CHAPTER 1

LIST OF PLATES

PLATE NUMBER	DESCRIPTION
PLATE 1-1	Lease Boundary Map

LIST OF APPENDICES

APPENDIX NUMBER	DESCRIPTION
APPENDIX 1-1	Lease Assignment
APPENDIX 1-2	USFS Road Use Permit
APPENDIX 1-3	USFS Special Use Permit for Facilities
APPENDIX 1-4	USFS Special Use Permit for Potential Surface Effects
APPENDIX 1-5	Land Ownership (Surface Lease from A.R.C.O.)
APPENDIX 1-6	Mining Suitability Determination
APPENDIX 1-7	Negative Unsuitability Determination
APPENDIX 1-8	Newspaper Advertisement
APPENDIX 1-9	Current Owners and Controllers of Andalex Resources, Inc. And Andalex Resources, Inc. Parent Entities
APPENDIX 1-10	Certificate of Insurance
APPENDIX 1-11	List of Previous Violations
APPENDIX 1-12	Current and Previous Coal Mining Permits
APPENDIX 1-13	South Crandall Federal Lease UTU-78953
APPENDIX 1-14	SITLA/PacifiCorp Sub-Lease
APPENDIX 1-15	Modification of Federal Lease UTU-68082
APPENDIX 1-15A	BLM/Forest Service Joint Decision (UTU-68082 Lease Mod)

CHAPTER 1

LEGAL, FINANCIAL, COMPLIANCE, AND RELATED INFORMATION

1.12 Identification of Interest

1.12.1 Business entity

Applicant is a corporation, incorporated under the laws of the state of Utah, and registered to do business in Utah.

1.12.2 Applicant

Applicant:

GENWAL Resources, Inc.
P.O. Box 1077
Price, Utah 84501
Telephone (435) 888-4000
Employer I.D. #87-0533099

Operator:

GENWAL Resources, Inc.
P.O. Box 1077
Price, Utah 84501
Telephone (435) 888-4000

Resident Agent:

Gary E. Gray
GENWAL Resources, Inc.
P.O. Box 1077
Price, Utah 84501
Telephone (435) 888-4000

As operator of the mine, GENWAL Resources, Inc. will continue as Permittee under Permit No. ACT/015/032.

Revised 1/13/2004
Revised 4/05/2003

1.12.23 Abandoned Mine Land Reclamation Fee

The abandoned mine land reclamation fee will be paid by Mr. Gary Gray, representing GENWAL Resources.

1.12.3 Ownership and Control

The joint owners of applicant are Intermountain Power Agency and Andalex Resources, Inc.:

1. Intermountain Power Agency, Joint owner:

c/o Los Angeles Department of Water and Power
P.O. Box 111, Suite 1107
Los Angeles, California 90051-0100
Telephone (213)481-4104
Employee I.D. #87-0366288

Name and address of IPA's general manager:

Reed T. Searle
Intermountain Power Agency
480 East 6400 South, Suite 200
Murray, Utah 84107
Telephone (801)262-8807
Assumed position September, 1989

Resident Agent for IPA:

Mark Buchi
Holme, Roberts, and Owen
111 East Broadway, Suite 1100
Salt Lake City, Utah 84111
Assumed position January, 1988

2. Andalex Resources, Inc., Joint Owner:

Andalex Resources, Inc.
45 West 10000 South, Suite 401
Sandy, Utah 84070
Employer ID No. 61-0931325

Name and address of Andalex's President is:

Douglas H. Smith
Andalex Resources, Inc.
45 West 10000 South, Suite 401
Sandy, Utah 84070
Assumed position 07/01/94

Resident Agent of Andalex:

Mike Glasson
Andalex Resources, Inc.
P.O. Box 902
Price, Utah 84501
Telephone (435) 637-5385

Names and addresses of officers of GENWAL Resources, Inc.:

OFFICERS	TITLE	DATE POSITION WAS ASSUMED
Peter B. Green	Chairman of Board of Directors	01/09/95
Douglas H. Smith	President	01/09/95
John Bradshaw	Vice President Finance & Treasurer	01/09/95
Samuel C. Quigley	Vice President	01/09/95

DIRECTORS	TITLE	DATE POSITION WAS ASSUMED
Peter B. Green	Director	12/13/94
Ronald C. Beedie	Director	12/13/94
Douglas H. Smith	Director	12/13/94

The address for the above officers and directors is:

GENWAL Resources, Inc.
45 West 10000 South, Suite 401
Sandy, Utah 84070

Revised 4/05/2003

Names and addresses of officers, directors and principal shareholders of IPA: (R645-301-112-310)

Officers of IPA:

Reece D. Nielsen, Chairman
105 South 600 East
Hyrum, Utah 84319
Assumed position January, 1983

R. Leon Bowler, Vice-Chairman
Dixie-Escalante Rural Electric Assoc., Inc.
Beryl, Utah 84714
Assumed position January, 1983

Ray Farrell, Secretary
35 North 500 East
Heber, Utah 84032
Assumed position November, 1984

Clifford C. Michaelis, Treasurer
Bountiful Light & Power
198 South 200 West
Bountiful, Utah 84010
Assumed position January 1990

Directors of IPA:

Reece D. Nielsen, Chairman
105 South 600 East
Hyrum, Utah 84319
Assumed position January, 1983

R. Leon Bowler, Vice-Chairman
Dixie-Escalante Rural Electric Assoc., Inc.
Beryl, Utah 84714
Assumed position January, 1983

Ray Farrell, Secretary
35 North 500 East
Heber, Utah 84032
Assumed position November, 1984

Clifford C. Michaelis, Treasurer
Bountiful Light & Power
198 South 200 West
Bountiful, Utah 84010
Assumed position January, 1990

Robert O. Christiansen, Director
269 West Center
Beaver, Utah 84713
Assumed position January, 1989

Russell F. Fieldsted, Director
The Sportsman
129 North Main
Logan, Utah 84321
Assumed position January, 1989

Ted L. Olson, Director
265 East 400 South (75-8)
Ephraim, Utah 84627
Assumed position January, 1989

Principle Shareholders of IPA:

IPA has no shareholders. IPA is a political subdivision of the State of Utah, and as such, has not issued stock.

Names and addresses of officers, directors, and principal shareholders of ANDALEX Resources, Inc:

OFFICERS	TITLE	DATE POSITION WAS ASSUMED
Peter B. Green	Chairman of Board of Directors, and	05/11/90
	Chief Executive Officer	09/30/96
Douglas H. Smith	President	07/01/94
John Bradshaw	Vice President of Finance	02/05/90
Samuel C. Quigley	Vice President of Western Operations	05/15/95

DIRECTORS	TITLE	DATE POSITION WAS ASSUMED
Peter B. Green	Director	05/11/90
Ronald C. Beedie	Director	01/05/88
John Bradshaw	Director	07/01/94

The principal shareholder of Andalex Resources, Inc. is as follows:

The capital stock of Andalex Resources, Inc. is one hundred percent (100%) owned and controlled by Prospect Holdings S.A. Prospect Holdings S.A. does not have an employer identification number. Andalex Resources, S.A. and Andalex Holdings, LTD, owners and controllers of the parent entity do not have employer identification numbers, Appendix 1-9 Section A.

Andalex Resources, Inc.
45 West 10000 South, Suite 401
Sandy, Utah 84070

Other names under which Andalex Resources, Inc. and Prospect Holdings S.A. is or has operated in the United States within the last five years preceding the date of this application are listed below:

Andalex Resources, Inc., Tower Division
Andalex Resources, Inc., Cimarron Division
AMCA Coal Leasing, Inc.
West Ken Coal Corporation
Andalex Resources, Inc., Little Creek Division

Legal owners of area to be affected by surface operations and facilities:

United States Government
Administered by the United States
Department of Agriculture, Forest Service,
Intermountain Region
Manti-La Sal National Forest
599 West River Drive
Price, Utah 84501

GENWAL Resources, Inc.
P.O. Box 1077
Price, Utah 84501
Telephone (435) 564-4000
Employer I.D. #87-0533099

1.12.4 List of current or previous coal mining permits and pending permit applications:

GENWAL Resources, Inc. has not previously held a mining permit.

A list of current and previous mining permits held by Andalex and its affiliates is included in Appendix 1-12.

Corporate Status of Joint Owners

IPA is a political subdivision of the State of Utah created under the Interlocal Cooperation Act, Title II, Chapter 13, Utah code Ann. 1953, as amended.

Andalex is a Delaware Corporation (The parent companies of Andalex Resources, Inc. do not have employer identification numbers).

1.12.5 Leasehold Interest

Holders of record of any leasehold interest in areas to be affected by surface operations or facilities:

U.S. Forest Service and GENWAL Resources, Inc are the surface owners in within the disturbed portions of the mine permit.

Holders of record of any leasehold interest in the coal to be mined:

The U.S. Forest Service, the State of Utah, and GENWAL Resources, Inc are surface owners within the permit area. The State of Utah, the BLM, and GENWAL Resources, Inc are the coal owners within the permit area (see Appendix 1-1).

1.12.6 Owners of Contiguous Areas Both Surface and Underground:

Surface Ownership:

United States Government
Administered by the United States
Dept. of Agriculture, Forest Service
Intermountain Region
Manti-La Sal National Forest
599 West Price River Drive
Price, Utah 84501

GENWAL Resources, Inc.
P.O. Box 1077
Price, Utah 84501
Telephone (435) 888-4000

Mineral Ownership:

United States Government
Administered by the United States
Dept. of Interior, Bureau of Land Management
Moab District
P.O. Box AB
Price, Utah 84501

Dick Nielson
c/o Kris Lison
4819 Mandell Street
Houston, Texas 77006

Utah School and Institutional Trust Lands Administration (SITLA)
675 East 500 South
Salt Lake City, Utah 84102

Owners of contiguous areas both surface and underground:
See Plate 1-1

1.12.7 Mine Identification: MSHA Numbers

Crandall Canyon Mine 21 Nov, 1991
MSHA No. 42-01715

West Ridge Mine
MSHA No. 42-02356

South Crandall Canyon Mine
MSHA No. 42-02356

Andalex Resources, Inc. - Tower Division
MSHA No. 42-01474, 42-01750, 42-02028, 42-01864

1.12.8 Pending Interests of Lands Contiguous to Permit Area:

The applicant has no pending interests in lands contiguous to the permit area.

1.13 Violation Information:

The applicant currently operates coal mining operations under ACT/015/032 for the Crandall Canyon Mine in Emery county, Utah. Permit ACT/015/032 was approved and issued May 13, 1993.

The Applicant, nor any subsidiary, affiliate, or persons controlled by or under common control with the applicant, has not had a Federal or State mining permit suspended or revoked in the last five years. Nor have they forfeited a mining bond or similar security deposited in lieu of a bond. There are no unabated cessation orders or air and water quality violation notices received prior to the date of the application, by any coal mining and reclamation operation owned or controlled by GENWAL or by any person who owns or controls GENWAL. Refer to Appendix 1-11 for a list of previous violations.

1.14 RIGHT OF ENTRY AND OPERATION

Applicant bases its legal right to enter and begin underground mining activities in the permit area upon the following documents:

Federal Coal Lease U-54762, issued to GENWAL on December 1, 1986, currently owned by Andalex and IPA. IPA and Andalex have undivided 50% interest as tenants in common of all leases previously under GENWAL's sole ownership (Andalex Resources, Inc has now assumed all leases or portions of the leases previously held by NEICO through the purchase and transfer of those rights to GENWAL Resources, Inc. effective 1/11/95). Federal coal lease UTU-78953 (also known as the South Crandall tract) was acquired in June 2003. (Refer to Appendix 1-13) A 40 acre parcel of the SITLA Millfork Lease was subleased from PacifiCorp in February, 2004. (Refer to Appendix 1-14). In December, 2004 the BLM issued a decision to approve Federal Lease UTU-68082, to include an additional 120 acres . (Refer to Appendix 15-A.) The approval became effective in the early part of 2005 (Refer to Appendix 1-15).

It should be noted that throughout this Mining and Reclamation Plan the combined area of Federal Lease UTU-78953 and the SITLA/PacifiCorp sublease are collectively referred to as the South Crandall lease area, the South Crandall tract, the South Crandall mining area, and similar such terms.

Assignment of Federal Lease SL-062648 and SL-050655 from heirs of John F. Sanders to applicant. BLM approval of assignment to applicant from heirs of John F. Sanders.

The Joint Owners will succeed to all the rights and duties held by Permittee by operation of law, including the legal right to enter and continue coal mining and reclamation operations. Permittee will continue to operate the mine under the direction of the Joint Owners.

The present Joint Owners (Andalex and IPA) base their legal right to enter and continue underground mining activities in the permit area upon the following documents and the NEICO/Andalex sales contract:

Federal Coal Lease Assignments

Assignment of Federal Coal Lease U-54762 issued to GENWAL on December 1, 1986 and assigned to the Joint Owners (NEICO and IPA) on July 11, 1991.

Assignment of Federal Coal Lease SL-62648, assigned to the Joint Owners (NEICO and IPA) on July 11, 1991

Assignment of Federal Coal Lease UTU-68082, assigned to the Joint Owners (NEICO and IPA) in March, 1994.

State Coal Lease Assignments

Assignment of Utah State Coal Lease ML-21568, assigned to the Joint Owners (NEICO and IPA) on July 11, 1991

Assignment of Utah State Coal Lease ML-21569, assigned to the Joint Owners (NEICO and IPA) on July 11, 1991

Copies of the Assignments are included in Appendix 1-1. The Assignments are not subject to pending litigation. (However, reassignment of these leases does require BLM approval; reassignment of the leases is currently being processed by the BLM and based on contract documents from NEICO and verbal approval from BLM and State Lands, GENWAL Resources, Inc. has right of entry in the interim.

Special Use Permit Assignments

Special Use Permit, 1.5 acres, 150 x 400 ft adjacent to the eastern boundary of GENWAL's Federal Coal Lease SL-062648 (See Appendix 1-3)

Special Use Permit, .10 acres located in Section 6, SW quarter NE quarter T16S R7E SLBM (See Appendix 1-3).

Special Use Permit, 0.9 acres for stockpiles 1, 2, and 3 dated 8/17/87 (See Appendix 1-3)

Road Use Permit Assignment for F.S. No. 50248 road issued May 21, 1981 by the United States Forest Service (Appendix 1-2).

Permit Legal Description

The permit area is located and described as follows:

PARCEL	ACREAGE	LEGAL DESCRIPTION
FEDERAL LEASE U-68082	2979.49	T 15 S, R 6 E
		Section 25: S ½
		Section 26: S ½
		Section 35: ALL
		T 15 S, R 7 E
		Section 30: Lots 7-12 SE ¼
		Section 31: Lots 1-12 NE ¼ N½SE¼ SW¼SE¼
		T 16 S, R 6 E
		Section 1: Lots 1-12 SW¼
		T 16 S, R 7 E
		Section 6: Lots 2-4 SW¼NE¼
MODIFICATION TO U-68082	120.00	T15S, R7E
		Section 32: W½NW¼ NW¼SW¼

FEDERAL LEASE U-54762	256.49	T 15 S, R 7 E	
		Section 31:	SE¼SE¼
		Section 32:	S½SW¼ SW¼SE¼
		T 16 S, R 7 E	
		Section 5:	Lots 2, 3, and 8
FEDERAL LEASE SL-062648	161.17	T 16 S, R 7 E	
		Section 5:	Lots 5 and 6
		Section 6:	Lot 1 SE¼NE¼
FEDERAL LEASE U-78953***	880.00	T 16 S, R 7 E	
		Section 4:	W½SW¼ S½SW¼NW¼
		Section 5:	SE¼ S½SE¼NE¼
		Section 8:	E½ NE¼NW¼ S½NW¼
		Section 9:	NW¼
STATE LEASE ML-21568	997.69	T 16 S, R 6 E	
		Section 2:	ALL
STATE LEASE ML-21569	640.00	T 15 S, R 6 E	
		Section 36:	ALL
FEE SURFACE AND COAL (Dellenbach)	160.00	T 16 S, R 7 E	
		Section 5:	SW¼

BLM RIGHT OF WAY UTU-77975 (underground mining rights)	50.00	T 16 S, R 6 E Section 3: E½E½SE¼NE¼ E½E½NE¼SE¼ E½SE¼SE¼ Section 10: NE¼NE¼NE¼
SITLA/PACIFICORP SUBLEASE***	40.0	T 16 S, R 7 E Section 8: NW¼NW¼
FOREST SERVICE SPECIAL USE AREAS: (all in T 16 S, R 7 E)		
SEDIMENT POND (7/28/83)	1.5	Section 5: located within SW¼SW¼SE¼NW¼,
TOPSOIL PILE #1 (8/17/87)	0.2	Section 5: located within SE¼SE¼SE¼NW¼,
TOPSOIL PILE #2 (8/17/87)	0.2	Section 5: located within SW¼NW¼SE¼NE¼,
TOPSOIL PILE #3 (8/17/87)	0.5	Section 4: located within NW¼NW¼SE¼NW¼,
TOPSOIL PILE #4	0.5	Section 4: located within SW¼SW¼NE¼NW¼
TOTAL PERMIT AREA	5367.74	

*** NOTE: Federal Lease U-78953 and the Sitla/Pacificorp Sublease are subject to pending permitting action and are not presently included within the DOGM permit area. These areas are not included within the permit acreage shown above.

The right to continue underground mining operations will apply to the property attached hereto as Appendix 1-1.

The surface facility area and permit area is not within 300 feet of any occupied dwelling and is not subject to the prohibitions or limitations of the State and/or Federal Regulations.

GENWAL DISTURBED ACREAGE

Area	Section	within	Acres	parcel
minesite	Section 5	NW ¼	7.768*	Fed Lease UTU-54762
		SW¼	6.086*	Dellenbach Fee
Topsoil Pile #1	Section 5	NW¼	0.2	Forest Service Special Use Permit
Topsoil Pile #2	Section 5	NE¼	0.2	Forest Service Special Use Permit
Topsoil Pile #3	Section 4	NW¼	0.5	Forest Service Special Use Permit
Topsoil Pile #4	Section 4	NW¼	0.5	Forest Service Special Use Permit
TOTAL			15.254	

* Includes all areas within "permitted" disturbed area. Not all acreage is presently disturbed. See Figure 8C.

