the riparian area and pinyon juniper area must be sampled or commit to selecting range site reference areas as soon as weather conditions permit.

10. **R645-301-330,** Prior to mining, the application must identify specific impacts to raptor nests, and discuss avoidance of the nests when mining. If nest avoidance is not possible then the Division will consult with USFWS as to specific protection and mitigation required. The applicant in conjunction with USFWS, DWR, and the Division will develop a raptor protection and mitigation plan.

By accepting this permit the Canyon Fuel Company, LLC (permittee) has committed to comply with the requirements of the following permit conditions, within 120 days of permit issuance, and in accordance with the requirements of:

11. **R645-301-321.200.** The plant list on page 3-8 must be modified to reflect actual riparian species.

12. **R645-301-323.400 and R645-301-742.320.** Plate 3-1 and Plate 3-1A must not contradict. The south and east facing slopes above the disturbed area show that the vegetation type according to the NRCS and Plate 3-1A should be pinyon Utah juniper. This information is used in Appendix 7-9 to calculate required designs for the culvert and reclamation channel in Dugout Creek and is part of the range site success standard. This map must be corrected.

13. **R645-301-322.220,** the plan must be modified to adequately identify habitats of unusually high value for fish and wildlife such as cliff escarpments and important riparian habitat.

14. **R645-121.200,** the Applicant must provide information about the primary road in Section 534.300 of the PAP or cross reference the information.

The following items are considered reclamation plan deficiencies for which Canyon Fuel Company, LLC (permittee) has provided additional bond to cover their development. By accepting this permit Canyon Fuel has committed to comply with these requirements, and provide the required plan details by the Mid-Term of this permit, at which time the bond may be adjusted in accordance with the more accurate cost estimate.

15. **R645-301-413 and R645-301-358.400,** the reclamation plan must be revised to reduce the slope gradient and length within the riparian zone. Some type of structural controls (i.e. rock, logs, wattles) may help reduce the slope length where slope gradients cannot be reduced.

16. **R645-301-342.100,** Seed Mix #2 must be modified to accurately account for all the tree and shrub transplant numbers which are stated in the spacing requirement for the riparian restoration planting design.

17. **R645-301-342.100,** the application must provide the specific criteria for the selection of the type of in stream obstruction structures to be used in reclamation. For example the rock or log spurs are used to direct flow. The typicals of these structures, Figure 7-12, must also be modified to reflect actual on site conditions.

18. **R645-301-342.100,** Figure 3-1 must be modified to reflect typical on site conditions or removed

from the application. If removed additional information must be provided to clarify specific planting zones.

19. **R645-301-342.100,** cottonwoods must be specified as pole plantings or at least large enough transplant size to reach the water table. Otherwise the application may describe an irrigation program for the cottonwood transplants. The application must also commit to a low flow planting time for the hydrophytic vegetation or provide a low flow water table level anticipated at the time of reclamation.

20. **R645-301-353.100,** the riparian seed mixture must provide greater diversity and life form by adding additional species such as northern sweetvetch, Kentucky bluegrass, Louisiana sagebrush, carex spp., and horsetail. Reclamation seed mixture #1 should add slender wheatgrass, Idaho fescue, thickspike wheatgrass, Louisiana sagebrush, fourwing saltbrush, and bitterbrush. Snowberry and Utah serviceberry should be planted from seedlings or bareroot stock instead of seed.

21. **R645-301-121.200,** Statements regarding final seedbed preparation with dozer tracks must be removed to provide a suitable seedbed and consistency between sections.

22. **R645-301-233,** Soil stabilization techniques after topsoil is placed on steep slopes greater than 2:1 are needed during reclamation, especially within the stream corridor where the culvert will be removed. Specific techniques should be stated in accordance with slope steepness to ensure that soil will remain intact on the steep slopes while vegetation is being established.

23. **R645-301-142.100,** Plate 5-2C must either show the area subject to the requirements of R645-200 or remove the statement that no areas were subject to the requirements of R645-200 thru R645-203.

24. **R645-301-355 and R645-301-752,** the plan must commit to the use of a high quality erosion control matting or propose some other type of structural control on steep slopes. The application must also propose a sediment control plan for reclamation which has been designed.

25. **R645-301-830.140,** The Applicant will provide additional specifics as to how backfilling, grading and revegetation are to be accomplished in order that the Division may prepare a more specific bond cost estimate.

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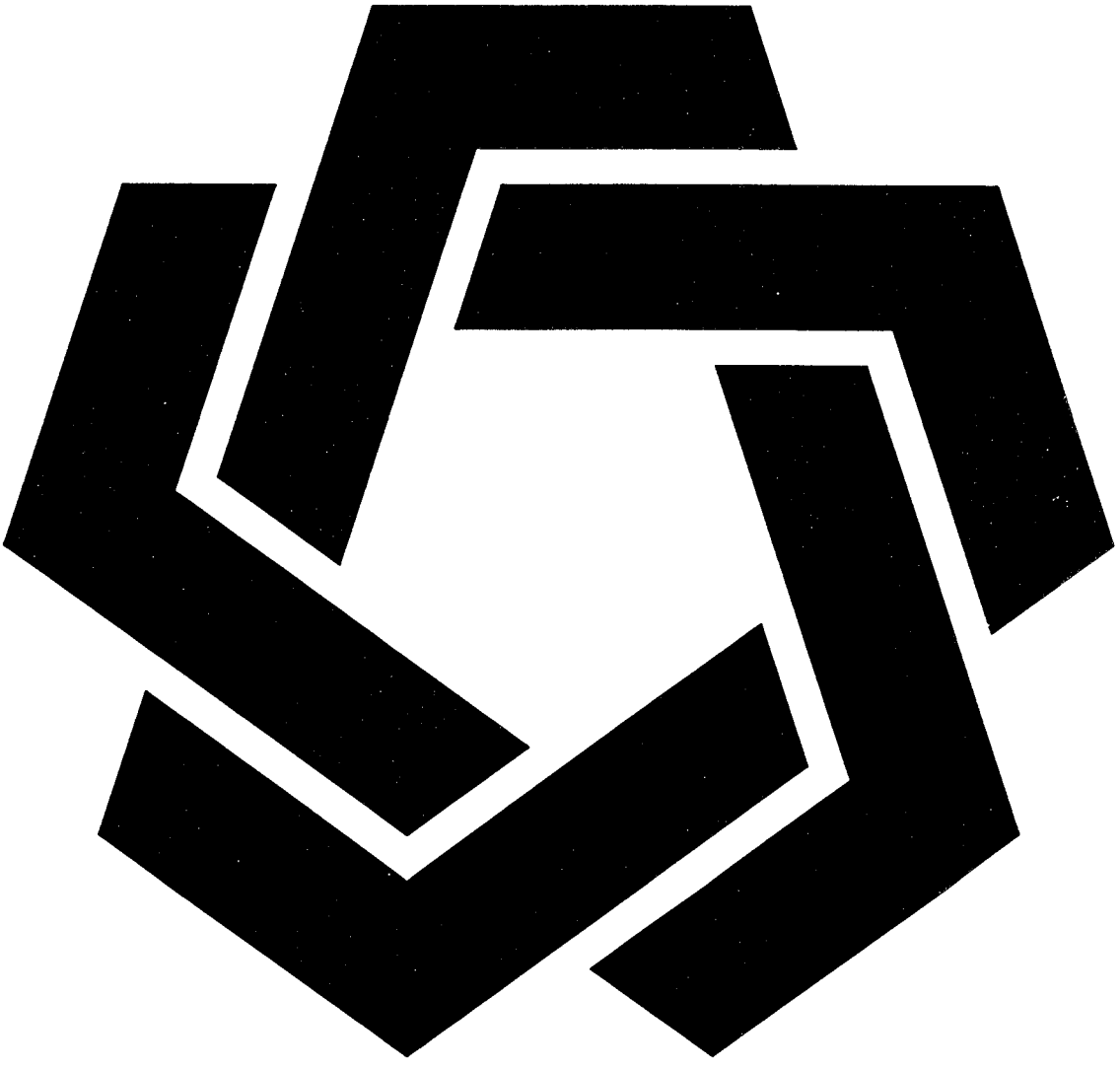
State of Utah
Division of Oil, Gas and Mining
Utah Coal Regulatory Program



Technical Analysis and Findings
Dugout Canyon Mine
PRO/007/039
March 16, 1998

Figure 1

TECHNICAL ANALYSIS

INTRODUCTION

This Technical Analysis (TA) is written as part of the permit review process. It documents the Findings that the Division has made to date regarding the application for a permit and is the basis for permitting decisions with regard to the application. The TA is broken down into logical section headings which comprise the necessary components of an application. Each section is analyzed and specific findings are then provided which indicate whether or not the application is in compliance with the requirements.

Often the first technical review of an application finds that the application contains some deficiencies. The deficiencies are discussed in the body of the TA and are identified by a regulatory reference which describes the minimum requirements. Once all of the deficiencies have been adequately addressed, the TA will be considered final for the permitting action. In the event that information presented in the plan is considered adequate if certain provisions or conditions are committed to or met, the Division may issue permit conditions. Thus the TA may contain permit deficiencies but would be finalized and the deficiencis would become permit conditions to approval.

Those sections that are not discussed in this document are generally considered to be in compliance.

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ADMINISTRATIVE

Regulatory Reference: R645-301-114, Right-of-Entry Information

Analysis

Plate 1-1, Surface Ownership replaced Fig. 1-1 and shows the ownership on a Range and Township map. Similarly, Plate 1-3, Surface Ownership Along County Road shows the entire road and property ownership. In addition, an expanded view shows the mine site disturbed area has been reduced to eliminate that which was formerly on BLM land. The expanded view shows which portion of the disturbed area is on Canyon Fuel Co. land, and on State land. The lower 500 feet is on State land. Appendix 1-2 contains the lease documents which give permission for the Operator to conduct operations on State land.

Findings:

The plan fulfills the requirements of R645-301-114.100, which specifies "An application will contain a description of the documents upon which the applicant bases their legal right to enter and begin coal mining and reclamation operations in the permit area....".

PUBLIC NOTICE

Regulatory Reference: R645-300-121, Filing and Public Notice

Analysis:

In Appendix 1-2, the permit application contains an affidavit of publication and a public notice that has been published once a week for at least four consecutive weeks.

Findings:

The requirements of R645-300-121 have been met. Specifically, 121.100, "Upon submission of an administratively complete application, an applicant for a permit, ... will place an advertisement in a local newspaper of general circulation in the locality of the proposed coal mining and reclamation operation at least once a week for four consecutive weeks. A copy of the advertisement as it will appear in the newspaper will be submitted to the Division."

ENVIRONMENTAL RESOURCE INFORMATION

Regulatory Reference: Pub. L 95-87 Sections 507(b), 508(a), and 516(b); 30 CFR Sec. 783., et. al.

GENERAL

Regulatory Reference: 30 CFR Sec. 783.12; R645-301-411, -301-521, -301-721.

Analysis:

The environmental resource information required in Section R645-301-521 pertains to land subject to surface coal mining operations. A detailed analysis of those requirements will be done in the permit area subsection of the environmental resource section of the Ta.

Findings:

The environmental resource information required in Section R645-301-521 pertains to land subject to surface coal mining operations. A detailed analysis of those requirements will be done in the permit area subsection of the environmental resource section of the TA.

PERMIT AREA

Regulatory Requirements: 30 CFR Sec. 783.12; R645-301-521.

Analysis:

Surface ownership for permit area and adjacent lands are shown on Figure 1-1. Figure 1-2 shows coal ownership in and around the permit area. The permit boundary contains all of lease ML-42648 except for the E1/2 of Section 8 and the NE1/4 of Section 17 and the permit boundary also includes the S1/2SE1/4 of Section 9 from lease ML-42649.

In Section 114 of the PAP the Applicant states:

> "The disturbed area boundary encompasses 10.4 acres. That acreage includes a pre- and post mining road with an area of 0.9 acres."

The legal descriptions for the lease areas are given in Appendix 1-4 and in Section 114 Right-of-Entry Information. The leases are described as:

Lease ML-42648 - (3640 acres) - Approved
T. 13 S., R. 12 E., SLBM, Utah
Section 8: E1/2
Section 10: S1/2
Section 11: S1/2
Sections 14 and 15: All
Section 17: NE1/4; E1/2SW1/4; SE1/4
Section 20: E1/2NW1/4; SW1/4NW1/4; N1/2NE1/4
Section 21: N1/2NW1/4; NE1/4
Section 22: N1/2; N1/2S1/2
Section 23: W1/2NW1/4

Lease ML-42649 - (2212 acres) - Approved
T. 13 S., R. 12 E., SLBM, Utah
Section 3: Lots 1, 2, 3, 4, S1/2 (all)
Section 4: Lots 1, 2, 3, 4, S1/2 (all)
Section 5: Lots 1, 2, SE1/4
Section 9: All
Section 10: N1/2
Section 11: N1/2

Fee land owned by Soldier Creek Coal Company (800 acres) as described below:

T. 13 S., R. 12 E., SLBM, Utah
Section 16: All

Section 23: E1/2NW1/4; W1/2NE1/4

The permit area is also shown on other plates. Plate 5-5 shows the proposed permit boundaries and was certified by a professional engineer.

Findings:

The Applicant meets the requirements of R645-301-521.

MAPS, PLANS, AND CROSS SECTIONS OF RESOURCE INFORMATION

Regulatory Reference: 30 CFR Sec. 783.24, 783.25; R645-301-323, -301-411, -301-521, -301-622, -301-722, -301-731.

Analysis:

When required by the Coal Mining Rules, cross sections, maps, and plans included in the MRP and have been prepared by or under the direction of and certified by a qualified, registered, professional engineer with assistance from experts in related fields.

Findings:

The Applicant has met the minimum regulatory requirements of this section.

Affected Area Boundary Maps

Analysis:

The Applicant has met the requirements of R645-301-521.141. Plate 5-5 clearly shows the boundaries of all areas proposed to be affected over the estimated total life of the coal mining and reclamation operations.

In Section 523 of the PAP the Applicant states that they schedule mining to begin in 1998. The dates on Plate 5-5 show that the Applicant hopes to mine until 2025. Not all the proposed mining areas are in the proposed permit area. The Applicant wants to learn the mining conditions before permitting total proposed area. The Division understands the Applicant cannot determine that mining condition until production begins. The Division will allow the Applicant to permit part of the life-of-mine area at this time. If the Applicant wants to expand the permit area he can do so later. Increasing or decreasing the affected area boundaries will require a separate permitting action.

Findings:

The Applicant has met the minimum regulatory requirements of this section

Coal Resource and Geologic Information Maps

Surface geology for the permit and adjacent areas is shown on Plate 6-1, a certified map. Elevations (to the nearest 40 feet) and locations of test borings are also shown on Plate 6-1. Coal crop

lines are shown on Plates 6-1 and 6-2. Strike and dip of strata at the surface are shown on Plate 6-1 for several locations within and adjacent to the southwest corner of the proposed permit area: dip is also indicated by cross-section A-A' (Figure 6-1). Strike and dip are apparently uniform over a larger area, but explicit information for the larger area would be useful.

Limited information on nature, depth, and thickness of the Rock Canyon seam, which is the coal seam to be mined, is on bore hole logs in Appendix 6-1 (Confidential binder) and on cross-sections B-B' and C-C' (Plate 6-3). Similar information on the overlying Sunnyside seam and the underlying Gilson seam is on cross-sections B-B' and C-C' (Plate 6-3), and also on bore hole logs in Appendix 6-1. Overburden is shown on bore hole logs in Appendix 6-1. Plate 6-4 is an isopach map of the Rock Canyon seam overburden thickness and Plate 6-5 is an isopach map of the Rock Canyon to Gilson seam interburden thickness. Isopach thickness maps of the Rock Canyon and Gilson seams are on Plates 6-6 and 6-7 in the Confidential binder. There is no isopach thickness map of the Sunnyside seam, the principal rider seam.

Existing Structures and Facilities Maps

Analysis:

In Section 521.100 of the PAP the Applicant states:

"No buildings are located in and within 1000 feet of the permit area. No transmission lines, pipelines, or agricultural drainage tile fields exist within, passing through, or passing over the proposed permit area. Hence, they do not provide a map of these nonexistent facilities in accordance with R645-301-521.123 and R645-301-124.

An existing county road enters the permit area in the NE1/4, SE1/4 Sec. 22, T. 13 S., R. 12 E., extending within that section for approximately 500 feet within the permit area. The road then exits the permit area for approximately 1300 feet of road length, then reenters the permit area in the SW1/4 NW1/4 Section 23, where it ends at the southern edge of the proposed disturbed area boundary. The county road lies on land either owned by the State of Utah or the United States of America. Other existing roads within the disturbed area and permit area are privately owned and maintained roads (see Plate 4-1). The general locations of roads within and adjacent to the permit area are shown on Plate 5-5."

There is an existing power line in the proposed permit and disturbed area. The Applicant contacted Utah Power and Light about the power line. The Applicant claims that the power line is not considered a transmission line by Utah Power and Light. The only potential customer that will use the power line is the Applicant. The Applicant plans on having the line move and modified during construction. Division staff has visited the area and is aware of the power lines location. While the Division would prefer that the Applicant show the existing power line on a map that information is not needed at this time.

Findings:

The Applicant has met the minimum regulatory requirements of this section.

Existing Surface Configuration Maps

Analysis:

In Section 521, Land Surface Configuration the Applicant states:

"Surface contours of undisturbed areas adjacent to proposed disturbed areas associated with the mine are shown on Plate 5-2A. As stated in Section 512.100 of this M&RP, surface facilities have been in existence on the west side of Dugout Canyon since March 1952. As a result, pre-mining topographic maps do not exist. However, the surface contours in undisturbed areas shown on Plate 5-2A are considered generally indicative of original land slopes in the vicinity of the mine. A map showing topographic conditions prior to disturbance by SCM is provided as Plate 5-2C"

Plate 5-2C meets the requirements of R645-301-521.151 because it shows the contour 100 linear feet above and below the disturbed area.

Findings:

The Applicant met the minimum regulatory requirements of R645-301-521.151.

Mine Workings Maps

Analysis:

Plate 5-1 shows the location of the mine workings that existed before the Division issued the permit. Plate 5-1 shows the pre-SMCRA mine workings in the Rock Canyon and Gilson seams and the old mine openings. Richard White certified plate 5-1.

Findings:

The Applicant has met the minimum regulatory requirements of this section.

Monitoring Sampling Location Maps

Locations and approximate elevations of bore holes are shown on Plate 6-1. Collar elevations, some estimated from topographic maps, and elevations of cored sections are given in Appendix 6-1 (Confidential binder).

Elevations and locations of monitoring stations used to gather data on water quality and quantity in preparation of the application are on Plate 7-1.

Permit Area Boundary Maps

Analysis:

Figure 1-1, Figure 1-2 and Plate 5-2A met the requirements of R645-301-521.131, R645-301-521.132 and R645-301-521.141.

Figure 1-1 and Figure 1-2 are in Chapter 1 of the PAP. They show the surface and coal ownership. The Applicant show the legal descriptions of the fee land, coal and coal leases in Chapter 1 of the PAP. Plate 5-2A shows the permit boundary for the first five years and the life-of-mine area.

Findings:

The Applicant has met the minimum regulatory requirements of this section.

Surface and Subsurface Manmade Features Maps

Analysis:

Plates 4-1 and 5-2A depict the location of all surface and subsurface manmade features within 1,000 feet of the proposed permit boundary. The only major manmade features in the area are roads and power lines.

Findings:

The Applicant met the minimum requirements of this section.

Surface and Subsurface Ownership Maps

Analysis:

Figure 1-1 and Figure 1-2 met the requirements of R645-301-521.131 and R645-301-521.132.

Figure 1-1 and Figure 1-2 are in Chapter 1 of the PAP. They show the surface and coal ownership. The Applicant show the legal descriptions of the fee land, coal and coal leases in Chapter 1 of the PAP.

Findings:

The Applicant has met the minimum regulatory requirements of this section.

Subsurface Water Resource Maps

A potentiometric surface map for the Castlegate Sandstone, covering the eastern portion of the proposed permit and adjacent areas, is shown on Plate 7-3. There are no maps, plans, or cross-sections showing potentiometric surfaces for shallower or deeper strata. Subsurface water within the proposed permit and adjacent areas occurs mainly in perched aquifers in the Blackhawk Formation, the underlying Starpoint Sandstone, and in overlying strata, so an exact areal and vertical distribution of ground water is not known. There is no map of a potentiometric surface for a regional aquifer. Data in the MRP indicate an irregular potentiometric surface in the Blackhawk Formation, near the Soldier Canyon Mine, that is influenced by the outcrop of the Blackhawk Formation in nearby Soldier Canyon, the mine workings, and the non-uniformity of screen length and placement within the strata, and the lateral discontinuity of the strata (p. 7-29). There is no portrayal of seasonal differences of head in different aquifers on cross sections or contour maps, but hydrographs for several springs and graphs of water levels in four monitoring wells are provided.

The relationship of geology to ground water is discussed extensively in the text, yet there is no

map that relates geology to ground water occurrence, in particular the location of springs in relation to surface exposures of stratigraphic units.

Spring 10 in the Soldier Canyon Mine permit area issues from the North Horn Formation but the water may originate in a deeper formation and reach the surface through a fracture. The chemistry and long-term hydrographs of Spring SP-10 are more consistent with a deep source, rather than a shallow source such as seen in springs issuing from the Flagstaff, North Horn, and Price River Formations. Isotopic and solute compositions are similar to those in ground water from the Blackhawk Formation. There is no fracture mapped but the major water-bearing fracture in the Soldier Canyon Mine coincides approximately with the surface location of this spring.

Surface Water Resource Maps

There are no water-supply intakes for current users of surface waters flowing into, out of, and within the proposed permit and adjacent area. Surface waters that will receive discharges from affected areas in the proposed permit area are shown on Plate 7-1. Location of surface water bodies such as streams, lakes, ponds, springs, constructed or natural drains, and irrigation ditches within the proposed permit and adjacent areas are shown on Plate 7-1.

Well Maps

There are no gas and oil wells within the proposed permit and adjacent areas. There are no water wells in the proposed permit and adjacent areas.

Contour Maps

Findings:

Resource hydrologic information presented on maps, plans, and cross sections that were reviewed for this Technical Analysis, in particular information that pertains to ground water resources, is considered adequate to meet the requirements of this section.

SOILS RESOURCE INFORMATION

Regulatory Reference: 30 CFR Sec. 783.21, 817.200(c); R645-301-220, -301-411.

Analysis:

Chapter 2, Soils, Sections 220 through 224, discusses the soil resources within the proposed Dugout Canyon Mine disturbances. Relevant soils information includes current and published soil surveys, characterizations, and substitute topsoil identification. The Analysis section discusses resource information as follows:

- Prime Farmland Investigation
- Soil Survey Information
- Disturbed Soils
- Undisturbed Soils
- Soil Productivity

- Substitute Topsoil

Prime Farmland Investigation

No prime farmland has been identified within the presently proposed Dugout Canyon Mine permit area. A negative prime farmland determination was concluded in 1980 for the Sage Point-Dugout Mine permit (ACT/007/009). Within the immediate mine facilities area, the Soil Conservation Service's (SCS) "Soil Survey of the Carbon County Area"[1] identify Croydon Loam, Comodore-Datino Variant complex, Midfork family-Comodore complex, and the Rock outcrop-Rubbleland-Travessilla complex as non-irrigated soils. The Croydon Loam is rated good for livestock grazing and is well suited for timber harvesting of aspen. For Comodore-Datino Variant, Midfork family-Comodore complex, and Rock outcrop-Rubbleland-Travessilla complex, these soils are not considered grazeable by livestock and the soil-unit areas are limited for harvesting wood products because of slope steepness, surface stones and boulders, and abundant rock outcrops.

Soil Survey Information

Soil survey information is provided by both a general-area Order-III and a site-specific Order-I soil surveys. The Order-III survey is reproduced from the SCS "Soil Survey of the Carbon County Area" and is delineated on a general area soils map (Plate 2-1). According to the SCS soil survey, soils present on the east/south-east facing slopes of Dugout Canyon are part of the Rock outcrop-Rubbleland-Travessilla complex (#96) while those on the west/north-west facing slopes are shown as Croydon loam (#21) at lower elevations and Midfork family-Comodore complex (#62) at higher elevations in the upper reaches of the canyon. The SCS map (#11) shows a subjective line that separates the #21 soil from the #62 soil with no apparent vegetation break separating the soils. Mr. Leland Sassar, Soil Scientist, NRCS, was contacted on 3/3/98 concerning the apparent discrepance and lack of coherency for placing #21 soils on steeper, Douglas-fir dominated slopes. Mr. Sassar indicated that some #20 (Comodore-Datino Variant Complex) soils probably exist within the #21 soils. The #21 soils are characterized as higher-elevation, non-rocky, deep loams, dominated by quaking aspen, whereas the #20 soils are characterized as lower-elevation, rocky, shallow soils, dominated by Douglas-fir.

Generally, the predominantly stoney to gravelly sandy loam soils formed from sandstone, shale colluvium, and alluvium. Soils within the Rock outcrop-Rubbleland-Travessilla complex and the Midfork family-Comodore complex are typically well drained with moderate permeability, rapid runoff, and are highly susceptible to water erosion. Soils within the Croydon loam have moderately slow permeability, and therefore, depending on slope, erosion characteristics vary from slight to severe. The main point is that because of steepness of slope and soil quality, all of these soils are highly erosive. Shallow soils dominate the east facing side slopes while generally deeper soils characterize the west facing toe slopes.

The Order-I survey was conducted for the Dugout Canyon Mine to describe soils found within the surface facilities area. A total of 12 soil test pits were excavated and are located on a soils map, Plate 2-2, Disturbed Area Soil Map. Soil test pits located in disturbed/overburden soils include TP-2, 3, and 11; pits located in Type TS soils include TP-1, 4, 5, 6, 7, 8, 9, 14, and 14A. Soils were delineated and described in accordance with the standards of the National Cooperative Soil Survey. Soil Test Pits TP-1, 2, 3, 4, 5, 6, 8, 9, and 11 were sampled and characterized according to the DOGM's Guidelines for Topsoil and

[1]Jensen, E. H., and Borchert, J. W., 1988. Soil Survey of Carbon Area, Utah. Soil Conservation Service, U. S. Department of Agriculture, Washington D. C.

Overburden[2]; laboratory data and analytical summaries for each of these samples are provided in Table 2-1 of the PAP. Pits 7, 14 and 14A were not sampled, but pit descriptions were used to estimate soil volumes.

Chris Hansen of EarthFax Engineering, Inc., gathered the soil resource information. A Qualification statement for performing the Dugout Canyon soil survey and a personal Resume are provided in Appendix 2-3, Soil Test Pit Logs.

Disturbed Soils

A large portion of the mine facility's area is covered by overburden and disturbed soils consisting of soil mixed with coal waste and/or waste rock from previous mining operations. These soils are described by soil test pits TP-2, TP-3, and TP-11. The overburden is a mixture of rock and/or coal waste with Travessilla soils. The Travessilla soils are classified by the SCS soil survey as loamy, mixed (calcareous) mesic, Lithic Ustic Torriorthents. The overburden is found in the flat areas and on most of the steep slopes; is moderately well drained, and supports sage brush, juniper, rabbit brush, and a variety of grasses. Soil thickness varies from a few feet to more than eight feet. Generally, the overburden soils are described as a "gravelly loam" with rock concentrations between 10 and 40 percent and rock size that varies from gravel to boulder. Rock fragments are composed of sandstone with some siltstone blocks.

Undisturbed Soils

The remainder of the facilities area has soils that appear to be undisturbed or have been only slightly disturbed. Soils present in the canyon bottom lie within the disturbed and undisturbed areas of the mine. The undisturbed soils were identified by the Order-1 survey as part of the SCS listed soil unit Datino Variant complex, and were given the distinction "Soil Type TS." According to the SCS Carbon County soils survey, the Datino Variant soil complex is characterized as very deep, well drained, moderate permeable soils on mountain slopes being formed in colluvium derived dominantly from sandstone and shale. The SCS survey defines Datino Variant soils as loamy-skeletal, mixed Typic Haploborolls. The typic subgroup of Haploborolls[3] is defined as freely drained soils with a moderately thick brownish mollic epipedon. Typic Haploborolls were formed in alluvium during the late-Pleistocene or Holocene ages, do not have a shallow lithic (stone) contact, and do not have deep wide cracks in most years. The USDA handbook further states that where slopes are suitable, Haploborolls are mostly under cultivation.

Undisturbed TS soils, as represented by soil test pits TP-1, 4, 5, 6, 7, 8, 9, 14, and 14A, are found on both sides of Dugout Creek in the northeastern portion and in the southwestern portion of the facilities area. The TS soils are found in flat lying areas and on slopes with grades up to 40 percent or more. The soil supports vegetation consisting of sage, cottonwood, gambel oak, grass, pinyon, and fir. Information condensed from soil test pit TP-4, TP-6 and lower sections of pit TP-1 show soil horizons O1 (1 inch), A1 (1 to 5 inches), B2 (5 to 14 inches), B3 (14 to 28 inches), and C (28 inches to 9 feet). Portions of TP-5 and TP-8 soil profiles appear to have been reworked by Dugout Creek; the upper four feet of TP-1 soil profile appear disturbed. Undisturbed Type TS soils have acceptable physical and chemical characteristic results consistent with requirements outlined by DOGM's soil and overburden guidelines as recorded in Table 2-1.

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[2]Leatherwood, J., and Duce, D., 1988. Guidelines for Management of Topsoil and Overburden for Underground and Surface Coal Mining. State of Utah Department of Natural Resources, Division of Oil, Gas and Mining.

[3]Soil Conservation Service, U.S. Department of Agriculture, Agriculture Handbook No.436, pp 288-289.

Other undisturbed soils located within the Disturbed Area Boundary and described by the SCS soils Order-III survey include Croydon loam, Comodore-Datino Variant complex, and Rock Outcrop-Rubbleland-Travessilla complex soils.

Soil Productivity

Current soil productivity for the undisturbed and/or slightly disturbed soils is reported by the 1996 survey for living cover percentages as recorded in Section 321.100.

Substitute Topsoil

The disturbed soils within the mine area have been significantly altered by previous mining activities and have lost their native identities. These disturbed soils, or overburden materials, typically contain waste rock and/or coal waste. With the exception of rock fragments and coal waste, these overburden materials have physical and chemical properties that are within DOGM's acceptable range for soil and overburden guidelines and could therefore be considered a substitute topsoil. The Division recognizes that native soils contain high percentages of rock fragments, is inevitable and does not present a reclamation hazard. Indeed, to reclaim and restore the land to pre-mining conditions will require soils with indigenous rock fragment volumes and content. Therefore, it is not only acceptable, but desirable to salvage soils containing intrinsic rock. Waste and coal waste will be segregated from the soils and disposed of properly.

Findings:

The information provided meets the regulatory requirements of this section.

HISTORIC AND ARCHEOLOGICAL RESOURCE INFORMATION

Regulatory Reference: 30 CFR Sec. 783.12; R645-301-411.

Analysis:

Appendix 4-1 of the permit provides a Cultural Resource Evaluation of the Dugout Canyon Mine. An intensive archeological surface evaluation of the Dugout Canyon Mine area was conducted in 1980 under the direction of Eureka Energy Company by Archeological-Environmental Research Corporation (AERC). Four of the sites reported as possible nominations are in the area of the current proposed mine. The four sites include one prehistoric rock art locus (42CB 92) and three historic coal mine loci: The Dugout Creek Mine (42CB 2005/291), the Fish Creek Mine (42CB 204/290) and the Pace Canyon Mine (42CB 206/292/574). The Fish Creek Mine and the Pace Canyon Mine were subsequently determined to not be eligible for nomination to the National Register of Historic Places (NRHP).

Files at the State Historic Preservation Office, Bureau of Land Management Office, and records of the NRHP were consulted. Further field evaluations were conducted by AERC on the prehistoric rock art and the Dugout Creek Mine in November 1995. In this study the Dugout Creek Mine was determined not to be eligible for inclusion on the NRHP due to the lack of context and cultural integrity.

Findings:

Information provided in the plan meets the minimum requirements of this section.

VEGETATION RESOURCE INFORMATION

Regulatory Reference: 30 CFR Sec. 783.19; R645-301-320.

Analysis:

Numerous vegetative communities are represented within the proposed permit area. The permit area ranges in elevation from 7000 feet to 8600 feet. The permit describes the plant communities as having been heavily impacted from man's activities throughout the years. Baseline sampling were done on several of the vegetative communities within the permit area. A Dr. Steve Richardson and Steven Viert conducted vegetation inventories in 1980, Dr. Patrick Collins conducted studies in 1996, and Patricia Johnston in 1997. The current disturbed area has been changed throughout the various studies. The permit area vegetation map (Plate 3-1) delineates broad vegetative communities within and surrounding the permit area. The permit describes vegetative cover, production and shrub density of the Douglas fir, mixed conifer, pinyon juniper, deciduous streambank, and shrub/grass/juniper within the general area of the permit.

The disturbed area vegetation map is shown on Plate 3-1A. Plate 3-1 and Plate 3-1A contradict. The south and east facing slopes above the disturbed area should be pinyon Utah juniper instead of mixed conifer. The NRCS soils map (Plate 2-1) and Plate 3-1A show the area to be pinyon Utah juniper. This is important since Appendix 7-9 uses this information to calculate the culvert and reclamation channel for Dugout Creek and this is the stated range site. Plate 3-1 must be changed.

The pinyon Utah juniper community had a total vegetative cover of 66 percent when sampled in 1997. Big sagebrush, pinyon and juniper were the dominant species by cover in the community. Shrub density was 2300 stems per acre.

The riparian (deciduous streambank) community occurs within the proposed area to be disturbed. Generally, this community consists of deciduous trees and shrubs such as narrowleaf cottonwood, Rocky Mountain maple and Douglas fir. Dominant shrubs were red-osier dogwood, woods rose and mountain snowberry. In 1998 total vegetative cover, including canopy was 85 percent. Shrub density was 1625 stems per acre. Productivity of the understory in this community was measured at 912 pounds per acre in 1980. In 1997 the NRCS estimated that the productivity was 1500 pounds per acre and was rated as being in fair range condition. In 1991 this community was described in fair to poor range condition by the Bureau of Land Management. A site visit in 1996 suggested that this area had not been as heavily grazed as reported in the past but still in a somewhat degraded condition. This community type is the most productive in terms of forage availability in the area. Page 3-8 describes several species found in the riparian area of which six species appear to be unrelated to the riparian community sampled this should be modified.

The applicant has been asked to identify areas of extensive rock outcrops as part of the baseline information. This has not been provided. This reviewer will provide the information as site conditions allow but prior to site disturbing activities.

The area of past disturbance is described as once dominated by pinyon juniper and has a potential forage production of 800 pounds per acre The proposed disturbed area was sampled in 1996 (excluding the riparian area). This area had been disturbed by past mining and coal exploration activities. The area was seeded after the exploration activities. The dominant shrub species by cover was big-toothed maple while rubber rabbitbrush had the greatest number of individuals present. The area is dominated by species which indicate the site has been disturbed. Yellow sweetclover contributed the most vegetative cover to the total

cover of 37 percent (Appendix 3-1).

A review of literature and field studies for the area indicate no threatened or endangered plant species are present in the area or likely to be present (Section 322.200). Field studies were conducted 1979 through 1984. A letter from Robert Thompson (Forest Service Botanist), 1995, is found in Appendix 3-1 stating a negative finding of threatened and endangered plant species. The inventory conducted June 24, 1995 found Canyon Sweetvetch along Dugout Creek approximately a half mile below the gate.

Findings:

Information provided in the application does not meet the minimum requirements of this section. Prior to approval, the applicant must provide the following in accordance with:

R645-301-321.200. The plant list on page 3-8 must be modified to reflect actual riparian species.

R645-301-323.400 and R645-301-742.320. Plate 3-1 and Plate 3-1A must not contradict. The south and east facing slopes above the disturbed area show that the vegetation type according to the NRCS and Plate 3-1A should be pinyon Utah juniper. This information is used in Appendix 7-9 to calculate required designs for the culvert and reclamation channel in Dugout Creek, and is part of the range site success standard. This map must be corrected.

FISH AND WILDLIFE RESOURCE INFORMATION

Regulatory Reference: 30 CFR Sec. 784.21; R645-301-322.

Analysis:

A Fish and wildlife resource survey was conducted December 1979 through November 1981 for the proposed Sage Point - Dugout Canyon coal mining project (Appendix 3-3). Wildlife count data were collected along eight experimental and four control transects through four different vegetation types: riparian, desert shrub, pinyon-juniper and conifer-bush. Each transect monitored reptiles, non-game birds, big game, medium sized mammals and small mammals. Upland and migratory game birds were not documented in this study due to their low frequency of occurrence in the survey area. A limited number of species of macroinvertebrates were found in 1979 and since the creek is not a fishery resource further studies were not conducted.

Detailed information such as numbers and species presence was collected in these studies within the then proposed permit area in 1979 through 1981. All though this study has provided valuable site species information these data should not be considered as baseline information for the current mine plan. The current designated permit area and facilities area is much smaller then the earlier proposed design. The study was designed to monitor the effects of coal mine development on wildlife and not a baseline description.

Appendix 3-3 contains two maps which show Carbon County deer and elk habitat. Portions of the permit area contain critical winter and summer deer habitat. Elk habitat is classified as high value winter and yearlong habitat. DWR states (letter dated April, 1996) that much of the area is classified as critical deer winter range and is heavily used by deer and occasionally by elk and antelope. Mule deer in the area are considered part of Herd Unit 11b and the elk as part of Herd Unit 11b. Designated critical range and/or any riparian areas are considered high value habitats for wildlife.

Section 322.200, Site-specific Resource Information, states that no threatened or endangered plant and wildlife species were discovered in recent inventories by DWR, Forest Service and qualified personnel. Three listed species (black-footed ferret, bald eagle, and peregrine falcon) could potentially inhabit the area. The peregrine falcon has been observed in several recent surveys of the Carbon County area. No confirmed sitings of black-footed ferrets have occurred within Carbon County during 1995, 1996, and the first quarter of 1997 (Bill Bates, UDWR, Section 322.200).

A raptor nest survey was conducted by the DWR in 1995 and 1997. The nest locations identified in that survey are shown on Plate 3-2 (confidential file). Plate 3-2 shows that the permit area contains the following nests:

Section 20	1 prairie falcon nest (scrape?), old dilapidated
Section 22	1 active golden eagle nest
Section 16	1 golden eagle nest, old dilapidated
	2 buteo or red tail hawk nest
Section 23	2 golden eagle nest, old dilapidated

Numerous active and tended golden eagle nests and prairie falcon scrapes are located outside the permit area but immediately adjacent to the permit area. No known raptor nests are within the area to be disturbed by facility construction, although a pair of golden eagles are frequently sited soaring at the cliff edge in full view of the proposed facilities. (the other nests associated with the eagle pair using the active nest in Section 22 have not been observed.) Since bird nest surveys can change from year to year, the permit should be stipulated with the condition that prior to any site disturbing activities an on the ground nest survey must be conducted for all raptors and bird species of special interest.