1.15 STATUS OF UNSUITABILITY CLAIMS

All available information concludes that the proposed permit area is not within an area designated as unsuitable for underground mining activities (refer to Appendix 1-7). The map required to be maintained by the regulatory authority under 764.25(b), does not indicate this permit area as unsuitable for underground mining. The regulatory authority has also stated that this area is not under study for designation in an administrative proceeding. The permit area is located in the Wasatch Plateau as described in the following, "Known Recoverable Coal Resource Area", as indicated in the San Rafael Planning Area Management

Framework Plan, published in July 1979, by the United States Department of Interior, Bureau of Land Management. Pages 43 and 44 of that publication, copies of which are included with this application and found at the end of this chapter as Appendix 1-6, indicate that none of the acreage in the KRCRA was determined to be unsuitable for underground mining. In addition, the Land Management Plan, Ferron-Price Planning Unit, Manti-La Sal National Forest, published in May 1979, by the United States Department of Agriculture, Forest Service, Intermountain Region. The Forest Service has stated that this permit area, which is included in the Section A3 minable coal area of this publication, will not be considered unsuitable for leasing or mining. Page 149 of the document is included with this application as Appendix 1-7.

The applicant was notified of a public hearing scheduled for June 2, 1981, at 3:00 p.m. in Huntington, Utah, at the Senior Citizens Center. An officer of GENWAL was present at the hearing. The public hearing dealt with the proposed mining activities of the Crandall Canyon Mine within 100 feet of a public road (Forest Service Development). The USFS has issued a Special Use Permit for the Crandall Canyon Mine and accepts that the operation will occur within 100 feet of the Forest Service Development road.

The surface facility area and permit area is not within 300 feet from any occupied dwelling and is not subject to the prohibitions or limitations of State and/or Federal Regulations.

The area to be included in the Incidental Boundary Change (IBC) is immediately adjacent to the current permit area. Since mining in the IBC will be primarily first mining (longwall setup entries and barrier pillars), no surface impacts are expected to occur. Protection of the resources in this IBC are provided under the Mining and Reclamation Permit as well as state and federal.

1.16 PERMIT TERMS

The applicant requests a permit term of five years from the date of approval, however mining activities will continue longer than five years if the coal becomes available and feasible to mine. The starting and termination dates in one year increments is shown on Plate 5-2. The horizontal extent of the underground mine workings is also shown. GENWAL will commit to comply with all applicable standards during times of temporary and permanent cessation of operations. Further discussion may be found in Chapter 5, Engineering.

1.17 INSURANCE, PROOF OF PUBLICATION

1.17.1 Insurance

A Certificate of Liability Insurance with Andalex and IPA is included in Appendix 1-10.

1.17.2 Proof of Publication

A copy of the newspaper advertisement of the application for a renewal of Crandall Canyon Mine permit was included in the permit package, as required under R645-300-121.100. Also, a copy of the newpaper advertisement for the permit amendment to install a culvert in Crandall Canyon has been included. See Appendix 1-8 for both copies.

1.18 FILING FEE

This permit application to conduct coal mining and reclamation operations pursuant to the State Program was accompanied by a fee of $5.00.

1.20 APPLICATION FORMAT AND CONTENTS

This application is structured based on the R645 regulations of the Division of Oil, Gas, and Mining. The chapter divisions in the application are based on the different sections of the R645 regulations. Each section of the application is based on the corresponding sections of the GENERAL CONTENTS of the R645 regulations.

1.23 VERIFICATION OF APPLICATION

I hereby certify that I am a responsible official (Resident Agent) of the applicant (Andalex and IPA for GENWAL Resources, Inc.) and that the information contained in this application, inclusive of the Incidental Boundary Change for the U-68082 federal lease modification is true and correct to the best of my information and belief in all respects with the laws of Utah in reference to commitments, undertakings, and obligations, herein

_____ **Signed - Name - Position - Date**

Subscribed and sworn to before me this__ day of_____, 19_

_____

Notary Public

My commission Expires: _____, 19___)

Attest: STATE OF _____) ss:

COUNTY OF _____)

CRANDALL CANYON MINE
PERMIT NUMBER 015/032

DOGM VIOLATIONS 2001 THROUGH OCTOBER 2004

VIOLATION/ CESSATION NO.	DATE ISSUED	ABATEMENT DATE	VIOLATION DESCRIPTION
NO3-49-2-1	7/30/03	8/20/03	Failure to submit surface blast plan pf more than 5 pounds. Abated with submittal and approval of plan.
NO3-49-1-1	1/8/03	4/15/03	Failure to request permit renewal 120 days prior to permit expiration. Abated with submittal of permit renewal application.
NO4-49-4-1	8/19/04	8/23/04	Employee Parking in Forest Service trail-head. Vehicle removed from trail-head.
N04-49-5-1	9/8/04	9/13/04	Failure to control non-coal waste. Non-coal waste was picked up and stored in appropriate area.

WESTRIDGE MINE
PERMIT NUMBER 007/041

DOGM VIOLATIONS 2001 THROUGH OCTOBER 2004

VIOLATION/ CESSATION NO.	DATE ISSUED	ABATEMENT DATE	VIOLATION DESCRIPTION
NO2-49-2-1	11/19/02	2/18/02	Diverting mine water through channels and culverts and storing in sediment pond. Abated with submittal of permit change allowing use.
NO2-49-1-1	2/19/02	5/20/02	Failure to maintain or construct diversions according to approved MRP. Abated with the completion of a permit change approval and construction measures.
NO4-49-1-1	1/22/04	1/22/04	Failure to request permit renewal 120 prior to permit expiration. Abated with submittal of permit renewal application.

CENTENNIAL MINES
PERMIT NUMBER 007/019

DOGM VIOLATIONS 2001 THROUGH OCTOBER 2004

VIOLATION/ CESSATION NO.	DATE ISSUED	ABATEMENT DATE	VIOLATION DESCRIPTION
NO4-49-2-1	1/24/04	3/25/04	Failure to maintain disturbed diversion DD-4 and culvert.

APPENDIX 1-15

MODIFICATION OF FEDERAL LEASE U-68082

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

Serial No. UTU-68082

MODIFIED COAL LEASE

Date of Lease March 1, 1994

PART I.

THIS MODIFIED COAL LEASE is entered into on November 29, 2004, by and between the UNITED STATES OF AMERICA, hereinafter called the Lessor, through the Bureau of Land Management, and

Intermountain Power Agency (50%)
Los Angeles Dept. of Water and Power
111 North Hope Street, Room 1263
Los Angeles, CA 90012-2694

ANDALEX Resources, Inc. (50%)
45 West 10000 South, Suite 401
Sandy, UT 84070

hereinafter called Lessee.

This modified lease shall retain the effective date of March 1, 1994, of the original COAL LEASE UTU- 68082, and is effective for a period of 20 years therefrom, and for so long thereafter as coal is produced in commercial quantities from the leased lands, subject to readjustment of lease terms at the end of the 20th lease year (September 1, 1976), and each 10-year period thereafter.

Sec. 1. This lease is issued pursuant and subject to the terms and provisions of the: (NOTE: Check the appropriate Act or Acts.)

XX Mineral Lands Leasing Act of 1920, as amended, 41 Stat. 437, 30 U.S.C. 181-287, hereinafter referred to as the Act;

_ Mineral Leasing Act for Acquired Lands of 1947, 61 Stat. 913, 30 U.S.C. 351-359;

and to the regulations and formal orders of the Secretary of the Interior which are now or hereafter in force, when not inconsistent with the express and specific provisions herein.

Sec. 2. Lessee as the holder of Coal Lease UTU- 68082, issued effective March 1, 1994, was granted the exclusive right and privilege to drill for, mine, extract, remove or otherwise process and dispose of the coal deposits in, upon, or under the lands described below as Tract 1.

The Lessor in consideration of fair market value, rents and royalties to be paid, and the conditions and covenants to be observed as herein set forth, hereby grants and leases to Lessee the exclusive right and privilege to drill for, mine, extract, remove, or otherwise process and dispose of the coal deposits in, upon, or under the lands described below as Tract 2.

Tract 1: T. 15 S., R. 6 E., SLM, Utah
Sec. 25, S½,
Sec. 26, S½,
Sec. 35, all.
T. 15 S., R. 7 E., SLM, Utah
Sec. 30, lots 7-12, SE;
Sec. 31, lots 1-12, NE, N½SE, SWSE.
T. 16 S. R. 6 E., SLM, Utah
Sec. 1, lots 1-12, SW;
T. 16 S., R. 7 E., SLM, Utah
Sec. 6, lots 2-4, SWNE.

Tract 2: T. 15 S., R. 7 E., SLM, Utah
Sec. 32, W½NW, NWSW.

containing 3,099.49 acres, more or less, together with the right to construct such works, buildings, plants, structures, equipment and appliances and the right to use such on-lease rights-of-way which may be necessary and convenient in the exercise of the rights and privileges granted, subject to the conditions herein provided.

Part II. TERMS AND CONDITIONS

Sec. 1.(a) RENTAL RATE - Lessee shall pay Lessor rental annually and in advance for each acre or fraction thereof during the continuance of the lease at the rate of $3.00 per acre for each lease year.

(b) RENTAL CREDITS - Rental shall not be credited against either production or advance royalties for any year.

Sec. 2.(a) PRODUCTION ROYALTIES - The royalty shall be 8 percent of the value of the coal as set forth in the regulations. Royalties are due to Lessor the final day of the month succeeding the calendar month in which the royalty obligation accrues.

(b) ADVANCE ROYALTIES - Upon request by the Lessee, the authorized officer may accept, for a total of not more than 10 years, the payment of advance royalties in lieu of continued operation, consistent with the regulations. The advance royalty shall be based on a percent of the value of a minimum number of tons determined in the manner established by the advance royalty regulations in effect at the time the Lessee requests approval to pay advance royalties in lieu of continued operation.

Sec. 3. BONDS - Lessee shall maintain in the proper office a lease bond in the amount of $139,000. The authorized officer may require an increase in this amount when additional coverage is determined appropriate.

Sec. 4. DILIGENCE - This lease achieved diligent development August 31, 1994, and is subject to the conditions of continued operation. Continued operation may be excused when operations under the lease are interrupted by strikes, the elements, or casualties not attributable to the Lessee. The Lessor, in the public interest, may suspend the condition of continued operation upon payment of advance royalties in accordance with the regulations in existence at the time of the suspension.

The Lessor reserves the power to assent to or order the suspension of the terms and conditions of this lease in accordance with, inter alia, Section 39 of the Mineral Leasing Act, 30 U.S.C. 209.

Sec. 5. LOGICAL MINING UNIT (LMU) – Either upon approval by the Lessor of the Lessee's application or at the direction of the Lessor, this lease shall become an LMU or part of an LMU, subject to the provisions set forth in the regulations.

The stipulations established in an LMU approval in effect at the time of LMU approval or modification will supersede the relevant inconsistent terms of this lease so long as the lease remains committed to the LMU. If the LMU of which this lease is a part is dissolved, the lease shall then be subject to the lease terms which would have been applied if the lease had not been included in an LMU.

Sec. 6. DOCUMENTS, EVIDENCE AND INSPECTION - At such times and in such form as Lessor may prescribe, Lessee shall furnish detailed statements showing the amounts and quality of all products removed and sold from the lease, the proceeds therefrom, and the amount used for production purposes or unavoidably lost.

Lessee shall keep open at all reasonable times for the inspection of any duly authorized officer of Lessor, the leased premises and all surface and underground improvements, works, machinery, ore stockpiles, equipment, and all books, accounts, maps, and records relative to operations, surveys, or investigations on or under the leased lands.

Lessee shall allow Lessor access to and copying of documents reasonably necessary to verify Lessee compliance with terms and conditions of the lease.

While this lease remains in effect, information obtained under this section shall be closed to inspection by the public in accordance with the Freedom of Information Action (5 U.S.C. 552).

Sec. 7. DAMAGES TO PROPERTY AND CONDUCT OF OPERATIONS - Lessee shall comply at its own expense with all reasonable orders of the Secretary, respecting diligent operations, prevention of waste, and protection of other resources.

Lessee shall not conduct exploration operations, other than casual use, without an approved exploration plan. All exploration plans prior to the commencement of mining operations within an approved mining permit area shall be submitted to the authorized officer.

Lessee shall carry on all operations in accordance with approved methods and practices as provided in the operating regulations, having due regard for the prevention of injury to life, health, or property, and prevention of waste, damage or degradation any land, air, water, cultural, biological, visual, and other resources, including mineral deposits and formations of mineral deposits not leased hereunder, and to other land uses or users. Lessee shall take measures deemed necessary by Lessor to accomplish the intent of this lease term. Such measures may include, but not limited to, modification to proposed siting or

design of facilities, timing of operations, and specifications of interim and final reclamation procedures. Lessor reserves to itself the right to lease, sell, or otherwise dispose of the surface or other mineral deposits in the lands and the right to continue existing uses and to authorize future uses upon or in the leased lands, including issuing leases for mineral deposits not covered hereunder and approving easements or rights-of-way. Lessor shall condition such uses to prevent unnecessary or unreasonable interference with rights of Lessee as may be consistent with concepts of multiple use and multiple mineral development.

Sec. 8 PROTECTION OF DIVERSE INTERESTS, AND EQUAL OPPORTUNITY - Lessee shall: pay when due all taxes legally assessed and levied under the laws of the State or the United States; accord all employees complete freedom of purchase; pay all wages at least twice each month in lawful money of the United States; maintain a safe working environment in accordance with standard industry practices; restrict the workday to not more than 8 hours in any one day for underground workers, except in emergences; and take measures necessary to protect the health and safety of the public. No person under the age of 16 years shall be employed in any mine below the surface. To the extent that laws of the State in which the lands are situated are more restrictive than the provisions in this paragraph, then the State laws apply.

Lessee will comply with all provisions of Executive Order No. 11246 of September 24, 1965, as amended, and the rules, regulations, and relevant orders of the Secretary of Labor. Neither Lessee nor Lessee's subcontractors shall maintain segregated facilities.

Sec. 9.(a) TRANSFERS
(Check the appropriate space)

X This lease may be transferred in whole or in part to any person, association or corporation qualified to hold such lease interest.

___ This lease may be transferred in whole or in part to another public body, or to a person who will mine the coal on behalf of, and for the use of, the public body or to a person who for the limited purpose of creating a security interest in favor of a lender agrees to be obligated to mine the coal on behalf of the public body.

___ This lease may only be transferred in whole or in part to another small business qualified under 13 CFR 121.

Transfers of record title, working or royalty interest must be approved in accordance with the regulations.

(b) RELINQUISHMENTS - The Lessee may relinquish in writing at any time all rights under this lease or any portion thereof as provided in the regulations. Upon Lessor's acceptance of the relinquishment, Lessee shall be relieved of all future obligations under the lease or the relinquished portion thereof, whichever is applicable.

Sec. 10. DELIVERY OF PREMISES, REMOVAL OF MACHINERY, EQUIPMENT, ETC. - At such times as all portions of this lease are returned to Lessor, Lessee shall deliver up to Lessor the land leased, underground timbering, and such other supports and structures necessary for the preservation of the mine workings on the leased premises or deposits and place all workings in condition for suspension or abandonment. Within 180 days thereof, Lessee shall remove from the premises all other structures, machinery, equipment, tools, and materials that it elects to or as required by the authorized officer. Any such structures, machinery, equipment, tools, and materials remaining on the leased lands beyond 180 days, or approved extension thereof, shall become the property of the Lessor, but Lessee shall either remove any or all such property or shall continue to be liable for the cost of removal and disposal in the amount actually incurred by the Lessor. If the surface is owned by third parties, Lessor shall waive the requirement for removal, provided the third parties do not object to such waiver. Lessee shall, prior to the termination of bond liability or at any other time when required and in accordance with all applicable laws and regulations, reclaim all lands the surface of which has been disturbed, dispose of all debris or solid waste, repair the offsite and onsite damage caused by Lessee's activity or activities incidental thereto, and reclaim access roads or trails.

Sec. 11. PROCEEDINGS IN CASE OF DEFAULT - If Lessee fails to comply with applicable laws, existing regulations, or the terms, conditions and stipulations of this lease, and the noncompliance continues for 30 days after written notice thereof, this lease shall be subject to cancellation by the Lessor only by judicial proceedings. This provision shall not be construed to prevent the exercise by Lessor of any other legal and equitable remedy, including waiver of the default. Any such remedy or waiver shall not prevent later cancellation for the same default occurring at any other time.

Sec. 12. HEIRS AND SUCCESSORS - IN-INTEREST - Each obligation of this lease shall extend to and be binding upon, and every benefit hereof shall insure to,

ATTACHMENT

STANDARD BLM AND SPECIAL FS
COAL LEASE STIPULATIONS
FOR FEDERAL COAL LEASE UTU-68082

1. The Regulatory Authority shall mean the State Regulatory Authority pursuant to a cooperative agreement approved under 30 CFR Part 745 or in the absence of a cooperative agreement, Office of Surface Mining. The authorized officer shall mean the State Director, Bureau of Land Management. The authorized officer of the Surface Management Agency shall mean the Forest Supervisor, Forest Service. Surface Management Agency for private surface is the Bureau of Land Management. For adjoining private lands with Federal minerals and which primarily involve National Forest Service issues, the Forest Service will have the lead for environmental analysis and, when necessary, documentation in an environmental assessment or environmental impact statement.

2. The authorized officers, of the Bureau of Land Management, Office of Surface Mining (Regulatory Authority), and the Surface Management Agency (Forest Service) respectively, shall coordinate, as practical, regulation of mining operations and associated activities on the lease area.

3. In accordance with Sec. 523(b) of the "Surface Mining Control and Reclamation Act of 1977," surface mining and reclamation operations conducted on this lease are to conform with the requirements of this Act and are subject to compliance with the Office of Surface Mining Regulations, or as applicable, a Utah program equivalent approved under cooperative agreement in accordance with Sec. 523(c). The United States Government does not warrant that the entire tract will be susceptible to mining.

4. Federal Regulations 43 CFR 3400 pertaining to Coal Management make provisions for the Surface Management Agency, the surface of which is under the jurisdiction of any Federal agency other than the Department of Interior, to consent to leasing and to prescribe conditions to insure the use and protection of the lands. All or part of this lease contain lands the surface of which are managed by the United States Department of Agriculture, Forest Service Manti-La Sal National Forest.

The following stipulations pertain to the lessee responsibility for mining operations on the lease area and on adjacent areas as may be specifically designated on the National Forest System lands.

5. Before undertaking activities that may disturb the surface of previously undisturbed leased lands, the lessee may be required to conduct a cultural resource inventory and a paleontological appraisal of the areas to be disturbed. These studies shall be conducted by qualified professional cultural resource specialists or qualified paleontologists, as appropriate, and a report prepared itemizing the findings. A plan will then be submitted making recommendations for the protection of, or measures to be taken to mitigate impacts for identified cultural or paleontological resources.

If cultural resources or paleontological remains (fossils) of significant scientific interest are discovered during operations under this lease, the lessee prior to disturbance shall, immediately bring them to the attention of the appropriate authorities. Paleontological remains of significant scientific interest do not include leaves, ferns, or dinosaur tracks commonly encountered during underground mining operations.

The cost of conducting the inventory, preparing reports, and carrying out mitigating measures shall be borne by the lessee.

6. If there is reason to believe that threatened or endangered (T&E) species of plants or animals, or migratory bird species of high Federal interest occur in the area the lessee shall be required to conduct an intensive field inventory of the area to be disturbed and/or impacted. The inventory shall be conducted by a qualified specialist and a report of findings will be prepared. A plan will be prepared making recommendations for the protection of these species or action necessary to mitigate the disturbance.

The cost of conducting the inventory, preparing reports, and carrying out mitigating measures shall be borne by the lessee.

7. The lessee shall be required to perform a study to secure adequate baseline data to quantify the existing surface resources on and adjacent to the lease area. Existing data may be used if such data is adequate for the

intended purposes. The study shall be adequate to locate, quantify, and demonstrate the inter-relationship of the geology, topography, surface hydrology, vegetation, and wildlife. Baseline data will be established so that future programs of observation can be incorporated at regular intervals for comparison.

8. Powerlines used in conjunction with the mining of coal from this lease shall be constructed so as to provide adequate protection for raptors and other large birds. When feasible, powerlines will be located at least 100 yards from public roads.

9. The limited area available for mine facilities at the coal outcrop, steep topography, adverse winter weather, and physical limitations on the size and design of the access road, are factors which will determine the ultimate size of the surface area utilized for the mine. A site specific environmental analysis will be prepared for each new mine site development and for major modifications to existing developments to examine alternatives and mitigate conflicts.

10. Consideration will be given to site selection to reduce adverse visual impacts. Where alternative sites are available, and each alternative is technically feasible, the alternative involving the least damage to the scenery and other resources shall be selected. Permanent structures and facilities will be designed, and screening techniques employed, to reduce visual impacts, and where possible achieve a final landscape compatible with the natural surroundings. The creation of unusual, objectionable, or unnatural land forms and vegetative landscape features will be avoided.

11. The lessee shall be required to establish a monitoring system to locate, measure, and quantify the progressive and final effects of underground mining activities on the topographic surface, underground and surface hydrology and vegetation. The monitoring system shall utilize techniques which will provide a continuing record of change over time and an analytical method for location and measurement of a number of points over the lease area. The monitoring shall incorporate and be an extension of the baseline data.

12. The lessee shall provide for the suppression and control of fugitive dust on haul roads and at coal handling and storage facilities. On Forest Development Roads (FDR), lessees may perform their share of road maintenance by a commensurate share agreement if a significant degree of traffic is generated that is not related to their activities.

13. Except at specifically approved locations, underground mining operations shall be conducted in such a manner so as to prevent surface subsidence that would: (1) cause the creation of hazardous conditions such as potential escarpment failure and landslides, (2) cause damage to existing surface structures, or (3) damage or alter the flow of perennial streams. The lessee shall provide specific measures for the protection of escarpments, and determine corrective measures to assure that hazardous conditions are not created.

14. In order to avoid surface disturbance on steep canyon slopes and to preclude the need for surface access, all surface breakouts for ventilation tunnels shall be constructed from inside the mine, except at specifically approved locations.

15. If removal of timber is required for clearing of construction sites, etc., such timber shall be removed in accordance with the regulations of the surface management agency.

16. The coal contained within, and authorized for mining under this lease, shall be extracted only by undergrounc mining methods.

17. Existing Forest Service owned or permitted surface improvements will need to be protected, restored, or replaced to provide for the continuance of current land uses.

18. In order to protect big game wintering areas, elk calving and deer fawning areas, sage grouse strutting areas, and other critical wildlife habitat and/or activities, specific surface uses outside the mine development area may be curtailed during specific periods of the year.

19. Support facilities, structures, equipment, and similar developments will be removed from the lease area within 2 years after the final termination of use of such facilities. This provision shall apply unless the requirement of Section 10 of the lease form is applicable. Disturbed areas and those areas previously occupied by such

facilities will be stabilized and rehabilitated, drainages reestablished, and the areas returned to a pre-mining land use.

20. The lessee at the conclusion of the mining operations, or at other times as surface disturbance related to mining may occur, will replace all damaged, disturbed, or displaced corner monuments (section corners, quarter corners, etc.) their accessories and appendages (witness trees, bearing trees, etc.) or restore them to their original condition and location, or at other locations that meet the requirements of the rectangular surveying system. This work shall be conducted at the expense of the lessee, by a professional land surveyor registered in the State of Utah and to the standards and guidelines found in the manual of surveying instruction, U.S. Department of Interior.

21. The lessee at his expense will be responsible to replace any surface water identified for protection, that may be lost or adversely affected by mining operations, with water from an alternate source in sufficient quantity and quality to maintain existing riparian habitat, fishery habitat, livestock and wildlife use, or other land uses.

22. The lessee must comply with all the rules and regulations of the Secretary of Agriculture set forth at Title 36, Chapter II, of the Code of Federal Regulations governing the use and management of the National Forest System (NFS) when not inconsistent with the rights granted by the Secretary of the Interior in the lease. The Secretary of Agriculture's rules and regulations must be complied with for (1) all use and occupancy of the NFS prior to approval of a permit/operation plan by the Secretary of Interior, (2) uses of all existing improvements, such as Forest Development Roads, within and outside the area licensed, permitted or leased by the Secretary of Interior, and (3) use and occupancy of the NFS not authorized by a permit/operation plan approved by the Secretary of the Interior.

All matters related to this stipulation are to be addressed to :

Forest Supervisor
Manti-La Sal National Forest
599 West Price River Drive
Price, Utah 84501
Telephone No.: (435) 637-2817

who is the authorized representative of the Secretary of Agriculture.

23. The lessee/operator will be required to drill horizontally ahead of the advance of development workings to the west in the vicinity of the Joes Valley fault zone to locate any faults and determine if they contain significant amounts of water. If significant water is encountered, the operator will be required to take appropriate measures, subject to approval of the Bureau of Land Management and Forest Service, to prevent diverting this water into the mine workings.

24. Except at specifically approved locations, mining that would cause subsidence will not be permitted within a zone along the Joes Valley Fault determined by projecting a 22 degree angle-of-draw (from vertical) eastward from the surface expression of the Joes Valley Fault, down to the top of the coal seam to be mined.

ATTACHMENT
SUPPLEMENTAL FS STIPULATION
MODIFICATION OF FEDERAL COAL LEASE UTU-68082

Stipulation:
Except at locations specifically approved by the Authorized Officer, with concurrence of the surface management agency, full extraction mining will not be authorized where the fracture zone created by subsidence is projected to reach the surface, as calculated by 50 times the thickness of coal removed plus 50 feet.

ANDALEX Resources, Inc.
Company or Lessee Name)

(Signature of Lessee)

Douglas H. Smith, President
(Title)

JANUARY 12, 2005
(Date)

Intermountain Power Agency
Company or Lessee Name

Reed J. Searle
(Signature of Lessee)

Gen. Manager
(Title)

JAN 12, 2005
(Date)

The United States of America

BY James F. Koller

JAMES F. KOLLER
(Signing Officer)

CHIEF, BRANCH OF SOLID MINERALS
(Title)

Feb. 28, 2005
(Date)

Title 18 U.S.C. Section 1001, makes it a crime for any person knowingly and willfully to make to any department or agency of the United States any false, fictitious or fraudulent statements or representations as to any matter within its jurisdiction.

the heirs, executors, administrators, successors, or assigns of the respective parties hereto.

Sec. 13. **INDEMNIFICATION** - Lessee shall indemnify and hold harmless the United States from any and all claims arising out of the Lessee's activities and operations under this lease.

Sec. 14. **SPECIAL STATUTES** - This lease is subject to the Federal Water Pollution Control Act (33 U.S.C. 1151 - 1175); the Clean Air Act (42 U.S.C. 1857 et seq.), and to all other applicable laws pertaining to exploration activities, mining operations and reclamation, including the Surface Mining Control and Reclamation Act of 1977 (30 U.S.C. 1201 et seq.)

Sec. 15. **SPECIAL STIPULATIONS** -

SEE ATTACHED STIPULATIONS

APPENDIX 1-15A

BLM/FOREST SERVICE JOINT DECISION
UTU-68082 LEASE MODIFICATION

CHAPTER 2

SOILS

2.10 Introduction

This chapter presents soil resource data and soil mapping for the Crandall Canyon Mine. This information has been compiled from the previously approved Mine Reclamation Plan ACT/015/032 and newly gathered data associated with the approved culvert expansion. Additional soil information from the proposed south portals is also included. Soil studies were conducted in accordance with guidelines issued by the Utah Division of Oil, Gas, and Mining. All surveys fulfilled the requirements established by the Soil Conservation Service (SCS).

The permit area and coal leases are delineated on Plate 1-1. The disturbed area is presented on Plate 5-3. There will be no surface disturbance within the Incidental Boundary Change area. The area is being added to facilitate the extension of underground main entries and will not affect the ground surface or vegetation. There will be no surface disturbance within the South Crandall Lease area nor the U-68082 lease mod area as a result of mining within the lease.

This chapter presents a description of the premining soil resources, feasible use of substitute soils, topsoil and subsoil to be saved, stockpiling of soils, and surveys of the soils.

2.20 Environmental Description

The mine and existing area of disturbance is at an elevation of approximately 7500-7800 feet on a southern exposure with slopes ranging from 5% to 70%. The disturbance associated with the culvert expansionl include the canyon floor and the associated toeslopes. The mean annual soil temperature is 40 to 44 degrees F and the average annual precipitation is 20 to 23 inches.

The soils are classified as Entisols and Mollisols. The Entisols are shallow, found on the steeper slopes and have a moderate to high erosion hazard. The Entisols are classified as poor for the recoverability of topsoil due to the steepness of slope (50-70 percent) and the high percent of large rocks on and in the surface layer (35-60 percent). Recovery of topsoil from these areas is difficult.

The Mollisols are found on more moderate slopes and are deep, well drained soils which have a moderate to low erosion hazard. The Mollisols generally have a deep, well formed A horizon. These soils in general can produce large amounts of topsoil and subsoil that can be removed, stockpiled, and used as good growth medium for reclamation.

Revised 4/05/2003

2.21 Prime Farmland Investigation

The land within the permit area has not been historically used as cropland nor is the area conducive to intensive agricultural uses. GENWAL contacted SCS in Salt Lake City and obtained a letter of negative determination enclosed as Appendix 2-1 from Mr. T.B. Hutchings Ph.D., SCS State Soil Scientist. There is no prime farmland within the South Crandall lease area nor the U-68082 lease mod area. (Refer to Appendix 2-10)

Also, information from the field survey completed by Valley Engineering was sent to SCS and a letter was received by GENWAL indicating a negative determination for the presence of an alluvial floor. The SCS letter is included with this application as Appendix 2-2. Both of these negative determinations are supported by the findings of Mr. Dean Larson, Soil Scientist with the Price Office of the U.S. Forest Service (Appendix 2-3A).

2.22 Soil Survey

The initial soil survey was conducted by Valley Engineering. Refer to Plate 2-1 for the existing surface disturbance. Accurate soil survey information and productivity data were obtained and are representative of the entire disturbed area (see Appendix 2-3 and Plate 2-1).

A supplemental soil survey was conducted by GENWAL personnel, Chris Hansen of Earthfax and David Steed of EIS in the summer of 1995 and 1996 to assess the undisturbed soils in the area of the culvert expansion project (Plate 2-4). These data have close correlation with and support the findings of the previous soil surveys.

2.22.2 Soil Identification

The "Soil Study" report prepared by Valley Engineering is included as Appendix 2-3 and the "Soil Types Study Map" is included as Plate 2-1. An additional soils study, prepared by the U.S. Forest Service, is included under Appendix 2-3A. The data collected for the approved culvert expansion project are contained in Appendix 2-3B. An additional soil study was prepared by James Nyenhuis for the south portal expansion (see Appendix 2-6). A map is included with this report.

2.22.3 Soil Description

Soil descriptions are found in the "Soil Study" report prepared by Valley Engineering included as Appendix 2-3 and on the "Soils Types Study Map" included as Plate 2-1. Refer to Plate 2-6 for the regional soil classification, including the soils within the South Crandall lease area.

Also, additional soil survey information can be found in Addendum to Appendix 3-2, Synopsis of Riparian Baseline Inventory of Crandall Creek and Review of Baseline Riparian Inventory of Crandall Creek Proposed Crandall Mine Expansion for a more thorough discussion on hydric soils.
Revised 4/05/2003

CHAPTER 3

LIST OF APPENDICES (continued)

APPENDIX NUMBER	DESCRIPTION
APPENDIX 3-13	Wetland Delineation Crandall Creek Mine Expansion Area
APPENDIX 3-14	Woody Plant Species Density Measurements of the Proposed Disturbed Riparian Areas of Crandall Creek
APPENDIX 3-15	Productivity Estimate (NRCS) - Expansion Area
APPENDIX 3-16	DWR Raptor Survey (2003)
APPENDIX 3-16A	DWR Raptor Survey (2004)
APPENDIX 3-18	Water Depletion
APPENDIX 3-19	DWR Habitat Information, 2004
APPENDIX 3-20	Final Environmental Assessment, Modification of Federal Coal Lease UTU-68082, U.S. Forest Service
APPENDIX 3-21	Perennial Stream Considerations at "No-Name Creek" & Blind Canyon Creek, Tributaries to Huntington Canyon Creek (Mt. Nebo Scientific)

Note: Bold number plates and appendices are included with this submittal.

CHAPTER 3

BIOLOGY

3.10 Introduction

This chapter presents a description of the biological resources found within the life of mine permit area. The sections addressed in this chapter are:

- the vegetative, fish and wildlife resources;
- the potential impacts to vegetative, fish and wildlife resulting from the proposed operations,
- the mitigation plans and measures to minimize the impacts;
- and the reclamation plan to restore the vegetative, fish and wildlife resources to a condition suitable to the postmining land use.

3.11 Vegetation, Fish and Wildlife Resources

Vegetation, fish and wildlife resources of the permit area and adjacent area are described under 3.20.

The proposed Incidental Boundary Change will not create any surface disturbance or affect any vegetation resources. Regional vegetation information for the Incidental Boundary Change area can be found on Plate 3-2. Regional wildlife information for the IBC are is shown on Plate 3-1. Mining within the South Crandall lease will not create any surface disturbance or affect any vegetation or wildlife resources. Regional wildlife information for the South Crandall lease area is shown on Plate 3-1. Regional vegetation information for the South Crandall lease area is shown on Plate 3-2.

Mining within the U-68082 lease mod area will not create any surface disturbance or affect any vegetation or wildlife resources. Regional wildlife information for the U-68082 lease mod area is shown on Plate 3-1 and Appendix 3-19. Regional vegetation information for the U-68082 lease mod area is shown on Plate 3-2. Photographs of the regional vegetation of the lease mod area can be found in Appendix 7-64. A discussion of the vegetation in the drainages and perennial stream considerations in the lease mod area can be found in Appendix 3-21. Refer to Appendix 3-20 "Final Environmental Assessment, Modification of Federal Coal Lease UTU-68082, U.S. Forest Service" for additional information regarding wildlife and vegetation in the lease mod area.

3.12 Potential Impacts to Vegetation, Fish, and Wildlife Resources

Potential impacts and methods to minimize these impacts are described under 3.30.

3.13 Restoration and Enhancement

Reclamation procedure to restore and or enhance resources are addressed under 3.40.

There are no known locations of drumming logs in Crandall Canyon or near the proposed disturbance areas, according to Larry Dalton of the Utah Division of Wildlife Resources. The mine permit and contiguous area inventoried to make this determination begins at the confluence of Horse Canyon with Huntington Canyon to the confluence of Mill Canyon with Huntington Canyon, and thence west to the west side of East Mountain.

No raptor nests where located in the riparian zone. The target species of the riparian inventory was the Goshawk. During the 1992 inventory no Goshawks were observed or located. (For further information, see the Environmental Assessment of Coal Lease UTU-68082, Crandall Canyon Tract by the USFS, Manti-La Sal National Forest.) Raptor nests have been located in Crandall Canyon (Plate 3-1A). One of the nests was occupied by a nesting pair of Golden Eagles in the Spring of 1995. During the raptor survey conducted in 1996 the nests were classified as "old, dilapidated" meaning that they were not active nests and had not been tended (based on communication with Ben Morris in March 1997).