A bat survey of the proposed disturbed area was conducted September 1997. Several bats were found in the area, however the Spotted Bat (Category 2) and Townsend's big eared Bat (UDWR, Category 2) were not found nor potential habitat. Additional surveys will be conducted in the zone of potential subsidence. Plate 3-3 shows the locations of cliff escapements within the permit area. The permit states "no data or definition was available to determine the criteria for an area to be classified as of "unusually high value" for bats." High value habitat is considered as habitat critical to the existence of the animal. Cliff escarpments are considered unusually high value for bats and raptors.

Numerous references in Chapter 3 refer to Dugout Creek as intermittent, however in the Hydrology section Dugout Creek is referred to as perennial. The reference to intermittent must be changed to perennial.

Findings:

Information regarding the requirements of this section is not considered to be complete at this time. Additional information must be provided by the permittee in order for the Division to approve all the requirements of this section.

R645-301-322.220, the plan fails to adequately identify habitats of unusually high value for fish and wildlife such as cliff escarpments and important riparian habitat.

LAND-USE RESOURCE INFORMATION

Regulatory Reference: 30 CFR Sec. 783.22; R645-301-411.

Analysis:

Land use resource information is given in Chapter 4 of the plan. The stated premining landuse for the permit area is rangeland for cattle and sheep grazing and wildlife habitat. The land has not been developed nor improved for these uses. Recreational use of the permit area is limited due to lack of access through private property. Carbon County has zoned the permit area for mining and grazing (Section 4.11.120). A logging operation was conducted within the permit area in 1996 as shown on a map in Exhibit B, Appendix 4-3. Cascade Resources, logging contractor, reported harvesting six million board feet from the areas shown in Exhibit B. Most of these areas are within the Dugout Creek drainage. Mr. Payne, CFR, revealed that another logging contract had been arrange for 1998.

Current productivity of the land surrounding the proposed disturbed area was estimated by George Cook, National Resources Conservation Service, on August 6, 1996 to be 1400 pounds per acre air dry herbage and in low good condition. On December 3, 1997 Mr. Cook reported the Dugout Canyon Mine to have 800 and 1500 pounds per acre air dry herbage in the Pinyon Juniper Sage and Riparian area respectively. (A phone conversation with Mr. Cook, 3/5/98, revealed that there was no snow on site at the December 3 visit.) Previous productivity statements about the Dugout Canyon showed the area to be severely overgrazed and degraded in the late 1970's and early 1980's. The proposed disturbed area is still grazed but is in somewhat better condition.

A drive through of the permit area above the disturbed area where logging operation had been conducted revealed a degraded condition in summer 1997. Steep slopes along Dugout Creek had been logged, roads cut with material side cast, and limited visible revegetation had occurred at that point. Timber slash was in the stream, a culvert plugged and several small slides had deposited sediment into Dugout Creek. Flatter riparian areas were over grazed with streambanks sluffing and grass approximately an inch high. DWR stated that areas logged had little ground cover and numerous roads which concentrate water flows. Appendix 7-9, page 2, states that the Douglas fir logged area was rated in fair condition. The description of the Douglas fir logged area did not accurately reflect on the ground conditions. Mike Suflita, Division Hydrologist, stated that the culvert sizing was conservitive and adequate to account for the increased runoff and sedimentation from logging activities within the water shed.

Coal mining has occurred within Dugout Canyon since 1925. The Red Glow Mine on the east side of Dugout Canyon was hand-developed by D. J. Collins in 1925. The Rock Canyon seam on the west side of Dugout Canyon was first mined in 1952 by E.S.O. Coal Company. The Knight Ideal Coal Company mined the Rock Canyon and Gilson coal seams between 1958 and 1964. They extracted approximately 1,326,000 tons of coal in that period. No coal has been extracted since 1964, although the portals have been opened and explored several times since then.

Fish Creek and Pace Canyon Mines which operated in the early 1900's are also located within the permit area.

Findings:

Information in this section meets the minimum regulatory requirements.

GEOLOGIC RESOURCE INFORMATION

Regulatory Reference: 30 CFR Sec. 784.22; R645-301-623, -301-724.

Analysis:

Geologic information includes a description of the geology of the proposed permit and adjacent areas down to and including the stratum immediately below the lowest coal seam to be mined and the aquifer below the lowest coal seam to be mined that may be adversely impacted by mining. This description includes the areal and structural geology of the permit and adjacent areas, and other parameters that influence the required reclamation. It also shows how areal and structural geology may affect the occurrence, availability, movement, quantity, and quality of potentially impacted surface and ground water. The description is based on maps and plans required as resource information for the plan, detailed site specific information, and, geologic literature and practices.

Descriptions of the stratigraphy and lithology of strata from the Mancos Shale up to the Colton Formation and of Quaternary pediment gravels and alluvium are in Section 624.100. That section also contains a discussion of geologic structure and a very brief description of the nature, depth, and thickness of the coal seams and the interburden between the Sunnyside, Rock Canyon, and Gilson seams. Plate 6-4 is an isopach map of the Rock Canyon seam overburden thickness and Plate 6-5 is an isopach map of the Rock Canyon to Gilson seam interburden thickness. Plates 6-6 and 6-7 in the Confidential binder are, respectively, isopach thickness maps of the Rock Canyon and Gilson seams.

The Gilson and Rock Canyon seams are both sufficiently developed to allow for economic mining in the proposed permit area but only the Rock Canyon seam is to be mined under the proposed MRP. Minable coal in the Rock Canyon seam ranges from five to eight feet in thickness (p. 6-15). Although the current permit application does not include federal acreage, an R2P2 for the logical mining unit that includes Soldier Canyon and Dugout Canyon Mines and federal lease U-07064-027821 is included in the Confidential binder.

Appendix 6-1 (Confidential binder) contains cutting and core logs for drill holes 3-1, 9-1, 9-2, 10-1, 11-1, 13-1, 13-2, 14-1, 15-1, 15-2, 15-3, 19-2, HCC-4 (H-4), KCC-A and KCC-E. Collar or ground elevations are included in Appendix 6-1. Drill hole locations and elevations are shown on Plate 6-1.

Some bore holes have been logged from the surface to total depth, for others only the coal seams and adjacent strata have been logged. Together, the logs describe lithologic characteristics and thickness of each stratum from the surface to below the coal seams. Ground water occurrence was not marked on these logs at the time the holes were bored (p. 6-17). Bore hole logs were used to construct the cross sections on Plate 6-3, which show the interval from the Sunnyside coal zone to below the Gilson coal zone. Figure 6-1 is a more general cross section from the surface to the Mancos Shale.

Analysis reports on coal, floor, and roof samples from the Rock Canyon and Gilson seams are found in Appendix 6-2 (Confidential binder). Floor and roof samples of the Rock Canyon seam were collected from one of the portals of the abandoned Rock Canyon seam mine in Dugout Canyon (portals shown on Plate 5-1) and a sample of coal was taken from a fresh coal outcrop located a few-hundred feet inside. The location where the coal, roof, and floor samples were collected for the Gilson seam is shown on Figure A1 in Appendix 6-2 in the Confidential binder.

Samples were analyzed for acid- or toxic-forming and alkalinity-producing materials, including total sulfur but not pyritic or other specific forms of sulfur. BTU, ash, and sulfur content of the Rock Canyon coal are briefly summarized at the end of Section 624.100. No unacceptable values were reported

for the parameters listed in Table 2 of UDOGM's "Guidelines for Management of Topsoil and Overburden for Underground and Surface Coal Mining".

Data from one location are probably insufficient to determine the potential for acid- and toxic-forming materials for the entire proposed mine. However, waste material from the mine is not to be used in reclamation. (Although not part of this permit submittal, future development of a waste-rock disposal site has been contemplated.) Limited topsoil will be available for reclamation, so selected overburden materials from the facilities area and B and C horizon soils from the sediment pond area will be used as substitute topsoil and growth media during reclamation. Current information indicates these materials are within acceptable acid- and toxic-forming parameters (Table 2-1). Data from the adjacent Soldier Creek Mine and other operations in the Book Cliffs support the determination of low potential for acid- and toxic-forming or alkalinity-producing material. The MRP contains a commitment (p. 2-29) that where overburden materials are used to supplement topsoil, they will be used only after it has been demonstrated that the resultant soil is suitable for supporting revegetation.

Clay content was determined for the roof and floor rock samples. The sample from the roof of the Gilson seam contained twenty percent clay, but clay content of the other roof and two floor samples was less than ten percent. Drill-hole logs indicate lithology of strata immediately above and below the minable coal varies within the permit and adjacent areas. Several factors, such as thickness of overburden, use of a 35^0 angle of draw in formulating the subsidence control plan, anticipation that most of the land within the permit area will eventually be affected by subsidence, and the low potential for material damage from subsidence indicate additional determination of engineering properties of roof and floor rock would be of little value. No additional determinations of thickness and engineering properties of clays or soft rock are needed prior to approval of the proposed MRP.

Rock Canyon coal thickness in the proposed permit area ranges from 5 to 8 feet, except for a want in the north-central part of the proposed permit area, where coal thins to under three feet (Plate 6-6). Maximum subsidence can be projected as 3.5 to 5.6 feet, based on the assumption that the surface will subside up to 70% of the thickness of the extracted coal. Overburden thickness ranges from 600 feet in the south part of the proposed permit area to over 2400 in the north. Overburden consists of the upper Blackhawk Formation, the Castlegate Sandstone, and the Price River, North Horn, and Flagstaff Formations, which are described in Section 624.100. Gilson to Rock Canyon interburden thickness is 30 to 80 feet over most of the proposed permit area, and up to 100 feet at the west edge (Plate 6-5), and Rock Canyon to Sunnyside thickness is 140 to 180 feet.

The application includes geologic information in sufficient detail to assist in determining the probable hydrologic consequences of the operation upon the quality and quantity of surface and ground water in the permit and adjacent areas, including the extent to which surface and ground water monitoring is necessary; and determining whether reclamation as required by the R645 Rules can be accomplished and whether the proposed operation has been designed to prevent material damage to the hydrologic balance outside the permit area.

At this time the Division does not require the collection, analysis, and description of additional geologic information to protect the hydrologic balance, to minimize or prevent subsidence, or to meet the performance standards.

The applicant has made no request the Division to waive in whole or in part the requirements of the bore hole information or analysis required of this section. However, the applicant has requested,

within the text of the PAP, that the information in Appendices 6-1 and 6-2 be kept confidential. The Applicant should provide this information in a folder or binder separate from the rest of the PAP and marked "Confidential".

Findings:

Information in the geologic resource section is considered adequate to meet the requirements of this section.

HYDROLOGIC RESOURCE INFORMATION

Regulatory Reference: R645-301-731.

Analysis:

Primarily on page 7-54, but elswhere also, the plan describes the construction methods to be used and specific methods used to conrol sediment flow into Dugout Creek. Specificly, a substantial silt fence, referenced as Fig. 5-5, along the upper banks all along both sides of the creek. On Plate 7-5 the plan describes putting silt fences every 200 feet along the culvert, perpendicular to the culvert, to reduce sediment loading. The refenced method, Fig. 5-5, is an appropriate silt fence installation method.

Several places mention the discharge of an estimated 190 gallons per minute of water resulting from mining into the creek. These include pages 7-46, 7-50 and 7-69. Page 7-53 describes the flow being directed into the spillway conduit or into the stream with attendant erosion protection riprap. A commitment is made to obtain a UPDES discharge permit for the flow.

On page 5-38 reference is made to installing four silt fences as shown in Fig. 5-5 which extend across the entire stream below the construction site. During the low flows expected during construction, these should be adequate to minimize silt contributions to Dugout Creek.

Findings:

The plan does fulfill the requirements of R645-301-731.121, which requires "Surface water quality will be protected by handling earth materials, groundwater discharges, and runoff in a manner that .... prevents, to the extent possible using the best technology currently available, additional contributions of suspended solids to streamflow outside the permit area; and otherwise prevents water pollution."

GENERAL HYDROLOGY

Regulatory Reference: 30 CFR Sec. 701.5, 784.14; R645-100-200, -301-720.

Analysis:

A potentiometric surface map for the Castlegate Sandstone, based on data from wells 10-2, 11-2, and 24-1, is shown on Plate 7-3. The gradient is to the north, downdip. USGS data indicate that ground water flow in the Blackhawk-Starpoint aquifer also is to the north.

There have been slow, long-term declines of hydraulic head measured in the Blackhawk Formation by monitoring wells GW-5-1 and GW-6-1, located in the Soldier Canyon Mine permit area

west of the proposed Dugout Canyon Mine. GW-5-1 was installed in 1977, GW-6-1 in 1989. GW-32-1, also in the Soldier Canyon Mine area, has shown generally increasing water levels since monitoring began in 1990. The nearest Blackhawk outcrop (Plate 6-1) is updip of and over a mile from the three wells. Mine workings have been advanced from the outcrop in Soldier Canyon towards the locations of these monitoring wells since 1906, although most coal removal has been since the mid-1970's. When mining came within 150 feet and 2100 feet, respectively, of GW-5-1 and GW-6-1 in 1993 there was a slight rise of head followed by rapid declines. The non-uniformity of length and placement of screened zones within the strata affect data reliability or continuity (p. 7-29). Based on the data and experience from GW-5-1, GW-6-1, and GW-32-1, Canyon Fuel Company has concluded that mining has had little or no effect on ground water levels in the Blackhawk Formation except very near the mine workings and that it is fruitless to attempt a map of the potentiometric surface of the Blackhawk Formation based on water level data from wells.

Data in the MRP indicate an irregular and probably discontinuous potentiometric surface in the Blackhawk Formation near the Soldier Canyon Mine, a potentiometric surface that is influenced by the outcrop of the Blackhawk Formation in nearby Soldier Canyon, the mine workings, and the lateral discontinuity of the strata.

There are no springs issuing from the Blackhawk Formation in Soldier Canyon or within several miles of the canyon. Three intermittent springs issue from the Blackhawk Formation in the Dugout Creek drainage.

Regional hydrostratigraphy from the Colton Formation down to the Mancos Shale is discussed in Section 724.100. Structural geology is discussed in Section 624.100. Ground water occurs in perched aquifer systems and in the regional system in the Blackhawk Formation and underlying Star Point Sandstone. These systems and ground water occurrence, including ground water in mines, are described and discussed in Section 724.100 and Appendix 7-3.

Sampling and analysis.

Sampling and analysis is addressed on page 7-4, Section 723. This section states that, where feasible, all water-quality analyses performed to meet the requirements of the Coal Mining Rules have been conducted according to the "Standard Methods for the Examination of Water and Wastewater" or the methodology in 40 CFR Parts 136 and 434. Where feasible, water-quality sampling has been conducted according to the methodologies in the same two references.

Baseline information.

Ground-water information.

There are no water-supply wells in the permit or adjacent areas. Locations of ground water monitoring wells are shown on Plate 7-1. Collar elevations, depths, and other information are summarized in Table 7-1. Locations of springs are shown on Plate 7-1 and water rights are shown on Plate 7-2. Ground water is used for wildlife and stock watering. Monitoring locations are shown on Plate 7-1. A hydrologic evaluation of the area, by Mayo and Associates, is in Appendix 7-3.

Data on ground water have been collected by the Soldier Canyon Mine operators from 97 springs, seeps, and mine water inflows in and adjacent to the proposed permit area. An additional 8 dry locations have been monitored. Some data are from as early as 1976. In 1995, 58 spring and seep locations were

monitored, an average of twice each: 44 had at least one measured flow, 7 had only seepage, and 7 were dry. In addition, 9 in-mine locations were monitored, once each. Water quality analyses and isotope ratio determinations were performed. Many of these locations had not been monitored previously.

Ground-water monitoring results are summarized in Table 7-2 of the PAP and in Appendices 7-2 and 7-3. Data in Appendix 7-2 are from multiple sources, so not all samples were analyzed following DOGM Guidelines. However, the data are indicative of baseline conditions within the permit and adjacent areas. Manganese data in Appendix 7-3 represent determination for total manganese concentrations (p. 7-6).

Water monitoring that potentially meets the minimum requirements of SMCRA and the Utah Coal Mining Rules appears to have been done at only 13 (6 springs and 7 in-mine locations) of the 97 sites. On average only three samples have been analyzed for these sites, so determination of baseline seasonal quality is problematic.

Wells GW-10-2, GW-11-2, and GW-24-1 (all completed in the Castlegate Sandstone) and springs SP-65 (Colton Formation), SP-20 (Flagstaff Formation), and SC-14 and SC-100 (North Horn Formation) will be used to monitor ground water conditions in the proposed permit area. Locations of wells and springs to be monitored are on Plate 7-1.

Spring SC-80 and the nearby SC-81 are the only identified springs issuing from the Castlegate sandstone in the permit and adjacent areas. They are located outside the proposed permit boundary and updip of the proposed mine. Dugout Canyon, deeply eroded into the Book Cliffs, at least partially isolates these springs and the hydrologic system supporting them from the area to be mined. These springs appear to be a poor choice for monitoring the effects of the proposed Dugout Canyon Mine on the Castlegate aquifer. However, the owner of adjacent lands, the Milton and Ardith Thayn Trust, owns a water right on SC-80.

Springs SC-61, SC-62, and G-100 are identified as issuing from the Blackhawk Formation in the Dugout Canyon area. All three appear associated with local flow systems rather than a regional system. G-100 and SC-61 are intermittent.

Mining operations at the Soldier Canyon Mine intercept ground water stored in the Blackhawk Formation in regional and perched systems. Indications are that ground water from younger, shallower strata is not being affected by the mine. Mine operations at Dugout Canyon are predicted to have a steady-state inflow of up to 220 gpm from sources within the Blackhawk Formation without disturbing ground water systems in the younger, overlying strata.

Ground-water quantity descriptions include approximate rates of discharge or usage and depth to the water in the coal seam and in each water-bearing stratum above and potentially impacted stratum below the coal seam.

The determination of the probable hydrologic consequences (PHC) indicates adverse impacts to the hydrologic balance, on or off the proposed permit area, will not occur. Based on limited analysis of rock within the proposed permit area and on data from the adjacent Soldier Canyon Mine, acid-forming or toxic-forming materials that may result in the contamination of ground-water or surface-water supplies are not present. Waste rock will not be used during reclamation, and soil substitutes will be used only if their chemical and physical properties are adequate. Supplemental information is not needed to evaluate such

probable hydrologic consequences and to plan remedial and reclamation activities.

Baseline cumulative impact area information.

Section 725, page 7-40 says that information necessary for the Division to develop a Cumulative Hydrologic Impact Assessment (CHIA) is presented in Chapters 6 and 7. Most if the necessary data are found in the Probable Hydrologic Consequences (PHC), Section 728 beginning on page 7-41, Appendices 7-2, 7-3, 7-4, 7-5, and 7-7. Additional hydrologic and geologic information for the cumulative impact area, which may be needed to assess the probable cumulative hydrologic impacts of the proposed operation and all anticipated mining on surface and ground water systems, is available from appropriate Federal or State agencies.

Modeling.

Modeling techniques, interpolation, or statistical techniques have not been used in preparing the permit application.

Probable hydrologic consequences determination.

The PHC determination, prepared by Mayo and Associates, is in Appendix 7-2. Previous studies in the vicinity of the Soldier Canyon Mine were reviewed for information on geology, hydrology, and hydrogeology. They were also reviewed for data on discharge, sediment, and other surface and ground water parameters, and seventeen additional ground and surface water samples were collected in 1995 for chemical and isotopic analyses. In spite of a large data base, most of the analyses lack information on the basic parameters required by the Coal Mining Rules and SMCRA, and on seasonal variation. Additional water quality samples were collected and analyzed during 1997 at the operational monitoring points to help provide more complete baseline data.

Potential adverse effects to the hydrologic balance from the proposed mining operations are: decreased stream flows and spring discharges due to capture of surface or ground water by subsidence, bedrock fracturing, and aquifer dewatering; increased stream flows due to increased discharge of ground water from the Blackhawk Formation through the mine workings; and increased ground water recharge to overlying ground water systems.

Chemical and isotopic analyses of ground water, data from hydrographs, and the behavior of ground water systems in and adjacent to the Soldier Canyon Mine indicate that mine has not adversely impacted ground water quantity or quality. Subsidence and surface fracturing have not occurred above the Soldier Canyon Mine. Mining locally dewaters strata immediately adjacent to the Blackhawk Formation but does not appear to draw additional recharge from other overlying or underlying ground water systems. Similar geologic, hydrogeologic, and hydrologic conditions exist at the proposed Dugout Creek Mine and the proposed operations should not adversely impact water quantity or quality in ground water systems overlying and underlying the coal to be mined.

Baseflow in Soldier Creek upstream of the Soldier Canyon Mine and the Blackhawk Formation outcrop responds to seasonal climate variations, low flow in the creek being as little as 5 gpm in drought years and as high as 140 gpm in wet years. Canyon Fuel Company has determined average low flow is approximately 50 gpm. Below the mine, where mine discharge is a major contributor to stream flow - especially during summer and autumn, measured flows for August have been as low as 170 gpm.

Steady-state inflow to the Dugout Canyon mine is expected to be approximately 220 gpm (p. 7-49). Mine consumption is estimated to be 30 gpm, leaving 190 gpm (306 acre-feet/yr) discharge to Dugout Creek, which would represent an increase of approximately 6% over average annual flow of 5,100 acre-feet/year (p. 7-50).

In Appendix 7-3 it is estimated that the maximum discharge from both the Dugout Canyon Mine and the Alkali Tract of the Soldier Canyon Mine will be 800 gpm, and that approximately 400 gpm of the maximum can be attributed to each operation. If this maximum rate were sustained for a full year it would be a 13% increase in the estimated average annual flow of Dugout Creek (p. 7-50).

The potential for mine water discharge and increased flow rates in Dugout Creek are based on the studies of Lines (1985 - see MRP for reference). Actual data that could be used to correlate coal production rates to mine water discharge rates at the Soldier Canyon Mine and to predict mine water discharge rates for the Dugout Canyon Mine are not in the PAP. Annual reports provide some information.

Subsidence, propagation of fractures from mine workings to the surface, and increased infiltration at the surface induced by dewatering of ground water systems have the potential to increase the rate and quantity of recharge to ground water systems overlying the Blackhawk Formation. At the Soldier Canyon Mine, ground water systems in the Blackhawk Formation are hydraulically isolated from ground water systems in overlying strata, and subsidence and fracturing have not altered the hydrologic balance between ground water systems. There has been no observed increase in rate or quantity of recharge at the Soldier Canyon Mine and no increase is expected at the Dugout Canyon Mine.

Findings:

Information in the sections on hydrologic resources that were reviewed for this Technical Analysis, in particular those sections that pertain to ground water resources, is considered adequate to meet the requirements of those sections.

OPERATION PLAN

TOPSOIL AND SUBSOIL

Regulatory Reference: 30 CFR Sec. 817.22; R645-301-230.

Analysis:

Chapter 2, Soils, Sections 230 through 234, discusses the soil's operation plan for the proposed Dugout Canyon Mine. Relevant information includes soil salvage, stockpiling, and topsoil substitutes and supplements. The Analysis section discusses operational information as follows:

- Topsoil and Subsoil Removal
- Culvert Expansion Soil Removal
- Topsoil Substitutes and Supplements
- Topsoil Storage

Topsoil and Subsoil Removal

The PAP attempts to preserve and protect the natural soil resources by using soil salvage plans for maximizing soil recovery volumes for both topsoil and subsoils within Type TS soils. All B and C horizons will be salvaged in addition to salvaging the A horizon topsoil from the undisturbed, Type TS soils for salvage areas #2, 3, 4A, and 4B. The undisturbed TS soils are deep rich Mollisols, with deep subsoils (B and C horizons) of excellent quality material available for salvage. These B and C horizon soils will be salvaged, segregated and stockpiled as substitute topsoil.

Area #4B is identified as topsoil borrow. Soils from Area #4B will be utilized as substitute topsoil at final reclamation. The PAP states that soils will be removed from this area during construction to protect the soils from coal fines originating from coal haulage trucks and to reduce steep slopes adjacent to the haulage road. A significant portion of the needed soil volume for reclamation is contained within this area; that is, 7680 CY of soil, or 50% of the total volume of soil projected for the 15 inches of soil cover over the 7.6 acres of disturbance. Without this soil borrow, only 7.5 inches of soil is available . The bottom line is that the volume of borrow soil contained in Area #4B is critical for revegetation success at reclamation which meets regulatory requirements. *However, regulations also require that the MRP contain a plan for protecting vegetation by disturbing the smallest practable area at any one time. Therefore, until borrow soil is needed for reclamation, or will be disturbed for approved mining activities, it needs to be left in place, undisturbed, and under established natural vegetation. Preserving borrow soil in-place until reclamation not only preserves soil structure under natural vegetation cover, but also allows "live haul" of the soil at reclamation. "Live haul" gives the greatest success for reclamation and vegetation re-establishment because soil structure is much less impacted and soil microbiology remains viable and active. Stockpiled soil can be negatively impacted with weeds, severely damaged soil structure, and non-existent micro-flora, depending on storage duration and stockpile depth.*

The estimated volumes of stockpiled soils are presented in Table 2-2 and in Appendix 2-5 which includes soil recovery calculations. Topsoil and subsoils are salvaged from the temporary waste rock storage area (4,869 CY), the sediment pond area (8,684 CY), the water tank area (1,120 CY) and the Dugout Creek culvert area (1,051 CY). Overburden soils are salvaged from the water tank area (553 CY). In total, 16,257 CY of soil will be salvaged and stockpiled.

A non-biased, third party, professional soil scientist will be on-site during soil salvage to monitor and supervise soil salvage operations for the purpose of maximizing soil salvage volumes and quantities. Surface disturbance activities will only take place after topsoil removal.

Undisturbed soils marked #96 will not be disturbed although they are within the disturbed boundary. These southwest facing, undisturbed soils are therefore considered a buffer zone.

Culvert Expansion Soil Removal

Canyon Fuel Company has committed to salvage soils from steep slopes within the culvert expansion area along Dugout Creek provided that salvage operations do not jeopardize slope stability and safety of construction workers. A qualified soils scientist will decide which soils from steep slopes are suitable for salvage. The construction supervisor will decide which slopes are safe to remove soil from. By mutual agreement, the decision for soil salvage on what slopes will be made based on slope steepness, the potential for slope failure, and timing within the construction sequence. Timing is critical to help maximize safety and slope integrity during salvage operations by coordinating culvert installation and fill placement immediately after soil removal. The placed fills will stabilize the hillsides and will remain in place at final reclamation. After construction, an as-built map will illustrate which areas received salvaged and what volumes of soil

were salvaged.

Appendix 2-5 contains additional information regarding soil removal from within the culvert expansion area of the Dugout Creek. The Appendix contains an original report submitted to the Division on October 15, 1997, a modified, updated Plate 2-5A, and an addendum correcting soil salvage volumes due to a correction in the disturbance area boundary. The original appendix and Plate 2-5A shows seven different salvage areas along Dugout Creek. The culvert expansion project has been modified by shortening the downstream portion of the culvert. As a result, Areas 1, 2, and 3 will not be disturbed and soils will not be removed. This results in a 517 CY reduction of soil salvaged from these three areas.

Except for the large woody vegetation, all vegetation will be salvaged with the soil and incorporated in the stockpiled soils. The approximate volume of soil to be removed is calculated at 1,051 CY. The soil removal volumes are based on the assumption and calculations provided in Attachment B and the Addendum of Appendix 2-5. Soils removed during culvert construction will be stored separately from other soils and are expressly designated for reclamation of the Dugout Creek, riparian area.

Topsoil Substitutes and Supplements

Substitute topsoil are identified in three different categories as follows for salvage and possible use during reclamation:

1. The B and C horizon soils from the temporary waste rock storage area, the sediment pond area and the area southwest of the sediment pond will be salvaged prior to construction and used during reclamation as substitute topsoil.

2. The disturbed soils within the water tank area will also be removed and stored prior to construction. Soil volume is estimated at 533 CY.

3. The proposed coal pile area contains disturbed soils that meet the Division's guidelines for topsoil and overburden. Approximately 6,504 CY of substitute soils could be generated during reclamation from this area after they have been tested and approved for use. This volume of soil is not included in the calculations for soil salvage or available topsoil/growth media. Any waste will be segregated from the soil material and material heavily contaminated with coal waste will not be used.

Soils listed in #1 and #2 above will be salvaged and used in conjunction with salvaged topsoil during reclamation. With the exception of the coarse fragment concentration, the physical and chemical properties of the overburden and the B and C horizon soils fall within the "acceptable range" of the Division Guidelines for substitute topsoil.

Culvert installation and pad construction will require importing fill. The PAP commits to demonstrate the suitability of the imported fill by determining if the fill is acid- and/or toxic-forming prior to placement. Acid and/or toxic-forming materials will not be used.

Topsoil Storage

As stated in the PAP, the topsoil stockpile will be located at the Soldier Canyon Mine topsoil storage area (Plate 2-3) with the Dugout stockpile marked and kept separate from the Soldier Canyon Mine stored soils. A contiguous containment berm separates the Dugout soil pile from the Soldier Canyon Mine piles. The containment berm is designed as a self contained Alternate Sedimentation Control Area (ASCA). Section 231.400 gives the construction, modification, use, and maintenance of the storage piles. The pile is designed to hold a maximum volume of 17,000 CY of soil. The total projected volume of soil salvage from Dugout, culvert expansion area, and topsoil borrow is 16,257 CY of soil.

The current Soldier Canyon Mine soil stockpile is infested with Cheatgrass. Therefore, the operator has committed to maintain, to the extent possible, the stockpile's interim vegetation in a noxious weed- and Cheatgrass-free state. Discussion has focused on controlling the Cheatgrass using both selective and non-selective herbicides in early spring before dormancy breaks with other desirable plants, and by using pre-emergent herbicides in the fall to kill germinating Cheatgrass.

The PAP states that stockpiled soil in jeopardy of being detrimentally affected in terms of soil quantity and quality by mine operations may be temporarily redistributed. Such action will only take place by prior approval of DOGM with appropriate amendment changes to the MRP.

Findings:

The permittee must provide the following, prior to approval, in accordance with the requirements of:

R645-301-232.100, R645-301-232.720 and R645-301-331, In order to meet regulation requirements, the volume of borrow soil contained in Area #4B is critical for revegetation success at reclamation. However, regulations also require that the MRP contain a plan for protecting vegetation by disturbing the smallest practable area at any one time. Therefore, until borrow soil is needed for reclamation, or will be disturbed for approved mining activities, it needs to be left in place, undisturbed, and under established natural vegetation. Preserving borrow soil in-place until reclamation not only preserves soil structure under natural vegetation cover, but also allows "live haul" of the soil at reclamation. "Live haul" gives the greatest success for reclamation and vegetation re-establishment because soil structure is much less impacted and soil microbiology remains viable and active. Stockpiled soil can be negatively impacted with weeds, severely damaged soil structure, and non-existent micro-flora, depending on storage duration and stockpile depth.

FISH AND WILDLIFE INFORMATION

Regulatory Reference: 30 CFR Sec. 784.21, 817.97; R645-301-322, -301-333, -301-342, -301-358.

Analysis:

Protection and enhancement plan.

Although the permit states that wildlife protection and enhancement for the mine will include keeping the disturbed area to a minimum. Approximately 600 feet (500 feet at the southwest end and 100 feet at the northeast end) of high value riparian area is proposed to be culverted that the applicant has not demonstrated the need to be disturbed. The application justifies the length of the culvert primarily on future expansion of

the surface facilities and the following:

1. Adequate turning angle for facilities loop;
2. Equipment, materials and snow storage;
3. Parking;
4. Safety;
5. Preexisting coal fines within the riparian area washing into the water; and
6. Wind blown fines

Items 1 thru 4 are certainly a concern for the mine. Specific safety problems have not been disclosed and items 2 thru 3 are really based on future expansion needs. Item 1 is justified at the beginning of the turning loop. Above items 2 thru 4 could be resolved if the mine was committed to avoidance. Items 5 and 6 should not be items of concern to the mine. Wind blown fines will be controlled by the Operator (Appendix 4-2). The plan further states that the steam side is in such poor current condition that the reclamation will be an enhancement to the area. (This reviewer does not agree with this assessment nor does the NRCS who rated the area as in fair condition.) However, a mature riparian area is not easily restored or replaced. Mitigation upstream will help reduce sedimentation but the steep gradient will not be conduce to developing the wide band of deciduous steambank community found on this lower reach.

The operator commits to reseed with an interim seed mixture (Section 341.200, Interim Seed Mix (Drill Quantities), broadcast quantities to be doubled). The Permittee commits to a wildlife awareness and protection training in it's annual training curriculums for all employees and haulage contractors. A culvert will contain Dugout Creek throughout the length of the disturbed area. This will significantly impact wildlife within the area. Habitat loss due to the culvert and subsequent loss of riparian habitat will be off set with a mitigation and enhancement plan up stream, within the permit area from the culvert (Section 322.200). This mitigation should occur prior to placement of the culvert and will involve a length of 7500 feet. Mitigation will include replanting and may include in stream structures.

The permit states that all power lines within the disturbed area will be raptor safe. The Applicant has committed to construct in accordance with "Power Line Contacts by Eagles and Other Large Birds".

The Permittee further proposes to minimize impacts by controlling and monitoring the surface water discharge and water quality.

During construction activities all mining, supplier personnel and their corresponding equipment will be required to stay within the disturbed area boundary. Loading, unloading, and staging of materials and equipment designated for the construction of the Dugout Canyon Mine facilities will be done within the disturbed area. DWR suggests limiting the construction period between December 1 and April 15 (dates are approximate depending on actual snow conditions).

Endangered and threatened species

No endangered or threatened plant or animal species are known within the area. As required by R645-301-358.100 the permittee must promptly report to the Division any state or federally listed endangered or threatened species within the permit area of which the operator becomes aware. Seasonal or migrating Bald Eagles are expected and a wintering Bald eagle would not need to be reported. Dugout Creek is within the drainage of the Green JRiver which is habitat for the endangered Colorado River fish.

Bald and golden eagles.

Nests within the permit area are identified in the resource section of this technical analysis. Plate 5-5, Proposed Mine Sequence and Planned Subsidence Boundary show the following nests to be within the subsidence zone boundary.

Section 20	1 prairie falcon nest (scrape?), old dilapidated
Section 22	1 active golden eagle nest
Section 16	1 golden eagle nest, old dilapidated
	2 buteo or red tail hawk nest
Section 23	1 golden eagle nest, old dilapidated

Section 332 describe potential effects as displacement of birds, injury or death of birds, and/or nest destruction. The application states six months prior to planned subsidence the mine will discuss with the Division and UDWR protection of the nests in Section 16. The nest in Section 22 will be monitored. The Applicant is pursuing a letter of authorization for the two old dilapidated nests in Section 23.

Discussion of nest protection six months prior subsidence in not acceptable. No discussion has been provided which discusses nest avoidance. Initial discussion must center around nest avoidance. If nest avoidance is not possible protection is the second priority. A protection plan must be approved for all nests which may be affected prior to approval of the five year mining plan and permit. The Division will consult with the USFWS and DWR if avoidance is not possible and after specific effects have been identified.

A commitment is made to continue monitoring of the permit area by helicopter for any new or previously undisturbed raptor nests. Annual monitoring will concentrate in the areas which will be mined in the next two years. If any nests are found, the Permit must be updated, immediately, with this information and an assessment will be made at that time if the mining will affect the nest.

Raptor breeding and nesting territories must be avoided February to early July. Raptor nests are legally protected year long whether active or not.

Wetlands and habitats of unusually high value for fish and wildlife.

A letter from Robert Thompson (USDA, Forest Service Botanist, 1995) states that a site inventory was conducted and no wetlands were found within the then proposed disturbed area. Although Mr. Thompson is not certified by the Army Corp of Engineers to make this statement, he is a respected professional and his statement is enough not to require a wetlands survey.

The statement is made in the text that habitats within the proposed disturbed area are not considered to be of unusually high value. However, it does state habitats of high value include the riparian area and cliff escarpments. This reviewer would state that the riparian area and cliff escarpment is considered unusually high value habitat. Most all water areas and associated stream side vegetation in Utah are considered high value habitat. Additionally, the Appendix 3-3 identifies critical summer and winter range within the permit area.

Findings:

Information found in the plan does not meet the minimum regulatory requirements of this section.

Information must be provided by the permittee in order for the Division to approve this section. High value habitat designation has been address in a deficiency found in **Fish and Wildlife Resource Information**.

R645-301-330, the application must identify specific impacts to raptor nests, and discuss avoidance of the nests when mining. If nest avoidance is not possible then the Division will consult with USFWS as to specific protection and mitigation required. The applicant in conjunction with USFWS, DWR, and the Division will develop a raptor protection and mitigation plan.

MINING OPERATIONS AND FACILITIES

Analysis:

Type and Method of Mining Operations

In Section 523 the Applicant states:

"Room-and-pillar mining methods will be used in the Dugout Canyon Mine. The use of this mining method has been selected to maximize coal recovery and enhance production rates within the specific geologic constraints of the permit area. Longwall mining methods are not planned because these methods do not allow the selective horizon control that is necessary to reduce dilution of the coal with rock from the in-seam partings.

Continuous miners will be used, with either electric or diesel shuttle cars to haul coal to a feeder breaker at the section conveyor belt terminal end. Alternatively, electric continuous haulage system(s) between the miner and the section conveyor belt may be used. The continuous haulage system is comprised of a coal collecting hopper car located at the miner discharge boom, several track-mounted articulating mobile bridge conveyors, intermediate suspended bridge sections, and a rigid frame module conveyor assembly to discharge onto the section conveyor belt. The continuous haulage configuration is designed for higher production rates as compared with shuttle car haulage and will be used mostly in first and second mining panels. Roof bolters, scoops, power centers, and other auxiliary support equipment will be used in all mining sections.

Mining will consist of driving five to seven main and submain entry systems. Production panels, driven from these access entry systems, will consist of rooms and pillars. Pillar extraction in the panels (second mining) is planned up to overburden depths of approximately 1,750 feet. It is anticipated that full roof bolting plans will be mandatory from MSHA and that bolting of the ribs throughout the mine will not be required.