No raptor nests were found within either the existing permit area or Incidental Boundary Change area during the 1998 raptor survey conducted on May 20, 1998 (personal communication with Ben Morris, May 1998). DWR conducted a raptor survey of the South Crandall lease area in May 2003. No nests were found. The results of this survey area shown in Appendix 3-16. DWR raptor surveys in 2003 and 2004 covered the U-68082 lease mod area, and no nest were found (see Appendix 3-16 and 3-16A).

Reptiles and Amphibians

The ranges and habitat preferences obtained from published data for the vertebrate species of southeastern Utah have been compared with the location and available habitats of Crandall and Huntington Canyons. Table 3 in Appendix 3-3 presents a list of the reptiles which may be found in the area and their relative abundance.

Reptiles are found throughout the mine permit area from the riparian areas to the mesic hillslopes and ridgetops. Amphibians are found near water in the habitats associated with Huntington and Crandall Creeks or near springs and seeps located on the hillsides above the creeks. (See Appendices 3-2 & 3-3 and refer to Table 5 included within Appendix 3-3). Baseline studies in the spring and summer of 1994 did not encounter the presence of any threatened or endangered reptile or amphibian.

3.22.21 Listed or Proposed Endangered or Threatened Species of Plants and Animals, and Critical Habitat

FEDERALLY LISTED AND PROPOSED ENDANGERED (E) AND THREATENED (T) SPECIES AND THEIR HABITAT IN EMERY COUNTY

In a 2004 listing the following T and E Species were identified for Emery County. They are:

Bonytail	*Gila elegans*	E
Colorado Pikeminnow	*Ptychocheilus lucius*	E
Humpback Chub	*Gila cypha*	E
Razorback Sucker	*Xyrauchen texanus*	E
Bald Eagle	*Haliaeetus leucocephalus*	T
Mexican Spotted Owl	*Strix occidentalis lucida*	T
Western Yellow-billed Cuckoo	*Coccyzus americanus occidentalis*	C
Black-footer Ferret	*Mustela nigripes*	E
Southwestern Willow Flycatcher	*Empidonax traillii extimus*	E

Listed threatened and endangered species potentially present in the permit area is the Bald Eagle (Haliaeetus leucocephalus) (E). (Source: U.S. Fish and Wildlife Service, July, 1994)

None of the species are likely to occur within the mine permit area, (including the South Crandall lease area and the U-68082 lease mod area) because habitats for these species in the permit area are marginal. Areas of potential occurrence include riparian forests along Huntington Canyon for the Bald Eagle.

A revised (2004) list of wildlife and vegetation T & E species within Emery County is provided in the second addendum to Appendix 3-3.

<u>Migratory Birds of High Federal Interest</u>

This group of especially significant species is comprised of 22 bird species identified by FWS as occurring in the Uintah-Southwestern Utah Coal Production Region. Of the 22 species 7 species have the potential of migrating within the region where the mine is permitted.

1. Bald Eagle
2. Golden Eagle
3. Ferruginous Hawk
4. Cooper's Hawk
5. Prairie Falcon
6. Western Bluebird
7. Flammulated Owl
8. Black Swifts
9. Williamson's Sapsuckers

Data from the U.S. Forest Service indicate that a list of mammals, birds, fish, amphibians and plant species which are sensitive species that are potentially present in the area of influence of the proposed mine permit. They are:

1. Townsend Big-Eared Bat (Mammal)
2. Northern goshawk (Bird)
3. Flammulated owl (Bird)
4. Colorado Cutthroat Trout (Fish)
5. Spotted Bat (Mammal)
6. Three-Toed Woodpecker (Bird)
7. Peregrin Falcon (Bird)

Goshawks and Colorado Cutthroat Trout are the only species on this list that have been observed in the permit area or contiguous to the permit area. According to the Forest Service the Colorado Cutthroats are hybrids, not pure. However, GENWAL has a firm commitment to report the presence of threatened or endangered species to the regulatory authority (irrespective of which list the plants or animals appear on). For example, a monitoring program to determine adaption of any nesting golden eagles was implemented.

Several raptor surveys have been conducted since the original survey in which a golden eagle was reported at a nest site the spring of 1980. The nest site was inactive upon inspection by the DWR in 1987 and no eagles were sited in the vicinity. A 1995 raptor survey conducted in June of 1995 found a nesting pair of Golden Eagles, with fledgling, in a nest on the ridge immediately north of the mine (Appendix 3-3). However, survey work later in 1996 showed the nest sites to be "old and dilapidated". The nests were not active and were in poor condition. No nests were found in the permit area or the Incidental Boundary Change area during the May 1998 raptor survey, (personal communication with Ben Morris, May 1998). DWR conducted a raptor survey of the South Crandall lease area in May 2003. No nests were found. The results of this survey area shown in Appendix 3-16. The U-68082 lease mod area was also surveyed and no nests were found (see Appendix 3-16 and 3-16A).

To further protect this potential valuable resource, an aerial survey for the purpose of identifying cliff-nesting raptors, will be conducted every three years or on request of the U.S. Fish and Wildlife Service (USF&W) or the Utah Division of Wildlife Resources (UDWR).

3.22.220 Habitats of Unusual High Value for Fish and Wildlife

Plates 3-1 and 3-1A identify wildlife usage areas of high or critical value. The haul road and surface facilities within the permit area will not disturb any winter range for deer or elk. Plate 3-1 shows elk and deer winter range in the valley bottoms.

Crandall Canyon represents only a portion of winter habitat for moose, the winter range encompasses all the Huntington Canyon drainage, with a very large amount of unoccupied adjacent habitat, (reference Larry Dalton). Thus, the projected impacts will be minimal. According to Larry Dalton of the State of Utah Division of Wildlife Resources, there is a sufficient volume of adjacent unoccupied habitat suitable to absorb displaced moose. The southeastern Utah moose herd is

SECOND ADDENDUM TO APPENDIX 3-3

LISTING OF CURRENT (2004) THREATENED & ENDANGERED

WILDLIFE AND VEGETATION SPECIES

FEDERALLY LISTED AND PROPOSED ENDANGERED (E) AND THREATENED (T) SPECIES AND THEIR HABITAT IN EMERY COUNTY

Barneby Reed-mustard	*Schoenocrambe barnebyi*	E
Jones Cycladenia	*Cycladenia humilis* var. *jonesii*	T
Last Chance Townsendia	*Townsendia aprica*	T
Maguire Daisy	*Erigeron maguirei*	T
San Rafael Cactus	*Pediocactus despainii*	E
Winkler Cactus	*Pediocactus winkleri*	T
Wright Fishhook Cactus	*Sclerocactus wrightiae*	E
Bonytail[4,10]	*Gila elegans*	E
Colorado Pikeminnow[4,10]	*Ptychocheilus lucius*	E
Humpback Chub[4,10]	*Gila cypha*	E
Razorback Sucker[4,10]	*Xyrauchen texanus*	E
Bald Eagle[1]	*Haliaeetus leucocephalus*	T
Mexican Spotted Owl[1,4]	*Strix occidentalis lucida*	T
Western Yellow-billed Cuckoo	*Coccyzus americanus occidentalis*	C
Black-footer Ferret[6]	*Mustela nigripes*	E
Southwestern Willow Flycatcher	*Empidonax traillii extimus*	E

1 Nests in this county of Utah.

4 Critical habitat designated in this county.

6 Historical range.

9 Candidate species have no legal protection under the Endangered Species Act. However, these species are under active consideration by the Service for addition to the Federal List of Endangered and Threatened Species and may be proposed or listed during the development of the proposed project.

10 Water depletions from any portion of the occupied drainage basin are considered to adversely affect or adversely modify the critical habitat of the endangered fish species, and must be evaluated with regard to the criteria described in the pertinent fish recovery programs.

For additional information contact: U.S. Fish and Wildlife Service, Utah Field Office, 2369 West Orton Circle, Suite 50, West Valley City, Utah 84119 Telephone: (801) 975-3337.

SENSITIVE SPECIES LISTED FOR THE MANTI-LA SAL NATIONAL FOREST

- Chatterlay Onion *Allium geyeri chatterleyi*
- Sweet -flowered rock jasmine *Andorsace chanaejasme carinata*
- Link Trail columbine *Aguilegia flavescens rubicunda*
- Bicknell Milkvetch *Astagalus consobrinus*
- Creutzfeldt-flower cryptanth *Cryptantha creutzfeldtii*
- Pinnate spring-parsley *Cymopterus beckii*
- Abajo daisy *Erigeron abajoensis*
- Carrington daisy *Erigeron carringtonae*
- Kachina daisy *Erigeron kachinensis*
- LaSal daisy *Erigeron mancus*
- Canyonlands lomatium *Kinatuyn katukibyn*
- Canyon sweetvetch *Hedysarum occidentale var. canone*
- Arizona willow *Salix arizonica*
- Musinea groundsel *senecio musiniensis*
- Maguire campion *Silene petersonii*

APPENDIX 3-16

DWR RAPTOR SURVEY (2003)

APPENDIX 3-16A

DWR RAPTOR SURVEY (2004)

APPENDIX 3-20

FINAL ENVIRONMENTAL ASSESSMENT

MODIFICATION OF FEDERAL COAL LEASE UTU-68082,

U.S. FOREST SERVICE

APPENDIX 3-21

PERENNIAL STREAM CONSIDERATIONS AT

"NO-NAME CREEK' & BLIND CANYON CREEK,

TRIBUTARIES TO HUNTINGTON CANYON CREEK

(MT. NEBO SCIENTIFIC)

CHAPTER 4

LIST OF PLATES

PLATE NUMBER	DESCRIPTION
PLATE 4-1	Oil and Gas Leases and Grazing Allotments
PLATE 4-2	Landuse Map
PLATE 4-3	Oil and Gas Development Map
PLATE 4-4	Surface Ownership Map

LIST OF APPENDICES

APPENDIX NUMBER	DESCRIPTION
APPENDIX 4-1	Archeological Reconnaissance in Crandall Canyon
APPENDIX 4-1A	Archeological Study- East Mountain Locality
APPENDIX 4-2	Cultural Resource, Determination of Effect
APPENDIX 4-3	OSM Clearance
APPENDIX 4-4	Cultural Resource Report, Sherman Shelter
APPENDIX 4-5	Archaeological Survey Map
APPENDIX 4-6	Cultural Resource Survey
APPENDIX 4-7	Approval Order, Air Quality
APPENDIX 4-8	Air Quality Approval Order Modification
APPENDIX 4-9	Letter from SHPO (South Crandall Lease Area)
APPENDIX 4-10	Archeology Report, U-68082 Lease Mod Area (Senco-Phenix, 2004)

Note: Bold number plates and appendices are included with this submittal.

CHAPTER 4

LAND USE

4.10 Regional Land Use

The majority of the land use in the Wasatch Plateau is administered by the United States Forest Service and is managed as a multiple use forest area.

4.10.1 Land Use In Mine Plan Area

Prior to 1939, the permit area was used for non-developed recreation, grazing by native big game species and habitat for small game and non-game animals. From 1939 until 1955, the area was mined by traditional room and pillar methods. Approximately 35,000 tons were removed from the Hiawatha Seam. When mining operations were terminated in 1955, the land reverted to its original uses. In 1983, mining activities were resumed. At present, cattle are moved through the canyon to grazing areas at higher elevations. Riparian areas are grazed during the movement through the canyon. A land use map has been prepared and is included as Plate 4-2.

Mining in the South Crandall lease and the U-68082 lease mod area will not affect the present land use of the area. The area is classified as rangeland. The existing landuse will continue during, as well as following, mining in this area. Refer to Plate 4-2.

After mining operations cease, the mine site surface area will be restored to its approximate original contours. The access road will be left in place, pursuant to the wishes of the U.S. Forest Service (USFS) the surface landowner.

4.11 Premining

The premining use of the land was for dispersed non-developed recreation, native wildlife habitats and dispersed cattle grazing. The wildlife habitats within the mine area are described in Appendix 3.2 and 3.3.

The area was used for a previous mining operation. The previous operation prepared level areas to allow access to the coal seam and for coal loading operations. This made the area more accessible to the general public and to the present mining operation.

The previous operation left lumber, deteriorating buildings, fuel and oil cans, and various other trash in the area. A portion of the existing vegetation was also disturbed with no evidence of revegetation.

After reclamation, the area will be restored to support premining land uses. Vegetation will be restored to provide habitat and a food source for wildlife. It is expected that the cattle grazing will continue after reclamation. The access road will remain pursuant to the wishes of the USFS and to support underdeveloped recreation.

4.11.1 Historic Land Use

The Manti-La Sal Division of the United States Forest Service has this area shown on their land use map as suitable for dispersed, non-developed recreation, and limited grazing as the slopes are steep. There is not enough of the necessary vegetation for extensive grazing. It is also classified as unsuitable for logging operations as conifer is only a marginal component of the area.

Crandall Canyon is not actually being used as summer range for cattle, but cattle are moved through the canyon to grazing areas at higher elevations. Because the cattle are moved through the canyon, although undesirable, grazing does occur without noticeable depletion of vegetation in the riparian zone. It is expected that sporadic cattle grazing will continue after mine life.

By returning the disturbed area to its original contour, the canyon outside the riparian zone will be too steep for grazing by other than native wildlife. Wildlife grazing and habitat will be part of the postmining land use.

Plate 4-1 shows the grazing allotment boundaries of the existing permit area and the South Crandall lease area and the U-68082 lease mod area. Plate 4-3 presents the oil and gas analysis areas as well as the existing gas wells.

4.11.110 Surface Land Status/Mine Plan Area

Ownership of the surface rights within and contiguous to the mine plan and permit area is shown on Plates 1-1, 5-3 and 4-1. The surface within the lease areas and the contiguous lands are administered by the USFS. Also as shown on Plate 1-1 there are no structures within 1000' of the mine permit area.

4.11.112 Ownership

The United States Government under the supervision of the Manti-La Sal National Forest owns most of the surface rights in the immediate area of the permit and mine plan area as shown on Plates 1-1 and 4-4.

4.11.113 Surface Managing Authorities

The United States Department of Agriculture, Forest Service, Intermountain Region is the surface managing authority.

4.11.114 Utility Corridors and Other Right-Of-Ways

No utility corridors or other rights-of-way exist on the surface within the existing permit area nor the U-68082 lease mod area. A utility corridor exists within the permit area in the South Crandall lease area. See Plate 4-2. There are no surface or subsurface mad-made features within or passing over the permit or Incidental Boundary Change areas.

There has been no change in the premining use of the land within the last five years.

4.11.115 Affect Of Operation On Land Use

GENWAL feels that greater portion of permit area will not be affected by mining operations and that premining land use will be applicable except for the disturbed area surrounding the portals and the access road.

The maximum area of possible subsidence is shown on Plate 5-2 as the area contained within the zero subsidence contours. As explained in Chapters 5 and 7 no adverse effects are expected to occur as a result of the subsidence mechanisms and no mitigation measures are proposed. In the event subsidence damages or alters streams, roads, etc. GENWAL will repair or replace such structures in conjunction with prudent and reasonable environmental designs and in compliance and agreement with USFS lease stipulations.

4.11.12 Land Capability

In the Manti-La Sal National Forest Land and Resource Management Plan (LRMP), 1986, the Forest Service has developed certain management objectives for the area. The permit area includes four separate management units.

The bottom of Crandall Canyon is included in the MMA (Leasable Minerals Area) Management Unit where management emphasis is on leasable minerals development. This unit includes the surface facilities for the mine.

The eastern portion of the permit area lies within the GWR (General Big Game Winter Range) Management Unit where management emphasis is on providing general big game winter range.

The north and west areas of the permit area lies within the RNG (Range Forage Production) Management Unit. Management emphasis is on production of forage and cover for domestic livestock and wildlife. The Incidental Boundary Change area lies within the RNG use classification. Surface land uses and resources will not be affected by underground mining operations. The South Crandall lease area lies within the RNG and MWS use classifications (see Plate 4-2). The U-68082 lease mod area lies within the RNG use classification.

The riparian area along Crandall Creek is included in the RPN (Riparian) Management Unit. RPN areas include the aquatic (including fish) ecosystem, the riparian (characterized by distinct vegetation), and adjacent ecosystems that remain within approximately 100 feet measured horizontally from the edge of all perennial streams and springs, and the shores of lakes and other still water bodies, i.e., from seeps, bogs, and wet meadows. Emphasis is on preservation of the riparian areas and component ecosystem.

The historic use of the land has been for recreation, forestry, wildlife habitat, and mining as indicated by previous zoning, historic documentation and visual examination.

4.11.13 Land Use/Zoning

Emery County had previously zoned this area as a recreation forestry and mining area. However, as of November 12, 1979, this area has been rezoned to CE-1 which is a critical environment zone. A county zoning of CE-1 does not prohibit mining. Therefore, the area did not have to be rezoned.

4.11.14 Cultural and Historic Resource Information

A Cultural, Historic and Archeological inventory conducted on June 19 and 20, 1980 on all areas to be disturbed in the proposed permit area. No recorded or unrecorded archeological sites were found in the project area. A copy of the report on the archeological inventory is included as a supplement to this chapter as Appendix 4-1.

All of the areas potentially affected by surface disturbing activities in Genwal's Crandall Canyon Mine Plan were investigated for cultural resources. No prehistoric remains were located in the mine plan area. A single site, however, near a haul road from the mine was recorded in 1975, by the Forest Service. This site (42EM722), a rock shelter, is some 50 meters in length and contains at least one meter of cultural deposits. Remains include stone tools, pottery, lithic debris, abundant charcoal, bone and pictographs on the cliff face above. Extensive vandalism has taken place; however, undisturbed areas in the shelter still remain. The site is eligible for inclusion to the National Register of Historic Places. Therefore, it needs to be protected. The major threats to the site appear to be a direct impact from possible road improvement and present ensuing impacts caused by increased vandalism brought about by the improvement of the road. The site was fenced to be a solution to the vandalism problem.

The archeological site at the mouth of Crandall Creek is not threatened by road improvements and the area is fenced as stated in the plan. The initial road development has progressed along Crandall Canyon past site (42EM722) and Genwal has fenced off the designated site accordingly. A detailed report on the Sherman Shelter was completed by the USFS and is included within this chapter as Appendix 4-4. An additional archaeological survey was conducted for LBA #9 in 1992. Data associated with this report are contained in Appendix 4-1A. Additional survey information for the surface facility expansion area is also contained in Attachment 3 in the Addendum to Appendix 3-2.