Equipment heights and economics will limit seam mining heights to a minimum of 6 feet. Roof bolters planned for use at the Dugout Canyon Mine (Fletcher Model HDDRs) are 73 inches high. The Long Airdox continuous haulage system operator cabs are 77 inches high. The rock duster-equipped Joy continuous miner is 72 inches high. It is presumed at this time that these equipment pieces may be modified to less than 72-inch operating and transport heights without impairing performance, safety, or upper limit operating heights to allow 72-inch mining heights. If such modifications are disallowed by MSHA or not made possible by the equipment manufacturers, or impede productivity, recovery of reserves in this height range may not be possible.

Anticipated Production. Anticipated annual production of coal from the Dugout Canyon Mine during the permit term is a follows:

1998 - 0.1 million tons
1999 - 1.0 million tons
2000 - 1.5 million tons
2001 - 2.0 million tons
2001 - 2.0 million tons

Through the remaining life of the mine, coal production from the mine is anticipated to be 2.0 million tons per year."

The Applicant met the requirements for R645-301-523 by giving the Division a description of the proposed mining method. The Applicant has stated that they plan to use longwall mining when the development work is completed. The Applicant does not want to modify the PAP to show this change out of fear that the change would increase the time needed to approve the permit. The Division told the Applicant that the permit will be processed as is. The Division cannot guarantee if or when any changes to the permit will be approved.

Findings:

The Applicant met the minimum requirements of R645-301-523 by describing the type and method of coal mining, the anticipated annual and total coal production, and the major equipment to be used for coal mining. The Division is aware of the Applicant's intent to use longwall mining methods.

Facilities and Structures

The Applicant lists the existing and proposed facilities and structures in Section 526 and 528 of the PAP. The Division has enough information to evaluate those structures. The Division's analysis of each structure is given in the section of the TA that deals specifically with that structure.

Findings:

The Applicant met the requirements of R645-301-526 and R645-301-528 that deal with sending the Division information about the existing and proposed surface structures and facilities. The Division's analysis of those structures and facilities is given in other parts of the TA.

EXISTING STRUCTURES:

Analysis:

The two existing structures in the permit area are the main access road and the power lines. The main access road is owned by the county up to the Applicant's property line. The dirt road continues through the proposed disturbed area. There is a power line in the proposed permit and disturbed area. The only potential user for the power line is the Applicant. The Applicant plans on upgrading and moving the power

line during construction.

There are several dirt roads, jeep trail and wheel tracks in the proposed permit area. Those roads are owned by the Applicant and access is limited. The Division will not require the Applicant to identify each of the dirt roads, jeep trail and wheel tracks that will not be used for mining activities or used only for monitoring and data collection activities.

Findings:

The Applicant has meet the minimum regulatory requirements of this section

RELOCATION OR USE OF PUBLIC ROADS

Analysis:

In Section 526.116 of the PAP the Applicant states:

> "They will conduct no coal mining operation within 100 feet of a right-of-way line of any public road, except where mine access or haul roads join the right-of-way."

In Section 521.100 of the PAP the Applicant states:

> "An existing county road enters the permit area in NE1/4, SE1/4 Sec.22, T. 13S., R. 12E., extending within that section for approximately 500 feet within the permit area. The road then exits the permit area for approximately 1,300 feet length, then reenters the permit area in the SW1/4, NW1/4 Section 23 where it ends at the southern edge of the proposed disturbed area boundary."

In Section 527.00 of the PAP the Applicant states:

> "The road which will access the mine is a county road that extends from the Soldier Creek Road (Utah Highway 53) to the mine (a distance of approximately 7.5 miles). Carbon County is currently planning the upgrade of this road to handle the increased traffic which is anticipated as a result of mine operation. The County will construct the upgrade and charge SCM a toll for use of the road."

The Applicant does not propose to move a public road. The County will upgrade the existing county dirt road that goes from the Soldier Creek Road to the mine site. The Division considers the upgrade to the existing dirt road to be a county activity and outside the Division's jurisdiction. The Division will not require the upgrade to be permitted.

The Applicant does not propose to conduct mining and reclamation operations within 100 feet of a public road accept where the mine road accesses the public road. The county road is outside the subsidence zone and disturbed area. Mining and reclamation activities should not interfere with the public's use of the county road. The Applicant has met the requirements of R645-301-521 and R645-301-526 that deals with public roads in or near the permit area.

Findings:

The Applicant has met the minimum requirements of R645-301-526.116 and R645-301-521.133.

COAL RECOVERY

Analysis:

In Section 522 of the PAP the Applicant states:

> "Mining operations at the Dugout Canyon Mine during the first 5-year mining term will occur in the Rock Canyon Seam. Future mining operations may also occur in the Gilson Seam. If the decision is made to mine in the Gilson Seam, information pertaining to the mining of this seam will be included in the M&RP prior to the performance of such mining. The overall objective of mining operations in the permit area will be maximum coal recovery coupled with safety. Coal recovery at the mine has been and will continue to be maximized through the following efforts:
>
> - Based on pre-mining analysis of drill-hole data and information obtained from past mining operations in the area, estimates of the nature, depth, and thickness of the coal seam and associated partings have been made. Using these data, the mine plan and mining methods will be periodically evaluated and amended as necessary to maximize coal recovery; and
>
> - Experience gained during mining will be used to amend future mine plans if coal recovery can be increased."

The mine layout has been planned relative to panels, barriers, and pillars to optimize both coal recovery and safety.

Additional inromation regarding the coal recovery plan is provided in the Confidential Information folder associated with this M&RP. Generally, the minimum mining height will be 6 feet. Based on the anticipated room and pillar mining method, the overall recoverable ratio of the in-place coal reserve is anticipated to be 55 percent.

The Division's staff have reviewed the coal recovery plan in the confidential folder. The guidelines for coal recovery are similar to those approved by the BLM for coal recovery on federal leases. The Division has determined that the Applicant's plan will maximize coal recovery. The Division knows that as information about the coal and mining conditions becomes available that the coal recovery plan will change.

The Division is aware of the Applicant's intentions to use longwall mining. By using longwall mining methods coal recovery should increase. The Division will not approve longwall mining until we have approved an amendment that addresses longwall issues.

Findings:

The Applicant has meet the minimum regulatory requirements of this section.

SUBSIDENCE CONTROL PLAN

Renewable resources survey.

Analysis:

R645-301-525.100, requires the Applicant to survey the permit and adjacent areas for structures and renewable resources that have the potential for being damaged by subsidence. Section 525.100 of the PAP contains the subsidence control plan in it the Applicant states:

As noted in Section 521.100, no transmission lines, pipelines, or agricultural drainage tile fields exists within the area of potential subsidence. As described in Section 527.200, the roads within the area of potential subsidence consist of private roads that are owned and maintained by the parent company of SCM. These are unimproved dirt roads that will be used for access to the lease area. While localized damage may occur to these roads from subsidence, this damage will not be monetarily significant to the owner, since the owner is the parent company of SCM. No other structures are known to exist within the area of potential subsidence.

Renewable resource lands within the permit and adjacent areas are shown on Plate 4-1 and discussed in Section 411 of this M&RP. The area of potential subsidence is currently used for livestock grazing and wildlife habitat, with limited timber production on adjacent lands to the east of Dugout Canyon (see Section 411.120). Hydrologic resources in the area are discussed in Chapter 7 of this M&RP. Information regarding baseline groundwater conditions is provided in Section 724.100.

Findings:

The Applicant has met the minimum regualatory requirements of this section.

Subsidence control plan.

Analysis:

Since the survey listed the structures and renewable resources that have the potential for subsidence damage the Applicant is required by R645-301-525.100 to develop a subsidence control plan.

Findings:

The Applicant has met the minimum regulatory requirements of this section.

Mining Methods

Analysis:

The Applicant states in Section 523 and Section 525.100 that the room-and-pillar method will be used. Entries, haulage routes and airways will be protected by leaving pillars. Both primary and secondary mining will occur in the panels. The size, sequence, and timing for the development of the underground workings are shown on Plate 5-5. The Division has enough information about mining methods to understand where subsidence will occur. The Applicant has met the requirements of R645-

301-525.110.

The Division was informed that the Applicant wants to use longwall methods in the future. If the Applicant wants to switch to longwall mining by must amend their subsidence control plan.

Findings:

The Applicant has met the minimum regulatory requirements of this section.

Physical Conditions Affecting Subsidence

Analysis:

The Applicant provides a detailed description of the physical conditions that influence subsidence in Chapter 6. The geologic setting of the Dugout Mine is similar to take of the Soldier Canyon Mine and others in the area. Subsidence has not caused major problems in the area and the Division has no reason to assume that subsidence at the Dugout Mine will be different. The Applicant has met the requirements of R645-301-525.120.

Findings:

The Applicant has met the minimum regulatory requirements of this section.

Subsidence Control Measures

Analysis:

The main subsidence control method is to conduct mining away from important structures in the permit area. The mine's surface facilities and county road are the major structures in the permit and adjacent areas that need subsidence protection. The county road and surface facilities are outside the subsidence zone and damage to those structures is unlikely. See Plate 5-5. The Applicant has met the requirements of R645-301-525.130.

There are raptor nests in the area scheduled to be subsided. Information on the raptor nests and the protective measures is discussed in Section 333.300 of the PAP. The Division's analysis of the raptor protection plan is given in the biology section of this TA. Approval of the subsidence control plan is dependent upon approval of the raptor protection plan.

Findings:

The Applicant has not yet met the minimum regulatory requirements of this section because the raptor protection plan has not been approved by the Division. Once the Division approves the raptor protection program then the Applicant will have met the requirements of this section.

Subsidence Monitoring

Analysis:

The Applicant will monitor subsidence with annual terrestrial surveys, and aerial surveys when needed. Other mines in the area use similar subsidence monitoring programs. The results of those programs have met the Division's requirements.

The subsidence monitoring stations give the Division information about the settlement that occurs after mining, the angle-of-draw and how long subsidence will occur after mining. This information is useful in evaluating future subsidence monitoring activities.

Terrestrial surveys are the best method for finding subsidence damage. The Applicant should inspect important area such as roads and springs periodically to decide if any subsidence damage has occurred.

The Applicant has established many control points within the permit and nearby areas to help in subsidence surveys (see Plate 5-5). Coordinates and elevations of these control points (as established in January 1984) are provided in Table 5-2. The control points consist of traverse monuments, benchmark monuments, and survey stations (as indicated on Plate 5-5) which the Applicant has constructed generally as follows:

Traverse and Benchmark Monuments - These monuments are constructed with a 3¼-inch diameter tap-on convex cap with a center punch mark and a 5-foot long center rod. The center rod has been empaled in a 5.5- to 6-foot deep poured concrete casing of approximately 10 inches in diameter. Where rock was encountered before the required depth, the rock was broken with a stone rod and an anchor point was grouted into the rock using a concrete patching material. Alternatively, monuments in rock were emplaced as described below ("Rock Monuments and Stations"). The diameter of the upper portion of the monument pour was enlarged to 1.0 to 1.5 feet. Concrete was emplaced in a continuous pour.

Survey Stations - These stations consist of No. 5 rebar rods with a length of 5 feet. Each rebar has been fitted with a 2-inch diameter aluminum cap which has a plastic insert designed to secure the cap to the rod. The caps are plain with a center punch mark and a concave label across the top. Where survey stations are installed in boulders or rock which did not allow the use of a 5-foot length of rebar, they were installed as indicated below ("Rock Monuments and Stations").

Rock Monuments and Stations - Where survey monuments and stations are established in boulders and rock which does not allow the installation of a 5-foot long rod in a concrete casing, these monuments consist of an aluminum alloy convex marker with a center punch and concave label. They are secured by drilling a ¾-inch diameter hole to a depth of approximately 3 inches and installing the cap in a concrete grout mixture. This product can be obtained from any concrete products center.

The Applicant will install future monuments and stations required for proper survey controls as described above. Since geologic and mining uncertainties often force a change in planned mining sequences, the Applicant may install future control points only after the mine panels are in their development phase.

The Applicant will carry out subsidence monitoring annually and will entail direct ground surveys and visual surveys of the permit area. The major concerns of the subsidence monitoring will be the

renewable resources, including perennial streams and springs. The methods used for monitoring are ground surveys of monuments and visual surveys of areas surrounding monitored seeps, springs, and streams during water monitoring or any other surface activities.

Future surveys will concentrate on areas that the Applicant has mined in the past or anticipates mining within the upcoming year. Therefore, the Applicant may expand the survey area each progressive year.

Annual resurveys of the mine permit area will produce vertical control at the same sites as the previous year. The Applicant will monitor each monument annually while they are mining the area underlying the site or is still potentially subsiding. The subsiding monuments that show no change for two consecutive years will be considered stable and omitted from future annual surveys. If the Applicant anticipates additional mining within the stable areas occurs, these areas will again be added to the annual surveys.

Besides the ground surveys, the Applicant will include aerial photogrammetric methods in the surveys when the areas become too large to handle with ground surveys feasiblely. This method may be added to enhance the ground surveys and to cover larger areas as the mine expands. The Applicant will make visual checks for subsidence during all surface activities, especially during water monitoring activities. These visual surveys will detect surface irregularities, and surface cracks.

Each year, the Applicant will send a subsidence monitoring report to the Division. This report will include dates of surveys, a description of the methodology used, and results obtained. This report will also include changes in the monitoring plan that the Applicant may make due to economic conditions or technical advancement in subsidence monitoring.

Findings:

The Applicant has met the minimum regulatory requirements of this section.

Performance Standards for Subsidence Control.

Analysis:

The Applicant states in Section 525.200 of the PAP they do not anticipate that subsidence damage to surface resources. However, should material damage occur, SCM will correct any material damage to the extent technologically and economically feasible. In addition, SCM will notify the Division of any slide, rock fall, or other disturbance caused by subsidence that will affect the environment. The Applicant has met the requirements of R645-301-525.170.

Findings:

The Applicant has met the minimum regulatory requirements of this section.

SLIDES AND OTHER DAMAGE

Analysis:

In Section 515.100 of the PAP the Applicant states:

"If a slide occurs within the permit area that may have a potential adverse effect on the public, property, health, safety, or the environment, SCM will notify the Division by the fastest available means following discovery of the slide and will comply with any remedial measures required by the Division."

The Applicant has met the minimum requirements of R645-301-515.100 by including a commitment to report slides.

Findings

The Applicant has met the minimum regulatory requirements of R645-301-515.100 for reporting and responding to slides.

ROAD SYSTEMS AND OTHER TRANSPORTATION FACILITIES

Road Systems

Analysis:

R645-301-527.100, requires the Applicant to classify each road in the permit area as either primar or ancillary. All roads in the disturbed area are classified as primary and will meet primary road standards.

There are several dirt roads, Jeep trail and wheel tracks in the permit area. The Applicant does not plan on using any of the dirt roads, Jeep trails and wheel tracks for mining and reclamation activities with using the roads for access to monitoring and data collection sites. The Applicant requested the dirt roads, Jeep trails and wheel tracks that are outside of the disturbed boundaries not be classified.

If the dirt roads, Jeep trails and wheel tracks are classified as ancillary roads then they must be reclaimed. The Applicant ownes the land and wants to retain the roads for the post mining landuse. If the dirt roads, Jeep trails and wheel tracks are classified as primary roads then the Applicant would have to bring those roads up to primary road standards. Bringing the dirt roads, Jeep trails and wheel tracks up to primary road standards would be expensive and provide neglagable environmental protection.

Several mines in Utah have dirt roads, Jeep trails and wheel tracks that are used for access to monitoring and data collection sites. The Division does not require those roads be be classified as long as they are used only for monitoring and data collection activities.

The Division will not require the Applicant to classify the dirt roads, Jeep trails and wheel tracks that are located outside the disturbed area boundaries provided the roads are not used for mining and reclamation activities with the exception of access to monitoring and data collection sites. If the dirt roads, Jeep trails or wheel tracks are used for any mining or reclamation activities with the exception of access to monitoring and data collection site the Applicant must then classify the road.

Findings:

The Applicant has met the minimum regulatory requirements of this section.

Plans and drawings.

Analysis:

(1) The Applicant must include a map, appropriate cross sections, design drawings, and specifications for road widths, gradients, surfacing materials, cuts, fill embankments, culverts, bridges, drainage ditches, low-water crossings, and drainage structures. In Section 527.200 of the PAP the Applicant states:

Road Specifications. Cross sections of roads that will be used or maintained by SCM are provided in Figure 5-2. Information regarding road drainage structures is presented in Chapter 7.

The road that will access the mine is a county road that extends from the Soldier Creek

Road (Utah Highway 53)to the mine (a distance of approximately 7.5 miles). Carbon County is currently planning the upgrade of this road to handle the increased traffic that is anticipated as a result of mine operation. The County will construct the upgrade and charge SCM a toll for use of the road.

As currently anticipated, primary roads within the proposed surface facilities will have a 16-foot finished width. As indicated in Figure 5-2, the roads will consist of 2 to 4 inches of granular material, asphalt, or concrete on a compacted, in-place subgrade. The surface of the roads will generally be crowned in the middle and slope at angles of 1% to 2% for drainage. The grade of the disturbed area primary roads will vary, but should not exceed 10%. Specifically, the primary haul road (see Plate 5-2A) will be constructed at a grade of approximately 8%, the primary storage pad roads will generally be constructed with an approximate grade of 6%.

R645-301-527.200 requires the Applicant to submit detailed description of each road. The description will include a map, appropriate cross sections and specification such as: road width, road gradient, road surface, road cut fill embankment, drainage ditch and drainage structures. The Division does not have any design specifications. The plans were approved by a registered engineer and the Division considers that certification adequate.

(2) The Applicant does not propose: to locate a road in a channel of an intermittent or perennial steam, ford a perennial or intermittent stream, low water crossing. Those items have not been specifically addressed.

(3) Contain a description of measures to be taken to obtain approval of the Division for alteration or relocation of a natural stream channel;

In Section 527.200 Drainage way Alterations the Applicant states:

Coal haulage trucks will enter and leave the surface facilities area in the loop shown on Plate 5-2A immediately upstream from the sediment pond. Culverting of the stream will allow a sufficient turning angle for the coal trucks to access and safely maneuver in this area.

The surface facilities at the Dugout Canyon Mine have been designed to adequately control sediment which is generated from those facilities. However, as indicated in Section 521.100 and Plate 5-2C of this M&RP, past mining at the site has resulted in previous disturbance of the surface area. As a result, several areas along the banks of Dugout Creek which would otherwise not be disturbed by SCM (if the Dugout Creek culvert was not installed) contain overcast, disturbed soils which will continue to erode into Dugout Creek (see, particularly the area of "OB" soils noted on Plate 2-2). Culverting of the creek will protect it from this sediment as well as from wind-blown coal fines which could otherwise be transported to the stream throughout its length within the disturbed area.

The mine surface facilities will be constructed in a narrow canyon, not dissimilar to conditions at Canyon Fuel operations at the SUFCO and Soldier Canyon Mines. Surface storage and parking requirements at the mine site will be as follows:....

A final advantage of installing the Dugout Creek culvert throughout the disturbed area is the improved safety for surface operations that the culvert will afford. In several areas of the site the embankments into the stream have been over steepened by past activities, with vertical slopes present in selected areas where deep down cutting has occurred from past blockages of an old culvert at the site. Installation of the Dugout Creek culvert will eliminate the safety hazard associated with most of these steep slopes.

R645-301-358.400 requires that coal mining and reclamation operations be conducted in a manner that "will avoid disturbance to, enhance where practicable, restore, OR replace wetlands and riparian vegetation along rivers and streams..." (emphasis added). Installation of culverts DC-1 and DC-2 can unfortunately not be accomplished in a manner that will avoid disturbance to the riparian vegetation along Dugout Creek. However, as noted in Section 322.220 of this M&RP, the lost riparian vegetation will be replaced within the Dugout Creek watershed during the operational period at a ration of three feet of replacement to every on foot of lost vegetation. This action will also immediately enhance the riparian vegetation in the areas where the mitigation is implemented.

Furthermore, during reclamation of the site, the riparian vegetation within the disturbed area will be both enhanced and restored. Enhancement of the riparian vegetation will be facilitated through the construction of reclaimed Dugout Creek channels which, as indicated in Section 762.100 of this M&RP, have been specifically to improve the geomorphological stability of the stream. By increasing this stability, the riparian vegetation will be enhanced and restored along the stream to condition which more closely mimics that which probably existed prior to disturbance of the site. Hence, through installation of culverts DC-1 and CD-2, the requirements of R645-301-358.400 will be met by immediately replacing and enhancing riparian vegetation in the Dugout Canyon watershed, and by ultimately (upon reclamation) restoring the riparian vegetation within the disturbed area. The enhancement, restoration, and replacement activities will result in an improvement of the riparian system to a condition which greatly exceeds that which is present prior to installation of the culverts.

The Division finds that there is sufficient justification placing the culvert cross section U-U' to cross section Q-Q' on Dugout Creek and the tributary into Dugout Creek. The Division finds that the culvert will improve safety, allow additional storage space and prevent materials, such as coal fines, from entering Dugout Creek.

The justification for the culvert from cross section K-K' to U-U' is weaker. The culvert will not provide significant amounts of storage space or decrease stream contamination. The culvert is not needed to widen or straighten the road. The safety benefits of the culvert in this section would be minor.

The Division is concerned how the Dugout Creek will be reclaimed from cross section K-K' to U-U'. The Applicant does not give a detailed description of how reclamation will be accomplished. In the reclamation plan the Applicant gives a general description of what type of equipment will be used and what the final surface configuration will be.

The two main concerns about placing the culvert in the lower section of Dugout Creek are the riparian areas are important to wildlife and the area will be hard to reclaim. The Division concerns about not placing the culvert in the lower section of Dugout Creek are the culvert will protect the creek from mining activities such as snow removal. disturbing the area will not cause major environmental problems. While the Division does have concerns about disturbing the lower section of Dugout Creek, we do feel that the benefits

slightly out weight the negative impacts.

Findings:

The Applicant has met the minimum regulatory requirements of this section.

Road Specifications.

Analysis:

Cross sections and profiles of roads that will be used or maintained by SCM are provided in Figure 5-2. Information regarding road drainage structures is presented in Chapter 7.

The road which will access the mine is a county road that extends from the Soldier Creek Road (Utah Highway 53)to the mine (a distance of approximately 7.5 miles). Carbon County is currently planning the upgrade of this road to handle the increased traffic which is anticipated as a result of mine operation. The County will construct the upgrade and charge SCM a toll for use of the road.

As currently anticipated, primary roads within the proposed surface facilities will have a 16-foot finished width. As indicated in Figure 5-2, the roads will consist of 2 to 4 inches of granular material, asphalt, or concrete on a compacted, in-place subgrade. The surface of the roads will generally be crowned in the middle and slope at angles of 1% to 2% for drainage. The grade of the disturbed area primary roads will vary, but should not exceed 10%.

The remaining roads within the permit area that may be used by SCM are private roads that are owned and maintained by Canyon Fuel Company, LLC. These roads are private, unimproved dirt roads and will be used for access to the lease area surfaces for the collection of monitoring data (environmental and subsidence data) as well as other uses deemed appropriate by the landowner.

The Applicant stated that the cross sections for the roads are on Plate 2. They do not include plate 2 in the PAP. However, Figure 5-2 shows road cross sections. The road cross sections show the drainage ditches, road surface and embankments.

The Applicant did not include cross sections for the dirt roads in the PAP. Since the dirt roads are existing, structures the Applicant does not have to provide design drawings. Cross section that show that the dirt roads meet they must include the performance standards in the PAP.

In Section 542.600 of the PAP the Applicant states:

All roads not to be retained for an approved postmining land use will be reclaimed immediately after they are no longer needed for mining and reclamation operations. Roads which will be retained through the disturbed area for access to private land within the permit area are noted on Plate 5-3. All remaining roads within the disturbed area will be reclaimed. All roads to be reclaimed will be graded and/or backfilled as indicated above. Topsoil will be applied to the regraded surfaces and the area will be revegetated as discussed in Chapter 2 and 3 respectively.

In Section 534 the Applicant states:

"534.100 Location, Design, Construction, Reconstruction, Use, Maintenance, and Reclamation

Control of Damage to Public or Private Property. All roads used by SCM have been or will be designed according to applicable county and State standards. By designing according to these standards, damage to public or private property will be minimized.

In Section 534.300 of the PAP the Applicant describes the county access road and give little information about the roads in the disturbed areas. Most of the information about road specifications is given in Section 527 of the PAP. Since the county road is not permitted, the Applicant should reduce references to the county roads and technical specifications about it. The Applicant should give cross references in Section 534.300 that tell that most of the road specifications and designs are presented in Section 527 of the PAP.

Findings:

The Applicant has met the minimum regulatory requirements of this section regarding supplying technical information, however, the information is presented ina a way that is not clear and concise (R645-301-121.200). The Applicant should give cross references in Section 534.300 about the road specification in Section 527 and remove unnecessary information about the county road.

Road Surfacing.

Analysis:

The surface of the county road which accesses the mine site will consist of asphalt (see Section 527.200). All ancillary roads will be either asphalt-surface, gravel surface, or unimproved dirt roads. No acid- or toxic-forming materials will be used in the road surfaces.

Findings:

The Applicant has met the minimum regulatory requirements of this section.

Slope Stability.

Analysis:

The stability of the county road embankment has been evaluated where it passes next to the sedimentation pond. Results of this evaluation are presented in Appendix 5-4. This analysis shows that the access road embankment has a minimum safety factor of 4.2 under static unsaturated conditions and 2.1 under static saturated conditions. These values exceed the safety factor of 1.3 required by R645-301-534.130.

The Division analyzed the slope stability of the road embankment in cross section Z-Z' as shown on Plate 5-2B. The Division determined that the safety factor for the slope was less than one under saturated conditions. The Division informed the Applicant of the stability problem and they submitted and analysis of the slope.

The Applicant believes that the entire slope would not become saturated. They believe that the groundwater surface would always be below the ground surface. The Applicant supports this belief by

pointout that the operational slopes will be similar to the existing slope that have not failed.

The Applicant believes that the operational slopes will not become saturated, except for a few inches around the surface. They state that the soils will be compacted and that the permability of the soils will be greatly reduced. Total slope saturation would be impossible.

The Applicant's worst case senerio is for the sediment pond at the base of the slope in cross section Z-Z' was full and that the water table was at an equal elevation. The Applicant analized the slope under their worst case senerio and determined that the slope had a safety factor of 1.4. The Division analized the slope under the same conditions and determine the safety factor to be 1.24.

The Division analized the slope under the condition that the top 3 feet of soil had become saturated. Under that condition the slope failed. The failure surface was is the the saturated zone. The intial failure would be confined to the first few feet of the outslope.

The key factor to slope stability is soil saturation. The Applicant claims that only the top few inches of the surface would ever become saturated due to rain or snow melt. The Applicant's analysis shows that even under high groundwater conditions the slope would be stable. The Division does not believe that in a wet year only the top few inches of the slope would be saturated. The Division analysis of the slope shows that under high groundwater condition the safety factor for the slope would be less than 1.3, the minimum requirement.

Since failure will only occur when the soils are saturated one way of preventing slope failure is to develop and opertions plan that would minimize water infiltration near the slopes in cross sections Z-Z' and AA-AA'. The groundwater level at the slope's base could be reduced by having a maintanence program that keeps the water level in the pond at a minimum.

All other roads in the permit area exist on private land owned by Sage Point Coal Company (the parent company of SCM). The Applicant anticipates no stability problems for these roads. Since those roads will not be used for mining or reclamation activities, the Division has not jurisdiction over such roads.

Findings:

The Applicant has not met the requirements of R645-301-534.130. Before road construction the Applicant must demonstrate that the embankment in and around cross section Z-Z' has a safety factor of at least 1.3 for saturated soils.

Environmental Protection and Safety

Analysis:

R645-301-534.200 requires that all roads be constructed to ensure environmental protection and safety appropriate for their planned duration and use. The Division does not have specific design criteria for roads but may establish design criteria if needed. The Division has not specified any design criteria for the road in disturbed area. Such roads have been design by a registered professional engineer.

Findings:

The Applicant has met the minimum regulatory requirements of this section.

Primary Roads

Analysis:

All primary road designs have been certified by a registered professional engineer. All roads in the disturbed area are considered primary.

In Section 534.300, Primary Roads, the Applicant describes the county road that will be used to access the mine site. The Applicant gives little information about their primary roads in the disturbed area. Most of the information about those roads is presented in Section 527. To avoid confusion the Applicant should either address all relevant the R645-301-534.300 rules in Section 534.300 of the PAP or cross reference the information in Section 527.

An Analysis and Finding on the Dugout Canyon Road was made by the Division on January 28, 1998 which concluded that the "road up to the Dugout Canyon Mine disturbed area boundary does not need to be included in the permitted area for the Dugout Canyon Mine, and is thus exempted from the jurisdiction of the Utah Coal Regulatory Program." Details of this finding can be found in the Analysis and Finding document.

Findings:

The Applicant did not meet the requirement of R645-121.200 because the information about the primary roads is not given or cross referenced in Section 534.300 of the PAP. The Permit should be issued on the stipulation that the Applicant provide information about the primary road in Section 534.300 of the PAP or cross reference the information.

Road Alignment.

Analysis:

Selection of the final alignment of the reconstructed access road will be the responsibility of Carbon County. The alignment will be located generally along the alignment of the existing dirt road. The current road location had been in existence for many years and had not experienced major stability problems. Thus, the road will be located on the most stable available surface, giving consideration also to safety and environmental protection.

Findings:

The Applicant has met the minimum regulatory requirements of this section.

Road Surfacing.

Analysis:

The county road which accesses the mine site will be surfaced with a non-rutting asphalt concrete. This surface will be designed to account for the anticipated volume of traffic as well as the weight and speed of vehicles using the road.

Findings:

The Applicant has met the minimum regulatory requirements of this section.

Road Maintenance.

Analysis:

The access road will be maintained by Carbon County. The Applicant will maintain all roads in the permit area that are used for coal mining activities.

Findings:

The Applicant has met the minimum regulatory requirements of this section.

Road Culverts.

Analysis:

All culverts along the access road will be designed, installed, and maintained by Carbon County. Culverts to be installed within the surface facilities have been designed in accordance with the hydrologic criteria discussed in Section 742.300. These culverts will be installed in accordance with manufacturer's recommendations to sustain the vertical soil pressure, the passive resistance of the foundation, and the weight of vehicles using the road.

The main access road is a public road that will be upgraded and maintained by the county. The Division does not permit county roads that are outside the disturbed area.

The Applicant did not give the Division maps and cross sections of all primary roads in the disturbed area. The Applicant did not give the Division maps and cross section of primary and ancillary roads outside the disturbed area. Drawing showing that the designs for culverts located under primary roads were not included in the PAP.

In Section 542.600 of the PAP the Applicant states:

> "All roads not to be retained for an approved postmining land use will be reclaimed immediately after they are no longer needed for mining and reclamation operations. Roads which will be retained through the disturbed area for access to private land within the permit area are noted on Plate 5-3. All roads to be reclaimed will be graded and/or backfilled as indicated above. Topsoil will be applied to the regraded surfaces and the area will be revegetated as discussed in Chapters 2 and 3, respectively."

The Applicant did not provide specific information about that roads reclamation. They need to list all roads scheduled for reclamation and how they will accomplish that.

Findings:

The Applicant has met the minimum regulatory requirements of this section.

Performance standards.

Analysis:

The Applicant has met all the engineering performance standards for primary roads except demonstrating that the embankment has a safety factor of 1.3 or greater. Those engineering stands include:

- Prevent or control damage to public or private property
- Use nonacid- and nontoxic-forming substances in road surfacing
- Maintain all roads to meet the performance standards of this part and any additional criteria specified by the Division. A road damaged by a catastrophic event, such as a flood or earthquake, shall be repaired as soon as is practicable after the damage has occurred.
- The construction or reconstruction of primary roads shall be certified in a report to the Division by a qualified registered professional engineer, or in any State which authorizes land surveyors to certify the construction or reconstruction of primary roads, a qualified registered professional land surveyor, with experience in the design and construction of roads. The report shall indicate that the primary road has been constructed or reconstructed as designed and in accordance with the approved plan;
- Each primary road embankment shall have a minimum static factor of 1.3. The Division may establish engineering design standards for primary roads through the State program approval process, in lieu of engineering tests, to establish compliance with the minimum static safety factor of 1.3 for all embankments;

  The Applicant has not shown that all road embankments will have a minimum static safety factor of 1.3.

- Primary roads shall be surfaced with material approved by the Division as being sufficiently durable for the anticipated volume of traffic and the weight and speed of vehicles using the road.

Findings:

The Applicant has not met the minimum regulatory requirements of this section. The performance issue not adequately addressed in the PAP involves slope stability. This issue is addressed in another section of the TA.

Primary road certification.

Analysis:

The Applicant has provided certified maps and plans for the primary road design as required by R645-301-512.250.

Findings:

The Applicant has met the minimum regulatory requirements of this section.

Other Transportation Facilities.

Analysis:

The Applicant states that were will be two material handling conveyors on the surface at the mine site. As noted on Plate 5-2A, the Rock Canyon conveyor will transport coal from the mine to the coal stock pile. The reclaim belt will convey coal from the stock pile (via a reclaim tunnel) to the truck loading bin, from which the coal will be loaded into trucks for off-site transportation. Conveyor widths will range from 42 to 60 inches.

Findings:

The Applicant has met the minimum regulatory requirements of this section.

SPOIL AND WASTE MATERIALS

Noncoal

Analysis:

In Section 528.300 of the PAP the Applicant states:

"Non-coal (non-waste rock) waste generated in the permit area will be temporarily stored in a dumpster to be situated at a convenient location within the disturbed area. This dumpster will be located adjacent to the trailers shown on Plate 5-2A northeast of the coal pile. This waste will be disposed of periodically through Carbon County at a permitted landfill.

Liquid wastes such as oil and solvents will be contained and disposed of or recycled, in accordance with applicable State and Federal regulations, at facilities which are permitted to accept such wastes. Small quantities of such wastes (e.g. resulting from cleanup or small spills, etc.) May be contained onto absorbent pads prior to disposal. In all cases, disposal and/or recycling will be only at sites which are permitted by appropriate regulatory authorities to accept such waste.

No non-coal (non-waste rock) waste other than durable, non-acid and toxic forming, rock-type construction materials (e.g. cinder block) will be permanently disposed of within the permit area. If such waste is permanently disposed of in the permit area, it will be disposed of underground as outlined in Section 536.500 of this M&RP. If such waste is temporarily stored within the permit area prior to ultimate disposal, it will be stored either in a dumpster of in the temporary waste-rock storage area.

It is currently anticipated that no non-coal waste that is defined as hazardous under 40 CFR 261 will be generated at the mine. If such waste is generated in the future, it will be handled in accordance with the requirements of Subtitle C of the Resource Conservation and Recovery Act and any implementing regulations.

The Applicant committed in Section 528.300 of the PAP to dispose of all non-coal waste in either in state approved landfill or in an on site disposal area The Applicant has committed to dispose of all non-coal waste in an approved maner.

Findings:

The Applicant has met the minimum regulatory requirements of this section.

Coal Mine Waste

Analysis:

The Division defines coal mine waste as coal processing waste and underground development waste. Coal processing waste means earth materials separated from the coal during cleaning, concentrating, or the processing or preparation. In Section 528.300 of the PAP the Applicant states that SCM will not process their coal at the Dugout Canyon Mine beyond crushing and screening. Thus, the Applicant will generate no coal processing waste in the permit area.

The Division defines underground development waste as waste-rock mixtures of coal, shale, claystone, siltstone, limestone, or related materials that are excavated moved, and disposed of from underground workings in connection with underground coal mining and reclamation activities. In Section 528.200 of PAP the Applicant states:

Underground development waste which is generated at the Dugout Canyon Mine will be disposed of either:

- At the approved water-rock disposal facility at the SUFCO Mine; or
- At the approved waste-rock disposal facility at the Skyline Mine

Description of the waste-rock disposal facilities at the SUFCo Mine and the Skyline Mine are provided in their respective M&RP's. A discussion of disposal of development waste in the underground workings of the Dugout Canyon Mine is provided in Section 536.500 of this M&RP. The Division approved the disposal of waste rock material generated at the Dugout Mine to be placed in the waste rock disposal facilities at both the Skyline and SUFCo mines.

Findings:

The Applicant has met the minimum regulatory requirements of this section.

Refuse piles.

Analysis:

In Section 513.400 of the PAP the Applicant states:

"Waste rock generated from the Dugout Canyon Mine may be temporarily stored on the surface of the mine site at the location shown on Plate 5-2A. This storage will be for a short period of time prior to ultimate disposal either underground or in the waste-rock disposal areas associated with the SUFCo and/or Skyline Mines. Waste rock will be disposed of after a truck load of material accumulates or every 3 months, whichever is shorter. The short-term nature of this storage precludes the need for special precautions related to spontaneous combustion of the stored materials. Runoff from the stored materials will drain to the site sedimentation pond.

In Section 536 of the PAP the Applicant states:

> The coal mine waste generated from the Dugout Canyon Mine may be temporarily stored on the surface of the Dugout Canyon Mine facilities at the location shown of Plate 5-2A prior to ultimate disposal. Coal mine waste which is stored at the mine site will be removed from the temporary waste rock storage area and placed in its final disposal area at least once each calender year. Runoff from the temporary waste rock storage area will report to the mine site sedimentation pond and be treated accordingly. During the period of temporary storage, berms will be installed around the temporary storage area to contain and direct runoff to ditch DD-2a (see Plate 7-5). The berms around the temporary waste rock storage area ate not noted on Plate 7-5 or elsewhere since these will be located as necessary, depending upon the extent of the waste rock storage

The Applicant states in Section 513.400 that the material in the temporary storage site will be removed every three months or less.

Findings:

The Applicant met the requirements of R645-301-121.200.

Impounding structures

Analysis:

In Section 533 of the PAP the Applicant states:

"The only impoundment with an embankment that will be constructed, used, or maintained by CFC will be the sedimentation pond at the mine surface facilities (the remaining two impoundments noted on Plate 7-5 will be totally incised). A slope-stability analysis which was performed on this pond embankment is provided in Appendix 5-4. According to this analysis, the minimum safety factors for the sedimentation pond embankment are 4.2 under static unsaturated conditions, 2.1 under static saturated conditions, and 1.6 under seismic saturated conditions. All analyses were performed assuming that the pond was full to its maximum design depth. These safety factors exceed the minimum requirements of R645-301-533.100.

Analysis:

Embankment inslopes and outslopes will be revegetated following construction of the sedimentation pond, as outlined in Section 533.300. Riprap will also be placed on the upstream face of the embankment near the discharge structure.

Findings:

The Applicant has met the minimum regulatory requirements of this section.

Highwalls

Analysis:

No highwalls will be located below the water lines of the sedimentation pond.

Findings:

The Applicant has met the minimum regulatory requirements of this section.

MSHA Criteria

Analysis:

The sedimentation pond does not meet the size criteria of 30 CFR 216(a).

Findings:

The Applicant has met the minimum regulatory requirements of this section.

Pond Operation and Maintenance Plans

Analysis:

The sedimentation pond has been designed in accordance with R645-301-740. Details of these designs, and the requirements for operation and maintenance of the pond, are presented in Chapter 7 of this M&RP.

The sediment pond does not meet the criteria for being classified as an MSHA pond because the structure is less than 20 feet high, does not impound more than 20 acre-feet nor is the sediment pond located where failure would be expected to cause loss of life or serious property damage. Sediment ponds that do not meet the MSHA criteria have fewer stringent design and performance standards.

The designs for the sediment pond are in Appendix 7-8 of the PAP and on Plate 7-4. A registered professional engineer certified the designs and drawing.

The report on the slope stability analysis is in Appendix 5-4. The engineer that did the analysis concluded that the minimum safety factors for the sediment pond embankment are 4.2 under static

unsaturated conditions, 2.1 under static saturated conditions and 1.6 under seismic saturated conditions.

Stability during rapid drawdown is discussed in Appendix 5-4 of the PAP. The analysis indicates that the upstream slope of the embankment will be stable and have a safety factor of 1.6. Only the upstream slope was evaluated for stability during rapid drawdown. The Applicant beleives that when rapid drawdown does occur failure will first occur on the uptream slope. The Division agrees with that belief and considered the rapid drawdown analysis adequate.

Findings:

The Applicant has met the minimum regulatory requirements of this section.

Burning and Burned Waste Utilization

Analysis:

In Section 528.300 of the PAP the Applicant states:

If coal mine waste fires occur at the SUFCo and Skyline Mines, they will be controlled in the manner outlined in their respective permits.

Waste rock will only be temporarily stored at the surface of the Dugout Canyon Mine prior to ultimate disposal. If spontaneous combustion of this material does occur, the burning section will be removed from the pile using a backhoe or other appropriate means. The affected waste rock will then be spread so that the material can cool and mixed with soil to extinguish the fire. The extinguished material will then be returned to the waste pile.

The plan to handle burning waste rock is adequate. The plan is similar to those used by other mines and the Abandoned Mines Land Program.

Findings:

The Applicant met the requirements of R645-301-528.323.

Return of coal processing waste to abandoned underground workings.

Analysis:

In Section 528.300 the Applicant states that SCM will process their coal at the Dugout Canyon Mine beyond crushing and screening. They will generate no coal processing waste on site. The Applicant does not plan on returning coal processing waste to the underground workings. The Applicant has address the requirements of R645-301-528.300.

Excess Spoil

Analysis:

In Section 512.200 of the Pap the Applicant states that they will generate no excess spoil from the

permit area. The Applicant has met the minimum regulatory requirements for handling excess spoil.

Findings:

The Applicant has met the minimum regulatory requirements of this section.

HYDROLOGIC DESIGN INFORMATION

Analysis:

Discharges into an Underground Mine

In Section 513.600 of the PAP the Applicant states that no discharges will occur from the surface to mine workings underground.

Findings:

The Applicant has met the minimum regulatory requirements

Impoundments

Analysis:

- In Section 533.600 of the PAP the Applicant states that the sediment pond does not meet the size criteria of 30 CFR 216(a).
- Richard White a registered professional engineer certified the designs for the sediment pond.
- The embankment stability study for the sediment pond is in Appendix 5-4. The Applicant has shown that the design had safety factors that exceed 1.3. The Applicant has met the minimum regulatory requirements.

  In Section 533.200 of the PAP the Applicant states:

  "The Applicant has conducted soil investigations at the site of the proposed surface facilities. Results of these investigations are presented in Chapter 2 and Appendix 5-4 of this M&RP. During these investigations, the Applicant evaluated foundation conditions in the proposed sedimentation pond. Based on these investigations, the Applicant encountered no conditions which suggested that the pond's foundations would be unstable. The slope-stability analysis presented in Appendix 5-4 shows that the pond foundations will also be stable under operating conditions.

  Prior to construction of the sedimentation pond, all vegetative matter and topsoil will be removed from the foundation area. Detailed cross sections of the sedimentation pond are presented on Plate 7-4 of this M&RP."

The Applicant has met the minimum requirement of R645-301-533.200 to R645-301-533.220. The commitment in the PAP restates the requirement of these regulations.

In Section 533.300 of the PAP the Applicant states:

"The outslopes and inslopes of the sedimentation pond will be revegetated following construction to minimize surface erosion and protect the embankments against sudden drawdown."

In Appendix 5-4 the Applicant states that in the Sediment Pond/Access Road Stability Analysis that they assume that the soils will drain rapidly and excess pore pressure will not develop.

Vegetation does not protect the pond from sudden drawdown. Therefore the Applicant has not shown that they will protect the pond from sudden drawdown. In the stability analysis the Applicant neglects pore pressures. Since rapid drawdown can create negative pore pressures that assumption is not valid.

In Section 533.500 of the PAP the Applicant states that no highwalls are below the water lines of the sediment pond. The Division agreed with that statement and concluded that the Applicant has met the minimum requirements of R645-301- 533.500.

In Section 514.300 of the PAP the Applicant states that:

"Regular inspections will be made during construction of the sedimentation pond as well as upon completion of construction. These inspections will be made by or under the direction of a registered professional engineer experienced in the construction of similar earth and water structures."

Annual inspections of the sedimentation pond will continue until removal of the structure or release of the performance bond. A certified report of inspection will be prepared by a qualified registered professional engineer and submitted to the Division within two weeks after each inspection. The report will discuss any appearances of instability, structural weakness or other hazardous conditions, depth and elevation of any impounded waters, existing storage capacity, and existing or required monitoring procedures and instrumentation, and any other aspects of the structure affecting stability. A copy of this report will also be maintained at the mine site.

No impoundments are anticipated within the permit area that are subject to 30 CFR 77.216."

The Applicant has committed to meet the requirements of R645-301-514.311 to R645-301-514.313. Inspections will be done during the critical phases of construction and copies of the reports will be available on site. A qualified registered professional engineer will inspect the pond annually.

Findings:

The Applicant has met the minimum regulatory requirements.

Ponds, Impoundments, Banks, Dams, and Embankments

Analysis:

- Plate 7-4 shows the sediment pond design. The plan was certified by Richard White, a registered

professional engineer. The Applicant will excavate most of the pond. Part of the pond will consist of an embankment that is approximately two feet high. They did not include the specifications for the embankment in the plan. The Applicant needs to give the Division written specification for the construction of the pond. See R645-301-533.700.

- The Applicant gave the Division certified maps, and cross section of the sediment pond. Plate 7-4 shows detailed information about the sediment pond. Plate 5-2A and 5-2B also have information about the sediment pond.

- Plate 5-5 shows the areas where the Applicants anticipate subsidence. On that plate the sediment pond is outside the area of potential subsidence.

The Division has enough information to evaluate the stability of the sediment pond. The Division has determined that the pond will be stable and meet the requirements of R645-301-533. The Division does not have enough information about the construction of the sediment pond (R645-301-533.700). Prior to construction the Applicant must give the Division detailed construction specifications.

Findings:

The Applicant did not meet the minimum regulatory requirements of R645-301-533.700 because they did not give the Division detail plans for the construction of the sediment pond. Since that information is not needed until construction of the sediment begins, the Division should approve this portion of the PAP with the stipulation that prior to construction the Applicant will give the Division the contract specifications for the sediment pond.

SUPPORT FACILITIES AND UTILITY INSTALLATIONS

Analysis:

Plate 5-2A show the location of the surface facilities. The Applicant listed the surface facilities in Sections 521.100 subsection Surface Facilities in the PAP.

Findings:

The Applicant has met the minimum regulatory requirements.

Support Facilities

Analysis:

Support facilities at the Dugout Canyon Mine will be operated in accordance with the permit issued for the mine. Support facilities will be located, maintained, and used in a manner that:

- Prevents or controls erosion and siltation, water pollution, and damage to public or private property;

- To the extent possible, using the best technology currently available,

minimizes damage to fish, wildlife, and related environmental values; and

- Minimizes additional contributions of suspended solids to stream flow or runoff outside the permit area.

All support facilities will be removed following mining in accordance with the reclamation plan discussed in Section 540 of this M&RP.

Findings:

The Applicant has met the minimum regulatory requirements

Water Pollution Control Facilities

Analysis:

Water pollution control facilities at the Dugout Canyon Mine consist of the sedimentation pond, the appurtenant structures associated with the sedimentation pond, and the sewage disposal leach field. All water pollution control facilities will be removed following mining in accordance with the reclamation plan discussed in Section 540 of this M&RP.

The sedimentation pond and appurtenant structures will be constructed as discussed in Chapter 7 and will be used and maintained as discussed in Section 533.700. Sanitary sewage will be routed by gravity through a pipeline from the mine surface facility to the leach field at the location shown on Plate 5-2A. The sewage facilities were designed for a projected total employment of 150 persons. An operational permit has been applied for with the Utah Department of Health for use of the leach field.

Findings:

The Applicant met the minimum requirements of R645-301-526 regarding support facilities.

SIGNS AND MARKERS

Analysis:

Mine and Permit Identification Signs

Analysis:

A mine and permit identification sign will be displayed at the point where the county road ends and the private road forks into the surface-facilities area. This sign will be a design that can be easily seen and read, will be made of durable material, will conform to local regulations, and will be maintained until after the release of all bonds for the permit area. The sign will contain the following information:

- Mine name,
- Company name,
- Company address and telephone number,

- MSHA identification number, and
- Permanent program permit identification number as obtained from the Division.

The Applicant committed to place the mine and permit identification signs at all entrances that are accessable from a public road.

Findings:

The Applicant has met the minimum regulatory requirements.

Perimeter Markers

Analysis:

The perimeter of all areas affected by surface operations or facilities will be clearly marked before beginning mining activities. The markers will be a design that can be easily seen and read, will be made of durable material, will conform to local regulations, and will be maintained until after the release of all bonds for the permit area. Figure 5-2

Findings:

The Applicant has met the minimum regulatory requirements.

Buffer Zone Markers

Analysis:

Stream buffer zone markers will be placed adjacent to Dugout Creek within the disturbed area noted on Plate 5-2A. Each buffer zone marker will be a design that can be easily seen and read, will be made of durable material, will conform to local regulations, and will be maintained until after the release of all bonds for the permit area. Page 5-21 further delineates stream buffer zone marker locations and intervisibility between signs.

Findings:

The Applicant has met the minimum regulatory requirements.

Topsoil Markers

Analysis:

Markers will be placed on all topsoil stockpiles. These markers will be a design that can be easily seen and read, will be made of durable material, will conform to local regulations, and will be maintained until after the release of all bonds for the permit area.

Findings:

The Applicant has met the requirements of this section.

USE OF EXPLOSIVES

Analysis:

The Applicant states that no surface blasting will occur on the surface. Many underground coal mines in Utah do not have regular surface blasting activities. The Division does not require those mine to address the blasting and explosives regulation in detail. If the need for surface blasting should occur, the Division will require the Applicant to submit a detailed blasting plan.

Findings:

The Applicant has met the minimum regulatory requirement for the R645-301-524 regulations.

MAPS, PLANS, AND CROSS SECTIONS OF MINING OPERATIONS

Analysis:

The Applicant has supplied the Division with maps and cross sections that show the permit area and the disturbed areas. The Division reviewed the maps and cross section. Most of the analysis was done in the sections of the TA the deal with a specific map or cross section feature or requirement.

The only map that the Division finds inadequate is the mine map. The map does not contain enough details. The Division needed to have a detailed mine map similar to the mine plans supplied to MSHA. The Applicant said that detailed mine maps have not been developed but when they are the Division will receive a copy.

Findings:

The Applicant has not met the minimum regulatory requirements of R645-301-521.140 because they did not supply the Division with detailed mine maps. The Applicant needs to supply the Division with a detailed mine map similar to those submitted to MSHA. The Division should approve the permit with regards to mine maps but stipulate that prior to mining the Applicant give the Division a detailed mine map that is similar to the MSHA maps.

Certification

Analysis:

The Division has certified verifications that all maps listed under R645-301-512 will be completed when we have approved those maps.

Findings:

The findings for map certification will be done when we have approved the maps.

OPERATIONAL HYDROLOGIC INFORMATION

Regulatory Reference: 30 CFR Sec. 773.17, 774.13, 784.14, 784.16, 784.29, 817.41, 817.42, 817.43, 817.45, 817.49, 817.56, 817.57; R645-300-140, -300-141, -300-142, -300-143, -300-144, -300-145, -300-146, -300-147, -300-147, -300-148, -301-512, -301-514, -301-521, -301-531, -301-532, -301-533, -301-536, -301-542, -301-720, -301-731, -301-732, -301-733, -301-742, -301-743, -301-750, -301-761, -301-764.

Underground mining and reclamation activities are planned to be conducted to minimize disturbance of the hydrologic balance within the permit and adjacent areas, to prevent material damage to the hydrologic balance outside the permit area, and to support approved postmining land uses in accordance with the terms and conditions of the approved permit and the performance standards of this part. The Division has not required additional preventative, remedial, or monitoring measures to assure that material damage to the hydrologic balance outside the permit area is prevented.

Ground-water monitoring.

Analysis:

Wells GW-10-2, GW-11-2, and GW-24-1 (all completed in the Castlegate Sandstone) and springs SP-45 (Colton Formation), SP-2 Flagstaff Formation), SC-14 North Horn Formation) , and SC-80 (Castlegate Sandstone) will be used to monitor ground water conditions in the proposed Dugout Canyon Mine permit area. Locations of wells and springs to be monitored are on Plate 7-1. See the discussion of Ground Water Information under Baseline Information in the Environmental Resource Information section.

Findings:

The Applicant has met the minimum regulatory requirements.

Surface-water monitoring.

Analysis:

The surface-water monitoring plan begins on page 7-58 of the application. Stream monitoring locations are found on Plate 7-1. Table 7-5 on page 7-59 provides the surface water monitoring parameters. The monitor is plan was based on the PHC.

Streams and sediment ponds will be monitored during mining operations. One stations will be established to monitor surface water downstream from the mine site and two site will be established on the forks of Dugout Creek above the mine site. These sites will be monitored quarterly for the parameters listed in Table 7-5. Others sites will be located at the Castlegate Sandstone-Blackhawk Formation contact to provide information about the relationship between the Blackhawk Formation and the base flow of Dugout Creek. These sites, as well as the above mine sites, will be monitored on above normal and below normal precipitation years as described on pages 7-58 and 7-60.

Data will be collected from the sediment pond outflow and mine water discharge as required by the UPDES permit. Data will be collected on these site until mining and reclamation activities are complete.

Surface-water data will be submitted to the Division on a quarterly base, prior to the end of each quarter in which samples are taken.

Findings:

The applicant has met the minimum requirements for surface-water monitoring during mine operations.

Acid and toxic-forming materials.

No storage of acid- and toxic-forming materials and underground development waste is planned for the Dugout Canyon Mine. Although not part of this permit submittal, future development of a waste-rock disposal site has been contemplated. Waste rock will not be used during reclamation, and soil substitutes will be used only if their chemical and physical properties are determined to be adequate through appropriate analyses.

Findings:

The Applicant has met the minimum regulatory requirements

Transfer of wells.

Ownership of wells will be transferred only with prior approval of UDOGM and the conditions of such a transfer will comply with State and local laws. Soldier Canyon Mine will remain responsible for managment of the wells until bond release. This is discussed on page 7-61 under Section 731.400.

Findings:

The Applicant has met the minimum regulatory requirements

Discharges into an underground mine.

Analysis:

Section 731.500, page 7-61 states that there will not be any discharges into the proposed mine.

Findings:

The applicant has met the minimum requirements for discharges into an underground mine.

Gravity discharges.

Analysis:

Section 731.500, page 7-61 states that there will be no gravitational discharges from mine working.

Findings:

The applicant has met the minimum requirements for gravity discharges.

Water-quality standards and effluent limitations.

Analysis:

Water Quality standards and effluent limits are addressed in Section 751, page 7-86. This section states that "all discharges from the disturbed areas will be in compliance with all Utah and federal water quality laws and regulations and with effluent limitations for coal mining contained in 40 CFR Part 434." SC3 will be responsible for meeting any applicable water quality regulation that applies to this mine.

Findings:

The applicant has met the minimum requirements for water-quality standards and effluent limitations.

Diversions.

Analysis:

Diversions are covered in the text of the application on pages 7-64 through 7-66 and 7-77 through 7-82. The criteria for diversions and culverts are summarized in Tables 7-8 and 7-9 on page 7-81 and 7-82, respectively. Plate 7-5 shows the location and drainage patterns throughout the proposed mine site. Appendix 7-9 holds the calculations for diversions and culverts. Appendix 7-10 is the methodology used in making the calculations. Several berms are designed to divert water off of upper pads (Appendix 7-9, page 81a) and road ditches are used to route flow from much of the disturbed area into the ponds (page 5-2 and Table 7-8).

Plate 7-5 shows a simple drainage system. There is one undisturbed ditch that routes water from the southern slopes past the disturbed area. Undisturbed drainages on the northwest side of the disturbed area are treated by the sediment pond. About 40% of the disturbed area is covered by roads and there are two impoundments in the distrubed area which contain their respective design events. The result is minimum sediment contribution to Dugout Creek itself.

Essentially there are two disturbed area drainage ditches , one on the north side of Dugout Creek and one on the south, that run along the road and route water into a single sediment pond. The southern branch must cross Dugout Creek at the lower Dugout Creek culvert to reach the sediment pond. Drainage on the northern side of the facilities areas is aided to the ditch by a couple berms. Several culverts are used in the disturbed drainage system.

Dugout Creek and its eastern tributary will be routed under the entire disturbed area in a 60-inch corrugated metal culvert. The culvert has been sized giving due consideration to the watershed runoff characteristics, including vegetation types, soil types, and the harvesting of timber above the mine site. DOGM calculations indicate the culvert is conservatively designed using minimum slopes resulting in a capacity 25.3% greater than the design event. There is a hydraulic jump energy dissipator at the downstream end of the culvert which is designed to have a water exit velocity slightly less than the natural stream channel velocity. This should result in minimum erosion problems to the stream channel below the disturbed area.

A stream alteration permit has been granted by the Division of Water Rights.

All ditch diversions and disturbed drainage culverts have been designed to convey the 10-year, 24-hour event as prescribed in the Division Position Paper. The Dugout Creek culverts have been designed to convey the required 100-year, 6-hour storm event.

Findings:

The applicant has met the regulatory requirements for diversions and diversion designs.

Stream buffer zones.

Analysis:

Stream buffer zones are addressed in the application on page 7-61. A large portion of the surface facilities will be located with in 100 feet of Dugout Creek. The runoff and sediment control plan has been designed to ensure the operations with in buffer zone will not cause or contribute to degradation of water-quality or the stream channel quality. There will be a buffer zone designated and maintained between the mine facilities and the stream channel. The buffer zone will be marked.

Findings:

The applicant has met the minimum requirements for stream buffer zones.

Sediment control measures.

Analysis:

Alternate sediment control measures are designated for two area which cannot report to the sediment pond. These are the areas above the lower 600 feet of the Dugout Creek culvert (ASCA-1) and a hillside slope between the sed pond and the lower (southwest) end of the disturbed area (ASCA-2). ASCA-1 will be treated using silt fences perpendicular to the slope on 200 foot intervals. ASCA-2 will be treated with silt fences, straw bales, and berms until vegetation is established. These are typical methods, and although potentially maintenance intensive, they will work.

Page 5-38 describes installation of four silt fences below the energy dissipator which are intended to minimize sediment contributions to Dugout Creek during constuction of the disturbed area. Reference Fig. 5-5. This is seen as adequate, however, they need to be left in place until the completion of all construction activities and NOT removed as construction proceeds as described.

Finding:

The plan meets minimum requirements, except for retaining the downstream silt fences until ALL construction activities are completed.

Sedimentation ponds.

Analysis:

There is one sediment pond used in the proposed sediment control plan. This pond is designed in Appendix 7-8 and presented in the text on pages 7-63 and 7-64, and 7-74 through 7-80. The sediment pond will be used throughout the mining operations and reclamation. It is designed to contain more that five years of sediment accumulation based on the Universal Soil Loss Equation (USLE) plus the water volume resultant from the 10-year, 24-hour storm event. Both undisturbed area and disturbed area drainages are treated by the sediment pond. A staff guage will be used to mark the 60% clean-out elevation for the required clean-out. The pond will be equipped with a dewatering device and a spillway.

The primary spillway is a 24-inch drop inlet corrugated metal pipe (cmp) leading to an 18-inch cmp barrel, at an 8% slope, which leads to the 60-inch culvert containing the Dugout Creek flows. See Plate 7-4. An emergency spillway is provided consisting of an 18-inch drop inlet pipe leading into the primary spillway barrel. This arrangement was questioned initially, however, was deemed adequate since the primary spillway, including the barrel, will carry 42.2 cfs compared to the design event of 3.04 cfs. The appropriate 25-year, 6-hour event was used to size the combined primary and emergency spillways.

Findings:

The applicant has met the minimum requirements for sediment ponds.

Exemptions for siltation structures.

Analysis:

The application shows that all surface facilities areas will be treated by a sediment pond. There will be no areas exempt from siltation structures.

Findings:

The applicant has met the minimum requirements for exemptions for siltation structures.

Discharge structures.

Analysis:

Discharge structure information is covered in the application on pages 7-68 and 7-84. The applicant says that there will be two discharge structures: the sediment pond spillway and a discharge line from the underground workings. In addition, there is a discharge structure at the outlet of the main culvert.

The primary sediment pond spillway is a 24-inch drop inlet corrugated metal pipe (cmp) leading to an 18-inch cmp barrel, at an 8% slope, which leads to the 60-inch culvert containing the Dugout Creek flows. See Plate 7-4. An emergency spillway is provided consisting of an 18-inch drop inlet pipe leading into the primary spillway barrel. This arrangement was questioned initially, however, was deemed adequate since the primary spillway, including the barrel, will carry 42.2 cfs compared to the design event of 3.04 cfs. The appropriate 25-year, 6-hour event was used to size the combined primary and emergency spillways.

Page 7-53 describes the discharge from underground workings as being an estimated 190 gallons

(.42 cfs) per minute which will be discharged into Dugout Creek. The method of handling the discharge is through a pipe into the sed pond spillway or directly into the creek with riprap to prevent erosion.

There is a large hydraulic jump energy dissipator at the downstream end of the Dugout Creek culvert which is designed to have a water exit velocity slightly less than the natural stream channel velocity. The energy dissipator is over 56 feet long and nine feet wide with two- to three-foot thick rock lining. This should result in minimum erosion problems to the stream channel below the disturbed area.

Findings:

The plan does meet the requirements of R645-301-744, "Discharge from diversions will be controlled, by energy dissipators, riprap channels and other devices, where necessary to reduce erosion to prevent deepening or enlargement of stream channels, and to minimize disturbance of the hydrologic balance."

Impoundments.

Analysis:

There are two impoundments as part of this plan and they are described on pages 7-68 & 69 and in Appendix 7-9, pages 113 to 115. The appropriate 10-year, 24-hour design event was used to determine that the impoundments would completely contain the event. In addition, the upstream impoundment is 1.2 times the needed volume and the downstream impoundment is ten times the needed volume, thereby providing a significant safety factor over the design requirements. Since the design event is completely contained, no spillway is required. They are both designated as temporary impoundments.

Regular inspection of the impoundments is described. However, there is no commitment to clean out water and sediment collecting in the impoundments and this is a regulatory requirement.

Findings:

The applicant has met the minimum requirements for impoundments, except for cleaning them out. The applicant must commit to and perform impoundment cleanout.

Casing and sealing of wells.

Procedures for casing and sealing, capping, backfilling or otherwise properly managing drilled holes, exploration holes and boreholes, and wells are discussed on pages 5-65, 6-18, 7-70, 7-89, and 7-91.

Findings:

Hydrologic operations information that was reviewed for this Technical Analysis, in particular information that pertains to ground water resources, is considered adequate to meet the requirements of this section.

RECLAMATION PLAN

POSTMINING LAND USES

Regulatory Reference: 30 CFR Sec. 784.15, 784.200, 785.16, 817.133; R645-301-412, -301-413, -301-414, -302-270, -302-271, -302-272, -302-273, -302-274, -302-275.

Analysis:

The stated postmining land use is livestock grazing and wildlife habitat (Section 412.100). Final reclamation activities such as grading and seeding are stated to be completed in a manner to provide lands able to support the postmining land use. Many of the slopes are considered too steep for livestock grazing. The BLM in developing an a grazing management plan for the Randolph unit developed suitability tables based on slope percent and slope length. They found any slopes steeper than 50 percent (2h:1v) were considered unsuitable for grazing. Plates 5-3 and 5-4 (Sheets 1 of 3 thru Sheets 3 of 3) show numerous cross sections where slopes are steeper than 50 percent. The cross section Y-Y' indicate that slopes into Dugout Creek will be 75 feet long and have slopes steeper than 2h:1v. Cross section X-X' have slopes ranging from 2h:1v to steeper than 1.5h:1v into Dugout Creek. These slope lengths and steepness are not conducive to the stated postmining land use and riparian vegetation restoration. The applicant justifies the slope lengths and steepness by stating that they are similar to the surrounding area. The Division recognizes that the premining area has steep slopes, however given the land use and the unstable condition of the area until vegetation establishment steep slopes should be confined to an upland area and not thru the riparian zone (riparian zone as defined in Plate 3-1A and subsequent Division field measurements.) A finding cannot be made that the land will be useable to wildlife and livestock and the ripaiean zone restored following the proposed reclamation plan.

Much of the disturbed area was previously mined and not reclaimed to the current standards. Previous mining activities vary in the impacts from disturbed to affected. Exploration activities occurred on the site in the 1980's and then again in the 1990's. No topsoil was saved in initial development. However, adequate substitute material should be available to make up the difference as growth medium.

A road exists (prior to current mining) thought the permit and disturbed area. This road will remain in the postmining land use. The road is stated to have a current road width of 16 to 25 feet within the disturbed area. The postmining road will remain the same, 16 foot width. This current road width should be verified in the field.

The surface of the lands which will be reclaimed is owned by The State of Utah and Canyon Fuel Company. A letter from the State of Utah concurring with the stated postmining land use is found in Appendix 4-3.

Findings:

Information found in the plan does not meet the minimum regulatory requirements of this section. Prior to approval, the applicant must provide the following in accordance with:

R645-301-413 and R645-301-358.400, the reclamation plan must be revised to reduce the slope gradient and length within the riparian zone. Some type of structural controls (i.e. rock, logs, wattles) may help reduce the slope length where slope gradients cannot be reduced.

TOPSOIL AND SUBSOIL

Regulatory Reference: 30 CFR Sec. 817.22; R645-301-240.

Analysis:

Chapter 2, Soils, Sections 240 through 250, discusses the soil's reclamation plan for the proposed Dugout Canyon Mine. The Analysis section discusses reclamation information as follows:

- Soil Redistribution
- Soil Nutrients and Amendments
- Soil Stabilization

Soil Redistribution

Based on the 7,526 CY of salvaged soil (excluding 1,134 CY culvert topsoil) and 7,680 CY of borrow soil, an average soil redistribution across the 7.6 acres of disturbance yields a depth of 15 inches is available during reclamation. These deeper soil depths allow for the implementation of surface roughening reclamation techniques, such as deep pocking, or gouging of the soil surface without penetrating the subsurface fills.

The soils salvaged from the culvert expansion, 1,134 CY, were not included in the soil redistribution depths since these soils will be returned to the reclaimed channel area. If excess soil is available after channel reclamation, then these excess soils may be used else where in the disturbance area. Where dictated by the reclamation channel design, soils will be placed within the interstitial spaces of the riprap to promote riparian vegetation establishment. Soils placed outside the riprap areas will be reseeded following soil preparation and surface roughening.

Soil redistribution with the culvert expansion area will require placing soils on slopes greater than 2:1. According to the reclamation cross sections, these steep slopes exist throughout the reclaimed channel for Dugout Creek. The PAP does not discuss soil placement techniques on these steep slopes that drop directly into Dugout Creek.

The plan explains that any contaminated surface soil within the disturbed area will be removed and stored during final reclamation. Furthermore, the plan says that if the contaminated soils can not be rehabilitated, the contaminated material will be buried along with excess gravels, crushed stone, or other contaminants.

Soil Nutrients and Amendments

Soil nutrients and amendments will be applied to the redistributed soils based on analyses of samples collected from the stockpiled topsoil.

Soil Stabilization

Generally, within the reclamation area, standard soil stabilization practices include surface roughening techniques such as gouging and/or deep pocking, to help minimize compaction and reduce erosion.

Soil stabilization techniques after topsoil is placed on steep slopes greater than 2:1 are needed,

especially within the stream corridor where the culvert will be removed. Specific techniques should be stated in accordance with slope steepness to ensure that soil will remain intact on the steep slopes while vegetation is being established.

Findings:

The permittee must provide the following, prior to approval, in accordance with the requirements of:

R645-301-233, Soil stabilization techniques after topsoil is placed on steep slopes greater than 2:1 are needed, especially within the stream corridor where the culvert will be removed. Specific techniques should be stated in accordance with slope steepness to ensure that soil will remain intact on the steep slopes while vegetation is being established.

PROTECTION OF FISH, WILDLIFE, AND RELATED ENVIRONMENTAL VALUES

Regulatory Reference: 30 CFR Sec. 817.97; R645-301-333, -301-342, -301-358.

Analysis:

The plan identifies the two seed mixtures to be used in revegetation of the previously mined disturbance, pinyon juniper, and riparian communities. Since the postmining land use includes wildlife habitat, this mixture must be desirable for wildlife species of interest. The seed mixture provides for a variety of grass, forb and shrub species which have a high value as big game forage use. Transplants have been proposed for both the riparian and pinyon juniper communities. The trees and shrubs are desirable as both a food source and as cover.

Riparian Restoration

The applicant proposes to restore the Dugout Creek using a concept of macro and mirco channels. The macro channel will be a riprapped (size D_{50}-12") channel 8 to 12 feet wide. The mirco channel within the macro channel is approximately 3 feet wide and 1 foot deep. The formation of a micro channel will be developed by establishment of 3 types of in stream structures spaced every 60 feet. The structures are thought to backup sediment which in turn will allow vegetation establishment. These structures are low stage check dams, bank placed boulder, and rock or log spurs. Figure 7-12 show typical drawings of these structures and Plate 7-9 illustrates where these structures will be placed. The dimensions of rocks and logs shown in the typicals in Figure 7-12 don't appear to be designed for this stream channel. For example, the bank placed boulders are specified to be 24 to 36 inches and buried 12 inches. These boulders will be no different in height than the proposed riprap diameter. Mr. White, Earth Fax Engineering also stated in the stream structures were randomly placed on Plate 7-9. These structures have specific function within the channel. The application states that the exact location and type of obstruction at any individual point may vary from that indicated on Plate 7-9, depending on local conditions encountered at the time of reclamation. This is acceptable, however, the application must provide the specific criteria for the selection of the obstruction at the time of reclamation.

Riparian Planting

Stream banks will be seeded with the Final Reclamation Seed Mix #2 (Section 341.200). Trees and shrubs will be planted as specified in the mixture. Using the planting specifications provided in the application discussion the following plantings should occur:

- Tree and large shrubs will be planted on the top of the bank at the rate of approximately 500 per acre (this will provide an 8 foot distance between individuals, 2 deep (wide), both sides the length of Dugout Creek).

- Immediately adjacent to and into the riprap will be heavily planted (2 foot minimum spacings) with willow cuttings or species resilient to sediment deposition (for example, this zone may be 5 foot wide along both sides of Dugout Creek). This type of spacing requires 4000 plants per acre.

- The mid bank zone is not as heavily planted and so a 4 foot on center spacing is stated at 2500 plants per acre. Species such as the woods rose, current, snowberry, elderberry, and Serviceberry would be planted in this zone to upper bank. This zone varies widely throughout the 2000 foot length of disturbance.

The above planting densities are recommended by Hoag (page 3-42). Seed Mix #2 shrub and tree transplant numbers should be modified to reflect the proposed planting as described. Figure 3-1, illustrates the various planting zones within the riparian area, top of channel, reclaimed slope, and top of riprap. The figure is meaningless as it compares with the actual conditions at Dugout Canyon and the riparian zone delineated on Plate 3-1A. Typically the riparian zone is 50 feet wide (as the crow flies, much wider on the ground) with slope lengths exceeding 30 feet. Figure 3-1 should be clarified or removed. If removed additional information must be provided to clarify specific planting zones. The described planting zones must also incorporated the micro and macro channel concept for plantings of sedges and horsetails.

Cottonwoods are specified as seedlings and should be planted depending on depth to the lowest yearly water table either as pole plantings or large transplants. Seedlings will not provided the cover required in 10 years for bond release nor will seedlings fulfill the regulation which requires riparian restoration. Chris Hoag (USDA, Plant Materials Center, Aberdeen, ID) suggests that poles can be planted 9 feet deep (Arizona has had some success planting 22 feet deep, although mortality was high). Sufficient above ground pole should be left so that it will be above the surrounding vegetation (grass, in this case, 18 to 36 inches tall). Two to twelve year old wood (non-furrowed, smooth bark) is best. He stated that the most important factor is to place the pole eight to ten inches below the summer (lowest) water table. Therefore, the revegetation plan should not specify cottonwoods as seedlings unless a detailed irrigation plan is provided.

The application gives excuses why the summer water table cannot be specified (page 3-44). This can be removed from the application if the application will commit to planting at the lowest flow period and placing poles 8 to 10 inches into the water table (Hoag stated that summer plantings are successful if poles are put into the water table).

The riparian seed mixture should also include Northern Sweetvetch, Kentucky bluegrass, Louisiana sagebrush for added diversity. Carex and horsetail (equisetum) should also be added as transplants in the sediment deposition zones of the riprap sections.

Seed diversity in the Final Reclamation Seed Mix #1 should be increased by adding Slender wheatgrass, Idaho fescue, Thickspike wheatgrass, Louisiana sagebrush, Fourwing saltbrush, and bitterbrush. Snowberry and Utah Serviceberry should be planted from seedlings or bareroot stock.

Current on site conditions of Dugout Creek show a degraded riparian system. The cause of that condition (over grazing, down stream alterations, etc.) should be determined in order to create a stable system within the reclaimed area at the time of reclamation. In order to determine a postmining reclamation plan adequate premining conditions must be determined. The applicant has been requested to provide the Division with information such as rock exposure and specific information on the creek channel. They have not done that, therefore the Division should get this baseline information prior to site disturbing activities. This may be important for future reclamation needs.

Findings:

Information provided in the plan does not meet the minimum requirements of this section. A finding that Dugout Creek can be restored or replaced to at least pre 1998 mining condition cannot be made. Prior to approval, the permittee must provide the following in accordance with:

R645-301-342.100, Seed Mix #2 must be modified to accurately account for all the tree and shrub transplant numbers which are stated in the spacing requirement for the riparian restoration planting design.

R645-301-342.100, the application must provide the specific criteria for the selection of the type of in stream obstruction structures to be used in reclamation. For example the rock or log spurs are used to direct flow. The typicals of these structures, Figure 7-12, must also be modified to reflect actual on site conditions.

R645-301-342.100, Figure 3-1 must be modified to reflect typical on site conditions or removed from the application. If removed additional information must be provided to clarify specific planting zones.

R645-301-342.100, cottonwoods must be specified as pole plantings or at least large enough transplant size to reach the water table. Or the application may describe an irrigation program for the cottonwood transplants. The application must also commit to a low flow planting time for the hydrophytic vegetation or provide a low flow water table level anticipated at the time of reclamation.

R645-301-353.100, the riparian seed mixture must provide greater diversity and life form by adding additional species such as northern sweetvetch, Kentucky bluegrass, Louisiana sagebrush, carex spp., and horsetail. Reclamation seed mixture #1 should add slender wheatgrass, Idaho fescue, thickspike wheatgrass, Louisiana sagebrush, fourwing saltbrush, and bitterbrush. Snowberry and Utah serviceberry should be planted from seedlings or barcroot stock instead of seed.

CONTEMPORANEOUS RECLAMATION

Regulatory Reference: 30 CFR Sec. 785.18, 817.100; R645-301-352, -301-553, -302-280, -302-281, -302-282, -302-283, -302-284.

Analysis:

Contemporaneous reclamation activities should be well documented in the plan and monitored to

determine whether or not the reclamation treatments used in the area can be proven successful. These areas can provide invaluable information as well as demonstrating by field trials that reclamation treatments will be successful. However, contemporaneous reclamation at this small site is unlikely due to the space constraints. Additionally, no agreement as to the time and rate of contemporaneous has been establish by the Division.

Findings:

No definition of contemporaneous reclamation has been adopted by the Division.

REVEGETATION

Regulatory Reference: 30 CFR Sec. 785.18, 817.111, 817.113, 817.114, 817.116; R645-301-244, -301-353, -301-354, -301-355, -301-356, -302-280, -302-281, -302-282, -302-283, -302-284.

Analysis:

General requirements.

The details of the revegetation procedures are given in Section 340. The seed mixture is specified in Section 340.200. Additional comment concerning the seed mixture, transplants, and revegetation of the riparian area are detailed in the **PROTECTION OF FISH, WILDLIFE, AND RELATED ENVIRONMENTAL VALUES** section of this Technical Analysis.

When developing the Dugout Canyon site the mine proposes a topsoil borrow area (Plate 2-2, #4B). The application states (page 2-22) that the borrow material will be removed at the time of facilities construction to protect the soils from coal fines and to reduce the steep slope because of safety concerns. Removing the soil now will reduce the revegetation success on site. It is well documented in the literature that a direct haul of topsoil is most beneficial in reclamation. Stockpiled topsoil is biologically dead based on soil microbiology and as a seed bank of site adapted seeds. Deposition of coal fines from coal trucks presents little problems to vegetation as seen in Huntington Canyon which has a large volume of coal trucks. Slope safety concerns have not been demonstrated nor specific area identified through engineering designs, additionally, Plate 5-4 (sheet 1 of 3), section M-M' through P-P' show the slope going back to the same slope after reclamation which doesn't seem to present a safety concern. Regulations require that disturbance be minimized and the application has committed to this in Section 333 Plan to Minimize Disturbances and Adverse Impacts. Therefore, the soil borrow material must remain in an undisturbed condition until the time of reclamation.

Page 2-32 of the Application states that the Dugout Canyon topsoil stockpile area at the Soldier Creek Mine has an infestation of Cheatgrass. The application provides a plan for controlling this infestation. This treatment should begin immediately and specifically prior to any Dugout soil being transported to the site. Establishment of cheatgrass at reclamation very well could prevent successful reclamation since annuals are not counted towards revegetation success. Cheatgrass is an aggressive winter annual and will invade disturbed sites readily.