Since there will be nor surface disturbance within the South Crandall lease area nor the U-68082 lease mod area, no impact to cultural or historic resources will occur. In June, 2004 Senco-Phenix performed an intensive archeological survey of the U-68082 lease mod area and submitted its report to the Forest Service and SHPO. This report is included in Appendix 4-10.

4.11.141 Cultural and Historic Resource Maps

Cultural and Historic Resource maps are included in Appendix 4-5 and 4-6.

4.11.141.1 Boundaries of Listed Historic Resources

There are no public parks in the permit area. The only site of historical significance is a archeological site listed as "The Sherman Shelter 42EM722".

4.11.141.2 Location of Cemeteries

No cemeteries exist within the permit or IBC area or within any adjacent area subject to potential impacts.

4.11.141.3 National Trails/Scenic Rivers

No trails or the wild and scenic rivers or study area rivers exist within the permit area or areas of potential impact.

4.11.142 State Historic Preservation Officer

The State Historic Preservation Office in a letter dated August 8, 1980, (see Appendix 4-2) granted cultural resource clearance for the GENWAL Crandall Canyon Mine. Conditional clearance from OSM was provided by a letter dated April 17, 1981 (see Appendix 4-3). GENWAL has followed the recommendations contained in Appendix 4-1, the Archeological Reconnaissance Report, and fenced site 42EM722. With the acquisition of lease UTU-68082, an additional Paleo-Arch inventory was conducted in 1992. That report is attached as Appendix 4-1A. A subsidence monitoring plan is included as part of Chapter 5. According to the SHPO there are no significant cultural resources within the South Crandall lease area nor the U-68082 lease mod area. (See Appendix 4-9)

APPENDIX 4-10

ARCHEOLOGY REPORT, U-68082 LEASE MOD AREA
SENCO-PHINIX, 2004

CHAPTER 5

LIST OF APPENDICES (continued)

APPENDIX NUMBER	DESCRIPTION
5-16	Storage Pad Stability Analysis
5-17	Road Expansion (within permit area) Safety Factor, Drawings
5-18	Fire Prevention Plan
5-19	Slope Stability Investigation Portal Pad
5-20	Bond Estimate (DOGM determination)
5-21	Reclamation Fill Stability Analysis At The Crandall Canyon Mine Emery County, Utah
5-22	Crandall Canyon Mine Site Reclamation Plan
5-23	Air Quality Permit Amendment, South Portals
5-24	R2P2 (Resource Recovery and Protection Plan) Approval Letter (South Crandall Federal Lease UTU-78953)
5-24A	R2P2 (Resource Recovery and Protection Plan) Approval Letter (120 Acre Modification, Federal Lease UTU-68082)
5-25	Subsidence Survey Letters of Notification

GENWAL is requesting an Incidental Boundary Change in order to mine a long, narrow block of coal adjacent to projected longwall panels in Section 2, T. 16 S., R. 6 E. This block contains about 40,000 tons of federal coal that would not otherwise be mined. An Incidental Boundary Change would allow for maximum recovery of the coal reserves by allowing the longwall setup entires and panels to be moved westward but, in no case, would the longwall panels extend into the 22 degree angle projected downward from the surface expression of the Joe's Valley Fault. The amending the permit boundary would include approximately 50 acres in T 16 S, R 6 E as the Incidental Boundary Change area. Refer to Plates 1-1 and 5-2 for GENWAL's existing lease area and the Incidental Boundary Change Area. This addition would allow GENWAL to mine additional coal reserves located on the eastern edge of sections 3 and 10 from their proposed underground workings in section 2 thus optimizing the coal reserves in this area. This coal would not be mineable from the west due to the Joes's Valley fault, nor from the north or south because of limited access.

GENWAL will obtain a coal right-of-way (application has been submitted) from the BLM in order to extend the longwall panels up to the western boundary of section 2. By extending the longwall panels to the western edge of section 2, a total of approximately 300,000 additional tons could be mined in this area of the mine. The Incidental Boundary Change area would consist of first mining only. The right-of-way would accommodate the setup rooms and barrier pillars for the longwall panels allowing the panels to be extended to the western boundary of section 2. The legal description for the area included in the Incidental Boundary Change is as follows:

T. 16 S., R. 6 E.	Section 3	E1/2 E1/2 SE1/4 NE1/4	10 acres
		E1/2 E1/2 NE1/4 SE1/4	10 acres
		E1/2 SE1/4 SE1/4	20 acres
	Section 10	NE1/4 NE1/4 NE1/4	10 acres
		TOTAL	50 acres

Refer to Plate 5-2 for mine projections in the IBC area.

GENWAL acquired federal lease UTU-78953 (South Crandall tract) on June 2003 (refer to Appendix 5-24 for right of entry information.) Lease UTU-78953 is described as follows:

T. 16 S., R. 7 E.	Section 4	W1/2 SW1/4,	80.00 acres
		S1/2 SW1/4 NW1/4	20.00 acres
	Section 5	SE1/4	160.00 acres
		S1/2 SE1/4 NE1/4	20.00 acres
	Section 8	E1/2	320.00 acres
		NE1/4 NW1/4	40.00 acres
		S1/2 NW1/4	80.00 acres
	Section 9	NW1/4	160.00 acres
		TOTAL	880.00 acres

GENWAL Resources acquired the SITLA/PacifiCorp sublease in February 2004 (Refer to Appendix 1-14 for right-of-entry information.) This sublease is described as follows:

T. 16 S., R. 7 E.	Section 8	NW¼NW¼	40.00 acres

GENWAL Resources acquired the Nielson Fee Lease in April 2004 (Refer to Appendix 1-15 for right-of-entry information.) This sublease is described as follows:

T. 16 S., R. 7 E.	Section 8	SW¼	160.00 acres

It should be noted that throughout this Mining and Reclamation Plan the combined area (1080 acres) of Federal Lease UTU-78953, the SITLA/PacifiCorp sublease and the Nielson Fee Lease is collectively referred to as the South Crandall lease area, the South Crandall tract, the South Crandall mining area and other similar terms.

GENWAL Resources acquired the modification of Federal Lease U-68082 in February, 2005. (Refer to Appendix 1-15 for right of entry information.) This modification is described as follows:

T.15S., R. 7 E.	Section 32	W½NW¼	80.00 acres
		NW¼SW¼	40.00 acres
		Total	120.00 acres

5.21.14 Mine Maps and Permit Area Maps

Plate 1-1 shows leases of the existing permit area (including the South Crandall lease area and the U-68082 lease mod area) and defines the Incidental Boundary Change area. Plate 5-2 shows the boundaries of all areas affected by mining operations, including the proposed underground workings within the IBC area. Plate 5-3 shows the disturbed surface area within the permit area including the culvert expansion. The location and extent of potential subsidence is shown on Plate 6-2.

5.21.15 Land Surface Configuration Maps

Topographic maps used by GENWAL to depict surface contours within the permit area are represented on Plate 5-3.

5.21.16 Maps and Cross-Sections of the Features and Proposed Features

Maps produced by GENWAL show the facilities, disturbed area, disturbed area boundary, (Plate 5-3), explosive storage (there is no explosive storage on the surface), and point source discharges (Plate 7-5). These maps are located within this application.

5.21.17 Transportation Facilities Maps

This application describes each road and conveyor system to be constructed and used by the applicant as required by R645-301-527. Maps supporting this section include Plates 5-3, 5-6, 5-10, 5-19, 7-5, 7-5A, 7-5B and 7-5C.

5.21.18 Support Facilities

Drawings showing support facilities are located on Plates 5-3, 5-6, 5-7, 5-8, 5-18, 7-5, 7-5A, 7-5B, and 7-5C.

5.21.20 Signs and Markers

Signs and Markers are posted, maintained, and removed by the operator; will be of uniform design that can be easily seen and read, be made of durable material, and conform to local laws and regulations, and be maintained during all activities to which they pertain. Identification signs will be placed, maintained, and marked in accordance with R645-301-243.

5.21.24 Mine and Permit Identification Signs

Mine and permit identification signs will be displayed in accordance with R645-301-521.240 through R645-301-521.244.

5.21.25 Perimeter Markers

The perimeter of all areas affected by surface operations or facilities are or will be clearly marked.

5.21.26 Buffer Zone Markers

Signs which have been or will be erected for buffer Zones as required by R645-301-731.600 will be clearly marked.

5.21.27 Topsoil Markers

Markers have been and will be erected to mark where topsoil or other vegetation-supporting material is stockpiled as required under R645-301-234.

5.22 Coal Recovery

The Bureau of Land Management (BLM) and the Utah State Division of Natural Resources govern the conservation and royalty payments of the coal located within GENWAL's proposed permit boundary. Mining plans must be approved by the BLM before mining can occur within the new area. A Resource Recovery Protection Plan (R2P2) is currently on file with the BLM and all federal coal will be mined in accordance with the R2P2 to ensure the diligent development and extraction of all minable coal. (See Appendix 5-24 and Appendix 5-24A)

The lower Blackhawk Formation of the Wasatch Plateau is known to contain two minable seams in this general area. These two seams are locally referred to as the Hiawatha and Blind Canyon (lower and upper coal respectively) seams. Drilling which began in March of 1985, and has since concluded, revealed that the upper seam is not of minable thickness in previous Lease Area. In the South Crandall lease area both seams are minable. In the U-68082 lease mod area only the Hiawatha seam is minable.

In the State lease (M-21568) GENWAL has committed to drilling 150 foot "up-holes" every half-mile in the mains prior to second mining. Installation of the 150 foot up-holes will allow for location and evaluation of the overlying seams for coal production. Mine development plans for the upper seam will be developed and submitted for approval if the horizontal extent and mining conditions make mining the upper seam economically feasible. The BLM has determined the upper seam is not minable and during 1985, approval was given by both the BLM and the Division to commence pillaring of the lower seam.

GENWAL will mine from rock to rock in areas where coal is less than 8' thick and geologic conditions allow. However, in areas where the top is poorly consolidated (i.e. shale partings are present with laminae of carboniferous materials with slickensides) and the roof is not self-supporting, coal top may be left. In addition, on development only, in areas where the coal is more

case scenario. The subsidence values were reduced according to Figure 5-5 for areas that border a barrier pillar along the perimeter of the lease shown on Plate 5-2.

Horizontal movement which would create slope failure along the escarpment is not expected to occur due to subsidence because only limited coal outcrop occurs within the lease (the east side of the lease area). Within that area of old works no pillar extraction is anticipated.

As with areas in the western part of lease SL-062648 and at the Co-Op's Trail Canyon and Bear Canyon Mines and the Beaver Creek #4 mine, no escarpment failure has occurred. Horizontal movement creating tension or compression cracks can not be projected due to the overburden thickness and lack of jointing density and attitude data along the surface rock exposures.

In addition, GENWAL will second mine no closer than 200 feet to any outcrop (with the exception of portals) and, in accordance with Forest Service Stipulation #20, no mining will be done within a zone that might impact the Joes Valley Fault. This area is determined by a 22 degree angle-of-draw (from vertical) eastward from the surface expression of the Joes Valley Fault was used to project the outer limits of subsidence. Thus, subsidence will not intercept the Joes Valley Fault. If subsidence does occur along the western perimeter, all effects of the subsidence will be maintained within the mining permit boundary. No perennial streams will be affected. On the Dellenbach fee tract mining will not extend closer than 200 feet from the outcrop (other than portals) and no closer than 50 feet from the property boundaries. It should be noted that the mine projections and timing for the Dellenbach tract, and the South Crandall lease and the U-68082 lease mod area are shown on Plate 5-2.

It is accepted practice in this area to use two sources of information for subsidence evaluation. The sources are: 1) "Some Engineering Geologic Factors Controlling Coal Mine Subsidence in Utah and Colorado",Geologic Survey Professional Paper 969, by C. Richard Dunrud, 1976, and 2) "SME Mining Engineering Handbook", Volume 1, by Arthur B. Cummins and Ivan A. Given, 1973. The conclusions based upon the above source material are tempered by on site evaluation and actual experience based on similar mining conditions in late Cretaceous overburdens with similar thicknesses and strengths. The surface area topography within the lease is shown on Plate 3-1, 3-1a, 1-1 and others. The topographic map shows the relative steep sloping sides of the canyons which contains Crandall Canyon Creek, Blind Canyon Creek, and Horse Canyon Creek where rock outcrops are abundant. However, there are few, if any, talus slopes.

5.25.10 Subsidence Control Plan

The Subsidence Control Plan contained herein addresses specifically those items that are required by R645-301-525 Pertaining to Subsidence. This plan is an amendment to the original application filed on December 17, 1980, by GENWAL the SUBSIDENCE CONTROL PLAN FOR GENWAL COAL COMPANY, INC., as prepared by David A. Skidmore and L. G. Manwaring of Revised 4/05/2003

Coal Systems Inc., on August 28, 1981; and the Mid-term permit revisions dated 5-30-86. The format of the currently approved COAL SYSTEMS report will be used with the conclusions based upon the results of the drilling of the Blind Canyon seam which was obtained in April, 1985, and the Hiawatha seam data obtained to date during mine development. The original application was submitted pursuant to the following: Title 40, Chapter 10, Utah Code Annotated, 1943, as amended, the "Cooperative Agreement between the United States Department of Interior and the State of Utah"; the Surface Mining Control and Reclamation Act (P. L. 95-87); and all regulations promulgated under those Acts affecting mining operation conducted in the State of Utah.

It should be noted that, according to the stipulations of federal lease UTU-78953, there will be no second mining or subsidence under Little Bear Creek within the South Crandall lease area.

Surface Features and Facilities Subject to Subsidence.

An examination of the surface area as well as of state, federal, and county records indicate there are no man made structures, utilities right-of-ways and public or private resources necessitating protection from subsidence (Plates 5-12, 5-13, and 5-3) within the mine permit boundaries. In addition, aerial inspection of the permit and adjacent area confirmed the absence of existing man made structures. The occurrence of subsidence will not produce material damage or diminution of value of properties or foreseeable use of lands. Possible effects of mine subsidence on groundwater resources are discussed in Chapter 7. Creeks within the area include Crandall Canyon Creek, Blind Canyon Creek, and the left fork of Horse Canyon. Both forks of Crandall Creek are considered to be perennial at least up to the federal lease boundary with State Lease ML-21568.

The surface in the area is controlled and administered by the United States Forest Service with a small southern parcel of land owned by GENWAL (Plate 2-1). The land is used for domestic grazing in the areas of gentle slope and wildlife habitat and recreation over the total acreage. The vegetative resources will not be negatively impacted by subsidence. Thus, the current land use is expected to continue. Similar mining conditions and practices exist at Beaver Creek #4 Mine and CO-OP's Trail Canyon and Bear Creek mines and no significant loss of vegetation has occurred at those sites.

The Crandall Canyon Mine on the western half of lease SL-062648 has experienced second mining under conditions similar to Huntington Canyon and has not experienced any vegetation change, subsidence or escarpment failure. Visual impact will only be observed in the case of a total escarpment failure. Tension cracks, if any do develop, as viewed from the bottom of the canyons will not be visible and the maximum subsidence of three feet when viewed from below and at a distance of greater than ½ mile will not be visible. As per the USFS, there is no marketable timber in the area of potential subsidence.

Since the original submittal, several operations and construction modifications have been submitted to satisfy regulatory compliance requirements. Consideration was given to the subsidence experienced at nearby mines (CO-OP, Beaver Creek #4) exhibiting similar overburden composition and mining methods, on site inspections at the operating Crandall Canyon, CO-OP and Beaver Creek #4 mines and calculation based upon a generally accepted formulas using limited physical coal strength data in determining coal pillar sizes, barrier pillar design and direction of mining. The aforementioned mines were observed from the surface to note any surface effects from subsidence from pillar mining. No substantial affects from mining have been observed. The Crandall Canyon Mine has pillared coal in areas with as little cover as approximately 200' of overburden. The CO-OP

Overburden thicknesses in the upper perennial reaches of Crandall Canyon have been determine to be about 540 feet. Using a pillar size of 70 x 65 and the worst case analytical condition, the factor of safety has been calculated to be 2.2. The coal outcrops within Blind and Horse (both the north and south forks of Horse Canyon) Canyons are above the perennial portions of the stream. Thus, no subsidence will occur under perennial sections of Horse Canyon (the Blind Canyon drainage is ephemeral).

All state appropriated water within the subsidence zone of the South Crandall lease area is shown on Plates 7-14 and 7-15. Plates 5-2(H) and 5-2(BC) show the mine plan for the South Crandall lease area. Plate 5-2(H) shows the mine plan for the U-68082 lease mod area. These maps depict which areas will be longwalled (full extraction) and which areas will be developed as first-mining only. Subsidence Survey Letters of Notification to surface owners and water conservancy districts are included in Appendix 5-25.

The following state appropriated waters are located within the subsidence zone: 93-383, 93-381, 93-483, 93-191, 93-190 and 93-1180. Information about quality, quantity, and ownership of these waters can be found in Chapter 7, Table 7-6, and in Appendix 7-1.

5.25.14 Subsidence Monitoring

The applicant commits to implement the proposed subsidence control plan and applicant hereby incorporates the same into this submittal. An aerial monitoring system for the Crandall Canyon Mine which has been accepted for implementation and vertical and horizontal control have been established using ground control stations, shown on Plate 5-5. (The program is included as Appendix 5-8). Baseline flight lines were flown over Sections 31 and 32 of T15S R9E, Sections 5 and 6 T16S R7E, Sections 1 and 2 T16S R6E, and Sections 35 and 36 T15S R6E in October of 1989. Selected portions and/or all of Sections 34, 35, and 36 T15S R6E and Sections 2 and 3 T16S R6E (Plate 5-5) will be included in the 1995 Fall Survey to ensure that all projected mined areas within LBA#9 are included in the subsidence monitoring program. Control points within and adjacent to the leased area (including the South Crandall lease area) have been established and located by surveying practices. Prior to mining the area was photographed and a pin map was generated.