Seed will be spread by broadcast or drill seeding methods (Section 341.200). Grasses and forbs will be spread by drill seeding on slopes less than 3:1. (Yet, a disc will be used for seedbed preparation on slopes less than 2h:1v.) The shrub and tree seed will be broadcast seeded. All seed will be broadcast seeded on slopes greater than 3:1. When seed is broadcast the seeding rate will be doubled. Slopes steeper than 3:1 will

have the soil surface treated by dozer tracking or pocking by a trackhoe. This contradicts the statement on page 5-67 that the area will be deep gouged. The contradicting statements in Section 341.200 must be removed and the commitment to pocking remain. The Division highly recommends the use of any methods which creates the greatest surface roughness.

This roughened state has proven to be very important to the success of the reclamation project. Drill seeding and discing may reduce the surface roughness to an undesirable level. The operator may find at the time of reclamation that broadcast seeding will maintain the desired surface roughness.

Timing.

The plan commits to seeding late August through early October (Section 341.100). Generally, fall planting has ensured good early spring moisture for seed germination and meets the cold stratification requirements for several of the forb and shrub species. Areas which cannot be seeded during the fall window will be stabilized by seeding with an annual grain until the seeding window has opened.

Chris Hoag (USDA, Plant Material Center) states that fall plantings are acceptable when planting wetland species into a water table.

Mulching and other soil stabilizing practices.

Mulch will be spread following seeding. The permit states that Division-approved mulch will be used but for bonding purposes assume that 2000 pounds per acre with tackifier wood mulch will be used. This is somewhat confusing but acceptable that the Permittee obtain approval prior to reclamation for the specific mulch to be used. A commitment is made to use a high quality erosion control matting all slopes 3:1 or steeper (page 3-45). Page 3-51 states that a potential measure for the control of erosion on slopes 2:1 or steeper would be the use of a high quality erosion control matting. The statement on page 3-51 should be eliminated since it doesn't specifically commit to erosion control netting use. A high quality erosion control blanket is recommended on all slopes 2:1 and steeper.

The sediment control plan for reclamation is to use a silt fence along the base of the slope or banks to Dugout Creek. Committing to erosion control netting and pocking may help reduce the silt fence failure and sedimentation to the creek. The sediment control plan has not been designed for the slope lengths and gradients proposed.

Standards for success.

Numerous maps showing the vegetation community types within and adjacent to the proposed disturbed area are provided. Plate 3-1A is proposed for use when determining revegetation success standards. This maps shows two communities, one described as a range site and the other as a community type. The range site is an upland very steep shallow loam (Pinyon-Utah Juniper). The vegetative community type is Riparian.

The application remains confusing as to what methods are being used for success however, the following is this reviewers interpretation of those standards.

The exiting community types (disturbed community, pinyon juniper community, and riparian) are supposedly described as range sites (pinyon-Utah juniper and riparian) according to the Vegetation

Information Guidelines. However, no description of the riparian area as a range site was provided and specific data for the published pinyon-Utah juniper range site was not provided.

Revegetation success standards for cover will be based on range site baseline sampling performed by Patricia Johnson in 1997. Cover values will be 66 percent vegetative ground cover for the pinyon-juniper and 85 percent vegetative ground cover for the riparian. Associated statistics and raw data are provided in Appendix 3-1.

The standard for shrub density is a technical standard and will use 2200 stems per acre for both the pinyon-Utah juniper and the riparian communities as the success standard..

No productivity data was taken in either the riparian or pinyon juniper communities, however, the NRCS estimated the productivity to be 1500 pounds per acre for the riparian community and 800 pounds per acre in the pinyon juniper community. The application proposes that these values be used as a success standard. However, the Division's Vegetation Information Guidelines only approve the NRCS estimation when using the reference area method after the reference area is approved based on statistical cover similarity of the remined site. The application proposes that if the NRCS estimate is not sufficient than an adjacent range site will be selected at the time of reclamation and will be used as a reference area. The later method will be accepted except that the range site must be selected now and the range site must be similar (statistically, α=.1) to the cover of the premined site. The riparian area has not been described as a range site and either a corresponding reference area can be selected for productivity or the riparian area described as a range site.

A technical standard is proposed for diversity. The applicant proposes that the success standard for both the Pinyon Juniper and Riparian area to have 2 tree/shrub species, 3 grass species, and 2 forb species present and that to count toward the diversity it must exist in the community with at least 5 percent vegetative cover. It is unknown how the success standard was selected. Obtaining this standard at the time of bond release sampling is probably not realistic.

The success standard of R645-301-356.250 (for areas previously disturbed by mining) is not proposed for this site because the applicant felt that it would checker board the site. Sufficient areas have not been disturbed and many areas have only been affected and not disturbed by coal mining are present that they chose not to use the vegetation success standard of R645-301-356.250.

Findings:

Information found in the plan does not meet the minimum regulatory requirements of this section. An adequate revegetation plan for the riparian area must be provided as discussed in the **PROTECTION OF FISH, WILDLIFE, AND RELATED ENVIRONMENTAL VALUES** section of this technical analysis. Given the proposed reclamation and revegetation plan a finding of successful reclamation cannot be made. Prior, to approval, the permittee must provide the following in accordance with:

R645-301-121.200, Statements regarding final seedbed preparation with dozer tracks must be removed to provide a suitable seedbed and consistency between sections.

R645-301-142.100, Plate 5-2C must either show the area subject to the requirements of R645-200 or remove the statement that no areas were subject to the requirements of R645-200 thru

R645-203.

R645-301-356, the productivity of the riparian are and pinyon juniper area must be sampled or commit to selecting range site reference areas as soon as weather conditions permit. Statements that the application meets the requirements of the Division's Vegetation Information Guidelines must be removed from the application.

R645-301-333, the plan must be revised to not disturb the topsoil borrow site until the time of final reclamation. This will reduce disturbance to wildlife habitat and also increase the chance of revegetation success.

R645-301-355 and R645-301-752, the plan must commit to the use of a high quality erosion control matting or propose some other type of structural control on steep slopes. The application must also propose a sediment control plan for reclamation which has been designed.

APPROXIMATE ORIGINAL CONTOUR RESTORATION

Analysis:

The Applicant committed to comply with the approximate original contour provision of the R645 regulations. In Section 512.100 under the subheading of Variance From Approximate Original Contour the Applicant states:

> "No variance from the approximate original contour requirements of the regulations is being requested in this M&RP."

In Section 553.100 under the subheading of Approximate Original Contour the Applicant states:

> "As indicated in Section 512.100 of this M&RP, the area of the proposed Dugout Canyon surface facilities was disturbed by previous mining activities. No pre-mining topographic maps of the area are known to exist. The reclamation plan has been designed to allow that the site will be backfilled and graded to achieve the assumed apporximate original contour (i.e. to blend inot the surrounding topography) and eliminate existing highwalls.

Plate 5-3 shows the surface contours for the disturbed area after backfilling and grading have been completed. Cross sections for the reclaimed area are shown on Plate 5-4. The information in Plate 5-3 and Plate 5-4 show that the site's topography will be similar to the surrounding area. Since the site will blend in with the surrounding topography the AOC requirements have been meet.

The disturbed area has some highwalls that were made prior to SMCRA being enacted. Since the site has been disturbed the R645-301-553.600 regulations apply. Those regulations allow for highway retention when reasonably available backfill material is unavailable. The Applicant discusses reclamation of the preexisting highwalls in Section 533.100 of the PAP and the Division reviews the highwall in the backfilling and grading section of the TA.

Findings:

The Applicant has met the minimum requirements of R645-301-512, 301-531, 301-533, 301-553, 301-536, 301-542, with regard to the restoring the disturbed area to the approximate original contours.

BACKFILLING AND GRADING

General

Analysis:

The Applicant covers the engineering requirements for backfilling and grading in section R645-301-537, R645-301-552 and R645-301-553.

- R645-301-537 deals with regraded slopes that need special Division approval. In Section 537 of the PAP the Applicant states:

  "No mining or reclamation activities will be conducted in the permit area that require approval of the Division for alternative specifications of for steep cut slopes due to the inability of SCM to meet the regulatory requirement of R645-537.100."

R645-301-537.100 deals with steep slopes associated with road cuts. The Applicant has not proposed to construct any roads with steep cut slopes. The Division will not grant any variances from the general backfilling and grading requirements because of steep cut slopes associated with roads.

R645-301-537.200 applies to settled and revegetated fill. Under certain condition settled and revegetated fills do not have to be regraded during reclamation to achieve AOC. The Applicant states that they will grade all settled and revegetated fills that currently exist at the site. The Applicant has not applied for a waiver from the AOC requirements based on the settled and revegetated fills exemption. The Applicant has met the minimum requirements of R645-301-537.200.

- Section 552 deals with small depression and permanent impoundments.

R645-301-552 deals with permanent features such as small depression and permanent impoundments. The Applicant will leave small depression to retain moisture, minimize erosion, create and enhance wildlife habitat, or assist revegetation. No permanent impoundments will be left after reclamation. The Division encourages the Applicant to leave small depression on the regrade slopes to aid in revegetation and slope stability. The Applicant has met the minimum requirements of R645-301-552.

- Section 553.100 deals with the disturbed area that the Applicant will backfill and grade during final reclamation. Those requirements require the Applicant to backfill and grade the site to achieve the (AOC) approximate original contour under most circumstances. Exceptions for the AOC requirements can be granted by the Division for (PMA) previously mined areas and (CMA) continuously mined areas. The site was disturbed before SMCRA and highwalls exist at the site. The Applicant's backfilling and grading plan calls for the elimination of all highwalls. Since no variance from AOC was requested none was given.

The site was disturbed before SMCRA and there are no known premining topographic maps of the disturbed area. Restoring the site to its premining contour is impossible. The site will be restored to the approximate original contours meaning that the reclaimed contours will blend in with the surrounding

topography. The backfilling and regrading plan will restore the site to the approximate original contours.

The Applicant addressed the elimination of highwalls, spoils and depressions in Section 553.100 by stating:

"The backfilling and grading plan has been designed to eliminate highwalls at the site. No spoil piles exist. Except for the small depressions discussed in Section 552.100, no depressions will remain at the site following reclamation."

In Section 553.500 the Applicant restates that preexisting highwall will be eliminated. The Applicant committed to grading all slopes in the disturbed area to a minimum slope of 1.5H:1V and that the slopes will have a minimum safety factor of 1.3 (see Appendix 5-4 for details). The Applicant committed to backfill and regrade the disturbed area so the topography after reclamation will approximate the original contours. Since the Applicant does not know what the original contours were this commitment is taken by the Division to means that the topography of the site after reclamation will blend into the surrounding topography.

The Applicant claims that no spoil piles existed at the Dugout Canyon Mine site before the permit was issued and that no spoil piles will be created during mining and reclamation. The Division agrees that no spoil piles exist at the site before the permit being issued. The Applicant has addressed R645-301-553.210 and R645-301-553.220.

The Applicant addressed slope stability of the reclaimed slopes in Section 553.100 by stating:

"Backfilled and regraded slopes have been designed not to exceed the angle of repose (determined in Appendix 5-4 to be a slope of 1.5H:1V). At this slope, final reclamation slopes have been designed with a minimum static safety factor of 2.6 (see Appendix 5-4). The static safety factor increases as the slope angle increases. The slopes have thus been designed to prevent slides."

The Applicant states that the reclaimed slope angles will not excess the angle of repose, which they determined to be a 1.0 vertical rise to 1.5 horizontal run. The Division found several slopes that are steeper than 1V to 1.5 H. The Applicant needs to eliminate those steep slopes from the reclamation plan.

The Applicant addresses the erosion and water pollution at the site in Section 553.100 of the PAP by stating:

"Temporary sediment-control measures will be implemented during and following backfilling and regrading as outlined in Section 542.200 and Section 244 of this M&RP. As vegetation becomes established on the reclaimed surfaces, erosion potentials will be further minimized. By minimizing erosion, water pollution will also be precluded. Additional water-quality concerns do not exist at the site (see Chapter 7).

In an effort to eliminate preexisting highwalls at the site following reclamation, soil will be replaced during reclamation at slopes of up to 1.5H:1V. The steepness of these slopes will be reduced at their base, providing a concave slope. As noted above, these slopes will be geotechnically stable. Dozers will be used during placement of the topsoil or substitute topsoil on these steep slopes, taking care to achieve a reasonably uniform thickness of the final soil cover. Following placement and prior to seeding, all areas with a slope steepness of 3H:1V or steeper will be deep gouged using a trackhoe. The final surface will consist of mounds and depressions capable of holding runoff and difficult to walk on. Refer to Sections 355 and 341 regarding

erosion-control matting and revegetation.

Although the gouging will extend below the depth of the final topsoil layer, information presented in Section 222.400 of the M&RP indicates that the subsoils will be of acceptable chemical and physical quality, with the possible exception of the percentage of rock fragments. Hence, the surface will still be capable of sustaining an adequate vegetative cover, further minimizing long-term erosion of the slopes."

The Applicant committed to backfill and regrade the slopes so that they will supports the approved postmining land use. The Applicant has met the minimum requirements of R645-301-553.100 to R645-301-553.150

- Section 553.200 deals with spoil and waste, refuse piles, and coal processing waste.

In Section 553.200 of the PAP the Applicant states that they will generate no spoil or coal processing waste at the mine. That information is confirmed in the Applicant's operational plan. The Applicant scheduled the refuse to be disposed in either the SUFCO or Skyline mines' waste rock disposal site. They schedule no refuse to be disposed on the site. The Applicant will address final disposal of refuse material from the Dugout Canyon mine in the SUFCO and Skyline mine's M&RP. The Division approved the waste rock facility at the SUFCO and Skyline mines to receive refuse from the Dugout Mine.

The Division was unable to check the cut and fill calculations, due to time constraints. The Division had to rely upon the Applicant's cut-and-fill computer program. The Division assumes that the cut-and-fill calculations are correct.

Exposed Coal Seams

Coal seams that were exposed during mining will be covered with a minimum of 4 feet of nontoxic and noncombustible materials during final backfilling and grading. This cover material may consist of material removed during grading of the site (see Section 542.200), subsoil, and/or topsoil.

Acid- and Toxic-Forming Materials

No storage of acid- and toxic-forming materials and underground development waste is planned for the Dugout Canyon Mine. Although not part of this permit submittal, future development of a waste-rock disposal site has been contemplated. Waste rock will not be used during reclamation, and soil substitutes will be used only if their chemical and physical properties are determined to be adequate through appropriate analyses.

Combustible Materials

All combustible materials that are exposed, used, or produced during mining will be disposed of off site as outlined in Section 521.100.

In Section 542.200 of the PAP the Applicant states that:

"All coal outcrops within the proposed disturbed area will be covered with at least 4 feet of soil during reclamation."

The Applicant met the minimum requirements of R645-301-542.200.

Cut-and-Fill Terraces

In Section 553.400 the Applicant states:

"All surface structures associated with the mining operation will be removed as outlined in Section 542.200. A description ensuring that all structures and the sedimentation pond have been removed will be provided to the Division before seeking bond release or abandoning the permit area."

The Applicant does not propose to leave any cut-and-fill terraces. The Applicant has met the minimum requirements of R645-301-533.400.

Highwalls From Previously Mined Areas

In Section 553.500 of the PAP the Applicant states:

"Several highwalls currently exist within the proposed disturbed area that are the result of previous mining operations. The reclamation plan has been designed to eliminate these highwalls to the maximum extent technically practical."

The Applicant has met the minimum requirements of R645-301-553.500 by committing to eliminate all highwalls from the disturbed site.

Previously Mined Areas

In Section 553.600 of the PAP the Applicant states:

"As noted previously, the reclamation plan has been designed to eliminate preexisting highwalls from the site following reclamation, to the maximum extent technically practical. Section 542.200 of this M&RP indicates that the plan has been designed with a reasonable balance between cut and fill quantities. Section 553.100 indicates that slopes of up to 1:5H:1V will be required to eliminate the highwalls. The steepness of these slopes will be reduced at the base to provide a concave profile. According to Appendix 5-4, these slopes will be geotechnically stable. Procedures to minimize erosion on these reclamation slopes are discussed in Section 553.100"

Backfilling and Grading - Thin Overburden

R645-301-553.700 is not applicable to this PAP because no surface coal mining and reclamation activities involving thin overburden will occur within the permit area.

Backfilling and Grading - Thick Overburden

R645-301-553.800 is not applicable to this PAP because no surface coal mining and reclamation activities involving thick overburden will occur within the permit area.

Regrading of Settled and Revegetated Fills

In Section 553.900 of the PAP the Applicant states:

"No regrading of settled and revegetated fills is anticipated in the permit area."

In Section 537.200 of the PAP the Applicant states:

"All settled and revegetated fills which currently exist within the disturbed area due to historic mining in the area will be regraded during site construction activities. No plan is presented in this M&RP to retain these settled and revegetated fills following reclamation."

Findings:

General:

The Division has not identified any deficiencies in the backfilling and grading plan.

MINE OPENINGS

Analysis:

In Section 542.700 of the PAP the Applicant states:

"All mine openings will be sealed at least 25 feet inside the mine opening. Prior to installation of the seal, all loose material will be removed from the roof, floor, and rib of the mine within 3 feet of the seal area. The seal will then be constructed using solid concrete blocks (average minimum compressive strength of 1,800 psi) with nominal dimensions of 6 inches high, 8 inches wide, and 16 inches long. Mortar will consist of one part cement, three parts sand, and no more than 7 gallons of water per sack of cement.

The seal will be recessed at least 16 inches deep into each rib and 12 inches deep into the floor. No recess will be made into the roof. In the bottom course, each block will be laid with its long axis parallel to the rib. The long axis in succeedingly higher courses will be perpendicular to the long axis of the blocks in the preceding course. An interlaced pilaster will be constructed in the center.

The seals will have a thickness of approximately 16 inches. Following seal construction, the entries will be backfilled from the seal to the outside surface with soil that is sloped at the surface to match the final slope at the entry. The soil will then be raked and revegetated with the approved seed mixture (see Chapter 3).

Alternatively, a cast-in-place MSHA approved, seals will be installed with a minimum thickness of 3 feet and with a minimum compressive strength of 200 psi."

The mine opening seal plan is similar to others approved by MSHA and the Division. The Division has approved the mine opening closure plan.

Findings:

The Applicant met the minimum regulatory requirements of R645-301-542.700.

ROAD SYSTEMS AND OTHER TRANSPORTATION FACILITIES

Analysis:

In Section 542.600 of the PAP the Applicant states:

"All roads not to be retained for an approved postmining land use will be reclaimed immediately after they are no longer needed for mining and reclamation operations. Roads which will be retained through the disturbed area for access to private land within the permit area are noted on Plate 5-3. All remaining roads within the disturbed area will be reclaimed. All roads to be reclaimed will be graded and/or backfilled as indicated above.

In all cases (whether the road is to be retained for a post-mining land use or not), all asphalt or concrete surfaces will be removed from the roads during reclamation. The retained roads will then be regraded to the downslope side of the road. The road surface aterials will be buried on site beneath at least 4 feet of non-acid and non-toxic forming materials. All roads to be reclaimed will be graded and/or backfilled as indicated above."

Findings:

The Applicant met the minimum requirements of R645-301-542.600.

HYDROLOGIC DESIGN INFORMATION

Analysis:

Sedimentation Ponds

In Section 542.200 the Applicant states:

"The sedimentation pond will be retained for as long as practical during reclamation. Once backfilling and grading operations proceed to the location of the pond, it will be removed. Because the pond is designed primarily as an excavated structure, removal of the pond will consist primarily of backfilling. This removal will be accomplished using backhoes, loaders, dozers, and other appropriate earthmoving equipment.

As soon as regrading of an area no longer allows that area to drain to the sedimentation pond, silt fences will be installed along the base of the slopes adjacent to Dugout Canyon Creek to control erosion on an interim basis prior to revegetation success. These silt fences will be installed using a supportive backing and burying the toe of the filter fabric as noted in Figure 5-5.

On a temporary basis, straw-bale dikes may also be installed as necessary to control localized erosion prior to the establishment of revegetation efforts. If installed, locations of the straw-bale dikes will be selected to reduce sediment contributions to runoff based on field observations. Straw-bale dikes will be

installed by keying the bales into the ground as noted in Figure 5-5."

The Applicant has met the requirements of R645-301-542.400. That regulation requires that prior to abandoning a permit area or seeking bond release the all temporary structures shall be removed. The only sediment pond on a site is scheduled to be removed after all reclamation work except for replacing topsoil and seeding has occurred. According to the timetable on Figure 5-4 removing the sediment pond will occur in the later half of the eighth month of reclamation.

Reclamation of the sediment pond will be done according to the specifications outlined in Section 542.200, Plan for Backfilling, Soil Stabilization, Compacting and Grading, of the PAP According to the backfilling plan the sediment pond should be properly reclaimed.

Impoundments

There will be no permanent impoundments at the site.

Casing and Sealing of Wells

Procedures for casing and sealing, capping, backfilling or otherwise properly managing drilled holes, exploration holes and boreholes, and wells are discussed on pages 5-58, 6-18, 7-68, and 7-90.

Findings:

Hydrologic operations information that was reviewed for this Technical Analysis, in particular information that pertains to ground water resources, is considered adequate to meet the requirements of this section.

CESSATION OF OPERATIONS

Analysis:

In Section 515.300 of the PAP the Applicant states:

"Prior to a temporary cessation of operations within the permit area that will last for a period of 30 days or more or as soon as it is known that a temporary cessation will extend beyond 30 days, CFC will submit to the Division a notice of intention to cease or abandon operations. This notice will include the following:

- A statement of the exact number of surface acres and the horizontal and vertical extent of subsurface strata which have been affected by mining operations in the permit area prior to cessation of operations,
- A discussion of the extent and kind of reclamation activities which will have been accomplished prior to cessation of operations, and
- An identification of the backfilling, regrading, revegetation, environmental monitoring, underground opening closures, and water treatment activities that will continue during the

temporary cessation.

During the temporary cessation, CFC will support and maintain all surface access openings to underground operations. CFC will also secure surface facilities in areas in which there are no current operations but where future operations are to be resumed under an approved permit."

Upon the permanent cessation of coal mining and reclamation operations at the Dugout Canyon Mine, SCCC will close, backfill, or otherwise permanently reclaim all affected areas in accordance with the R645 regulations and this reclamation plan.

Surface Coal Mining and Reclamation Activities

No surface coal mining and reclamation activities will be conducted in the permit area.

Underground Coal Mining and Reclamation Activities

All surface equipment, structures, or other facilities not required for continued underground mining activities and monitoring, unless approved by the Division as suitable for the postmining land use or environmental monitoring, will be removed and the affected lands reclaimed following permanent cessation of mining operations.

Environmental Protection Performance Standards

The plan presented herein is designed to meet the requirements of R645-301 and the environmental protection performance standards of the State Program.

The Applicant has met the requirements of R645-301-515.300 for temporary cessation and R645-301-541 for permanent cessation. The Applicant will notify the Division in the event of temporary cessation and take appropriate action. When the site is permanently closed, the Applicant has committed to commence reclamation.

Findings:

The Applicant has met the requirement of R645-301-513.300 and R645-301-541.

MAPS, PLANS, AND CROSS SECTIONS OF RECLAMATION OPERATIONS

Analysis:

Affected Area Boundary Maps

Plate 5-1 shows the location of the permit and disturbed area boundaries. Plate 5-3 gives a detailed description of the disturbed area boundaries.

Bonded Area Map

Plate 5-3 shows the areas that are covered by the reclamation bond.

Reclamation Backfilling and Grading Maps

Plate 5-3 and Plate 5-4 show the surface and cross section of the reclaimed site.

Reclamation Facilities Maps

Plate 5-3 shows the facilities in the disturbed area that will be left after final reclamation. Those facilities are the main access road and culverts. The Applicant has not addressed the roads outside the disturbed area. If any road in the permit area is used for mining or reclamation activities it must either be reclaimed or approved as a postmining feature. The Applicant has not adequately addressed how roads outside the permit area will be reclaimed.

Final Surface Configuration Maps

Plate 5-3 shows the final surface contours to the disturbed area.

Reclamation monitoring and sampling location maps.

Elevations and locations of monitoring stations used to gather reclamation water quality and quantity data are on Plate 7-1.

Reclamation Surface and Subsurface Manmade Features Maps

The Applicant needs to show all permanent manmade surface and subsurface features on the reclamation maps. Those surface and subsurface features include transmission lines and underground pipelines.

Monitoring and sample location maps.

Elevations and locations of monitoring stations used to gather operational water quality and quantity data are on Plate 7-1.

Certification Requirements.

Cross sections, maps, and plans have been prepared by, or under the direction of, and certified by a qualified, registered, professional engineer.

Findings:

The Applicant has met the requirements of this section.

RECLAMATION HYDROLOGIC INFORMATION

Regulatory Reference: 30 CFR Sec. 784.14, 784.29, 817.41, 817.42, 817.43, 817.45, 817.49, 817.56, 817.57; R645-301-512, -301-513, -301-514, -301-515, -301-532, -301-533, -301-542, -301-723, -301-724, -301-725, -301-726, -301-728, -301-729, -301-731, -301-733, -301-742, -301-743, -301-750, -301-751, -301-760, -301-761.

Ground-water monitoring.

Analysis:

Wells GW-10-2, GW-11-2, and GW-24-1 (all completed in the Castlegate Sandstone) and springs SP-45 (Colton Formation), SP-2 Flagstaff Formation), SC-14 North Horn Formation) , and SC-80 (Castlegate Sandstone) will be used to monitor ground water conditions in the proposed Dugout Canyon Mine permit area. Locations of wells and springs to be monitored are on Plate 7-1. See the discussion of Ground Water Information under Baseline Information in the Environmental Resource Information section.

Surface-water monitoring.

Analysis:

The surface-water monitoring plan begins on page 7-58 of the application. Stream monitoring locations are found on Plate 7-1. Table 7-5 on page 7-59 provides the monitoring parameters for surface water. The monitor is plan was based on the PHC. The reclamation monitoring plan is essentially the same as the operational plan. The analysis for this information is covered under the Operational Surface-Water Monitoring Plan.

Findings:

The applicant has met the minimum requirements for surface-water monitoring during mine reclamation.

Transfer of wells.

Ownership of wells will be transferred only with prior approval of UDOGM and the conditions of such a transfer will comply with State and local laws. Soldier Canyon Mine will remain responsible for management of the wells until bond release. This is discussed on page 7-61 under Section 731.400

Findings:

The applicant has met the minimum requirements for transfer of wells.

Discharges into an underground mine.

Analysis:

Section 731.500, page 7-61 states that there will not be any discharges into the proposed mine.

Findings:

The applicant has met the minimum requirements for discharges into an underground mine.

Gravity discharges.

Analysis:

Section 731.500, page 7-61 states that there will not be any discharges into the proposed mine.

Findings:

The applicant has met the minimum requirements for gravity discharges.

Water quality standards and effluent limitations.

Analysis:

Water Quality standards and effluent limits are addressed in Section 751, page 7-86. This section states that "all discharges from the disturbed areas will be in compliance with all Utah and federal water quality laws and regulations and with effluent limitations for coal mining contained in 40 CFR Part 434." SC3 will be responsible for meeting any applicable water quality regulation that applies to this mine.

Findings:

The applicant has met the minimum requirements for water-quality standards and effluent limitations.

Diversions.

Regulatory Reference: R645-301-742.300

Analysis:

All corrugated metal culverts are removed during reclamation and the canyon is restored to its approximate original contour. The stream reclamation plan is covered on pages 7-92 through 7-99, and in Appendix 7-11. The basic plan is to line Dugout Creek and its main eastern tributary reclamation channels with riprap to form a stable "macrochannel". The required 100-year, 6-hour design event was used to size the channels. The channels are eight feet wide and three feet deep resulting in 1.9 feet of freeboard. The riprap is two feet thick with filter blankets sized to the underlying soil. Filter design will be finalized at reclamation to base the design on soils present at that time since there will be a mixture of soils during reclamation. Estimated riprap and filter quantities are contained in the appendix.

In addition, there will be a series of 29 " Channel Stability Enhancement Structures", to provide a "microchannel" environment to increase sediment deposition above the macrochannel. These are shown in Fig. 7-12 and are spaced about every 60 feet along the channel. Three types are employed: Low-Stage Check Dams, Bank-Placed Boulders, and Rock or Log Spurs. The overall impact of the stream reclamation will be to provide a channel that is significanlly improved over that which was left by pre-SMACRA mining and a channel that will promote riparian revegetation. It should be noted that no fish have been found in Dugout Creek.

Page 3-21 describes a mitigation plan whereby about 7,500 feet of streambank above the mine disturbed area is reseeded and vegetation is planted in the stream. This is consistent with the typical 3:1 mitigation for such projects and will result in immediate and long-term benefit to the stream.

Findings:

The plan meets the requirements of R645-301-742.313. Specifically, " A permanent diversion or a stream channel reclaimed after the removal of a temporary diversion will be designed and constructed so as to restore or approximate the premining characteristics of the original stream channel including the natural riparian vegetation to promote the recovery and the enhancement of the aquatic habitat."

Stream buffer zones.

Analysis:

Stream buffer zones are addressed in the application on page 7-61. A large portion of the surface facilities reclamation will be with in 100 feet of Dugout Creek. The runoff and sediment control plan has been designed to ensure the reclamation with in buffer zone will not cause or contribute to degradation of water-quality or the stream channel quality. There will be a buffer zone designated and maintained between the mine facilities and the stream channel. The buffer zone will be marked.

Findings:

The applicant has met the minimum requirements for stream buffer zones.

Sediment control measures.

Analysis:

Sediment control measures for the reclamation plan are found on pages 5-55. Alternate sediment control measures are shown in Figure 5-5 on page 5-56.

The sediment pond will be removed near the end of the reclamation process. It will be retained until the regrade process reaches the location of the pond at which time it will be backfilled. When an area no longer properly drains to the sediment pond silt fence will be installed along the base of the slope to create alternate sediment control areas (ASCA). The silt fences will be unutilized until vegetation is successfully established to control erosion. The utilization of silt fence is best technology currently available. However, a surface roughening technique would greatly enhance the sediment control measure and the vegetation establishment time would be hastened.

Findings:

The applicant has met the minimum requirements for exemptions for sediment control. The utilization of silt fence is best technology currently available.

Sedimentation ponds.

Analysis:

The operational sediment pond will be utilized in the reclamation process as long as possible. This design criteria for this pond is covered under the Operational Hydrology/Siltation Structures portion of this TA.

Findings:

The applicant has met the minimum requirements for exemptions for reclamation siltation structures and sediment ponds.

Exemptions for siltation structures.

Analysis:

Areas that will not report to sediment ponds are discussed under the Sediment Control in this section of the TA. Those areas are listed as alternate sediment control areas (ASCAs) and by Division policy they are not "exempt areas".

Findings:

The applicant has met the minimum requirements for exemptions for exemptions for siltation structures.

Casing and sealing of wells.

Procedures for casing and sealing, capping, backfilling or otherwise properly managing drilled holes, exploration holes and boreholes, and wells are discussed on pages 5-65, 6-18, 7-70, 7-89, and 7-91.

Findings:

Reclamation hydrologic information that was reviewed for this Technical Analysis, in particular information that pertains to ground water resources, is considered adequate to meet the requirements of this section.

BONDING AND INSURANCE REQUIREMENTS

Analysis:

- R645-301-830.110 states that the bond amount will be determined by the Division.
- R645-301-830.130 states that the bond amount will reflect the probable difficulty of reclamation, giving consideration to such factors as topography, geology, hydrology and revegetation potential.
- R645-301-830.140 states that the bond amount will be based on, but not limited to, the detailed estimated cost. With supporting calculations for the estimates submitted by the permit applicant.

The reclamation cost estimate for the Dugout Canyon Mine is found in Appendix 5-6 of the PAP. The reclamation costs are divided into demolition, earthwork and revegetation. The Applicant supplied

enough information for the Division to determine the demolition and revegetation costs.

The Division calculated the demolition cost estimates based on the methods outlined in the OSM Reclamation Costs Handbook and the unit costs given in Means. The Division did not have the time to estimate the earthwork costs prior to the permit being issued. The Division relied upon the Applicant's estimate. The Division increased the amount by 100% because of the uncertainty.

The Applicant's reclamation costs were based on generic haul and push distances and grades. Backfilling and grading steep slopes and earthwork in narrow canyons is different from working in flat open areas. The generic figures used by the Applicant may not be appropriate for this site.

In Section 542.200 of the PAP the Applicant states:

> All vegetation, organic matter, and debris will be cleared from areas to receive fill. The cut materials from site regrading will be placed as fill and graded to facilitate drainage from the mine site and contributing side areas. All fill placed during recontouring of the site will be compacted to at least 85 percent of maximum Proctor density (ASTM D698). Compaction will be accomplished using repeated passes of rubber-tired equipment, rollers, and other appropriate equipment. Side hill embankments, where the width is too narrow to allow access by compaction equipment, will be initially constructed by end dumping, but only to a width necessary to allow compaction equipment access."

In Section 553.100 of the PAP the Applicant states:

> "Dozers will be used during placement of the topsoil or substitute topsoil on these steep slopes, taking care to achieve a reasonably uniform thickness of final soil cover"

The Division does not want to dictate the earthwork methods that the Applicant must use to reclaim the site. For estimating reclamation costs the Division must use methods that they fell comfortable about. The Division does not consider end dumping to be an effective way of placing fill material on steep slopes, or the use of dozers to distribute topsoil on steep slopes. The Division needs to calculate the reclamation costs based upon methods that are commonly used in steep slope area. The Division must do a detailed earthwork reclamation cost estimate.

The Division considers the present bond adequate to the time being. The Division needs to estimate the reclamation cost properly. That estimate will be needed for updating the bond whenever there is a change in the permit or when periodically adjusting the bond for inflation.

Findings:

The reclamation bond determined by the Division is adequate to ensure reclamation of the site. However, the reclamation bond was not calculated according to standard methods because the Applicant did not provide a detailed reclamation plan. The Applicant needs to develop more detail to the reclamation plan that can be used to estimate the reclamation cost. One item that would be helpful to the Division is reclamation cross section where the horizontal and vertical scales are equal and in an ACAD drawing file.

The permit should be granted with the following stipulation in accordance with:

R645-301-830.140, The Applicant will provide additional specifics as to how backfilling, grading and revegetation are to be accomplished in order that the Division may prepare a more specific bond cost estimate.

Cumulative Hydrologic Impact Assessment (CHIA)

Canyon Fuel Company
Soldier Canyon Mine
ACT/007/018

and

Canyon Fuel Company
Dugout Canyon Mine
ACT/007/039

Carbon County, Utah

March 16, 1998

I. INTRODUCTION

The Soldier and Dugout Canyon Mines are located in the Book Cliffs Coal Field approximately 12 miles northeast of Price, Utah (Figure 1). The Book Cliffs form a rugged, southerly facing escarpment that separates the Uintah Basin to the north from the San Rafael Swell to the south.

Elevations along the Book Cliffs range from approximately 5,000 to 9,000 feet. Precipitation varies from 20 inches at the highest elevations to 8 inches along the Price River downstream of the town of Wellington. The Book Cliffs area may be classified as mid-latitude steppe to semi-arid desert.

Vegetation varies from the sagebrush/grass community type at lower elevations to the Douglas fir/aspen community at higher elevations. Other vegetative communities include mountain brush, pinyon-juniper, pinyon-juniper/sagebrush, and riparian. These communities are primarily used for wildlife habitat and livestock grazing.

Outcropping rocks of the Book Cliffs range from Upper Cretaceous to Quaternary in age. The rock record reflects an overall regressive sequence from marine on the valley floor and at the base of the cliffs (Mancos Shale) up through littoral and lagoonal (Starpoint Sandstone and Blackhawk Formation) to fluvial (Castlegate Sandstone, Price River Formation and North Horn Formation) and lacustrine (Flagstaff Formation and Green River Formation) depositional environments. The Colton Formation is a fluvial-deltaic sequence separating the Flagstaff and Green River deposits. Oscillating depositional environments within the overall regressive Cretaceous trend are represented by members of the Blackhawk Formation, which is the major coal-bearing unit within the Book Cliffs Coal Field.

Surface runoff from the Book Cliffs area flows into the Price River drainage basin of south-central Utah (Figure 2). Headwaters of the Price River are the drainages around Scofield

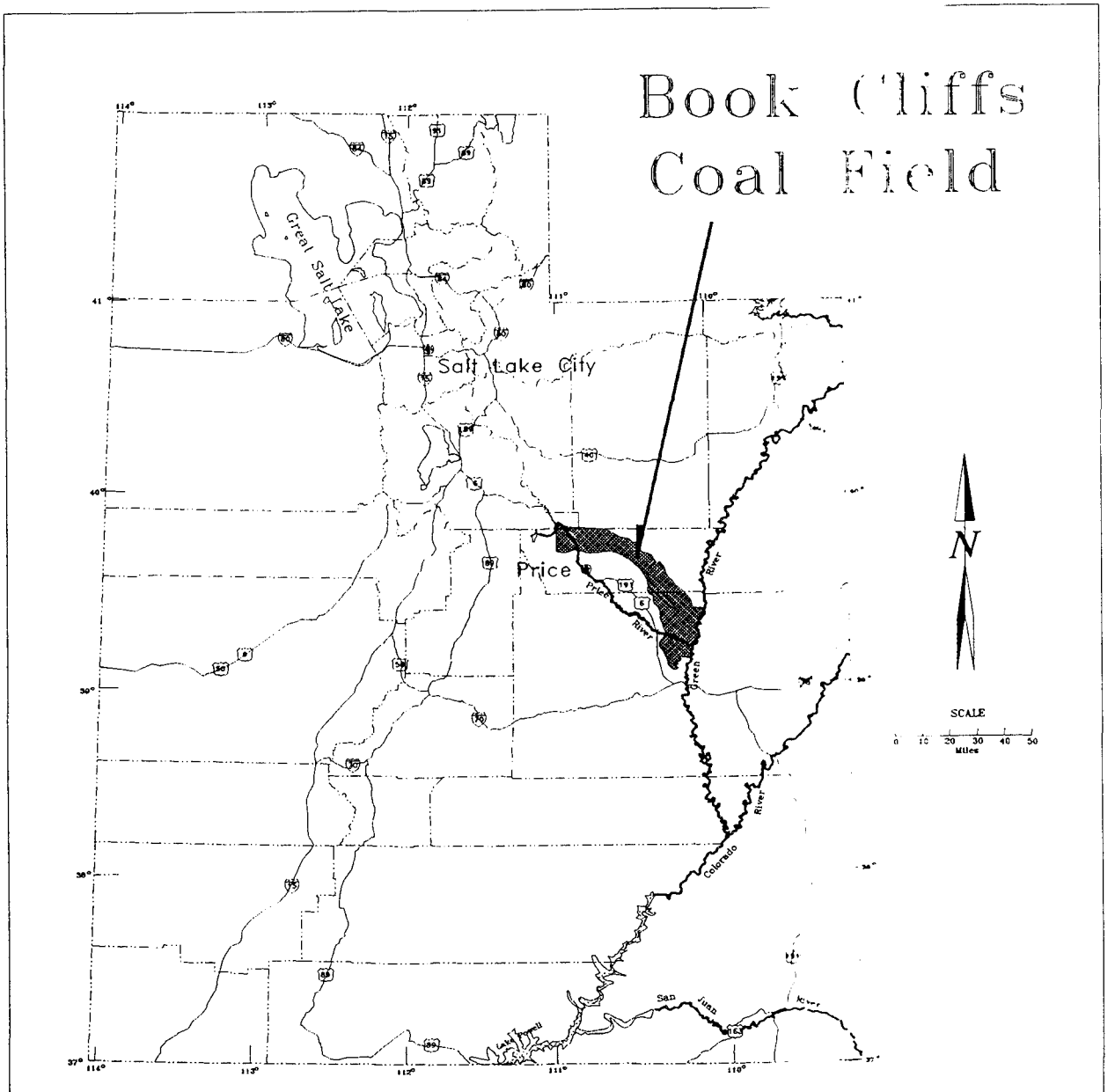

Figure 1 - Location of Book Cliffs Coal Field in Utah

CHIA - SOLDIER CREEK MINE AND ALKALI LEASE

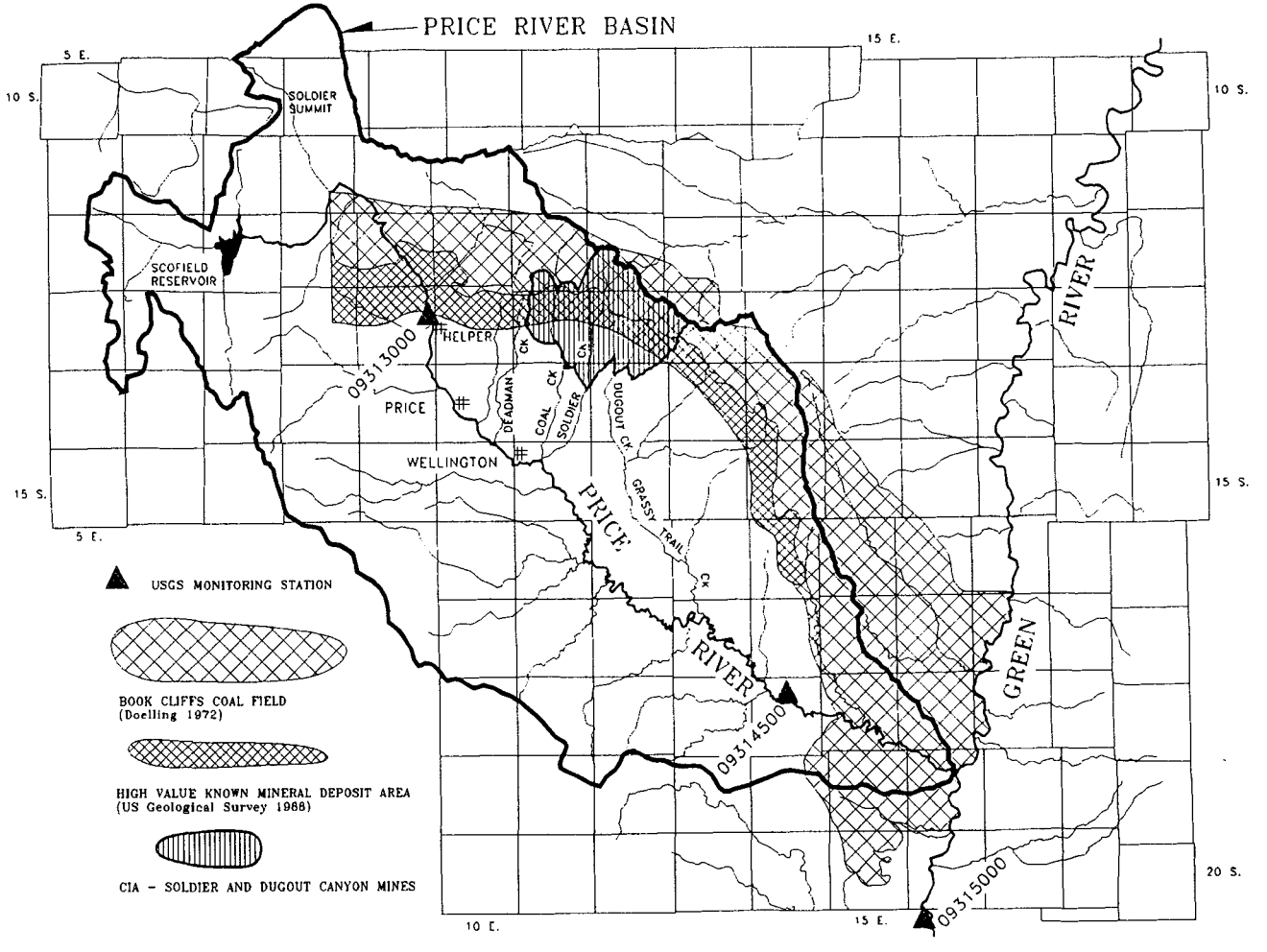

Figure 2 - Book Cliffs Coal Field and Price River Basin

Reservoir and Soldier Summit. The river flows southeasterly and joins the Green River approximately 15 miles north of the town of Green River, Utah. Water quality is good in the mountainous headwater tributaries, but deteriorates rapidly after the river leaves Price Canyon and flows across the Mancos Shale. The Mancos typically has low permeability, is easily eroded, and contains large quantities of soluble salts. Total dissolved solids (TDS) levels of 3,000 mg/L and sulfate concentrations over 1,000 mg/L are not uncommon in the lower reaches of the Price River.

This cumulative hydrologic impact assessment (CHIA) is a findings document involving an assessment of the cumulative impact of all anticipated coal mining operations on the hydrologic balance within the Cumulative Impact Area (CIA). Anticipated coal mining operations are Canyon Fuel Company's (formerly Soldier Creek Coal Company) Soldier Canyon and Dugout Canyon Mine operations, plus federal coal lease U-07064-027821 that is anticipated to be added to the Dugout Canyon Mine.

The CHIA is not a determination if coal mining operations are each designed to prevent material damage beyond their respective permit boundaries when considered individually, but rather is a determination if there will be material damage resulting from effects that become cumulative outside the individual permit boundaries. This report complies with federal legislation passed under the Surface Mining Control and Reclamation Act (SMCRA) and subsequent Utah and federal regulatory programs under R645-301-729 and 30 CFR 784.14(f), respectively.

The objectives of a CHIA document are to:

1.	Identify the Cumulative Impact Area (CIA).	(Part II)
2.	Describe the hydrologic system - including geology, identify hydrologic resources and uses, and document baseline conditions of surface and ground water quality and quantity	(Part III)
3.	Identify hydrologic concerns.	(Part IV)
4.	Identify relevant standards against which predicted impacts can be compared.	(Part V)
5.	Estimate probable future impacts of mining activity with respect to the parameters identified in 4.	(Part VI)
6.	Assess probable material damage.	(Part VII)
7.	Make a statement of findings.	(Part VIII)

A CHIA was prepared in 1984 for the Sage Point-Dugout Canyon Mine that was

permitted by Sunoco Energy Development Company but never developed. The current Dugout Canyon Mine permit area includes roughly the west half of this old Sage Point-Dugout Canyon permit area. The last CHIA for the Soldier Canyon Mine was dated February 4, 1987 and was updated October 7, 1996 to accommodate the addition of the Alkali lease.

II. CUMULATIVE IMPACT AREA (CIA)

The Soldier Canyon - Dugout Canyon Mines Cumulative Impact Area (CIA) is shown on Plates 1, 2, and 3 and Figures 2 and 3. The CIA is the area within which actual and anticipated coal mining activities may interact to affect the surface and ground water. The CIA is determined based on anticipated mining activities, knowledge of surface and ground water resources, and anticipated impacts of mining on those water resources.

The CIA encompasses approximately 42,000 acres. It includes the entire Soldier and Dugout Canyon Mine complexes and the easternmost part of the Andalex Resources, Inc. Centennial Project. The Soldier Canyon and Dugout permit areas consist of approximately 6,700 acres and 4,500 acres, respectively, and include the mine pads and portals, a topsoil storage area, and a sewage lagoon. The portion of the Centennial Project included in CIA is entirely underground. The CIA also includes federal coal lease U-07064-027821 because Canyon Fuel Company has indicated that it intends to expand the mine into this area in the near future. Coal, Soldier, Dugout, and Pace Creeks are the major drainages in the CIA, and Pine and Fish Creeks are major tributaries to Soldier Creek.

SCOPE OF MINING

Coal Canyon

Initial prospecting took place along Coal Creek in 1906. From 1946 to 1958 the two Knight Ideal Mines produced 1.7 million tons of coal from the Gilson seam (Doelling, 1972).

Approximately 320 acres of the Alkali lease addition to the Soldier Canyon Mine are on the west side of Coal Creek, north of Hoffman Creek (Plate 1), but no mining is planned in this western section of the permit area or under Coal Creek. Mining in the Rock Canyon and Gilson seams is projected beneath some tributary drainages east of Coal Creek. Coal will be produced by room-and-pillar mining methods, with some areas to be second-mined. Canyon Fuel Company has no plans to mine the Sunnyside seam beneath the Coal Creek drainage.

The portals for Andalex Resources, Inc.'s Centennial Project are located in Deadman Canyon, approximately 2 miles west of the Soldier Canyon Mine permit area boundary, and most of the Centennial Project permit area, including all disturbed areas, drains to the Price River by way of Deadman Creek. However, the eastern part of the Centennial Project permit area lies within the Soldier Canyon - Dugout Canyon CIA, in the drainages of Straight Canyon and Hoffman Creek, two tributaries to Coal Creek. A large section of the Gilson seam and smaller portions if the Lower Sunnyside seam have already been mined under this area, with overburden ranging from 0 to 800 feet. In this eastern area longwall mining is planned for one small panel in the Gilson seam under Hoffman Creek and for two small panels in the Aberdeen Upper "A" seam under Straight Canyon. Room-and-pillar mining in the Lower Sunnyside seam under both the

Straight Canyon and Hoffman Creek drainages is planned as part of the development of the Centennial Project, but actual mining of this seam will depend on market demand. Overburden thicknesses are from 400 to 1,200 feet.

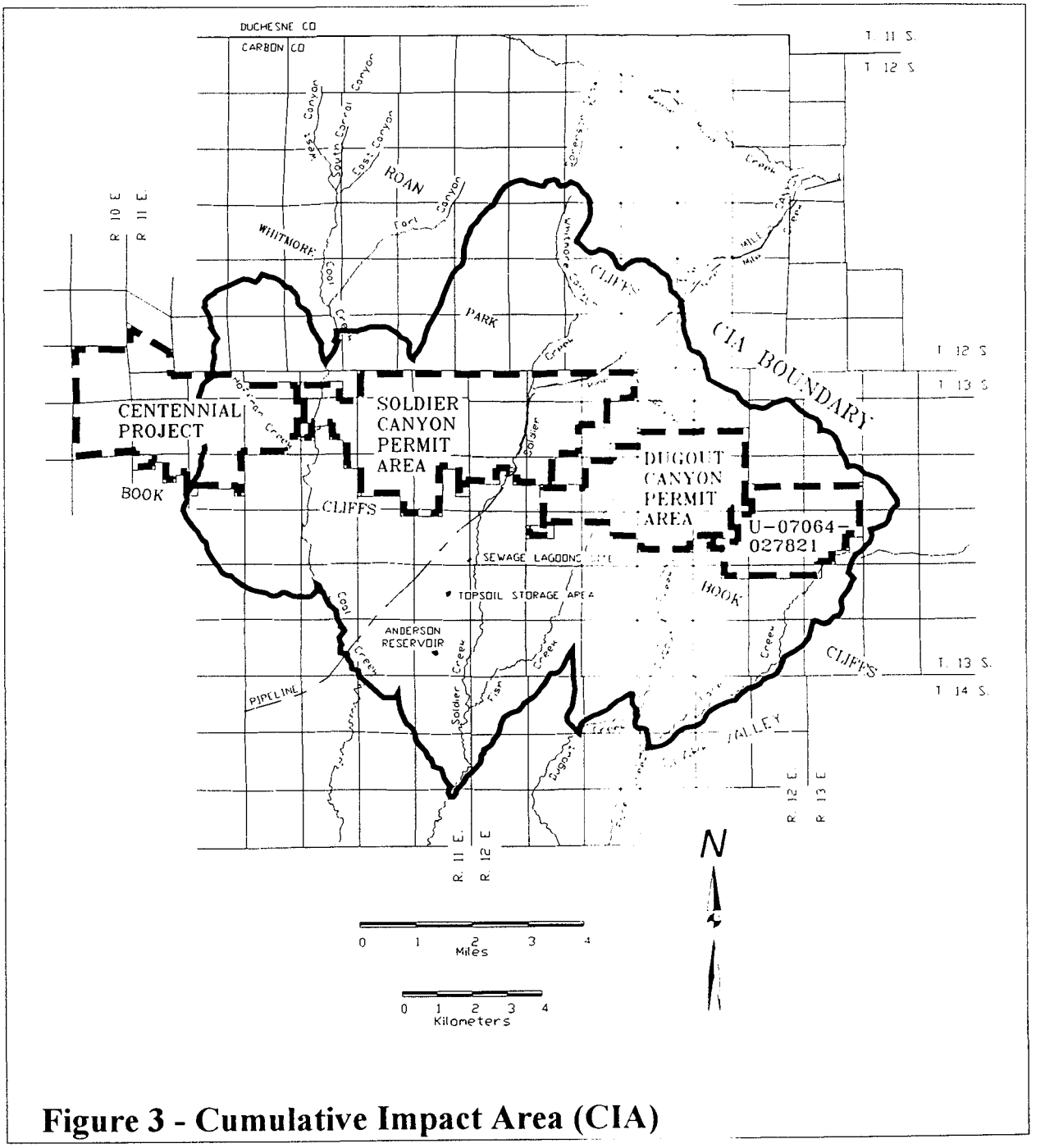

Figure 3 - Cumulative Impact Area (CIA)

The Centennial Project CIA and Soldier Canyon - Dugout Canyon CIA overlap in the Coal Creek drainage. However, it is probable that neither mine operation will cause measurable or noticeable impacts to the hydrologic balance of this drainage, either individually or cumulatively: there will be no surface facilities for either mine in the Coal Creek drainage, neither operation will cause subsidence beneath or immediately adjacent to Coal Creek, and other surface effects from mine operations within this drainage should be insignificant to non-existent.

Soldier Canyon

A mine in Soldier Canyon was opened in 1906, but little coal was produced until 1935, when Premium Coal Company became the operator. Premium operated the mine from 1935 until 1972. Production during that period was approximately 1.2 million tons (Doelling, 1972).

In September of 1974 California Portland Cement Company purchased the property and after making improvements resumed production on June 15, 1976.

On September 5, 1985 assets were transferred to Sunedco Coal Company, a subsidiary of Sun Company, Inc. Subsequently the mining equipment and facilities were transferred to a newly incorporated subsidiary, Soldier Creek Coal Company, with ownership of the federal and state coal leases held by two affiliate companies, Sunedco Coal Company and Sunoco Energy Development Company (Sunedco). Sunedco Coal Company expanded the Soldier Canyon Mine permit area to incorporate adjacent acreage that had not been included in Sunoco Energy Development Company's Sage Point-Dugout Canyon Mine permit. (A permit for Sunoco Energy Development Company's Sage Point-Dugout Canyon Mine was approved by OSM in May 1984 (UT-0041) and by Utah Division of Oil, Gas and Mining (UDOGM) June 5, 1984, (ACT/007/009) but poor coal markets dictated a delay in developing that mine.)

A corporate reorganization by Sun Oil Company, Inc. merged Sunedco Coal Company and Sunoco Energy Development Company into Sage Point Coal Company, which became the sole shareholder of Soldier Creek Coal Company. Coastal States Energy Company purchased all stock of Sage Point Coal Company and Soldier Creek Coal Company on September 16, 1993.

In 1996 Coastal States Energy Company and all of its subsidiaries were merged into a newly-formed, limited-liability company, Canyon Fuel Company, LLC. Then on December 20, 1996 Canyon Fuel Company, LLC was sold to ARCO Uinta Coal Company (a subsidiary of Atlantic Richfield Company) and Itochu Coal International, Inc. (a subsidiary of Itochu Corporation). At the time this CHIA was prepared Canyon Fuel Company owned and operated the Soldier Canyon Mine and was in the process of permitting the Dugout Canyon Mine.

Coal production at the Soldier Canyon Mine, 1985 through 1996, is summarized in Table 1. Maximum annual production has been projected as high as 1.75 million tons per year. The current air quality permit allows coal production of up to 3.5 million tons.

Existing underground workings at the Soldier Canyon Mine are approximately 2 miles in width and extend 1.5 miles downdip. Mining has been in the Rock Canyon and Sunnyside coal seams. Addition of the Alkali lease area will allow mining in the Rock Canyon seam to continue approximately 1.5 miles farther to the west and will allow future access to the Gilson coal seam. There are no plans to mine the Sunnyside seam in the Alkali tract. Coal will be produced by room and pillar mining methods.

Dugout Canyon

Beginning in 1925 the Red Glow Mine was developed by D. J. Collins in the Gilson seam on the east side of Dugout Canyon. The west side of the canyon was first mined in 1952 by E.S.O. Coal Company, in the Rock Canyon seam. The Knight Ideal Coal Company mined both seams on both sides of the canyon from 1958 to 1964. 1.3 million tons of coal were extracted using the room-and-pillar method and partial pillar recovery. Maps of these workings are on Plate 5-1 of the Dugout Canyon Mine MRP.

The mine facilities and rights to the coal have changed hands several times since 1964, but no more coal has been extracted. Pacific Gas and Electric (PG&E), through its subsidiary Eureka Energy Company, submitted a Mining and Land Use plan for the Sage Point-Dugout Canyon Mine to the BLM and USGS in 1976 and carried out limited exploration through existing portals in 1979. In December 1980 Eureka submitted a Permit Application Package (PAP) and MRP to UDOGM under the approved Utah State program. In May 1982 Sunedco purchased Eureka Energy Company's Sage Point - Dugout Creek properties and again limited exploration through existing portals was done. Permits to mine coal were approved by both OSM and UDOGM in 1984, but in 1987 the federal permit terminated due to lack of development or construction, the state permit was revoked, and mine plan approval canceled.

After both the Eureka and PG&E explorations, the portals were resealed with earthen fill. Soldier Creek Coal Company reopened four portals, two on the east and two on the west, in 1995. The east portals were resealed but the west portals were still open as of early 1998, with fencing providing safety, security, and access control.

In the proposed Dugout Canyon Mine only the Rock Canyon and Gilson seams appear sufficiently developed to be mined under current conditions. Although both seams have been previously mined in Dugout Canyon, the current permit application is for mining in the Rock Canyon seam only. Projected mining in the Dugout Canyon Mine will extend approximately 3 miles east-to-west and up to 1.5 miles north-to-south. There appears to be sufficient coal to anticipate extending the workings up to 2 miles east of the currently proposed permit area into federal lease U-07064-027821, but such an eastward extension is not part of the current (1998) Dugout Canyon Mine permit application.

Other

The Spring Canyon Mine operated from 1906 to 1910 in Section 21, T. 13 S., R. 12 E. (Doelling, 1972). This is within the Dugout Canyon Mine permit boundary, in the canyon of what is now called Fish Creek. The Pace Canyon Mine, also known as the Snow Mine, was reported to have operated in 1906 and from 1932 to 1940 but may have actually never been more than a prospect (Doelling, 1972). It is in Section 30, T. 13 S., R. 13 E., at the southeast edge of federal lease U-07064-027821. According to Canyon Fuel Company both mines have been considered for preservation by Utah State Historic Preservation Office (SHPO), but both were ineligible for nomination to the National Register of Historic Places.

TABLE 1
Coal Production at Soldier Canyon Mine 1985 to 1996

YEAR	Annual Coal Production	Annual Water Discharge	Annual Water Discharge / Annual Coal Production	Coal Moisture and Evaporation	Total Water Consumption / Annual Coal Production
1985	675,982 tons	39,123,000 gals	57 gals/ton	11,987,000 gals	75 gals/ton
1986	558,781 tons	88,397,000 gals	158 gals/ton	9,798,000 gals	175 gals/ton
1987	468,465 tons	54,444,000 gals	116 gals/ton	7,796.000 gals	132 gals/ton
1988	(not available)	(not available)		(not available)	
1989	1,112,016 tons	140,526,000 gals	126 gals/ton	13,262,000 gals	138 gals/ton
1990	1,207,432 tons	(not available)		(not available)	
1991	1,060,996 tons	(not available)		(not available)	
1992	422,345 tons	265,061,000 gals	627 gals/ton	9,941,000 gals	651 gals/ton
1993	512,621 tons	172,139,000 gals	335 gals/ton	(not available)	
1994	583,696 tons	6,500,000 gals	11 gals/ton	(not available)	
1995	480,895 tons	128,920,000 gals	268 gals/ton	(not available)	
1996	977,000 tons	(not available)		(not available)	

III. HYDROLOGIC SYSTEM and BASELINE CONDITIONS

Elevations range from less than 6,000 feet to approximately 8,500 feet in the CIA. Predominant features that exist in the Soldier Canyon - Dugout Canyon CIA are cliffs, narrow canyons, valleys and pediments. Drainage in the CIA is characterized by a southerly draining system of perennial, ephemeral, and intermittent streams. Soldier and Coal Creeks are perennial streams, with headwaters that originate at elevations of 7,500 to 8,000 feet. Headwater areas in Pine Canyon are described as appearing to be perennial in the Soldier Canyon Mine MRP (p. 7-32). Fish, Dugout, and Pace Creeks are major intermittent drainages, although, based on observations and water monitoring data, Dugout and Fish Creeks are described in the Dugout Canyon Mine MRP as perennial in the vicinity of the proposed Dugout Mine.

GEOLOGY

The geology of the Soldier Canyon - Dugout Canyon CIA consists of stratigraphic units of consolidated rock ranging in age from Late Cretaceous to Tertiary (Eocene) as seen in Figure 4. The oldest exposed rocks include members of the Mancos Shale. The Mesaverde Group overlies the Mancos Shale and consists of the Starpoint Sandstone, Blackhawk Formation, Castlegate Sandstone and Price River Formation. Overlying the Mesaverde Group are the North Horn Formation, Flagstaff Limestone, Colton Formation, and Green River Formation that, in this area, constitute the Wasatch Group of Paleocene to Eocene age. The Eocene Green River Formation is the uppermost consolidated formation in the CIA. Unconsolidated deposits formed by weathering and erosion exist as soils in Whitmore Park, terrace deposits and gravels along canyon streams, and pediments at the base of escarpments.

There are no major disconformities in the area. The formations were tilted north-eastward in response to the rise of the San Rafael Swell and Socally and Farnam anticlines. The strike of the area changes from N 84^0 W on the west to N 65^0 W on the east. The dip ranges from 6^0 to 12^0 and averages 8^0 northeast.

Fracturing is generally parallel to the strike of the Book Cliffs escarpment, and hence parallel to the strike of the strata. Fracturing appears to be the result of isostatic adjustment and general upwarping associated with the San Rafael Swell and subsequent erosional, tectonic and orogenic events. Measurements taken in the currently operating Soldier Canyon Mine show face cleat direction is within a few degrees of the strike of the coal bed.

Two small faults have been mapped in the CIA (Anderson, 1983). One fault with a few feet of down-to-the-north displacement was found between the right and left forks of Fish Creek (Sec. 20 and 21, T. 13 S., R. 12 E.). It strikes roughly east-west and may be related to slumping or breaking-away of rock from the escarpment. A northwest-southeast striking fault with approximately twenty-five feet of down-to-the-southwest displacement was mapped east of the Dugout permit area (Sec 12, T13 S., R 12 E. and Secs. 7 and 18, T. 13 S., R.

CHIA - SOLDIER CANYON AND DUGOUT CANYON MINES

System	Series	Stratigraphic unit		Thickness (feet)	Description
TERTIARY	Eocene	Green River Formation		–	Greenish gray and white claystone and shale, also contains fine-grained and thin-bedded sandstone. Shales often dark brown containing carbonaceous matter. Full thickness not exposed.
		Colton Formation	Wasatch Formation	300-2,000 3,000	Colton consists of brown to dark red lenticular sandstone, shale and siltstone, thins westwardly and considered a tongue of the Wasatch. Wasatch predominantly sandstone with interbedded red and green shales with basal conglomerate. Found in east part of field and equivalent to Colton and Flagstaff in west.
	Paleocene	Flagstaff Limestone		0- 500	Flagstaff mainly light gray and cream colored limestones, variegated shale, and fine-grained, reddish brown, calcareous sandstone.
		North Horn Formation *MINOR COAL*	Tuscher Formation	350-2,500 0- 200	Gray to gray green calcareous and silty shale, tan to yellow-gray fine-grained sandstone and minor conglomerate. Unit thickens to west. 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.
CRETACEOUS	Danian				
	Maestrichthian	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		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.
			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.
			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.
		Masuk Tongue	Mancos Shale	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.
		Emery Sandstone			
	Santonian				
		Garley Canyon Sandstone			
	Coniacian	Blue Gate Shale			
	Turonian	Ferron Sandstone *MINOR COAL*			
		Tununk Shale			
	Cenomanian	Dakota Sandstone		2- 126	Heterogeneous sandstone, conglomerate and shale, thin resistant cuesta former.

Figure 4 - General Stratigraphy of the Soldier Canyon - Dugout Canyon CIA

11 E.). There are numerous small, superficial faults that appear related to collapse over burned coal zones (Dugout Canyon Mine MRP).

Mining operations are restricted to the Blackhawk Formation. Data indicate five coal zones that show lateral consistency. From top to bottom they are the Sunnyside, Rock Canyon, Fish Creek, Gilson, and Kenilworth. The Sunnyside, Rock Canyon and Gilson Seams contain minable reserves: the Sunnyside and Rock Canyon seams have been mined by Soldier Creek Coal Company, and mining in the Rock Canyon and Gilson Seams is planned for the Alkali tract. The Gilson and Lower Sunnyside seam are planned to be mined from the Centennial Project. Only the Rock Canyon seam will be mined at the Dugout Mine under the currently proposed MRP (1998).

Roughly the eastern half of the Centennial project is within the Soldier Canyon - Dugout Canyon Mines CIA, and within that part of the Centennial project longwall mining is planned for the Gilson and Aberdeen Upper "A" seams and continuous mining for the Lower Sunnyside seam. Overburden thicknesses are from 400 to 1,200 feet. A large area of the Gilson seam and smaller portions if the Aberdeen and Sunnyside seams have already been mined in this area, with overburden ranging from 0 to 800 feet. As of 1995 there was no evidence of subsidence at the surface.

Overburden thickness ranges from approximately 100 feet under Soldier and Dugout Creeks to over 2,000 feet at the north edge of the permit areas.

HYDROLOGY

Ground water

The Blackhawk Formation, Castlegate Sandstone, Price River Formation, North Horn Formation, Flagstaff Limestone and Quaternary deposits all contain potential reservoirs or conduits for ground water in the CIA. Reservoir lithologies are predominately sandstone and limestone. Sandstone reservoirs occur where there is sufficient intergranular porosity and permeability in lenticular fluvial-channel and tabular overbank deposits, whereas limestone reservoirs have developed through dissolution and fracturing of tabular lacustrine deposits. Shale, siltstone, and cemented sandstone beds act as aquatards or aquacludes to impede ground-water movement. The Mancos Shale is a regional aquaclude that limits downward flow within the CIA. More localized aquatards occur within the North Horn, Price River, Castlegate and Blackhawk Formations. Ground water in the CIA, as is typical of ground water throughout the Price River basin, occurs under both confined and unconfined conditions.

Average annual precipitation ranges from approximately 8 inches along the lower reaches of Soldier and Dugout Creeks to 16 inches in the headwater regions (Mundorff, 1972, Plate 2). Recharge has been estimated to be 3 to 8 % (Danielson and Sylla, 1983) and 9 % (Waddell and others, 1986) of the average annual precipitation for areas in the Wasatch Plateau and Book Cliffs coal fields. Snowmelt provides most of the ground-water recharge. In the Book

Cliffs the recharge rate is generally greatest where limestones of the Flagstaff Formation are exposed as dip-slopes at the higher elevations.

Once recharge enters the ground the rate and direction of ground-water flow is governed mainly by gravity and geology. Lateral ground-water flow dominates in the gently-dipping Tertiary and Cretaceous strata of the Book Cliffs, where layers of low-permeability rock that impede downward movement are common. Both lateral and vertical flow may be channeled through faults and fractures, but plastic or swelling clays that can seal faults and fractures are abundant. Typically ground-water flow continues both laterally and downward until it intercepts the surface and is discharged as a spring or seep, enters a stream as baseflow, is transpired by vegetation, or simply evaporates. Ground water tends to flow more readily through shallower systems because the hydraulic conductivities are generally larger than those of deeper systems, but some of the ground water will flow along slower, deeper flow-paths.

Generally springs are associated with contacts between zones or strata of differing permeability or with faulting. The majority of springs in the Soldier Canyon - Dugout Canyon CIA issue near the contact between the Flagstaff Limestone and the North Horn Formation. Water percolates down through the Flagstaff but the clay, shale, and siltstone layers of the North Horn impede further downward movement, creating a perched system in the Flagstaff.

Springs or areas of multiple springs are or have been monitored within the Soldier Canyon - Dugout Canyon CIA by Canyon Fuel Company and its predecessors. A number of springs also were identified in SUNEDCO's Sage Point/Dugout Canyon MRP, in the original Soldier Canyon Mine permit application, by Waddell and others (1986), on USGS topographic quadrangles, in a 1993-1994 survey by EIS (sub-Appendix C of Appendix 7-3, Dugout PAP,), and by Seiler and Baskin (1988). (The EIS survey was patterned after a 1981 survey by PG&E but the PG&E survey itself was not available.) Plate 1 shows locations for springs, streams and surface water monitoring sites, bore holes, and ground-water monitoring wells. Plate 2 provides identification of the springs and surface monitoring sites and Plate 3 identifies bore holes and wells. There are multiple names for many of the springs; Table 2 gives locations of identified springs and correlates different names that have been used. Additional information may require revision of Table 2.

CHIA - SOLDIER CREEK AND DUGOUT CANYON MINES

FORMATION (possible alternative)	ELEV	LOCATION			NAME OR NUMBER						NOTES and COMMENTS
		Latitude and Longitude		Township and Range	Canyon Fuel Company CANYON FUEL COMPANY (1997)		SUNEDCO Sage Point/ Dugout Canyon MRP	Soldier Canyon MRP	USGS	EIS (1993; PG&E 1981)	Name (Most from Sage Point/ Dugout Canyon MRP)	Vaughn Hansen Assoc (1980)	
		39°	110°		Sldr Cyn	Dug't Cyn							
COLTON				13 S 12 E									
	8360*	42 40	31 06	12 adb s1		SC-50	50		*G-96		Wasatch		*Waddell and others (1986), Table 5 shows G-96 at 8360' elev. in Colton Fm., corresponding with 50, but Plate 1 shows G-96 at same location as 51 in Flagstaff at approx. 8000' elev.
				12 adb s2		SC-99							
(alluvium)	7670	43 37	33 09	35 cca		SC-46	46				Contact		
(alluvium; possibly Flagstaff)	7670	43 33	33 13	35 ccc		SC-45	45				Park		
				13 S 13 E									
(*North Horn; Flagstaff; near Colton - Flagstaff contact; this spring is also listed under North Horn)	8200	41 58	30 23	18 bac		SC-65	65						*Dugout Ck. MRP Plate 6-1 and 7-1 indicate Colton; Sage Ck. Table IV-B.11 indicates North Horn.
(Flagstaff)				20 aaa s1		SC-110							
(Flagstaff)				20 aaa s2		SC-111							
FLAGSTAFF				12 S 11 E									
(alluvium)				35 daa						CC-27			in canyon bottom-stream bed (EIS).
(alluvium)				35 dad						CC-28			in canyon bottom-stream bed (EIS).
	7080	44 09	37 50	36 aad	1		52						
(alluvium)				36 dbd						CC-37			in canyon bottom-stream bed (EIS).
				36 dca						CC-35			pond (EIS).
	8180			36 cdc	23					CC-36			possible bedrock spring (EIS).
				12 S 12 E									
	7560	44 22	37 13	30 dcc	2	SP-2	53						
	7400	44 00	35 33	33 bcc	3	SP-3	54						
	7605	43 32	34 15	34 ccd	4	SP-4	3						
				13 S 11 E									
	8064*			1 cca					*ACS1	CC-38			approx. 15 ft above stream bed (EIS); *Seiler and Baskin (1988).
(North Horn, alluvium)				1 ccd						CC-39			in canyon bottom-stream bed (EIS)
	7930	43 28	37 43	1 dab	5***		55	*S31-1	topo quad	CC-53		*S31-1	*shown in Sec 31 T12S, R12E, possible bedrock spring (EIS) ***two sites have been monitored as 5 by SOLDIER CREEK COAL COMPANY
	7940*			1 dab					*ACS2	CC-54			pond (EIS) *Seiler and Baskin (1988)
(North Horn)				1 dda	5***					CC-55			pond - labeled Spring 5 on EIS map ***two sites have been monitored as 5 by SOLDIER CREEK COAL COMPANY this is the current site apparently pipe flow into pond
(North Horn)	8040			12 bba	24					CC-40			possible bedrock spring (EIS)

TABLE 2 - Spring Names, Locations, and Geology for the Soldier and Dugout Canyon Mine Area

CHIA - SOLDIER CREEK AND DUGOUT CANYON MINES

FORMATION (possible alternative)	ELEV	LOCATION				NAME OR NUMBER							NOTES and COMMENTS
		Latitude and Longitude		Township and Range		Canyon Fuel Company CANYON FUEL COMPANY (1997)		SUNEDCO Sage Point/ Dugout Canyon MRP	Soldier Canyon MRP	USGS	EIS (1993; PG&E 1981)	Name (Most from Sage Point/ Dugout Canyon MRP)	Vaughn Hansen Assoc (1980)	
		39°	110°			Sldr Cyn	Dug't Cyn							
				13 S 12 E										
	7480	43 27	2934	4	acd	7	SP-7	57		*G-87				*Waddell and others (1986).
	7910	43 03	34 46	4	cdd	9	SP-9	33						
	7900	42 30	35 18	8	daa	15	SP-15	39		*G-90		Lower Little Pine		*Waddell and others (1986) - location of G-90 is unclear, may be either Spring 15 or 17.
	7940	42 31	35 25	9	cbb	17	SP-17	40	S8-1	*G-90; **topo quad;		Upper Little Pine	S8-1	*Waddell and others (1986). - location of G-90 is unclear, may be either Spring 15 or 17. **right on section line between sec's 8 and 9.
	8090*	42 11	43 39	9	dcc s1	18	SP-18	31		*G-91				*Waddell and others (1986) shows elevation as 8120.
	8090	42 12	34 18	9	ddc	20	SP-20	30		*G-92				*Waddell and others (1986).
	7740	42 55	33 26	10	abb	21	SP-21	4		*G-93		Water Hole		*Waddell and others (1986)
(alluvium)	7895	42 50	33 08	10	ada s1		SC-41	41						
	7870	42 42	33 11	10	adb s1	22	SP-22	42		*G-94		Pine Canyon		*Waddell and others (1986), includes stream seepage.
	7845	42 43	33 13	10	adb s2		SC-41A	41A						
	7990	42 34	32 16	11	acd		G-95	44		*G-95		Y Spring		*Waddell and others (1986), includes stream seepage.
(alluvium)	7980	42 42	32 56	11	bcb		SC-11	11						
(alluvium)	8070	42 45	32 42	11	cdb		SC-58	58						
(North Horn)				11	cba		SC-104							At contact with Flagstaff.
				11	bba s2		SC-105							
	7870	42 24	31 28	12	cad		SC-59	59						
	7940	42 28	31 48	12	cbb		G-97	49		*G-97				*Waddell and others (1986)
	8000*	42 32	31 17	12	dbb		G-96	51		*G-96				*Waddell and others (1986) Table 5 shows G-96 at 8360' elev in Colton Fm corresponding with 50 but Plate 1 shows G-96 at same location as 51 in Flagstaff at approx 8000' elev
				13	aaa s1		SC-115							
				13	aaa s2		SC-114							
	7920	41 58	30 49	13	aad		SC-83	60		*G-98				*Waddell and others (1986)
				15	b					*G-98.1				*Waddell and others (1986) same area as SC-12, SC-13, and SC-14
(Alluvium, at contact with North Horn)	8180	41 59	33 46	15	bac s1		SC-13	13						
(North horn)	8235	41 59	33 37	15	bad		SC-12	12						
				13 S 13 E										
				18	bbb		SC-84							
				18	bbc		SC-82							in canyon bottom-stream bed (DCMRP Plate 7-1).
				18	bbd s1		SC-85							in canyon bottom-stream bed (DCMRP Plate 7-1).
				18	bbd s2		SC-86							
(North Horn - at contact)				18	cab		SC-113							
(Colton - close to contact)				20	aaa s3		SC-112							in canyon bottom-stream bed (DCMRP Plate 7-1).
				20	aaa s4		SC-109							in canyon bottom-stream bed (DCMRP Plate 7-1).
(North Horn; at North horn - Flagstaff contact)				20	adb		SC-108							

Table 2 - continued - Spring Names, Locations, and Geology for the Soldier and Dugout Canyon Mine Area

CHIA - SOLDIER CREEK AND DUGOUT CANYON MINES

FORMATION (possible alternative)	ELEV	LOCATION			NAME OR NUMBER							NOTES and COMMENTS
		Latitude and Longitude		Township and Range	Canyon Fuel Company CANYON FUEL COMPANY (1997)		SUNEDCO Sage Point/ Dugout Canyon MRP	Soldier Canyon MRP	USGS	EIS (1993; PG&E 1981)	Name (Most from Sage Point/ Dugout Canyon MRP)	Vaughn Hansen Assoc (1980)	
		39°	110°		Sldr Cyn	Dug't Cyn							
NORTH HORN													
				13 S 11 E									
(North Horn - Price River contact)	7600			12 bcc					*ACS9				*Seiler and Baskin (1988).
				13 S 12 E									
(Flagstaff; at Flagstaff - North Horn contact)	7410	43 29	34 54	4 bdc	8	SP-8	2		*G-88 (Tf)				*Waddell and others (1986).
	6980	43 14	36 17	5 cbc s1	10	SP-10	8		*G-89		Sulfur		*Waddell and others (1986).
	6980*	43 16	36 16	5 cbc s2	11	SP-11	24		*ACS12				*Seiler and Baskin (1988), elevation listed as 6930.
	6970	43 09	36 20	5 ccb	12	SP-12	9						
(Castlegate)	7160			7 aba					*ACS13				*Seiler and Baskin (1988).
(Price River)	7600			7 cbb	14			S7-1				S7-1	
	6880	42 50	36 23	7 aad		SP-13	10						
	7840	42 26	35 18	8 dad	16	SP-16	38				Timber Road		
	8090	42 09	34 37	9 dcc s2	19	SP-19	32						
(Flagstaff - at contact)				12 cda s1		SC-100							
(Flagstaff - at contact)				12 cda s2		SC-101							
				13 cdb		SC-87							
				14 bdb		SC-102							
	8150	41 57	33 49	15 bac s2		SC-14	14				Buck Spring		
	8075	41 51	33 56	15 bca s1		SC-15	15						
	8050	41 49	34 00	15 bca s2		SC-16	16						
(Alluvium; at North Horn - Price River contact))	7800	41 42	34 22	16 adc		SC-17	17						
	7940	41 45	34 11	16 add		SC-18	18						
				13 S 13 E									
				17 ccc s1		SC-93							
				17 ccc s2		SC-95							
				17 ccd		SC-94							
(*Colton; Flagstaff; near Colton - Flagstaff contact; this spring is also listed under Colton.)	8200	41 58	30 23	18 bac		SC-65	65						*Dugout Ck. Plate 6-1 and 7-1 indicate Colton; Sage Ck. Table IV-B.1 indicates North Horn.
				18 cbd		SC-88							
(Flagstaff; at Flagstaff - North Horn contact)				18 dca		SC-89							
				19 aaa s1		SC-106							
				19 aaa s2		SC-116							
				19 aaa s3		SC-91							in canyon bottom-stream bed (DCMRP Plate 7-1).
				19 aad s1		SC-90							
				19 aad s2		SC-92							
				19 ada		SC-117							in canyon bottom-stream bed (DCMRP Plate 7-1).
				20 aac		SC-107							in canyon bottom-stream bed (DCMRP Plate 7-1).
				20 aca		SC-96							in canyon bottom-stream bed (DCMRP Plate 7-1).
				20 dac		SC-97							in canyon bottom-stream bed (DCMRP Plate 7-1).
				20 dad		SC-98							in canyon bottom-stream bed (DCMRP Plate 7-1).