Aerial surveys will be conducted by GENWAL each year for the areas above and within the 20 degree angle of draw of the actual mined area. Based on a written request by the Forest Service, GENWAL is revising the subsidence monitoring plan. Monitoring will now be conducted annually until subsidence of less than one foot has been measured for three consecutive surveys showing that subsidence is substantially complete.

The following information will be forwarded to the Division on an annual basis when it becomes available:

1. A current map of the underground workings with areas delineated as to where the second mining will begin.
2. The approximate dates when second mining will commence and terminate.
3. The date of monitoring.
4. The vertical and horizontal positions of all monitoring points and pins, directly over and within the 20 degree angle of draw to the mined area, surveyed by aerial photography for that specific year.

There was and has been no evidence of escarpment subsidence or failure. There are no further plans to monitor escarpments in the area not visible from Huntington or Crandall Canyons. The subsidence/escarpment survey results were recorded and submitted to the appropriate regulatory authority. No escarpment failure occurred.

5.25.15 Anticipated Effects of Planned Subsidence

If subsidence does occur, surface effects may include minimal ground lowering and temporary tensional fractures at the margins of the subsided area. Any subsidence occurring on the 160 acre Dellenbach fee tract should have minimal effects on the surface. There are no escarpments, raptor nests, archeology site, streams or springs located the Dellenbach tract. This tract (surface and underground) is privately owned by Genwal Resources Inc. The tract is within the presently approved permit area and is included in the current subsidence monitoring plan.

Subsidence monitoring for the South Crandall lease area and the U-68082 lease mod area will be done according to the existing plan approved for the Crandall Canyon mine. Pre-subsidence base-line aerial surveys have been completed and the initial survey control monuments have been installed on the ground. Additional control points (monuments) will be installed as mining progresses. (Refer to Plates 5-2 and 5-5 for the location of the existing and future monuments.)

In much of the area of the South Crandall lease area, both the Hiawatha and the Blind Canyon seams are proposed for full extraction longwall mining. In these areas the combined thickness of both seams ranges upward to about 12 feet. If surface subsidence in these areas is 80% of total mined seam thickness, then it may be possible to see nearly 10 feet of subsidence in some areas of the lease after mining. It should be noted that the Forest Service and BLM have imposed a special stipulation in the South Crandall federal lease specifically to provide additional protection to the Little Bear spring system. These lease stipulations prohibit full-extraction mining in the following areas;

a) area under the Little Bear stream channel with less than 600' of overburden.
b) area within 1000' of the southeast corner of the lease (to protect the Mill Fork graben.)
c) area within 1000' of southern boundary of lease (to protect possible water-bearing fracture system.)

GENWAL personnel will conduct a surface inspection of all areas where subsidence has occurred no sooner than 6 months but no later than 12 months after extraction mining has occurred.

5.25.16 Mitigation of Damages

As previously presented within this chapter, no material damage or diminution of value or foreseeable use of lands is expected to occur. GENWAL has been in consultation with the BLM and received their concurrence with the conclusions presented in this document, a copy of the BLM correspondence may be found in Appendix 5-5. Displacement of wildlife due to subsidence may

Revised 1/13/2004

be minimal. However, springs within the potential subsidence limit are a significant resource to the local wildlife and may be impacted.

Seeps and springs within the possible subsidence limit emit water from the North Horn Formation, Price River Formation, Blackhawk Formation, and the Castlegate Sandstone. A limited number of seeps and springs are found to issue from the Blackhawk Formation and Castlegate Sandstone units within the area of possible subsidence limits. These seeps and springs show only limited use by deer and elk. Subsidence from mining in these areas will have minimal impacts on water supplies from seeps and springs in the vicinity of the mine. Water monitoring and the Probable Hydrologic Consequences are discussed in detail in Chapter 7 of this permit.

Seeps and springs within the possible subsidence limit of mining emit water from the North Horn and Price River Formations 100 to 2100 feet (10 to 210 times the coal bed thickness) above the interval to be mined. If repeated subsidence via roof failure occurs, elastic deflation is believed to occur at a distance of nine coal seam thicknesses (90 feet) above the coal. If any tension cracks do develop, they should be sealed by clay migration occurring during elastic deformation. As a result, these seeps and springs should not be affected by subsidence. However, monitoring will be conducted as described in Chapter 7.

GENWAL recognizes the fact that the Division of Wildlife Resources, the Division of Oil, Gas, and Mining and the USFS consider all seeps and springs to be important to wildlife. If, during the monitoring of the springs, non-climatic diminutions of flow from any seep or spring in the area are substantiated, GENWAL will notify the Division of Wildlife Resources, the Division of Oil, Gas, and Mining, the State Engineer and the U. S. Forest Service. If documentation concludes that mining efforts at the Crandall Canyon Mine have reduced or eliminated the flow from the seeps and springs, then acceptable remedial action plans will be submitted for approval and subsequently installed.

In the event subsidence negatively impacts grazing, the applicant will compensate the owner or appropriate the party by paying the fair market value for the loss experienced. Compensation will be made after the grazing loss is proven to have resulted from surface subsidence related to the operation of the Crandall Canyon Mine.

Should any structures such as roads, bridges, etc., be adversely impacted as a direct result of subsidence directly related to the operation of the Crandall Canyon Mine, the operator will repair or replace the structure, whichever is more economical.

Mitigation for potential disruption to the Little Bear Spring will be accomplished through the construction of a water treatment plant which will provide replacement water for the spring if mining activity in the South Crandall lease area affects the quality or quantity of the spring. Construction of this water treatment plant will be done under the provisions of a water replacement agreement between GENWAL Resources, Inc. and the Castle Valley Special Service District who

maintain culinary water rights to Little Bear Springs. A copy of this water replacement agreement is included in Appendix 7-51.

It should be noted that neither the Little Bear spring, nor its recharge fault system, is located within the subsidence zone of the proposed South Crandall mine, nor are they even located within the South Crandall lease area.

Subsidence projections for the South Crandall lease area are depicted on Plates 5-2(H) and 5-2 (BC). Subsidence projections for the U-68082 lease mod area are shown on Plate 5-2(H).

The powerline that crosses the South Crandall lease was built by GENWAL to serve the Crandall Canyon mine. This powerline follows the highline of the ridge and is more than 1500' above the coal seam to be extracted. Due to the depth of cover no damage to this powerline is expected due to subsidence. If any damage occurs GENWAL will be out of power and will immediately make arrangements for any necessary repairs.

It shall be noted that the extent of possible subsidence in the U-68082 lease mod area is difficult to predict because the extent of mining in this area is extremely speculative due to the low coal (5' and less) in this area. However, in keeping with special lease stipulation #1 (see Appendix 1-15A, Attachment 3) there will be no second mining (and hence no subsidence) in any areas where the cover is less than 50 times the seam height plus 50', or approximately 300' overburden. A detailed discussion of this stipulation can be found in Appendix 3-20, (Final Environmental Assessment, Modification of Federal Coal Lease UTU-68082, U.S. Forest Service.)

5.25.20 Subsidence Control

GENWAL will comply with all provisions of the approved subsidence control plan and will correct any material damage resulting form subsidence to surface lands as a direct result of the operation of the Crandall Canyon Mine. This will be done to the extent technically and economically feasible, by restoring the land to a condition capable of maintaining the value and reasonably foreseeable uses which it was capable of supporting before subsidence.

The mine plan is designed so that mining will not result in material damage to perennial streams or impoundments having a storage volume of 20 acre feet, or which could result in environmental degradation or safety hazards to streams and associated structures.

5.25.30 Public Notice of Proposed Mining

At least six months prior to mining, or within that period if approved by the Division, all owners and occupants of surface property will be notified, by mail, identifying specific areas in which mining will take place, dates that specific areas will be undermined, and the location or locations where the operator's subsidence control plan may be examined.

5.26 Mine Facilities

The existing surface facilities were partially located in a predisturbed area and the only area where the coal outcropped in the lease area. The existing surface facilities are located in a very limited disturbed area. The culvert expansion project adds the minimally necessary area for additional and improved facilities. The use of a 72" diameter culvert, through which Crandall Creek is routed, is the primary feature used to minimizing the disturbed area within the steeply sloped canyon. See Plate 5-3 for the surface layout and Plates 3-7, 3-8, and 3-9 and 5-20 for the premining land configuration.

APPENDIX 5-24A

R2P2 (RESOURCE RECOVERY AND PROTECTION PLAN)

APPROVAL LETTER

(120 ACRE MODIFICATION, FEDERAL LEASE UTU-68082)

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Utah State Office
P.O. Box 45155
Salt Lake City, UT 84145-0155
http://www.blm.gov

TAKE PRIDE IN AMERICA

FEB 2 3 2005

IN REPLY REFER TO:
UTU-68082
U-54762
(UT-923)

Certified Mail--Return Receipt Requested

Mr. John C. Lewis
Mining Engineer
Genwal Resources, Inc.
P. O. Box 1077
Price, Utah 84501

Re: Minor Modification, Resource Recovery and Protection Plan (R2P2), Revised Life of Mine Plan, Low-Seam Longwall Panels, East and North Mining Areas, Crandall Canyon Mine

Dear Mr. Lewis:

The Bureau of Land Management (BLM) has received from Genwal Resources, a modification to the subject R2P2. The proposed modification revises mining plans for low-seam areas with the acquisition of low-seam longwall machinery, and updates timing for life of mine recovery. The changes are for Federal coal leases UTU-68082, U-54762, and adjacent State of Utah coal leases.

Genwal plans a number of revisions to the approved R2P2.

1. Convert a previously approved area for room and pillar mining to mine two small longwall panels, #'s 20 and 21. This area is south of West Mains and directly between the old longwall panel # 3 on the west and old works on lease SL-062648 to the east. The area had projected coal heights less than what the previous longwall equipment could mine. The acquisition of low-seam longwall equipment is Genwal's justification for the change.

2. Develop and mine longwall panel # 22 parallel to West Mains and east of old longwall panel # 2. Again, this area originally was projected with seam heights. In addition, Genwal has requested a lease modification for additional coal lands at the eastern boundary of UTU-86082, just west of the outcrop in Huntington Canyon. With the acquisition of low-seam longwall equipment, Genwal will attempt to develop and extend longwall panels into this area.

3. Probe/develop the area north of planned longwall panel # 22, as shown on Genwal's map of Oct 12, 2004, to ascertain if coal heights will support coal recovery. If probing/development proves a recoverable reserve, a panel plan will be submitted for approval. Any coal to be left unmined must be approved by BLM prior to abandoning the area.

4. Revise planned recovery of coal remnants in mains and sub-mains. Genwal plans retreat recovery of some pillars and barriers remaining in main entries and sub-main entries and updates timing and sequencing of this recovery.

The BLM has reviewed and analyzed the proposed revisions. Starting with the proposed longwall panels # 20 and # 21, we agree with the plan. When Genwal had earlier completed longwall panel # 19 and had developed Main East directly north of panel # 19, the BLM had given verbal approval to develop 3 ¼ East (a three entry development set) into this low coal block that was previously planned for room and pillar mining if coal heights were high enough. Subsequent quarterly inspections (June 29 and September 14, 2004) confirm coal heights above 5 feet thick and in the range of the new low-seam longwall equipment. Though the apparent and projected coal heights are near the minimum limits for operating the longwall equipment, the BLM encourages full recovery.

The area north of Main West and east of old longwall panel # 2 is also approved with similar conditions as in area one. This area was not previously scheduled for mining as the back end of old panel # 2 stopped due to coal below 6 feet which was the limits of the previous longwall machinery. With the acquisition of a low-seam continuous miner and longwall equipment, BLM gave verbal approval to connect up the Main West entries with the back end bleeder entries of old longwall panel # 2 (now called 3rd North off Main West) and then drive development entries east (called 1st Right Gate off of 3rd North) to ascertain coal heights for a low-seam longwall panel. In addition, Genwal applied for a lease modification for the east end of lease UTU-68082 to acquire unleased coal (if it exists with minable thickness) between the boundary and the outcrop to Huntington Canyon. An inspection on September 14, 2004, verified that the beginnings of 1st Right Gate had thicknesses of greater than 5 feet. We agree with the proposal and also the general plan to develop north of this proposed panel # 22 to recover minable coal with the new low-seam mining equipment. The requirements for the R2P2 for this lease modification area are met with your submission. However, Genwal is not authorized to mine in the lease modification area (west quarter of section 32, township 15 south, range 7 east) until a permit under the Surface Mining Control and Reclamation Act (administered by Utah Division of Oil Gas and Mining) is issued. This letter will be copied to Utah Division of Oil Gas and Mining (UDOGM) and will serve as our concurrence to them for requirements under the Mineral Leasing Act.

The fourth part of the proposed revisions depicts new sequencing and timing of mining remnant pillars left in the mains and sub-mains as part of final retreat mining. We agree and find the plan for recovering pillars in the mains and sub-mains a good attempt to recover remnant coal surrounded by mined out areas. We note that no retreat mining of Main West inby crosscut 116 is depicted on the latest submission. Genwal informed the BLM in late October, 2004, that they were planning to seal Main West due to adverse loading and the inability to maintain passage back to the end of Main West. BLM inspected the area on November 4, 2004, and noted the conditions. Heavy pillar loading was noted from crosscut 125 all the way back to near the end of Main West. Two large intersection caves were noted and heavy rib sloughage on the intake entry for most of this length. In addition, the rib line to the north barrier was pushing out coal well into the entry. It is apparent that pillar recovery will not be possible. First, before any additional mining can occur, all entries must be made travelable which will require all caves and failures clean up and secured. The depth for most of Main West is over 1500 feet with the middle area (where the worst conditions were noted) is over 2000 feet deep. Main West perform its function of

longwall gob return air courses for the life of the north and south longwall block near Joe's Valley fault but cannot be used for final pillar recovery. We agree that the pillars in Main West inby crosscut 116 cannot be recovered safely or practically. We also concur with sealing the area as the coal is not recoverable, return ventilation is no longer needed and equipment and any hazardous materials have been removed.

Our approval for these revisions to the R2P2 is conditioned on Genwal updating the recoverable reserve base for the Federal leases at the Crandall Canyon Mine within 30 days. Should extra time be necessary to finalize these numbers, please inform us at the contacts listed below. This is not a punitive measure, just an acknowledgement that reserve figures were not tracked in the past by all concerned. We wish to rectify recoverable reserves for all leases and lessees.

This approval of a minor modification to an existing R2P2 is Categorically Excluded from National Environmental Policy Act (NEPA) analysis in that no new surface disturbance will occur from this action as stated in Overview of BLM's NEPA Process, February 1997, Appendix 2, page 2-7 (F)(7). NEPA analysis was conducted for the lease modification area, and a Finding of No Significant Impact (FONSI) was signed in November 2004.

Genwal's proposed changes to the R2P2 complies with the Mineral Leasing Act of 1920, as amended, the regulations at 43 CFR 3480, the lease terms and conditions, and will achieve maximum economic recovery of the Federal coal. The mining plans as depicted on the October 12, 2004 submission (ACAD REF: R2P2 CRANDALL) is approved as submitted with the mentioned condition for reserves update. A copy of the approved mine map is enclosed. This approval constitutes our concurrence for R2P2 requirements for UDOGM on the area of the lease modification.

If you have any questions, please contact Stephen Falk in Price at (435) 636-3605 or Jeff McKenzie of my staff at (801) 539-4038.

Sincerely,

James F. Kohler
Chief, Solid Minerals Branch

Enclosure
Approved Mine Map

cc: Price Field Office (w/encl.)

Utah Division of Oil Gas and Mining (w/encl)
1594 West North Temple, Suite 1210
Salt Lake City, Utah 84114-5801

Chapter 6
(R645-301-600)

GEOLOGY

6.10 Introduction

This Chapter presents discussion of geologic conditions within and adjacent to the Genwal Mine Permit Area, which consists of Lease Areas SL062648 and U054762, State Lease ML-21569, State Lease ML-21568, Federal Lease UTU-68082 (including the lease modification), Federal Lease UTU-78953, the SITLA/PacifiCorp sublease and the Nielson Fee Lease. Conclusions herein are based on field reconnaissance, exploratory drilling and previous documentation. Report references are shown at the end of this chapter.

6.11 General Requirements

The geology within and adjacent to the permit area is discussed in Sections 6.21 through 6.27 of this chapter. Plans for casing and sealing of exploration holes and for subsidence monitoring are discussed in Sections 6.30 through 6.32.

6.12 Certification

All required maps, plans and cross-sections presented in this chapter have been certified by a registered professional engineer.

6.20 Environmental Description

This section presents a description of the geologic resources in, and adjacent to the permit area.

6.21 General Requirements

Regional Geology

The Wasatch Plateau consists of Tertiary and Cretaceous strata, mostly limestone, sandstone, and shale that differ in resistance to erosion (Davis and Doelling, 1977). Limestones and sandstones generally form cliffs, whereas the shales form recessive slopes.

Stratigraphic units present in the vicinity of the Crandall Canyon area include from youngest to oldest (1) the North Horn Formation (slope-forming mudstone and sandstone). (2) the Price River Formation which consists of the basal Castlegate Sandstone Member (cliff-forming sandstones, conglomerates and minor amounts of shale, of deltaic origin) and the Upper Price River Member (steep slope-forming sandstone with minor interbeds of pebble conglomerate and shale, of fluvial origin). (3) the Blackhawk Formation (cliff-forming sandstone underlain by slope-forming mudstone, shale and coal, of paludal origin). (4) the Star Point Sandstone (cliff-forming sandstones consisting of deltaic and beach deposits), and (5) the Masuk Shale Member of the Mancos Shale

(slope-forming marine shales), refer to Appendix 6-3 and 6-4 and Plate 6-1. The Star Point Sandstone contains several shale tongues of the underlying Masuk Shale in the Wasatch Plateau region.