Table 2 - continued - Spring Names, Locations, and Geology for the Soldier and Dugout Canyon Mine Area

CHIA - SOLDIER CREEK AND DUGOUT CANYON MINES

FORMATION (possible alternative)	ELEV	LOCATION				NAME OR NUMBER							NOTES and COMMENTS
		Latitude and Longitude		Township and Range		Canyon Fuel Company CANYON FUEL COMPANY (1997)		SUNEDCO Sage Point/ Dugout Canyon MRP	Soldier Canyon MRP	USGS	EIS (1993; PG&E 1981)	Name (Most from Sage Point/ Dugout Canyon MRP)	Vaughn Hansen Assoc (1980)	
		39°	110°			Sldr Cyn	Dug't Cyn							
	7940	40 32	28 17	21	cca			66				Pace Canyon		
PRICE RIVER				13 S 11 E										
(alluvium; North Horn*)	7320*			2	cdc					*ACS3	CC-7*			in canyon bottom-stream bed (EIS); *Seiler and Baskin (1988), shows ACS3 between CC-6 and CC-7.
(alluvium)				2	cdd						CC-6*			in canyon bottom-stream bed (EIS); *Seiler and Baskin (1988), shows ACS3 between CC-6 and CC-7.
				3	dbd						CC-18			"dry" (EIS).
				11	acc						CC-12			200 ft above streambed (EIS).
				13 S 12 E										
(North Horn; just below Price River - Blackhawk contact))	6880	42 50	36 23	7	aad	13	SP-13	10 (Kn)						
				11	cad		SC-103							Just below Flagstaff contact.
CASTLEGATE				13 S 11 E										
(Price River, alluvium)				3	dbb						CC-52			in canyon bottom-stream bed (EIS).
	7040			10	aaa					*ACS4				in canyon bottom-stream bed; *Seiler and Baskin (1988).
	7240			10	acb*					*ACS7				*Seiler and Baskin (1988), could be "acc".
(alluvium)				11	bbb						CC-5			in canyon bottom-stream bed (EIS).
				13 S 12 E										
				23	aad		SC-80							in canyon bottom-stream bed.
(Blackhawk; at Blackhawk - Castlegate contact)				23	ada		SC-81							
BLACKHAWK				13 S 11 E										
(alluvium)	6640*			10	bac					*ACS5	CC-3			in canyon bottom-stream bed (EIS); *Seiler and Baskin (1988).
	6600			10	bac					*ACS6				*Seiler and Baskin (1988).
(alluvium)				10	bad						CC-4			in canyon bottom-stream bed (EIS).
				10	d									25-1 in Centennial Project MRP.
	7000			11	cbd					*ACS8				*Seiler and Baskin (1988).
(Aberdeen)	6720	41 47	36 01	13	acc	6		56			CC-61	Drink		"not located" (EIS).
	6800			13	bdd					*ACS10				*Seiler and Baskin (1988).
(alluvium)				13	caa						CC-60			in canyon bottom-stream bed (EIS).
(alluvium)				13	dbc						CC-59			"no flow" (EIS).
(alluvium)				13	dca						CC-58			in canyon bottom-stream bed (EIS).
(alluvium)				14	bbc						CC-15			in canyon bottom-stream bed (EIS).
				14	bcb						CC-14			Issues from shale ledge (EIS).
(alluvium)	6460			15	bad					*ACS11				*Seiler and Baskin (1988).
(Mancos, alluvium)				15	dbd						CC-13			in canyon bottom-stream bed (EIS).

Table 2 - continued - Spring Names, Locations, and Geology for the Soldier and Dugout Canyon Mine Area

CHIA - SOLDIER CREEK AND DUGOUT CANYON MINES

FORMATION (possible alternative)	ELEV	LOCATION			NAME OR NUMBER							NOTES and COMMENTS
		Latitude and Longitude		Township and Range	Canyon Fuel Company CANYON FUEL COMPANY (1997)		SUNEDCO Sage Point/ Dugout Canyon MRP	Soldier Canyon MRP	USGS	EIS (1993; PG&E 1981)	Name (Most from Sage Point/ Dugout Canyon MRP)	Vaughn Hansen Assoc (1980)	
		39°	110°		Sldr Cyn	Dug't Cyn							
(near Mancos contact)	6920	40 44	34 21	13 S 12 E 21 dab		SC-61	61		*G-99		Corbula		*Waddell and others (1986).
(alluvium)	6950**	40 43	33 42	23 cbb		G-100	63		*G-100		Pictograph		*Waddell and others (1986); **Sage Creek MRP shows 6930
STARPOINT													The Starpoint is absent in parts of the Book Cliffs, and the Blackhawk and Mancos are interbedded.
(Mancos; just below Star Point contact)				*20 ddd		*SC-64							*probably same as Sage Point MRP spring 64; in canyon bottom-stream bed.
MANCOS													
(alluvium)				13 S 11 E 13 dcd						CC-57			in canyon bottom-stream bed (EIS).
(Black Hawk - just below Mancos - Blackhawk contact)		40 41	34 20	13 S 12 E 21 dac		SC-62	62		*G-99.5				*Waddell and others (1986); in canyon bottom-stream bed.
(alluvium)	6155**	40 23	35 20	*29 aaa			*64				Big Hole		*probably same as Dugout MRP spring SC-64 ; **topo maps show approximately 6400 feet at both 64 and SC-64; in canyon bottom-stream bed.

Table 2 - continued - Spring Names, Locations, and Geology for the Soldier and Dugout Canyon Mine Area

MW-1C, MW-1M, MW-2M, and MW-3M (Plate 2) were used to monitor water quality at the previously proposed waste rock disposal site beginning in 1991, but monitoring of these four wells was discontinued in 1997 when the proposed waste rock disposal site was removed from the Soldier Canyon Mine MRP. MW-1C was completed at the contact between surficial colluvium and Mancos Shale bedrock. The other three wells were completed in the Mancos Shale: MW-1M was drilled 50 feet into competent bedrock and MW-2M and MW-3M were drilled to elevations to match the elevation of MW-1M. The three bedrock wells were dry when initially measured soon after completion but subsequent water level measurements indicated a gradient of 0.021 to the north-northeast. This gradient, which is opposite to the apparent regional gradient in the Mancos, has been interpreted as indicating a mound of water that has been formed by seepage from nearby Anderson Reservoir into the Mancos. Water quality data support this concept. Water in the colluvium, measured in MW-1C, is perched on unsaturated shale and originates from the surface water system.

In August 1986 bore holes SC-11G, SC-12G, SC-13G were drilled from the Rock Canyon seam workings of the Soldier Canyon Mine down through the Gilson seam and a 13- to 20-foot thick, clean sandstone located approximately 40 to 50 feet below the Gilson seam. Hydraulic conductivities of $2x10^{-7}$ to 10^{-6} cm/sec were measured in SC-11G and SC-13G, but hydraulic conductivity was $1.5x10^{-3}$ cm/sec in SC-12G. The tests measured the hydraulic conductivity of the entire stratigraphic sequence. Ground water was under confined conditions in all three bore holes, but in SC-12G the measured head was 250 feet above the floor of the mine and water flowed into the mine until the hole was capped. The gradient determined from the three bore holes was 1,800 ft/mile (approximately 12°) in a direction N 11° E. Even assuming the bore holes measured the hydraulic properties of the same stratigraphic sequence at three different locations, the range of hydraulic conductivities shows great inhomogeneity and the true potentiometric surface is almost certainly not planar with a uniform dip to the north-northeast. No further measurements have been reported for these wells and they are no longer usable as far as is known. Information on these three bore holes, including driller's logs, is in Appendix 7-I of the Soldier Canyon Mine MRP.

Bore holes SC-2, SC-8, and SC-10 and a "gas boring" were also drilled from the Rock Canyon seam down to the Gilson seam some time prior to the boring of SC-11G, SC-12G, and SC-13G. Water levels measured in August 1986 in these four older borings indicated a potentiometric surface that roughly matched the strike and dip of the coal seam. It was concluded that the water in these uncased bore holes had drained from the mine floor and the water levels were not valid for determining a potentiometric surface (Appendix 7-I of the Soldier Canyon Mine MRP). Accessability and functionality of other in-mine borings is not discussed in the Soldier Canyon MRP.

Two water supply wells, #1 and #2, were constructed in 1980 at the Centennial Project, located to the west in Deadman Canyon. The Centennial MRP provides some information on their construction and testing. Well #1 was 130 feet deep and initially had a static water level 58 feet below the surface. The level was lowered to 67 feet after four hours of pumping at 50 gpm.

After three months of use the well was almost dry and there was little recharge. Well #2 was drilled to 155 feet and static water level was at 57 feet. Two hours of pumping at 30 gpm lowered the water level to 88 feet. The well was then deepened to 280 feet, and a second test lowered the level to 100 feet after only one hour pumping at 30 gpm. After three weeks well #2 almost stopped producing water, and recharge was very slow. These results indicate the aquifer is perched and small in size and not capable of sustained yield even though initial pump tests appeared favorable. Well #1 is monitored, but neither well is used for water supply because of excessive drawdown when pumped. [In the Mayo and Associates 14 August 1996 reports, Appendix 7-3 in the Soldier Canyon MRP and Appendix 7-M in the Dugout Canyon Mine MRP, these wells are identified as Water wells #1 and #3 on page 43 and the locations in Deadman Canyon are shown on Figure 9. The pump test and water level data for well #1 in these reports match the data for Centennial's Well #1 and data for well #3 match the data for Centennial's well #2.]

Four borings were done by Soldier Canyon Mine in Soldier Canyon to determine geotechnical properties and the potential for water inflow to a proposed #3 fan shaft. All four of those borings were dry (Exhibit 7.42-1, Soldier Canyon Mine MRP).

Most water entering the Soldier Canyon Mine comes through leaks in the mine roof. Average annual flow into the mine between 1988 and 1994 was approximately 420 gpm (220,000,000 gallons per year). Movement of water within the mine is managed by sumps, pumps and piping, and free flow along the mine floor. Water not used in the mine or lost to evaporation is collected in an in-mine settling pond and discharged to Soldier Creek through UPDES permitted discharge point 003, also identified as MW-2 (Mayo and Associates, 1996, p. 17).

Mine discharge rates in 1985 and 1987 to 1996, as measured at UPDES 003, varied from less than 100 gpm to over 700 gpm and averaged about 400 gpm (200,000,000 gallons per year). (UPDES data for 1986 were not available). Discharge rates increased slightly over the seven year period from 1987 to 1994. Canyon Fuel Company attributes the variability to changing water management practices in the Soldier Canyon Mine and measurement errors rather than to variations in flow into the mine; however, yearly coal production did increase slightly over that period, with production for 1989 through 1991 roughly double what is typical for the mine (Table 1).

During the exploration in 1995, the existing Dugout Canyon workings were found to be flooded. Water does not issue from the portals. Isotopic data indicate it is modern water.

Ground-water quality varies greatly, depending on geology, physiography, and elevation. Waddell and others (1986) indicate that TDS concentrations range from 250 to 2,000 mg/L in the Book Cliffs area. The best quality occurs in or near mountain recharge areas and the poorest quality in lowland areas. The chemical characteristics of the ground water vary vertically from formation-to-formation and areally within each formation. TDS in water from the Flagstaff Limestone ranges from 250 to 500 mg/L, whereas TDS in the Blackhawk and North Horn

Formations range from 500 to 2,000 mg/L. The principal chemical constituents in Flagstaff water are calcium and bicarbonate. Water from the Blackhawk is of variable chemical composition with no single dominant cation or anion. Where dissolved solids concentrations from water in the Blackhawk are affected by the Mancos Shale, sulfates of sodium and magnesium increase significantly. Waters from springs G99 and G99.5 that issue near the contact between the Blackhawk Formation and the Mancos Shale have specific conductances that indicate TDS concentrations of 1,600 and 2,000 mg/L, respectively (Mundorff, 1972; Waddell and others, 1986).

Saturation indexes indicate that most ground waters are at saturation with respect to calcite. Ground waters are generally undersaturated with respect to dolomite, gypsum, and anhydrite (Waddell and others, 1986).

Surface Water

The Soldier Canyon - Dugout Canyon CIA is situated in the Book Cliffs near the headwaters of the Price River basin (Figure 2). The CIA is drained by Coal and Soldier Creeks, perennial tributaries to the Price River (Figure 3, Plate 1) and numerous intermittent streams. Many streams that originate in the Book Cliffs are perennial at higher altitudes but become ephemeral as they emerge from the mountains and flow onto the lowlands (Waddell and others, 1981, p. 7)

Pine and Fish Creeks are major tributaries to Soldier Creek. Both are shown as intermittent streams on USGS topographic maps. However headwater areas in Pine Canyon are described as appearing to be perennial, and Fish Creek, based on observations and water monitoring data, is described as perennial in the vicinity of the proposed Dugout Canyon Mine (Dugout MRP p. 7-32).

Dugout and Pace Creeks are intermittent drainages, although, similar to Fish Creek, Dugout Creek is described as perennial in the vicinity of the proposed Dugout Mine (Dugout MRP p. 7-32). Dugout and Pace Creeks flow into Grassy Trail Creek several miles south of the Soldier Canyon - Dugout Canyon CIA boundary. Grassy Trail Creek is an intermittent tributary of the Price River. The Price River meets the Green River about 40 miles southeast of the mines (Figure 2). The Green River flows southward from its confluence with the Price River approximately 75 miles until it discharges into the Colorado River (Figure 1).

Flow in the Price River is regulated at Scofield Reservoir. Discharge is measured at several locations both upstream and downstream of the confluences with Coal, Soldier, and Grassy Trail Creeks. The area of the Price River drainage is 455 mile^2 above USGS gauging station 09313000 near Helper, approximately 17 miles upstream of Coal Creek, and 1,540 mile^2 above USGS streamflow gauging station 09314500 near Woodside, about 24 miles below the confluence with Soldier Creek (Figure 2). Between these two stations water is taken from the river and its tributaries for irrigation.

As of 1997, USGS water discharge data are available for station 093143000 for water years 1934 to 1969, 1979 to 1981, and 1990 to 1996. Records are fair except for estimated daily discharges, which are poor. [1] Extreme flows recorded were 9,340 cfs on September 13, 1940 and 0.4 cfs on August 21, 1961. The mean annual flow volume for the three periods of record is 110 cfs or 80,000 acre-feet/year.

USGS water discharge data are available for station 09314500 for water years 1909 to 1911 and 1945 to 1992. Records are fair except for estimated daily discharges, which are poor. Maximum recorded discharge was 11,200 cfs on September 7, 1991. Periods of no flow were recorded in 1960, 1961, 1963, and 1992. The mean annual flow volume (1947 to 1992) was 121 cfs or 88,000 acre-feet/year. Limited water quality data are available for 1946 to 1949, 1951 to 1988, and 1991 to 1996 (Table 3).

Discharge of the Green River has been measured at USGS gauging station 09315000 at Green River, Utah, about 12 miles below the confluence of the Price and Green Rivers (Figure 2). For water years 1894 to 1899 and 1904 to 1996 flow ranged from a minimum of 255 cfs on November 26, 1931 to a maximum of 68,100 cfs on June 27, 1917. Average annual discharge is 6,192 cfs or 4,484,000 acre-feet/year. Records are good except for estimated daily discharges, which are poor. Water quality data are available for 1928 to 1996 (Table 3).

Snowmelt is the major source of water for the perennial streams of the Price River basin. Intermittent and ephemeral streams are abundant, existing primarily at lower elevations where potential evapotranspiration exceeds precipitation. Intense summer thunderstorms may cause short-term flooding but not large volumes of runoff.

Water use in the higher elevations of the Price River basin is primarily for wildlife and stock watering purposes . The upper watershed provides most of the domestic water needs for the lower valley. Within the lower valley area, agricultural activities utilize some of the water (Mundorff, 1972). Minimum flows in the gauged streams and rivers in the basin occasionally reach zero. Storage reservoirs are common at higher elevations.

In general the quality of water in the headwaters of the Price River basin is excellent. Waddell and others (1981) report that the Price River and its tributaries generally have a TDS concentration of between 250 to 500 mg/L upstream from Helper, and the water type in this area is calcium bicarbonate. However, the quality of water in the Price River rapidly deteriorates down gradient. Below the town of Helper most flows originate on Mancos Shale or are irrigation return flows from lands situated on Mancos-derived soils (Price and Waddell, 1973). The Price

[1] "Good" means about 95% of reported daily discharges are within 10 % of the actual discharge, "fair" means within 15 %, "poor" means reported values have less than "fair" accuracy. Accuracy is based on 1) the stability of the stage-discharge relationship or, if the control is unstable, the frequency of discharge measurements; and 2) the accuracy of observations of stage, measurements of discharge, and interpretation of records.

River near the confluence with Soldier Creek has an average TDS content of about 1,700 mg/L, including sulfates of calcium, magnesium and sodium. At USGS station 09314500, the weighted average TDS content is between 2,000 and 4,000 mg/L, with the water type being strongly sodium sulfate (Mundorff, 1972).

Sediment yields from the upper portion of the Price River basin are small, with erosion rates varying from 0.1 to 0.5 ac-ft/mile^2/yr. Lowest rates are from the higher parts of the Book Cliffs, where exposed rocks are dominantly limestone and dolomite. The bulk of the sediment in the Price River comes from the more erodible sandstones and shales that are common at lower elevations, where annual sediment yields of 0.5 to 3.0 ac-ft/mile^2/yr are reported by Waddell and others (1981, Plate 6).

Surface Water Hydrology of the CIA

The Soldier Canyon - Dugout Canyon CIA covers approximately 42,000 acres of the Soldier, Coal, and Dugout Creek watersheds. Topography in the area is rugged, with elevations varying from 6,600 ft to approximately 8,300 feet above sea level. Slopes vary from vertical cliffs to less than 2% along the ridges.

Water resources within or adjacent to the Soldier Canyon - Dugout Canyon CIA include a few low yielding springs and streams. There are no major water bodies located within or adjacent to the CIA.

Soil cover varies with slope, with bare sandstone cliffs along the upper portions of the canyons, shallow silty soils on the milder slopes, and shallow sand-gravel alluvium in the channel bottoms. The soils classify as hydrologic soils group C and D. The infiltration rates of the soil results in moderately low infiltration capacity.

The approximate average annual sediment yield is 0.1 to 1.0 ac-ft/mile^2/yr across the CIA, but most of the area falls in the range of 0.5 to 1.0 ac-ft/mile^2/yr (Waddell and others, 1981, Plate 6). Thus, the average annual sediment yield of the Soldier Canyon - Dugout Canyon CIA is estimated to be 29 to 58 ac-ft/yr for undisturbed conditions.

Coal Creek

The headwater area of Coal Creek is near the crest of the Book Cliffs, on rocks of the Green River and Wasatch Formations, at an altitude of approximately 9,000 feet (Plate 1 and Figure 3). The stream cuts a steep, deep, narrow channel through Cretaceous strata to the base of the Book Cliffs, and from there meanders across a gently sloping plain on the Mancos Shale to its confluence with the Price River. USGS monitoring station 09313965 (Plates 1 and 2) is located on Starpoint Sandstone at an elevation of 6,370 feet, approximately 0.9 miles below the closed Knight Ideal Mine. The drainage area above station 09313965 is 25.3 miles^2 at an average

altitude of 7,700 feet. The stream is 8.8 miles long with a slope of 152 feet per mile (Waddell and others, 1986).

The USGS measured discharge of Coal Creek seasonally, May to November, for water years 1979 to 1981 at station 09323965. Record quality was good. As is typical of the region, most recorded flow was from snowmelt at the higher elevations, and in Coal Creek maximum daily mean discharge for the three-year period was 30 to 80 cfs from late May to early June. Maximum measured flow, 458 cfs on August 13, 1979, resulted from a thunderstorm, and no flow was observed for part of at least one day (Price and Plantz, 1987). Maximum and minimum daily mean discharges were 120 cfs on September 10, 1980 and 0.02 cfs on August 6 through 9, 1981 (USGS, 1981, 1982).

Baseflow measurements (Price and Plantz, 1987) indicate that in the reach above the Knight Ideal Mine the creek gains baseflow from the Blackhawk Formation at all flow stages. Below the mine, in the lower Blackhawk Formation and Starpoint Sandstone, the measurements indicate the creek gains flow at high stages and loses flow at low stages.

Water quality was measured in twenty-two samples from station 09313965 from 1979 to 1981. TDS ranged from 480 to 810 mg/L, with a mean value of 605 mg/L. Dominant cations were magnesium and sodium and dominant anions were bicarbonate and sulfate (Price and Plantz, 1987). Only three samples were analyzed for mercury, but mercury concentrations ranged from below-detection-limits up to 5 µg/L, the latter exceeding Utah Division of Water Quality criteria for domestic water sources (2 µg/L, Class 1C) and aquatic wildlife (2.4 µg/L, Classes 3A-3D).

Phenols come from natural organic sources but can also be indicators of polluting effluents from industrial processes, including coal mining. The limit for Class 1C waters is 300 µg/L (UDWQ, 1994). The Utah water quality standard for phenol for aquatic wildlife (Classes 3A-3D) is 10 µg/L. For many species of fish 5 µg/L has been reported to be harmful (Waddell and others, 1981). Phenol concentrations, determined from 9 samples, were from below-detection-limits to 35 µg/L (Price and Plantz, 1987).

Total Suspended Solids (TSS) in thirteen samples ranged from 3 to 2,710 mg/L. Calculated instantaneous sediment loads for the three water years ranged from less than 0.01 tons/day to 302 tons/day. Coal was only 0.4% of stream-bottom sediment (Price and Plantz, 1987).

Price and Plantz (1987) reported a healthy stream-bottom environment, indicated by benthic-invertebrate diversity. Phytoplankton had a fairly uniform distribution of green algae, probably reflecting the fairly good chemical quality of the water.

Soldier Creek

The headwaters of Soldier Creek are located in the Roan Cliffs and Whitmore Park as shown on Plate 1 and Figure 3. The creek flows for 13.5 miles generally southward to the Anderson Reservoir diversion. Anderson Reservoir stores water for irrigated fields. Soldier Creek discharges into the Price River about 10 miles south of the reservoir diversion. The lower 19 miles of Soldier Creek flows over Mancos Shale.

Soldier Creek is intermittent above G-1 (Plate 2), with springs contributing small quantities of water that maintain portions of the stream before the water is consumed by evaporation and infiltration. The stream is perennial between sampling location G-1 and the Anderson Reservoir diversion. Soldier Creek would be perennial in the reach between the diversion and the confluence with the Price River but irrigation often consumes the entire flow during the low-flow period.

Station G-1 monitors flow from an area of 5.4 mi^2 with an average altitude of 7,900 feet. The average stream gradient is 10% and the average gradient of the land surface is about 30%. From 1987 to 1993 Canyon Fuel Company sampled water from Soldier Creek at station G-1 from one to four times per year. Instantaneous flow varied from 1.7 cfs to 0.09 cfs, but some reports showing water quality data do not quantify flow volume. TDS ranged from 392 to 656 mg/L (see Appendix A of Appendix 7M, Soldier Canyon Mine MRP).

In 1997 UDOGM approved station G-6 to replace station G-1 for monitoring Soldier Creek upstream of the Soldier Canyon Mine disturbed area. G-6 is much closer to the disturbed area and will provide a more accurate basis for determining the impacts of mine operations on Soldier Creek. The plan is for G-1 and G-6 to be monitored concurrently for two years before abandoning G-1 after 1998. G-6 is also near the contact of the Blackhawk Formation and Castlegate Sandstone and will be used as part of a baseflow study.

Although the exact location of sampling location G-4 on Soldier Creek is no longer known, it was just below the confluence with Pine Creek. The watershed upstream of G-4 has a total area of about 15 $mile^2$. Water quality of Soldier Creek at G-4 is similar to that of Pine Creek. TDS concentrations in 54 samples, collected 1976 through 1986, varied from 310 mg/L to 860 mg/L and averaged 455 ($\sigma_{n-1} = 111$). The dominant constituents were calcium and bicarbonates. The pH varied from 7.6 to 9.84 (67 samples). Average pH was 8.3 ($\sigma_{n-1} = 0.4$). Suspended solids concentrations as high as 12,000 mg/L were measured during the February to May snowmelt, but typical levels were less than 70 mg/L (Appendix A of Appendix 7M, Soldier Canyon Mine MRP).

Sampling point G-5 is located on Soldier Creek just downstream from the Soldier Canyon Mine (Plate 2). The station is the same as USGS stream gauging station 09313975. The altitude of the gauge is 6,650 feet. Area of the drainage basin above the gauging station is 17.7 mi^2 and average elevation of the basin is 7,599 feet. The stream channel is 5.9 miles long and 10 to 20 ft wide near the gauging station. The creek bottom is on rocky alluvium and occasional outcrops of bedrock. Average stream channel gradient is 6% and average gradient of the land surface is 30%. For the entire basin, average stream and land gradients are 4% and 23%, respectively (Soldier

Canyon Mine MRP, p. 7-47).

The period of record for data from USGS station 09313975 is from September 1978 to September 1984 but measurements were seasonal with no measurements from December to February. Measured maximum and minimum discharges were 472 cfs on September 23, 1981 and 0.08 cfs on August 5, 1981 (Price and Plantz, 1987). Maximum and minimum daily mean discharges were 88 cfs in late May 1980 and 0.17 cfs in early August 1981 (USGS, 1981, 1982). Instantaneous flow at G-5, measured quarterly from June 1985 to October 1997 by Soldier Creek Coal Company, averaged 3.2 cfs ($\sigma_{n-1} = 5$). Maximum reported flow was 21.3 cfs and minimum reported flow was 0.35 cfs, but there was no flow measurement reported for several quarters even though water samples were collected.

Baseflow measurements (Price and Plantz, 1987) indicate that, at high stage, Soldier Creek loses flow across the Castlegate Sandstone and upper Blackhawk Formation but gains flow at lower stages. The middle Blackhawk Formation, above the Soldier Canyon Mine and station 09313975, gains at all stages.

Water quality was measured at sampling location G-5 by Soldier Creek Coal Company from 1979 to 1997 (Appendix A of Appendix 7M, Soldier Canyon Mine MRP and UDOGM database) and by the USGS from 1979 to 1984 (Price and Plantz, 1987). The USGS data do not reflect as much variability as the data obtained by Soldier Creek Coal Company. TDS measured by the USGS (31 samples) varied from 280 to 710 mg/L and averaged 533 mg/L, but in the mine operator's 83 samples values ranged from 220 to 1,566 mg/L and averaged 641 ($\sigma_{n-1} = 243$), with the higher concentrations generally occurring during summer months when flows were low. The dominant constituent was calcium bicarbonate; however, the higher TDS samples showed increases of bicarbonates of sodium and calcium with some increase in sulfates. The pH level varied from 7.5 to 8.7 with most samples being between 7.8 and 8.2. Suspended solid concentrations were generally less than 60 mg/L, with higher levels occurring during spring and early summer.

Phenol concentrations reported by Price and Plantz (1987) for 15 samples ranged from below-detection-limits to 38 µg/L.

Water in the vicinity of the Soldier Canyon Mine is typical of the regional environment. A comparison of Soldier Creek water quality data with Table 3 indicates that the quality of Soldier Creek water near the mine is much better than the quality of Price River water.

Pine Creek

The headwaters of Pine Creek are located in the area between the Book Cliffs and the Roan Cliffs near the northeastern part of the Soldier Canyon - Dugout Canyon CIA (Figure 3 and Plate 1). The creek flows generally westward for approximately 4 miles and discharges into Soldier Creek, 120 ft below surface-water sampling location G-3. The drainage area above G-3 is

3.5 miles^2, with an average altitude of 7,943 ft. The stream channel is narrow, 2 to 6 ft, for most of its length, and is on alluvium except for occasional outcrops of bedrock. The average gradient of the stream channel is 9%, and the average gradient of the land surface is 21% (Soldier Canyon Mine MRP, p. 7-48).

Pine Creek contains water throughout its length most of the time. However, during periods of unusually low precipitation, there are dry reaches between the springs that feed the stream. Such a dry period occurred in the summer of 1977 when there was no flow observed at G-3 during three visits (Soldier Canyon Mine MRP p 7-49).

Water quality in Pine Creek is good to excellent at G-3. In samples collected from 1976 through 1985 specific conductance varied from 430 to 756 mmhos/cm at 25^{0}C. Average value of 32 samples is 541 mmhos/cm ($\sigma_{n-1} = 84$). The water is predominantly a calcium bicarbonate type but a few samples showed high levels of sodium sulfate. The pH in 25 samples varied from 7.9 to 8.6, averaging 8.3 ($\sigma_{n-1} = 0.2$) (Appendix A of Appendix 7M, Soldier Canyon Mine MRP). Typically, suspended solid levels were below 60 mg/L except during spring snowmelt, when concentrations exceeded 450 mg/L. Storm runoff has produced suspended solids concentrations above 20,000 mg/L (Soldier Canyon Mine MRP, p. 7-49).

Dugout Creek

Dugout Creek originates at an elevation of approximately 8,800 feet, near the crest of the Book Cliffs (Figure 3 and Plate 1). It cuts a steep, deep canyon through the Book Cliffs, similar to the other major streams in the area. From the base of the escarpment Dugout Creek meanders across the Mancos Shale and flows into Grassy Creek, which is tributary to the Price River. Flow from Dugout Creek is diverted into the Pace Creek drainage for irrigation in Clark Valley (Plate 1), but farther downstream Pace Creek is itself tributary to Dugout Creek . The Dugout Canyon Mine will have portals along Dugout Creek, and the disturbed area will include a culvert to carry the stream beneath the mine pad for approximately 2,000 feet.

USGS station 09313985 is at an elevation of 6,960 feet, where Dugout Creek flows across the Blackhawk Formation. Seasonal records were collected during water years 1980 and 1981. Most flow was from snowmelt during May and June, and maximum average daily mean flows were 15 to 40 cfs during May (Price and Plantz, 1987, Figure 17). Thunderstorms in August and September produced high-flow peaks, and the highest recorded flow was 127 cfs from a thunderstorm on September 5, 1981. No flow was observed for part of at least one day (Price and Plantz, 1987, Table 3). For the two years, minimum and maximum mean daily flows were 0.05 cfs and 19.0 cfs with a mean daily flow of 1.8 cfs (Price and Plantz, 1987, Table 11). Canyon Fuel Company personnel have described the stream as perennial above the Dugout Canyon minesite but intermittent through the minesite.

Water quality appears to be slightly better in Dugout Creek than in Soldier and Coal Creeks. TDS in 15 samples collected during water years 1980 and 1981 ranged form 350 to 480

mg/L, with a mean of 396 mg/L. The dominant cations were calcium and magnesium and bicarbonate was the dominant anion (Price and Plantz, 1987). No constituent for which analysis was done was found in exceedance of Utah water quality standards. The maximum phenol concentration

CHIA - SOLDIER CANYON AND DUGOUT CANYON MINES

SUMMARY OF SELECT WATER QUALITY DATA FROM USGS STATIONS PRICE RIVER AT WOODSIDE AND GREEN RIVER AT GREEN RIVER UTAH

STATION NUMBER	STATION NAME	WATER YEAR		SPECIFIC CONDUCTANCE (micromohs)	pH (units)	TEMPERATURE (deg. C)	DISSOLVED SOLIDS RESIDUE at 180 deg. C	CALCIUM Ca	MAGNESIUM Mg	SODIUM Na	POTASSIUM K	CHLORIDE Cl	SULFATE SO_4	BICARBONATE HCO_3	IRON TOTAL Fe	IRON DISSOLVED Fe	MANGANESE TOTAL Mn	MANGANESE DISSOLVED Mn	SUSPENDED SEDIMENT
09314500	Price River at Woodside	1975-76	Min.	2,200	8.2	0	1,070	170	85	230	7.0	31	1,000	260	-	-	-	-	-
			Max.	4,950	8.0	26.5	4,830	310	250	730	12.0	78	2,000	330	-	-	-	-	-
		1976-77	Min.	1,370	7.4	0	1,150	220	16	77	7.0	15	600	170	440	10	-	8	17
			Max.	6,950	8.7	29.0	6,770	400	350	1,100	15.0	130	4,300	570	510,000	70	16,000	110	69,400
		1977-78	Min.	1,140	7.6	0	1,290	110	79	190	4.0	22	640	40	10	10	90	10	27
			Max.	6,090	8.7	26.0	4,990	330	290	760	13.0	100	3,100	450	18,000	20	860	60	4,420
		1978-79	Min.	1,110	8.0	-	822	83	51	110	3.4	17	390	240	280	-	10	-	16
			Max.	6,540	8.4	21.5	6,240	250	320	990	17.0	110	3,700	500	46,000	-	1,300	20	5, 560
		1979-80	Min.	1,090	8.0	0	761	-	-	-	-	-	-	270	-	0	-	-	93
			Max.	5,510	8.7	23.0	5,660	-	-	-	-	-	-	520	63,000	-	2,600	10	12,200
		1980-81	Min.	2,720	8.0	0	2,070	130	130	300	7.2	52	1,300	160		-	-	-	0
			Max.	4,480	8.3	21.0	3,860	250	230	640	12.0	96	2,500	330	-	-	180	-	5,200
		1981-82	Min.	1,170	8.0	0	830	82	53	97	2.9	16	360	194	9,600		240		150
			Max.	4,080	8.3	23.5	2,880	240	210	530	8.9	90	2,100	350	24,000		820		23,000
		1982-83	Min.	830	8.2	0	830	82	53	97	2.3	17	210	210	-		-	-	110
			Max.	3,920	8.4	20.0	3,500	260	220	520	8.9	79	2,200	340	36 000	-	960	-	12,000
09315000	Green River at Green River	1975-76	Min.	450	8.1	0	276	41	19	30	1.0	7.7	110	150	570	0	30	0	32
			Max.	1,030	8.7	26.0	704	82	35	110	3.3	35	300	270	32,000	60	1,000	20	3,403
		1976-77	Min.	530	7.7	0	335	49	15	44	2.1	15	150	160	1,300	0	30	0	-
			Max.	1,520	8.7	29.0	1,210	190	43	110	7.0	33	670	300	330,000	190	7,600	20	18,300.
		1977-78	Min.	300	7.9	0	212	33	13	33	1.0	7.1	69	190	1,700	10	50	0	95
			Max.	1,070	8.5	28.5	756	81	39	120	3.5	38	350	270	21,000	40	630	10	13,400
		1978-79	Min.	300	8.0	0	273	35	15	29	-	8	86	-	830	0	40	0	49
			Max.	1,240	8.5	28.0	852	87	42	110	9.5	41	390	330	19,000	120	500	8	47,500
		1979-80	Min.	320	7.6	0	214	29	12	21	1.5	7.4	70	130	2,000	<10	50	1	60
			Max.	1,310	8.5	27.0	798	85	37	110	5.0	38	410	260	39,000	40	1,100	10	11,600
		1980-81	Min.	320	7.8	0	273	47	19	50	1.8	14	160	110	1,200	<10	40	1	19
			Max.	1,200	8.3	26.0	852	82	41	110	3.7	40	350	190	27,000	30	880	10	5,760
		1981-82	Min.	290	8.0	0	196	29	10	19	0.6	6	60	90	10,000	5	210	<1	134
			Max.	1,060	8.4	27.5	749	82	40	100	3.3	37	320	180	31,000	20	840	6	16,700
		1982-83	Min.	400	8.0	0	494	30	15	29	-	9.3	98	111	-	6	-	3	64
			Max.	960	8.4	25.0	584	69	32	76	-	25	270	104	-	31	-	130	5,650

Notes: Station locations: See Figure 4 (Price River Drainage Basin. Constituents : in mg/L, except manganese and iron, which are in micrograms/L Specific Conductance: field determinations. pH: field determinations.

TABLE 3

was 10 µg/L, which just matches the Utah water quality standard for aquatic wildlife of 10 µg/L.

TSS ranged from 5 mg/L to 1,000 mg/L, correlating with periods of low and high flow, respectively. Instantaneous suspended-sediment loads ranged from less than 0.01 to 38 tons/day. Benthic invertebrae showed good diversity based on two samples collected in water year 1980, and green algae showed fairly uniform distribution based on five samples of phytoplankton collected in water year 1981 (Price and Plantz, 1987).

Pace Creek

Pace Creek is similar to Dugout Creek, originating in the Book Cliffs at an elevation of approximately 8,800 feet and cutting a steep, deep canyon through the Book Cliffs. Flow from Dugout Creek is diverted into Pace Creek for irrigation in Clark Valley, but farther downstream Pace Creek is itself tributary to Dugout Creek, which is in turn tributary to Grassy Trail Creek (Plate 1) .

Pace Creek was monitored at three locations, shown on Plate 2, for the Sage Point-Dugout Canyon Mine: at site 70 just below where the irrigation diversion from Dugout Creek flows into Pace Creek, at site PC1 at the base of the Book Cliffs just downstream of the Pace Canyon Mine , and at site PC2 in the Book Cliffs at the boundary between two sub-drainages. The Pace Canyon Mine was last active in 1940 (Doelling, 1972). The irrigation water diverted from Dugout Creek has been monitored at site 69, just before it flows into Pace Creek.

IV. IDENTIFY HYDROLOGIC CONCERNS

The CHIA is based on the best currently available data and is a prediction of mining related impacts to the hydrologic balance outside of the specific permitted coal mine areas. To verify that conditions remain within acceptable limits the mine operator is required to monitor water quality and quantity as part of the permit requirements. The plans for monitoring are set forth in the Mining and Reclamation Plans (MRP) for the Centennial Project and the Soldier and Dugout Canyon Mines and have been determined adequate by UDOGM to meet regulatory requirements. If monitoring results show significant departures from the values established in the MRP's and in this CHIA or exceed UPDES discharge requirements, immediate remedial actions are provided for by SMCRA.

Water quality standards for surface waters in the State of Utah are found in R317-2, Utah Administrative Code (UAC). The standards are intended to protect the waters against controllable pollution. Waters, and the applicable standards, are grouped into classes based on beneficial use designations. The Utah Division of Water Quality of the Department of Environmental Quality has classified surface waters in the Soldier Canyon - Dugout Canyon CIA as:

- 2B - protected for recreational uses except swimming,
- 3C - protected for nongame fish and aquatic life, and
- 4 - protected for agricultural uses.

General hydrologic concerns include changes of flow rates and chemical composition that could physically affect the off-permit hydrologic balance. Changes to the existing hydrologic regime or balance need to be limited in order to prevent economic loss to existing agricultural and livestock enterprises, prevent significant alteration to the channel size or gradient, and maintain adequate capacity for existing fish and wildlife communities. The basis for the limiting value of a parameter may differ according to specific site conditions.

Sediment is a common constituent of ephemeral stream flow in the western United States. The quantity of sediment in the flows affects stream-channel stability and most uses of the water. Excessive sediment deposition is detrimental to existing aquatic and wildlife communities. Large concentrations of sediment in streamflow may preclude use of the water for irrigating crops because fine sediment tends to reduce infiltration rates in the irrigated fields, and the sediment reduces capacities of storage facilities and damages pumping equipment. Mean sediment load is the indicator parameter for evaluating the sediment hazard to stream-channel stability and irrigation.

The concentration of dissolved solids is commonly used to indicate general water quality with respect to inorganic constituents. The quality of water from underground sources reflects the chemical composition of the rocks it passes through. That quality may be degraded by

intrusion of poorer quality water from wells or mines, by leakage from adjoining formations, or by recharge through disturbed materials. Ground water discharging from seeps and springs is used by wildlife and livestock. The state standard for TDS for irrigation of crops and stockwatering (Class 4) is 1,200 mg/L.

The Utah Department of Environmental Quality, Division of Water Quality can authorize a coal mine to discharge into surface waters under the Utah Pollutant Discharge Elimination System (UPDES). At the time this CHIA was prepared, the Dugout Canyon Mine had applied for two UPDES permits, one to discharge from the planned sediment pond and a second to discharge directly from underground sumps to Dugout Creek. However, copies of the Dugout UPDES permits were not available, so discussion is based mainly on the Soldier Canyon Mine UPDES permit, supplemented with information from UPDES permits at other coal mines.

The Soldier Canyon Mine UPDES permit contains site-specific limitations on TDS, total suspended solids, total settleable solids (for discharges resulting from precipitation events), total iron, oil and grease, and pH. There is no limit on flow but it is to be measured monthly. Additionally, there can be no more than a trace amount of visible sheen, floating solids, or foam and no discharge of sanitary waste or coal process water.

Macroinvertebrates are excellent indicators of stream quality and can be used to evaluate suitability of a stream to support fish and other aquatic life. Baseline studies of invertebrates (Lines and Plantz, 1981; Waddell, 1982; and USGS 1980, 1981, and 1982) provide standards against which actual conditions in Coal, Soldier, and Dugout Creeks can be evaluated if desired. Price and Plantz (1987) summarized invertebrate data.

Utah water quality standards exist for numerous parameters other than those already mentioned above, but at this time there is no evidence or reason indicating they are of concern or have a reasonable potential to affect the hydrologic balance of the CIA. However, those parameters that may have a reasonable possibility of affecting the hydrologic systems are included in routine water quality monitoring of the mine operations. Review of monitoring results by the mine operators and UDOGM will identify concerns or problems and generate revisions of the mine operations to mitigate those problems.

V. IDENTIFY RELEVANT STANDARDS

RELEVANT STANDARDS

Flow: There is no standard for flow in either the Soldier Canyon Mine UPDES permit nor in Utah water quality standards. At the Soldier Canyon Mine UPDES discharge is to be recorded twice monthly. It is not expected that the Dugout Canyon Mine UPDES permit will have a flow limitation. Characteristics such as stream morphology, vertebrate and invertebrate populations, and water chemistry can be affected by changes in flow and therefore can provide an indirect standard for flow.

Oil and Grease: There is no State water quality standard for oil and grease, but the UPDES permit limit for the Soldier Canyon Mine is a daily maximum of 10 mg/L; only one sample a month, either grab or composite, is required to measure this, but weekly visual monitoring is required. A 10 mg/L oil and grease limit does not protect fish and benthic organisms from soluble oils such as those used in longwall hydraulic systems, and UDWR has recommended soluble oils be limited to 1 mg/L (Darrell H. Nish, Acting Director UDWR, letter dated April 17, 1989 to Dianne R. Nielsen, Director UDOGM).

Total Dissolved Solids (TDS) concentrations: The concentration of dissolved solids is commonly used to indicate general water quality with respect to inorganic constituents. There is no state water quality standard for TDS for Classes 1, 2, and 3, but 1,200 mg/l is the limit for agricultural use (Class 4). The Soldier Canyon Mine UPDES permit limits instantaneous TDS concentration to 1,200 mg/L, determined by 2 grab samples a month. The total amount of dissolved solids discharged from all Soldier Canyon Mine operations is limited to 5 tons per day, determined by the twice monthly measurements of flow and TDS.

pH: Allowable pH ranges are 6.5 to 9.0 under both the Soldier Canyon Mine UPDES permit and State water quality standards for all Classes.

Total Suspended Solids (TSS) and Settleable Solids: There is no State water quality standard for solids in the water, but an increase in turbidity is limited to 10 NTU for Class 2A, 2B, 3A, and 3B waters and to 15 NTU for Class 3C and 3D waters. Soldier Canyon Mine's UPDES permit allows a daily maximum of 70 mg/L TSS but limits the 30-day average to 25 mg/L; 2 grab samples a month are used to determine TSS.

Under Soldier Canyon Mine UPDES permit, all samples collected during storm water discharge events are to be analyzed for settleable solids. Samples collected from increased discharge, overflow, or bypass that is the result of precipitation that does not exceed the 10-year, 24-hour precipitation event can comply with a settleable solids standard of 0.5 mL/L daily maximum rather than the TSS standard, although TSS is still to be determined. If the increased discharge, overflow, or bypass is the result of precipitation that exceeds

the 10-year, 24-hour precipitation event, then neither the TSS nor settleable solids standard applies.

Iron and Manganese: The Soldier Canyon Mine UPDES permit allows a daily maximum of 1.0 mg/L total iron, which is based on an assumption that total and dissolved iron concentrations are the same. Grab samples are taken twice a month to determine iron concentration. With approval from the Division of Water Quality, up to 2 mg/L total iron can be discharged under certain circumstances, which include maintaining dissolved iron at or below 1 mg/L. State water quality standards allow a maximum of 1,000 µg/L dissolved iron in Class 3A, 3B, 3C, and 3D waters, with no standard for Class 1, 2, and 4 waters.

Monitoring of total manganese is required by SMCRA and the Utah Coal Mining rules, but there is no UPDES or water quality standard for either total or dissolved manganese.

Macroinvertebrates: Macroinvertebrates are excellent indicators of stream quality and can be used to evaluate suitability of a stream to support fish and other aquatic life. Baseline studies of invertebrates (Lines and Plantz, 1981; Waddell, 1982; and USGS 1980, 1981, and 1982) provide standards against which actual conditions in Coal, Soldier, and Dugout Creeks can be evaluated if desired. Price and Plantz (1987) summarized invertebrate data. There no current plans to monitor invertebrate populations in the streams of the CIA.

Utah water quality standards exist for numerous parameters other than those mentioned above, but at this time there is no evidence indicating or reason to believe that those parameters are of concern in the Soldier Canyon - Dugout Canyon CIA. However, a DOGM guideline recommends additional parameters for routine monitoring and most of those DOGM recommended parameters are included in the water quality monitoring of the mine operations.

MATERIAL DAMAGE

Material damage to the hydrologic balance would possibly manifest itself as an economic loss to the current and potential water users, would result in quantifiable reduction of the capability of an area to support fish and wildlife communities, or would cause other quantifiable adverse change to the hydrologic balance outside the permit area. The basis for determining material damage may be found to differ from site-to-site within the CIA according to specific site conditions. Surface-water and ground-water concerns have been identified for CHIA evaluation.

Parameters for surface-water quantity and quality

The potential material-damage concerns this CHIA focuses on are changes of surface flow rates and chemical composition that would physically affect the off-permit stream channel systems as they presently function and affect aquatic and wildlife communities and agricultural and livestock production. Therefore, criteria are intended to identify changes in the present discharge regime that might be indicators of economic loss to existing agricultural and livestock enterprises;

of significant alteration to the channel size, or gradient; of a loss of capacity to support existing fish and wildlife communities. In order to assess the potential for material-damage to these elements of the hydrologic system, the following indicator parameters were selected for evaluation at each evaluation site: low-flow discharge rate, TDS, and sediment load.

The surface-water concerns will be evaluated at 25-2 in the Coal Creek drainage; G-1, G-2, G-5, G-6, G-7, G-8, G-9, and G-10 in the Soldier Creek drainage; and DC-1, DC-2, DC-3, DC-4, and DC-5 in the Dugout Creek drainage. Locations are identified on Plate 2.

Low-Flow Discharge Rate

Measurements provided by mine operators are generally of instantaneous flow and provide some indication of long-term trends, but are probably no more accurate either individually or as a whole than the "poor" USGS measurements. In the Wasatch Plateau Waddell and others (1981) found that correlating three years of low-flow records (September) at stream sites against corresponding records from long-term monitoring sites would allow the development of a relationship that could be used to estimate future low-flow volumes at the stream sites within a standard deviation of approximately 20 %. Ten years of record reduced the standard deviation to 16 - 17 % and 15 years of data to about 15 %. This relationship has not been demonstrated for streams in the Book Cliffs; however, it indicates that a change in low-flow rates of less than 15 to 20 % probably would not be detectable. A 20% decrease in the low-flow rate will provide a threshold indicator that decreased flows are persisting and that an evaluation for material damage is needed.

Monitoring of low-flow discharge rates will also provide a means to evaluate effects of mine discharge on the receiving streams. Mine discharge water will be monitored at Soldier Canyon Mine UPDES discharge points 001 and 002 and Dugout Canyon Mine discharge will be monitored at UPDES discharge points at the sediment pond and the direct discharge from the mine. The potential for material damage by mine discharge water is tied to the effect on the flow in the receiving streams.

Total Dissolved Solids (TDS)

The concentration of dissolved solids is commonly used to indicate general water quality with respect to inorganic constituents. Ground water discharging from seeps and springs is used by wildlife and livestock. Because wildlife and livestock use is the designated postmining land use, established dissolved solids tolerance levels for wildlife and livestock have been adopted as the thresholds beyond which material damage may occur. The state standard for TDS for irrigation of crops and stockwatering (Class 4) is 1,200 mg/L. If TDS concentrations persistently exceed 1,200 mg/L it will be an indication that evaluation for material damage might be needed. It must be kept in mind that there have been single samples from G-5, UPDES 003, and UPDES 001 on Soldier Creek in which TDS has exceeded this 1,200 mg/L threshold.

Sediment Load

Sediment is a common constituent of ephemeral stream flow in the western United States. The quantity of sediment in the flows affects stream-channel stability and most uses of the water. Excessive sediment deposition is detrimental to existing aquatic and wildlife communities. Large concentrations of sediment in streamflow may preclude use of the water for irrigating crops because fine sediment tends to reduce infiltration rates in the irrigated fields, and the sediment reduces capacities of storage facilities and damages pumping equipment. Sediment load measurement error is, at a minimum, the same as the flow measurement error because sediment load is directly dependent on flow and in practice cannot be measured more accurately than the flow.

TSS is the indicator parameter initially chosen for evaluating the sediment hazard to stream-channel stability and irrigation. Threshold values have initially been set as the greater of 1 standard error above the baseline mean TSS value or 120 % of the baseline mean TSS value (by analogy with the low-flow discharge rate measurement accuracy and assuming that the error in TSS will contribute equally to the error in flow when determining mean sediment load). If TSS concentrations persistently exceed these threshold values it will be an indication that evaluation for material damage from sediment load in the streams might be needed.

Parameters for ground-water quantity and quality

The potential material-damage concerns this of CHIA are intended to limit changes in the quantity and chemical composition of water from ground-water sources to magnitudes that: will not cause economic loss to existing or potential agricultural and livestock enterprises; will not degrade domestic supplies, would not cause structural damage to the aquifers; and will maintain adequate capacity for existing fish and wildlife communities.

To assess the potential for material damage to these elements of the ground-water hydrologic system, the following indicator parameters were selected for evaluation: seasonal flow from springs and TDS concentration in spring and mine-discharge water.

Ground-water concerns will be monitored at spring S25-1 in the Coal Creek drainage; springs 4, 5, 8, 10, 23, 24, SC-14, and SP-20 and wells 6-1, 32-1, and 10-2 in the Soldier Creek-Fish Creek drainage; springs SC-65, and SC-100 and well 11-2 in the Dugout Creek drainage; and well 24-1 in the Pace Creek drainage. Locations are identified on Plate 2.

Seasonal flow from springs

Maintain potentiometric heads that sustain average spring discharge rates, on a seasonal basis, equal or greater than 80% of the mean seasonal baseline discharge, in other words baseline minus 20% probable measurement error. The 20% measurement error is based on analogy with the accuracy of measuring low-flow surface discharge rates. A 20% decrease in flows,

determined on a seasonal basis, will indicate that decreased flows are probably persisting and that an evaluation for material damage is needed.

TDS concentration

The concentration of total dissolved solids is commonly used to indicate general water quality with respect to inorganic constituents. The quality of water from underground sources reflects the chemical composition of the rocks it passes through. Ground-water quality may be degraded by intrusion of poorer quality water from wells or mines, by leakage from adjoining formations, or by recharge through disturbed materials. Ground water discharging from seeps and springs is used by wildlife and livestock, and those are the designated postmining land uses. There is no water quality standard for TDS for aquatic wildlife. The state standard for TDS for irrigation of crops and stockwatering (Class 4) is 1,200 mg/L. If TDS concentrations persistently exceed 1,200 mg/L it will be an indication that evaluation for material damage might be needed..

Five samples were collected at Spring 6 in 1995 and 1996 that had consecutively increasing TDS and sulfate concentrations; TDS in the final two samples exceeded 1,200 mg/L. TDS concentrations at in-mine sampling location UG-11E have been consistently close to, and occasionally have exceeded, 1,200 mg/L. There was also a single sample from Spring 10 in which TDS exceeded 1,200 mg/L. So far there has been no evidence these concentrations above 1,200 mg/L have caused material damage to the hydrologic balance.

VI. ESTIMATE PROBABLE FUTURE IMPACTS OF MINING ACTIVITY

GROUND WATER

Dewatering and subsidence related to mining have the greatest potential for impacting ground-water resources in the CIA.

Dewatering

Underground mining removes the support to overlying rock causing caving and fracturing of the overburden. In most mining areas it is unlikely that fractures will reach shallower perched aquifers because of the thickness of the overburden, but in areas where fracturing is extensive, subsidence induced caving and fracturing can create conduits that allow ground water to flow into the mine. Dewatering caused by fracturing may decrease aquifer storage and ground-water flow to streams and springs (Figure 5). Water quality downstream from the mines could improve because water being discharged from coal mines in the Book Cliffs and Wasatch Plateau is often of better quality than natural spring flow or base flow.

Total ground-water storage above the Gilson seam at the Soldier Canyon Mine has been estimated by Canyon Fuel Company to be 490,000 ac-ft, assuming an average saturated thickness of 1,000 feet, an area of 4,900 acres, and a storage coefficient of 0.10 (Soldier Canyon Mine MRP p. 7-28). No estimate has been made for the Dugout Canyon Mine.

Average ground-water recharge for the 10.4 mi^2 of the Soldier Canyon Mine permit area is estimated to be 740 ac-ft using 9% as the average infiltration factor (Soldier Canyon Mine MRP Table 7.24-3). Because of hydrologic isolation between the Blackhawk Formation and the surface, Canyon Fuel Company does not foresee an increase in recharge rate at the surface caused by dewatering of deeper strata. A notable or measurable increase in recharge is also unlikely because recharge is generally available only for a few months during spring snowmelt and for very brief periods during summer thundershowers. During these seasonal, relatively short events the soils reach saturation quickly and reject most available water. Recharge and discharge relations for the Dugout Canyon area are discussed on page 7-31 of the Dugout Canyon Mine MRP, but no estimate of recharge volume is made.

Most water entering the Soldier Canyon Mine comes through leaks in the mine roof. Average annual flow into the Soldier Canyon Mine between 1985 and 1991 increased from about 160 acre-feet per year to approximately 1,000 acre-feet, with an average of 460 acre-feet per year (Soldier Canyon Mine MRP p. 7-151). Based on Soldier Canyon Mine Annual Reports, Mayo and Associates (Dugout Canyon Mine MRP Appendix 7-3, p. 17) calculated that the average annual flow into the mine between 1988 and 1994 was approximately 220,000,000 gallons per year (420 gpm or 680 acre-feet per year). Canyon Fuel Company's estimate of average ground-water interception due to continued mining activities at the Soldier Canyon Mine (Soldier Canyon

Mine MRP, p. 7-28) is 460 acre-feet per year (280 gpm or 150,000,000 gallons per year). The Blackhawk Formation is probably saturated in most areas (Waddell and others, 1986, p. 41) and the Dugout Canyon Mine should be expected to produce water at a rate similar to the Soldier Canyon Mine.

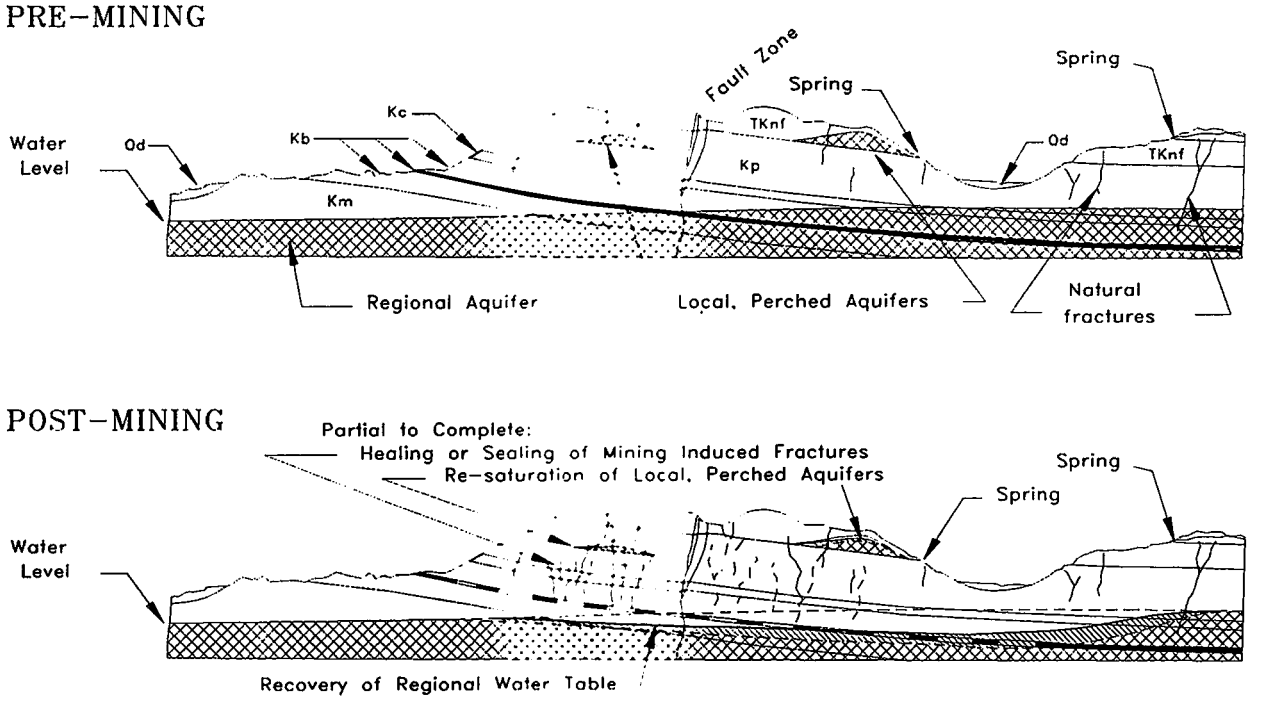

Figure 5 - Potential Long-term Effects of Coal Mining on Ground-water Resources

Subsidence

Subsidence impacts are largely related to extension and expansion of existing fracture systems and upward propagation of new fractures (Figure 6). Inasmuch as vertical and lateral migration of water appears to be partially controlled by fracture conduits, readjustment or realignment in the conduit system will inevitably produce changes in the configuration of ground-water flow. Potential changes include decreased flow through existing fractures that close, increased flow rates along existing fractures that open further, and the diverting of ground-water flow along new fractures or within newly accessible permeable lithologies. Subsurface flow diversion may cause the depletion of water in local aquifers and loss of flow to springs that are undermined. Increased flow rates along fractures could potentially improve water quality by

reducing ground-water residence time.

Subsidence surveys have been done at Soldier Canyon Mine on an annual basis since 1988 using ground surveying supplemented with photogrammetric methods if needed. Annual subsidence reports are provided to UDOGM. Annual reports for 1988, 1989, 1992, 1993, 1994, 1995, and 1996 indicate no subsidence over the current Soldier Canyon Mine permit area (indicated elevation changes are within the limit of accuracy of the survey method). The Castlegate Sandstone and thick overburden are responsible for reduced surface subsidence. Mining has occurred beneath 500 to 2,000 feet of overburden and mining is projected to be done beneath up to 2,250 feet of cover.

In the eastern part of the Centennial project that is within the CIA, longwall mining is planned for the Gilson and Aberdeen Upper "A" seams and continuous mining for the Lower Sunnyside seam. Overburden thicknesses over these areas are from 400 to 1,200 feet. A large area of the Gilson seam and a smaller area of the Lower Sunnyside seam have already been mined in this area, with overburden ranging from very thin near the outcrop to 1,200 feet (Plates 26-29, Centennial Project MRP). As of 1996 Centennial reported no evidence of subsidence at the surface.

Mining at the Dugout Canyon Mine is currently planned for the Rock Canyon seam only, and overburden thickness will generally be less than 1,600 feet. The potential for subsidence related surface impacts (e.g., ponding) to the subsurface and surface hydrologic regimes is not considered significant by Canyon Fuel Company.

SURFACE WATER

Changes in flow volume and in water quality have the greatest potential for impacting surface-water resources in the CIA.

Water Quality

The quality of the local surface waters can be affected by two basic processes. First, the runoff from the operator's disturbed lands and waste piles could increase sediment concentrations and alter the distribution and concentration of dissolved solids in the receiving streams. This potential for inducing water quality changes in Soldier and Dugout Creeks has been fully recognized, and the runoff control plan established for the mines is adequate in anticipating, mitigating and monitoring the potential impacts.

The second potential cause of surface water quality changes is related to the location and chemistry of ground-water discharges, both from the mines and from springs and baseflow. As discussed by Waddell and others (1986, p. 28), perennial flow of Soldier Creek is sustained by spring and seep discharge and baseflow from the Flagstaff Limestone during spring and early summer snowmelt. Discharge from the Flagstaff Limestone during the fall and winter is greatly

reduced and discharge from underlying formations, mainly the Blackhawk, sustains the stream flow.

TDS concentration in ground water from the Flagstaff Limestone is generally lower than that in ground water from underlying formations. Stream flow in the upper segment of Pine Creek contains baseflow from the Flagstaff Limestone. In water-years 1979 and 1980 TDS was 200 to 300 mg/L and magnesium, calcium and bicarbonate ions dominated. In contrast, the lower reaches of Soldier Canyon receive baseflow from the North Horn and Blackhawk Formations. In 1979 and 1980 TDS ranged from about 300 to 700 mg/L. At low flow the dominant ions were sodium, magnesium, sulfate, and carbonate, but at high flow calcium and bicarbonate dominated (Waddell and others, 1982; 1986) because ground water from the Blackhawk was contributing a smaller portion of total flow and therefore had a smaller effect on the quality of the stream water.

In 1989 Soldier Canyon Mine requested an increase in the daily limit on dissolved solids that could be discharged under the UPDES permit and Colorado River Salinity Standards because the inflow of ground water to the mine had increased to the point that dissolved solids flowing into the mine with the water exceeded 1 ton per day, which was the mine's UPDES discharge limit at that time. The current UPDES permit allows for Soldier Canyon Mine to discharge up to five tons of dissolved solids per day into Soldier Creek (total from all permitted outfalls). Maximum allowed TDS concentration is 1,200 mg/L. TDS concentrations have remained generally between 800 and 1,000 mg/L in recent years, but concentrations exceed 1,200 mg/L occasionally. In the water discharged from the mine, oil and grease occasionally exceeds the UPDES limit.

The Centennial project does not discharge into Coal Creek or other surface waters in the CIA. There is no UPDES permit for the Dugout Canyon Mine at present, but it is anticipated that discharge limits will be similar to those for the Soldier Canyon Mine. Continuation of Canyon Fuel Company's monitoring program will verify water consumption and discharge estimates.

At and below the point of constant mine discharge into Soldier Creek, during periods of low flow, there is little apparent variation between water quality of the stream and the mine discharge. During dry periods the mine discharge produces most of the stream flow. During periods of high flow the effects of mine discharge to the stream are negligible with respect to sediment transport and water chemistry.

Waddell and others (1986) describe the stream bed characteristics of Soldier Creek in some detail. The stream appears to be naturally saturated with respect to calcite and the sediments in the bed of Soldier Creek become cemented with carbonate precipitates during the low-flow period in fall and winter. A new benthic environment is created when sediment is added or redistributed by the spring runoff. The diversity of benthic invertebrates varies seasonally because of these processes that alternately cement and disturb the sediment.

The only current surface water monitoring in the Coal Creek drainage is at 25-2 on Hoffman Creek. Surface-and ground-water samples were collected at several locations in the

upper Coal Creek drainage in January 1981 by the operators of the Centennial mines. USGS station 09313965 on Coal Creek, just below the Hoffman Creek confluence, was monitored periodically for water quality and flow between September 1977 and September 1981, but no monitoring or sampling was done during the months December through April.

Surface water monitoring locations are shown on Plate 2. Table 4 contains information on G-1 through G-10, sites that have been or will be monitored by Canyon Fuel Company during operation and reclamation of the Soldier Canyon Mine. G-6 will replace G-1 for monitoring water quality upstream of the disturbed area; monitoring at G-1 is to be discontinued after 2 years of baseline data have been collected at G-6. G-6 should more accurately indicate the condition of surface water entering the disturbed area because G-1 is far from the disturbed area and factors other than mining can influence the water quality between G-1 and the disturbed area. G-2 is to be dropped at some future time after mining has ceased beneath the Pine Canyon drainage. G-3 and G-4 were monitored up to 1986 and 1985, respectively. Plate 2 shows their locations as near as can be determined from available information (Table 4). G-7, G-8, and G-9 are temporary sites that are to be used to determine the effects of mining on Pine Creek and the relationship between the Blackhawk Formation and creek flows. G-7 is at approximately the same location as G-4 and G-9 appears to be slightly upstream of G-3. Monitoring of G-5 will continue to provide water quality data below the disturbed area. Site G-10 has been added to monitor surface flow from part of the Alkali Tract (p. 7-166, Soldier Canyon Mine MRP).

At the Dugout Canyon Mine, surface water will be monitored at DC-1 below the disturbed area and at DC-2, DC-3, DC-4, and DC-5 upstream of the disturbed area. Baseline data were collected at DC-1 between 1976 and 1981. Beginning in 1997, quarterly baseline data have been collected at DC-1, DC-2, and DC-3 for the Dugout Canyon Mine permit application. Water quality at the Dugout Canyon Mine is expected to be similar to that at the Soldier Canyon Mine.

Dugout Canyon Mine Proposed Sediment Control

The Dugout Canyon Mine MRP describes construction methods to be used and specific methods used to control sediment flow into Dugout Creek.

There is one sediment pond used in the Dugout Canyon Mine proposed sediment control plan. The sediment pond will be used throughout the mining operations and reclamation. It is designed to contain more that five years of sediment accumulation based on the Universal Soil Loss Equation (USLE) plus the water volume resultant from the 10-year, 24-hour storm event. Both undisturbed area and disturbed area drainages are treated by the sediment pond. A staff gauge will be used to mark the 60% clean-out elevation for the required clean-out. The pond will be equipped with a dewatering device and a spillway. The appropriate 25-year, 6-hour event was used to size the combined primary and emergency spillways.

There is one undisturbed ditch that routes water from the southern slopes past the disturbed area. Undisturbed drainages on the northwest side of the disturbed area are treated by

the sediment pond. About 40% of the disturbed area is covered by roads and there are two impoundments in the disturbed area which contain their respective design events. The result is minimum sediment contribution to Dugout Creek itself.

The sedimentation pond will be retained for as long as practical during reclamation and will be removed near the end of the reclamation process. Once backfilling and grading operations proceed to the location of the pond, it will be removed. When an area no longer properly drains to the sediment pond silt fence will be installed along the base of the slope to create alternate sediment control areas (ASCA). The silt fences will be unutilized until vegetation is successfully established to control erosion.

A substantial silt fence will be used along the upper banks all along both sides of the creek. Silt fences will be placed every 200 feet along the culvert, perpendicular to the culvert, to reduce sediment loading. Four silt fences will extend across the entire stream below the Dugout Canyon Mine construction site. During the low flows expected during construction, these should be adequate to minimize silt contributions to Dugout Creek.

On a temporary basis, straw-bale dikes may also be installed as necessary to control localized erosion prior to the establishment of revegetation. Locations of the straw-bale dikes will be selected to reduce sediment contributions to runoff based on field observations. Straw-bale dikes will be installed by keying the bales into the ground.

At the Dugout Canyon Mine, ASCA's are designated for two area which cannot report to the sediment pond. These are the areas above the lower 600 feet of the Dugout Creek culvert and a hillside slope between the sed pond and the lower (southwest) end of the disturbed area . ASCA-1 will be treated using silt fences perpendicular to the slope on 200 foot intervals. ASCA-2 will be treated with silt fences, straw bales, and berms until vegetation is established.

Culverting of Dugout Creek

On March 6. 1998 BLM sent a letter to Utah Division of Water Rights indicating several concerns on the Dugout Mine stream alteration permit and the culverting of Dugout Creek through the minesite. The stream alteration has been determined not to be a significant problem for the following reasons.

1. The geologic formation in the mine disturbed area is the Blackhawk Formation that consists dominantly of sandstone, siltstone, and shale. The Blackhawk is underlain by the Mancos Shale. There are only a few faults in the entire permit area. Two vertical joints have been mapped in the disturbed area where the culvert will be placed (Anderson, 1983). Dip is 6 degrees to the north: the stream flow is to the southwest, or updip.

2. While there is alluvium in the stream, it is too thin or sparse in the mine area to be mapped on the geologic map. About 1500 feet downstream from the disturbed area Quaternary alluvium

and pediment gravels are mapped.

3. The Dugout Creek drainage area, above its confluence with Grassy Trail Creek (near Utah Highway 6), is over 43 square miles or 27,520 acres, as compared to the mine disturbed area of 10.4 acres. Similarly, the culvert would occupy 2,000 feet of the 9.5 miles of stream channel between the mine and Grassy Trail Creek. The portion of the watershed and of the potential recharge area to be disturbed are minor.

4. Water will not be lost by passing through the culvert. The water will be returned to the natural stream channel at the outlet where the it will be available to recharge groundwater aquifers in the area. There is no evidence to suggest that the reach of stream occupied by the culvert is of special significance to such recharge. Studies by Waddell and others (1986, p. 28), Price and Plantz (1987), and Mayo indicate that similar situations in nearby Soldier Creek result in streams gaining, not losing, water as they pass over the Blackhawk formation.

5. The USGS monitored site 09313985 at the lower end of the disturbed area for several years. Unfortunately, no monitoring was done above the site to define whether the disturbed area is a gaining or losing section. MRP has in it plans to monitor above and below the site at DC-1, DC-2, DC-3, DC-4, and DC-5 to determine a gain-loss hydrograph. One set of observations was made at these sites on August 27, 1997 (the driest time of year) that showed the flows above and below the disturbed area to be the same.

Overall, the culverted reach of stream is of very minor consequence when compared to the recharge mechanism for springs that issue from the Mancos shale down gradient of the Dugout Canyon Mine disturbed area, near the confluence with Grassy Trail Creek. Similarly, the streamflow in Dugout Creek is not expected to suffer any significant impacts.

Water Quantity

Water not used in the Soldier Canyon Mine or lost to evaporation is collected in an in-mine settling pond and discharged to Soldier Creek through UPDES 003, also identified as MW-2. The in-mine settling pond at the Soldier Canyon Mine reduces suspended solids. Waddell (1986, Table 6) estimated that discharge for December 1980 was only 15 ac-ft, approximately 15 gpm. Discharge rates measured at UPDES 003 from 1987 to 1994 varied from about 200 gpm to 700 gpm and averaged 390 gpm (203,000,000 gallons per year or 620 acre-feet per year) (Dugout Canyon Mine MRP Appendix 7-3, p. 17). Discharge rates increased slightly over that seven year period. Ongoing monitoring will indicate total ground-water discharge due to mining.

Upon termination of mining operations, discharge of ground water from the Soldier Canyon Mine to Soldier Creek will be discontinued and the mine will begin to flood. There will be an initial reduction in surface flow because of the loss of the mine discharge. However, surface flow may recover to pre-mining conditions if base flow to the stream is reestablished as the mine floods. The time required for mine flooding will depend not only on the rate of water inflow but

also on the amount of caving and the void space remaining after caving. Complete flooding of the mine may never occur because flow out of the mine through the roof, floor, and ribs and into the surrounding rock will increase as flooding increases the hydraulic head within the abandoned workings.

It is anticipated that discharge of water from the Dugout Canyon Mine operation will be similar what has been observed or predicted at the Soldier Canyon Mine. Upon termination of mining operations at the Dugout Canyon Mine, the mine will begin to flood and conditions can be expected to be similar to the Soldier Canyon Mine, except that pre-mining conditions will mean a return to intermittent flow, rather than perennial, in Dugout Creek.

It has been determined that Soldier Creek loses water where it crosses the Price River Formation and Castlegate Sandstone (Waddell and others, 1982; 1986). One purpose of the planned monitoring at DC-2, DC-3, DC-4, and DC-5 is to determine if a similar loss occurs on Dugout Creek. DC-4 and DC-5 will be used mainly to collect gain-loss hydrograph data and will be sampled for water quality only periodically.

ALLUVIAL VALLEY FLOORS

A negative determination has been made based on the studies conducted by Sunedco Coal Company for the approved Sage Point-Dugout Canyon MRP on the existence of unconsolidated streamlaid deposits holding streams and sufficient water to support agricultural activities within the mine plan area. A potential AVF exists downstream of the Soldier Canyon Mine along Soldier Creek.

VII. ASSESS PROBABLE MATERIAL DAMAGE.

The probable hydrologic impacts are summarized below under the headings entitled First Five Year Permit Term and Future Mining.

FIRST FIVE YEAR PERMIT TERM - DUGOUT CANYON MINE

The rate of dewatering will be less than the estimated recharge rate during the first five year permit term. Overburden thickness will be sufficient (500 to 2,000 feet) to restrict surface manifestations of subsidence. Subsurface propagation of fractures may produce changes in ground-water flow that could affect local aquifers and springs. Future monitoring will provide data applicable to documenting changes in the ground-water system.

Surface disturbance and the discharge of Soldier Canyon Mine water have not significantly degraded water quality in Soldier Creek. Sediment control measures such as those intended for use at the Dugout Canyon Mine have served to reduce contaminants and stabilize water quality at acceptable levels at Soldier Canyon Mine and at other mines in the Wasatch Plateau and Book Cliffs coal fields.

No AVF will be impacted during the first five year permit term by additional flow from increased mine water discharge.

FUTURE MINING

Increased rates of dewatering may, in the future, result in depletion of ground-water storage. Depletion of storage may terminate certain spring flows and base flow recharge to streams. Upon cessation of mining, mine water discharge to Soldier and Dugout Creeks will be discontinued. Mine flooding will probably result in reestablishment of the preexisting ground-water systems that, most likely, provided base flow to the streams.

Drainage from future surface disturbance will be managed through appropriate sediment controls. Future Soldier and Dugout Canyon mine discharges will be directed through sediment ponds.

At the termination of mining, downstream potential AVF's will experience decreased flow. The duration and extent of this impact cannot be accurately assessed at this time. However, flow rates may be partially to fully restored when the ground-water system is reestablished by flooding of the abandoned mines.

The operational designs for the Soldier Canyon Mine, Dugout Canyon Mine, and Centennial Project are determined, based on the information submitted in the mine plans and referenced literature, to be consistent with preventing damage to the hydrologic balance outside the mine plan areas.

VII. STATEMENT OF FINDINGS.

No evidence of material damage from the actual mining operations has been found. No probability of material damage from actual or anticipated mining operations has been found.

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