The stratigraphic record produced by these units indicates that deposition up through the Blackhawk Formation consisted mostly of fine-grained detritus under conditions of relatively quiet and uniform sedimentation (Davis and Doelling, 1977). An erosional disconformity exists at the top of the Blackhawk Formation, which is overlain by coarse clastics of the Castlegate Sandstone. These coarse continental sediments suggest tectonic movement to the west and probably mark the onset of the Laramide orogeny (Davis and Doelling, 1977).

The Wasatch Plateau lies in a transition zone between the relatively stable Colorado Plateau to the east and the relatively complex and unstable Basin and Range province to the west (Davis and Doelling, 1977). Strata of the western Wasatch Plateau dip into a complexly faulted monocline, whereas strata on the east side have predominantly gentle dips and faults are less numerous (Davis and Doelling, 1977).

Major faults present within the region of the coal fields are north-trending with maximum displacements of up to 2,300 feet (Davis and Doelling, 1977). Many north-trending faults with minor displacements are present and few east-trending faults, most of which have displacements of less than 100 feet, are also present locally.

Most of the strata in the coal field form broad anticlines and synclines that trend northeast or are roughly perpendicular to the principal fault zones (Davis and Doelling, 1977).

Geology of Project Vicinity

The drainage basins of Crandall Blind and Horse Canyons cover approximately 5.7, 2.0 and 7.0 square miles respectively and expose six geologic units which range in age from Cretaceous to Tertiary. Surface lands within the permit area consist entirely of outcrop exposures of sandstones, mudstones and coal of the Castlegate Sandstone, Blackhawk Formation, Star Point Sandstone, Price River Formation, and North Horn Formation and are shown on Plate 6-1.

The Hiawatha and Blind Canyon coal seams, which will be of importance in the permit area are present at or near the base of the Blackhawk Formation (Campanian in age). Several other thin lenticular coal seams are present at the property, but none are of significant thickness or of probable lateral extent to be of economic interest. In much of the permit area, including the U-68082 lease mod area, only the Hiawatha seam is of sufficient thickness to be economically recoverable. However, in the South Crandall lease area both seams are mineable.

The Hiawatha coal seam has been mined and is exposed at an approximate elevation of 7,900 feet amsl (Appendix 6-1). Mining overburden above the Hiawatha coal seam in the permit area consists of the Blackhawk Formation, Castlegate Sandstone, and the Upper Price River Member and the North Horn Formation. Surface outcrop of these formations rise from approximately 7,900 feet amsl to approximately 10,700 feet amsl in the center of Section 3.5 in Lease #UTU-68082. This

results in a maximum overburden of approximately 2,400 feet and an average overburden of approximately 1,100 feet. The entire area is underlain by the Star Point Sandstone.

The coal-bearing unit is the Upper Cretaceous Blackhawk Formation. The Blackhawk Formation is composed of grey sandstone, siltstone, shale, and coal; it is composed of about 50% fine-grained sandstone and is present in thicknesses of 650 to 1,000 feet at Crandall Canyon. The Hiawatha coal bed is the thickest coal bed present (10 feet at Crandall Canyon), and is found near the base of the Blackhawk (Lines, 1985).

The Upper Cretaceous Star Point Formation underlies the Blackhawk Formation. It is predominately composed of massive tan medium-grained sandstone with minor interbeds of shale and siltstone near its base. This formation outcrops east of the Crandall Canyon Mine and reaches a thickness of 350 to 450 feet. At the southeast end of Trail Mountain, where the Star Point is exposed, it is about 500 feet thick (Lines, 1985). This formation is of significance since it and the saturated portions of the Blackhawk Formation comprise a regional aquifer present at both mine sites.

The Upper Cretaceous Castlegate Formation overlies the Blackhawk Formation and is dominated by massive tan medium-grained massive sandstone. It has a thickness of about 170 to 200 feet at Trail Mountain, and is 250 feet thick at Crandall Canyon (Lines, 1985).

The Castlegate is overlain by the Upper Cretaceous Price River Formation, a grey medium - to coarse - grained sandstone interbedded with several thin shale beds at both mine sites. The Price River is about 700 feet thick at the Trail Mountain Mine (Lines, 1985), and is about 600 feet thick at the Crandall Canyon Mine.

Overlying the Castlegate is the North Horn Formation of Upper Cretaceous and Tertiary age. It is composed of interbedded shales, siltstone, sandstones, and limestones. At the Trail Mountain mine it reaches a thickness of about 1,000 feet, although thicknesses of only several hundred feet are present at Genwal, due to erosion. The North Horn Formation caps the mountain ridges in the area, and serves as a recharge unit to underlying formations and supplies water to springs within the formation.

The Joes Valley Fault breaks the continuity of these geologic units at both the Trail Mountain and Crandall Canyon Mines. The Joes Valley Fault lies along the west base of Trail Mountain, and along the west base of East Mountain at the Crandall Canyon Mine (Davis and Doelling, 1977). The Joes Valley Fault forms the eastern boundary of a graben about 3 miles wide which extends north and south of both mines (Davis and Doelling, 1977). Davis and Doelling (1977) estimate approximately 2300 feet of vertical displacement along the fault in this area. Stratigraphic dip at both mine sites is approximately 2 to 3 degrees to the southeast (Lines, 1985).

As discussed in Section 5.25, mining-induced subsidence will not intersect the Joes Valley Fault. The maximum limit of subsidence in the permit area is depicted on Plates 5-2, 5-2B, and Figure 5-9, and subsidence-induced hydrologic effects are discussed in Section 7.0.

Geologic inspection of the property indicates that prior mining of the Hiawatha Seam did not encounter subsurface water. The maps submitted in Appendices 6-3 and 6-4 and Plate 6-1 are included to show the relative location of the geologic formations to the mine permit area.

6.22 Cross Sections, Maps and Plans

Stratigraphic sections, best available BLM and Genwal data are shown in Appendices 6-1, 6-4 and 6-5. Drill hole results and cross sections are shown in Appendix 6-5. The Geologic map is on Plate 6-1. Coal seam isopachs for the Hiawatha, Blind Canyon and Bear Canyon Seams are shown on Plates (all applicable data) 6-3, 6-4 and 6-5, respectively. Overburden is shown on Plate 6-6. Structure is shown in Appendix 6-3. A structure contour map of the top of the Hiawatha seam is shown on Plate 6-7. Refer to Plates 5-2(H) and 5-2(BC) for information regarding the South Crandall lease area, and the U-68082 lease mod area including coal seam thickness, seam interval, overburden thickness, and drill hole locations. A generalized geologic cross-section is shown in Appendix 6-7.

6.22.1 Test Borings and Coal Sampling

Genwal has included two lithologic, depth correlated sections to show thicknesses of interburden and coal from the Star Point Sandstone to the surface. These geologic sections are provided in Appendix 6-1 and Appendix 6-5. The lithofacies of the Blackhawk Formation in the vicinity of the mine area are shown in stratigraphic section within Appendix 6-1 and Appendix 6-5. Two additional holes have been drilled, MW-3 and MW-4 in State Section ML-21569. MW-4 was drilled and cored and is a water monitoring source (Appendix 6-5). MW-3 was drilled down but not cored. These sections should provide sufficient technical information to determine the nature, depth and thickness of the coal seams, rider seams, overburden and interburden strata for the permit area. The thickness and extent of all formations in the area adjacent to the mine area are shown on Plates 6-1 through 6-6, with related discussion in Section 6.21. Borehole locations are shown on Plate 5-2. The known locations of proposed in-mine up-drilled borings and surface bore holes are shown on Plate 5-2.

The drilling results obtained during 1985 indicate the presence of the Blind Canyon seam although it is of unminable thickness in the vicinity of the Crandall Canyon No. 1 Mine (Appendices 6-1 and 6-5). The upper seam will be called the Blind Canyon Seam at the request of DOGM to simplify discussion. The same seam has been referred to as the "upper Hiawatha Seam" and the "lower Bear Canyon Seam" at various other locations.

Analysis of coal samples collected from the Hiawatha Seam indicate that it is a high volatile

bituminous coal with a BTU content ranging from 12,500 to 13,000 BTU, ash content of 6% to 8%, moisture of 3% to 5%, volatile matter from 40% to 44%, fixed carbon from 43% to 46% and sulfur from 0.44% to 0.55%. Forms of Sulfur average 0.016% pyritic sulfur, 0.09% sulfate sulfur, and 0.30% organic sulfur, Appendix 6-2. Locations of samples are at 1st Right Main West, 9th left 1st East, and 1st North 1st Right.

Within the South Crandall lease there is only one drill hole of geologic data, HC-4. This hole was drilled in 1981 and encountered 6'9" of coal in the Blind Canyon, and 5.0' in the Hiawatha, which is marginally mineable with low coal equipment. The coal analysis from this hole is: Blind Canyon 13352 BTU, 0.61% sulfur, 5.46% ash - Hiawatha: 13126 BTU, 0.56% sulfur, 6.3% ash. The location HC-4 is shown on Plates 5-2 (BC) and 5-2 (H).

6.22.2 Coal Seams, Overburden, Stratum Coal Seams

Additional technical information has been submitted to determine the nature, depth and thickness of the coal seams, rider seams, overburden and interburden strata for the permitted mine area based upon drilling completed to date (Appendices 6-1 and 6-5 and Plates 5-2). There is insufficient evidence to support the presence of the Blind Canyon Seam in Crandall Canyon, but it thickens southward to the Mill Fork area, beyond which it again is of little value (Doelling, 1972, p. 189). The old workings can provide information on the lower seam (Hiawatha) and some ground water information but nothing about the other seams. Additional geologic information was submitted by Mr. Wollen, a former operator of the Genwal property, which contained specific lithologic characterizations of the interburden, and the strata immediately above and below the coal seams (Appendices 6-1 and 6-2). Additional geologic information about the South Crandall lease area is found in Appendix 6-6.

Coal Reserves Coal-seam data for lease area SL 062648 indicates that approximately 840,000 tons of coal are in place, of which 400,000 tons are recoverable. Lease area U 54762 contains approximately 2.5 million tons of coal in place, of which approximately 1.5 million tons are recoverable. Approximately 0.5 million tons will be left in place for final retreat, leaving approximately one million tons minable during advance.

In-place tonnage for State Leases ML-215688 and ML-21569 is estimated at 18,000,000 tons, of which 8,000,000 tons are considered recoverable. The Lease #UTU-68082 has an estimated in-place tonnage of 36,000,000 tons, of which 12,000,000 tons are considered recoverable. In the South Crandall lease area the estimated recoverable reserves are 7.63 million tons. Due to the speculative nature of the U-68082 lease mod area no recoverable reserves are estimated.

All mining within the Crandall Canyon #1 Mine is within the Hiawatha seam. The Blind Canyon seam is present above the Crandall Canyon #1 Mine but is not thick enough to mine. (Coal seam isopachs for this area are shown on Plates 6-4 and 6-5) in the area of the South Crandall Mine (i.e., within the South Crandall lease area) both the Hiawatha and the Blind Canyon seams reach minable thickness. The approved R2P2 for the South Crandall Mine include extraction from both seams. The coal seam thickness isoapchs for the seams in the South Crandall lease area are shown on Plates 5-2(H) and 5-2(BC).

Drill hole and geological information for the area around the South Crandall lease area is shown on Plates 5-2(H) and 5-2(BC). There is only one drill hole on the South Crandall lease, HC-4. The driller's log for HC-4 is included in Appendix 6-6. The Bear Canyon seam in this hole is only 2' thick.

The information obtained from underground drill holes 1 and 2 show the Blind Canyon above the Crandall Canyon No. 1 Mine to be approximately 59 and 40 inches thick, respectively, which makes this seam unminable and of no economic value. Surface drill holes 3 and 4 indicate the Blind Canyon seam is 54 and 40 inches thick, respectively, in those areas. The Blind Canyon seam is located approximately 40 to 60 feet above the Hiawatha seam. Refer to Plate 5-2 for locations, DH-2 in Federal lease SL-062648 its location is shown on Plates 5-2(H) and 5-2(BC). There is approximately 60 acres of Blind Canyon coal at a thickness of 5 feet or more, equivalent to approximately 418,000 tons of coal in place. Although this seam remains fairly continuous across the property in the area above the Crandall Canyon No. 1 Mine , it is not mineable. In the area of the South Crandall mine the Blind Canyon seam is thicker and is considered mineable.

Additional drilling information has been provided for the State Leases. This information is included in Appendix 6-1 and 6-5. The seam information has been translated to the isopach maps, Plates 6-3, 6-4 and 6-5. As shown on the isopach maps, the Hiawatha Seam is the only seam which is considered economically recoverable.

Five monitoring wells have also been drilled underground for ground water evaluation. Details on these wells are provided in Chapter 7, Section 7.31.21 and Appendices 7-46 and 7-47.

Reserve Classifications. A map is provided delineating coal outcrop lines from the Hiawatha and Blind Canyon seams with the strike and dip indicated at one point, refer to Plate 6-1.

Stratigraphy. The Blackhawk Formation is comprised of approximately 1,000 feet of gray carbonaceous shales, siltstones, coals and thin interbedded sandstones. The coal beds to be mined near the base of the formation are 6 to 11 feet thick and are generally classified as a high volatile bituminous coal. The Blackhawk Formation is underlain by the massive cliff-forming Star Point Sandstone, which is 200 to 400 feet thick.

Appendix 6-1 includes two stratigraphic sections which were obtained by traversing the stratigraphic column from Crandall Creek to the Castle Gate Sandstone. The entire stratigraphic column is shown in Appendix 6-1 for the permit area. A generalized stratigraphic section is provided in Appendix 6-4. This section has been confirmed by field analyses of distances between coal seams and the thickness of the overburden in the mine area, as described above. The stratigraphic section accompanies this chapter as part of Appendix 6-4.

A coal isopach (Plate 6-3) and overburden isopach map showing the depth to the minable Hiawatha Seam is included as Plate 6-6 to support extrapolation of ground water hydrology projections from nearby mines to the Crandall Canyon Mine and to support projections of subsidence.

Structure. Formations in the central Wasatch Plateau generally dip 1-3 degrees to the west. This regional structural attitude is broken by several north-south trending, high angle normal faults which offset the rocks from less than 10 feet to approximately 250 feet or more. As mapped, there are no major faults (other than the Joe's Valley Fault) present within the boundaries of the permit area. Springs are present in the upper reaches of the canyon near the Castlegate Sandstone-Blackhawk Formation contact. Several seeps have been noted in the Crandall permit area issuing from the Star Point Sandstone. A complete discussion of the springs and seeps encountered within the permit area is in Chapter 7.

6.22.3 Coal Outcrop / Strike and Dip

Coal outcrops are shown on the isopach maps (Plates 6-3, 6-4 and 6-5) and on all mine plans and progress maps (Chapter 5). Plate 6-7 is a structure contour map of the top of the Hiawatha seam.

Plates 5-2 and 6-1 show strike and dip providing an average strike over the entire area where the coal outcrop data have been obtained. An average strike designation was necessary due to the severe erosional and geographic conditions of the area, which would make anything but an average direction highly inaccurate. This dip is to the southeast, and varies slightly from the regional dip due to local geologic conditions.

6.22.4 Gas and Oil Wells

There are no gas or oil wells known to exist within, or adjacent to, the permit area.

6.23 Geologic Determinations

The acid- or toxic-forming characteristics of the strata are discussed in Sections 6.24.32 and 6.24.33 and in Appendix 6-2.

The subsidence control and monitoring plans are discussed in Section 5.25 and in Chapter 5.

6.24 Geologic Information

(1) Information presented in Section 7 indicates that the water table in the Star Point Sandstone is below the coal seams of the lower Blackhawk Formation. The flow of ground water in the formation is toward Huntington Creek.

(2) The Star Point Sandstone, which underlies the Hiawatha seam, is predominantly a light-gray massive sandstone with minor interbedded layers of shale and siltstone near its base (Doelling, 1972). In the vicinity of the mine, the Star Point Sandstone is 200-400 feet thick. The Star Point Sandstone serves as a regional aquifer (Danielson et al., 1981) yielding water to several minor and some major springs where fractured and jointed.

(3) The Blackhawk Formation (at the base of the Hiawatha seam) could contain perched aquifers in lenticular sandstones interbedded within the shales. The shales of the Blackhawk Formation are not very permeable; consequently, ground water within the formation is perched. The shales of the Blackhawk Formation are bentonitic and swell when wet; therefore, faults and fractures in the Blackhawk tend to seal, limiting secondary permeability, refer to the exceptions itemized in Section 7.

Detailed Columns of Interest and Cross Sections. See Appendix 6-1 included with this chapter. Stratigraphic section A was taken at the portal area and stratigraphic section B was taken 500 feet east of the portal area.

Additional information on the regional and permit area geology is presented in Section 6.21, and on maps, cross-sections and plans presented in this chapter and in Chapters 5 and 7.

Geologic literature and practices are discussed throughout this chapter and in the list of references at the end of the chapter.

Geologic Information Pertaining to Little Bear Spring

The Little Bear Spring is located close to the southern boundary of the South Crandall lease area. This spring is an important source of culinary water for many residents of Emery County. In order to ensure that the spring would be protected from the effects of mining in the South Crandall lease area the Forest Service and the BLM required a number of detailed hydrology studies to ascertain the source of the spring. Based on the result of these studies the federal government has concluded that the potential for mining this lease to alter the flow of Little Bear Spring is low and has issued a Finding of No Significant Impact (FONSI) regarding the proposal to conduct mining operations within the lease. The following studies were required by the Forest Service and BLM prior to leasing action and are included in this MRP as appendices in Chapter 7. Each report includes an extensive discussion of the geology of the South Crandall tract as relates to the occurrence of ground-water, aquifers, and recharge sources of the Little Bear Spring.

7-51 Little Bear Spring Water Replacement Agreement

7-52 Supplemental Hydrogeologic Information for LBA 11

7-53 Summary of New Isotopic Information for LBA 11

7-54 Results of In-Mine Slug Tests

7-55 Investigation of Alluvial Ground Water System in Mill Fork Canyon

7-56 Investigation of Potential for Little Bear Spring Recharge

7-57 Determination of Recharge Location of Little Bear Spring (Dye Tracing)

7-58 Summary of Hydro logic Baseline Information, South Crandall Lease

7-59 Little Bear Spring Study (Initial study, 1998) AquaTrack

7-60 Little Bear Spring Study (Expanded Study, 1999) AquaTrack

7-61 Mill Fork Resistivity Study, 2001 AquaTrack

7-62 Little Bear Spring (2nd Expanded Study, 2001) AquaTrack

Revised 1/13/2004

6.24.2 Chemical Analyses of Overburden

N/A - Strata above the coal seam will not be removed by underground mining.

6.24.3 Chemical Analyses / Lithology

Strata above and below the coal seam will not be mined or removed. Samples have been collected and analyzed as required.

6.24.31 Drill Hole Logs

Drilling results and details are summarized in Appendix 6-5. Additional information on lithology and potential impacts of mining on ground water is provided in Section 6.24 and in Chapter 7.

6.24.32 Chemical Analyses - Strata

Alkalinity. The pyrite, alkalinity and clay content information is from samples taken by applicant and submitted to Standard Laboratories, Huntington, Utah for chemical analysis. The lab reports are included with this document as Appendix 6-2.

The pyrite content and alkalinity content of the stratum immediately above the coal seams are as follows:

	Hiawatha	Blind Canyon
Pyrite	0.03%	0.09%
Paste pH	7.6	7.25
Alkalinity	63.3 mg/1	87.4 mg/1

The pyrite content, alkalinity and clay content of the stratum immediately below the coal seams are as follows:

	Hiawatha	Blind Canyon
Pyrite	0.06%	0.07%
Paste pH	3.95	3.90
Alkalinity	4.0 mg/1	0.0 mg/1
Clay Content	9.5%	10.5%

As discussed in Section 5.28.30, waste rock is not produced during mining operations. When incidental quantities of rock are encountered, the rock is left in the mine and will not be removed at any time in the future; thus, no negative effects are expected from the acid-forming potential of strata which overlie and underlie the Hiawatha seam. However, to further characterize the acid-forming

potential of strata immediately above and below the Hiawatha seam, the applicant collected additional roof- and floor-rock samples from three equally spaced locations within the current mine workings (including the state leases and right-of-way areas). Analytical results from these three sets of samples are provided in Appendix 6-2 and are used to further characterize the acid-forming potential of the strata. The laboratory data indicate that neither the underburden or overburden are acid or toxic forming materials.

The characterization of the strata above and below the Blind Canyon Seam can not be done at this time due to no access to unweathered material. In approximately 6 months access to the Blind Canyon seam via the rock tunnel will be available. Samples and analysis will be done then.

6.24.33 Chemical Analysis - Coal

The total sulfur content of the Hiawatha coal has been analyzed at 0.58%, and the acid-base potential determined for the coal is +10.2 tons $CaCO_3$/1000 tons (Appendix 6-2). Under the current operation plan only a small quantity of coal is temporarily stockpiled on-site. The amount of coal remaining at the time of reclamation is likely to be insignificant. Plus, the data show that the coal is non-acid forming and non-toxic.

The characterization of the Blind Canyon Seam can not be done at this time due to no access to unweathered material. In approximately 6 months the rock tunnels from the Hiawatha seam will be completed. Samples and analysis will be done at that time.

6.24.34 Properties of Strata Above and Below Coal

This mine employs standard room and pillar mining operations and longwall technology; however, the stratigraphic sections (Appendix 6-1) and drilling results (Appendix 6-5) do not show any clays or soft rock immediately above or below the coal seam to be mined.

In the South Crandall lease area, where the Blind Canyon seam will be mined, the thickness of the clays and soft rock above and below the coal seam are shown on drill hole HC-4, Appendix 6-6. The engineering properties of these materials will be determined once the rock tunnels are constructed and access is gained to the Blind Canyon seam. Samples and analysis will be done at that time.

6.25 Additional Information

Additional information will be provided if determined necessary by the Division.

6.26 Waiver of Requirements

Not applicable.

6.27 Overburden Thickness and Lithology

Provided in Appendix 6-1 and Plate 6-6.

6.30 Operation Plan

6.31 Casing and Sealing of Exploration Holes and Boreholes

Exploration holes, boreholes, or other holes will not remain open for use as water supply wells or ground water monitoring wells and will normally not be completed with casing. These holes will be plugged, capped, sealed, backfilled or otherwise managed to protect water resources without the use or installation of casing, but casing will be used if it is needed to maintain boring wall integrity.

The measures to be used to close the holes will include filling the hole or opening with cuttings or inert material until it is level with the surface. Those holes which flow or might flow as a result of artesian conditions will be cemented, and any holes which penetrate two or more aquifers with significantly different ground water quality will be cased or cemented.

Installation and abandonment of monitoring wells (and other wells) will be done by a licensed driller following Division of Water Rights rules and procedures.

6.31.1 Temporary Casing and Sealing of Drilled Holes

Those holes which remain open for use as water supply wells or for use as ground water monitoring well will be completed with casing or piezometers at a sufficient height above the land surface to prevent drainage of surface water or entrance of other material into the well. In addition, they will be fitted with caps to prevent introduction of foreign objects, other than monitoring and sampling equipment, into the well. When ground water monitoring wells are no longer needed or required for any purpose, each well will be sealed in accordance with the measures described above by a licensed driller following Division of Water Rights rules and procedures.

6.31.2 Permanent Casing and Sealing of Exploration Holes and Boreholes

When no longer needed for monitoring or other use approved by the Division upon a finding of no adverse environmental or health and safety effect, or unless approved for transfer as a water will under R645-301-731.400, each exploration hole or borehole will be plugged, capped, sealed, backfilled or otherwise properly managed under R645-301-631 and consistent with 30 CFR 75.1711. Permanent closure methods will be designed to prevent access to the mine workings by people, livestock, fish and wildlife, and machinery and to keep acid or other toxic drainage from entering water resources.

6.32 Subsidence Monitoring

Subsidence monitoring is carried out on an annual basis and includes aerial surveys and visual surveys of the mine permit area. As required by R-645-301-525, a complete subsidence control plan addressing the regulations can be found in section 5.25 of this document. Projected subsidence from mining is shown on Plates 5-2(BC) and 5-2(H).

6.40 Performance Standards

6.41 All Exploration Holes and Boreholes

All exploration holes and boreholes will be permanently cased and sealed according to the requirements of R645-301-631 and R645-301-631-200.

6.42 Monuments and Surface Markers

All monuments and surface markers used as subsidence monitoring points and identified under R645-301-200 will be reclaimed in accordance with R645-301-521-210.

7-56 Investigation of Potential for Little Bear Spring Recharge

7-57 Determination of Recharge Location of Little Bear Spring (Dye Tracing)

7-58 Summary of Hydro logic Baseline Information, South Crandall Lease

7-59 Little Bear Spring Study (Initial study, 1998) AquaTrack

7-60 Little Bear Spring Study (Expanded Study, 1999) AquaTrack

7-61 Mill Fork Resistivity Study, 2001 AquaTrack

7-62 Little Bear Spring (2nd Expanded Study, 2001) AquaTrack

7-63 Hydrology/Geology Map of Little Bear Watershed

7-64 Baseline Information for the U-68082 Lease Mod Area

Note: Bold number plates and appendices are included with this submittal.

CHAPTER 7

HYDROLOGY

7.10 Introduction

This chapter presents a description of the hydrologic considerations for permitting of the Crandall Canyon Mine operations. The information in this chapter was provided by the staff of GENWAL Resources, Inc. and by various consultant firms as noted under specific sections. Conclusions drawn herein are based upon detailed field reconnaissance and spring/seep surveys of the area, limited exploratory drilling and published hydrologic information on the area.

7.11 General Requirements

This chapter presents a description of:

- existing hydrologic resources,
- proposed operations and the potential impacts to the hydrologic resources,
- methods of compliance with design criteria and performance standards, and
- hydrologic reclamation plans for the Crandall Canyon Mine operations.

7.12 Certification

All maps, plans and cross-sections presented in this chapter which deal with the design of facilities or the determination of watershed characteristics have been certified by a professional engineer.

7.13 Inspection

Impoundments included in the runoff control plan will be inspected as described in Section 5.14 of this application.

7.20 Environmental Description

This section presents a description of the hydrologic resources within the Crandall Canyon Mine permit area and the South Crandall Lease area and the U-68082 lease mod area. Refer to Appendix 3-20, "Final Environmental Assessment, Modification of Federal Coal Lease UTU-68082, U. S. Forest Service" for additional information regarding hydrology in the lease mod area.

7.21 General Requirements

This section presents a description of the hydrologic resources within the Crandall Canyon Mine permit area and the South Crandall Lease area and the U-68082 lease mod area.

7.22 Cross Sections and Maps

Figures 7-1 through 7-12 and Plates 7-1 through 7-17 of this chapter depict existing surface and groundwater occurrences within and adjacent to the Crandall Canyon Mine permit area and the South Crandall Lease area and the U-68082 lease mod area. These figures also illustrate the topography, streams, springs, wells, water monitoring locations, and other hydrologic design information pertinent to the Crandall Canyon Mine and the South Crandall Lease area and the U-68082 lease mod area. Refer to 7-63 for a detailed map of the Little Bear Canyon watershed showing mining projection, geology and location of seeps below the Castle Gate sandstone where cover is less than 800' above the coal seams.

Plates 7-14 and 7-15 have been updated to show the groundwater and surface water rights within and adjacent to the South Crandall lease area and the U-68082 lease mod area. Plates 7-12 (seep and spring) and 7-16 (stream monitoring) have also been updated relative to the South Crandall lease area and the U-68082 lease mod area. Note that Plate 7-13 has been deleted from the MRP.

7.2 Sampling and Analysis

All water samples are collected and analyzed according to methods in either the "Standard Methods for the Examination of Water and Waste Water" or the 40 CFR parts 136 and 434.

7.24 Baseline Information

(It should be noted that the Dellenbach fee tract is included in the currently approved permit area. All current data for hydrologic, geologic, and climatologic information applies to the Dellenbach tract.) Baseline hydrologic information for the South Crandall Lease area is summarized in Appendix 7-58. Baseline hydrologic information for seeps, springs, and streams in the U-68082 lease mod area are summarized in Appendix 7-64.

7.24.1 Groundwater Information

This section is a comprehensive view of the groundwater hydrology for the Crandall Canyon Mine permit and surrounding area and the the South Crandall Lease area and the U-68082 lease mod area.

Scope

This section presents discussions of groundwater conditions within and adjacent to the permit area, which consists of lease areas SL 062648 and U 054762, State leases ML21568 and

ML21569, UTU-68082 and the South Crandall Lease area, UTU-78953 and the U-68082 lease mod area (Plate 7-12). Conclusions drawn herein are based upon detailed seep and spring surveys of the area, limited exploratory drilling, results of stream monitoring, and the results of groundwater investigations conducted by others in the region of the mine.

Methodology

Seep and spring surveys were conducted in 1985, 1987, and 1989 through 1993, within an area that extended approximately one mile north, west, and south of the boundaries of the permit area. Springs and seeps in the South Crandall Lease area were monitored again during 2003. Seeps, springs, and streams in the U-68082 lease mod area were monitored again during 2004. The study area for the survey was bounded by Huntington Creek on the east, the east-west ridge between the North Fork of Horse Canyon and the South Fork of Huntington Creek on the north, Bald Ridge and Bald Mountain in Scad Valley to the west, and Mill Fork on the south.

An aerial reconnaissance of the survey area was initially conducted to provide an indication of spring locations and site accessibility. The area was then traversed on foot to allow springs and seepage points to be precisely located, examined, and sampled. Geologic conditions at all seeps and springs were noted in the field, including lithologic and structural controls and the geologic formation from which the seepage issued. Signs of usage were also noted. The flow rate was visually estimated and (if sufficient water was present) a sample of the water was collected. The temperature of the water issuing from the spring was measured at the site. All samples were subsequently analyzed in the field for pH and specific conductance.

Hydrologic characteristics of the North Horn, Price River, Castlegate, Blackhawk Formation and Star Point Sandstone are reviewed in this section. Locations of seeps and springs monitored during 1985, 1987,1989 through 1993, and during 2003, and during 2004, are shown on Plate 7-12. The geologic occurrence and use of seeps and springs are found in Appendix 7-16. Flow rate and temperature measurements appear in Appendix 7-17. Specific conductivity and pH measurements are found in Appendices 7-18 and 7-19 respectively. Field water-quality measurements are summarized in Appendix 7-20. Laboratory analytical reports for groundwater collected from the eight quarterly sampled seep/spring locations are also contained in Appendix 7-20. Hydrologic baseline information from the South Crandall Lease area is summarized in Appendix 7-58. Hydrologic baseline from the U-68082 lease mod area is summarized in Appendix 7-64.

Seep and spring surveys were conducted in the area around the IBC (Federal Right-of-Way UTU-77975) area during 1987, 1989 and 1990. No seeps or springs were identified in the IBC area. The area was resurveyed by Gary Gray and Erik Petersen in 1998.

Regional Groundwater Hydrology

Six formations outcrop in the Mine Permit Area (Plate 6-1). According to Doelling (1972), the Masuk Shale Member of the Mancos Shale (Km on Plate 6-1) is a light gray to blue-gray marine sandy shale in the mine vicinity. This unit is exposed at the mouth of Crandall Canyon and in

adjacent areas along Huntington Creek. The Masuk Shale Member yields water locally to seeps and springs but does not serve as a regionally important aquifer (Danielson et al., 1981).

The Star Point Sandstone (Ksp) is predominantly a light-gray massive sandstone with minor interbedded layers of shale and siltstone near its base (Doelling, 1972). In the vicinity of the mine, the Star Point Sandstone is 350 to 450 feet thick. The Star Point Sandstone yields water to several minor and some major springs where fractured and jointed.

The Blackhawk Formation (Kb) is the principal coal-bearing unit in the region (Doelling, 1972). This formation consists of interbedded layers of sandstone, siltstone, shale, and coal, and reaches a thickness of about 1000 feet in the mine area. The principal coal seam (the Hiawatha seam) is present at the base of the formation. The formation yields water to springs and coal mines when fractured. At GENWAL the water has been encountered within the Starpoint Sandstone approximately 50-100 feet below the contact point with Hiawatha seam.

The Price River Formation overlies the Blackhawk Formation and consists of the tan to brown cliff-forming Castlegate Sandstone (Kc) and the slope forming Upper Price River Member (Kpr). Fluvial sandstones of the Castlegate are massive and medium- to coarse-grained. In the area of the mine, the Castlegate is approximately 200 feet thick. The Castlegate yields water locally to seeps and springs, but does not serve as an important regional aquifer because it is commonly drained within short distances from its recharge area due to deeply incised canyons (Danielson et al., 1981).

The Upper Price River Member (Kpr) consists predominantly of friable calcareous sandstones interbedded with pebbly conglomerates and shales. It forms steep receding slopes and reaches a maximum thickness of about 600 feet in the mine areas (Doelling, 1972). This formation yields water locally to seeps and springs (Danielson et al., 1981). However, like the Castlegate Sandstone, deeply incised canyons in the area prevent the Upper Price River Member from being an important regional aquifer.

The uppermost formation that outcrops within the permit area is the North Horn Formation (Tkn). This formation consists of interbedded limestones, sandstones, and shales (Doelling, 1972). Due to the presence of low-permeability strata in the formation, downward vertical migration of groundwater is limited. Consequently, springs in the North Horn Formation are formed where perched groundwater is forced to flow laterally in the subsurface until the formation intersects the land surface, forming a spring.

Investigations by Danielson et al. (1981) indicated that most, if not all, groundwater in the region is derived from snow melt. Recharge tends to be limited in areas underlain by the Price River Formation and older rocks (relative to recharge in areas underlain by younger rocks) due to slope steepness and relative imperviousness (both of which promote runoff rather than infiltration of snow melt).

Detailed potentiometric surface data are not available for the region surrounding the permit area. However, the deeply incised canyons interrupt the flow of groundwater in much of the area. Danielson et al. (1981) suggest that groundwater generally moves from high areas of recharge to low areas of drainage, principally along stream channels.

The predominant chemical constituents in most springs in the region are calcium and bicarbonate (Danielson et al., 1981). Dissolved solids concentrations generally range from about 50 to 750 milligrams per liter. Regionally, the concentrations of major dissolved constituents in water from individual geologic units is highly variable, due to the complex lithologic nature of the area (Danielson et al., 1981).

Mine Plan Area Aquifers

Results of the initial seep and spring inventories conducted in the study area were submitted previously to DOGM (EarthFax Engineering, 1985a, 1985b). All data associated with subsequent seep and spring inventories are located within this MRP. Locations of the seeps and springs discovered during the inventories are shown on Plate 7-12. Data collected during the inventories are included in Appendices 7-16 through 7-20. Data from the 2003 inventories in the South Crandall Lease area are presented in Appendix 7-58.

Approximately 60% of all the seeps and springs found during the early-season surveys had flows of one gallon per minute or less (Appendix 7-17). These flows typically decreased by the time of the late-season surveys, with most of the low-flow sources issuing only as seeps or being dry. The majority of seeps and springs issue from bedding planes separating porous sandstones or fractured zones from underlying low-permeability siltstone and shale beds.

The primary exception to the above generality is flow from seeps and springs along the western edge of UTU-68082 which discharge from the North Horn Formation, alluvium covering the North Horn Formation, or from Tufa deposits in Upper Joes Valley. Flow from most of these seeps and springs is attributed to discharge from the Joes Valley fault zone.

The occurrence of groundwater at Trail Mountain (Lines, 1985) is very similar to that at Crandall Canyon. The major water bearing unit at both mines is the Blackhawk-Star Point aquifer. The Trail Mountain Mine is overlain by perched aquifers in the Blackhawk, Castlegate, Price River, and North Horn Formations; these perched aquifers are separated by unsaturated zones (Lines, 1985). Seep and spring survey results at Crandall Canyon and at the South Crandall Lease area and the U-68082 lease mod area also reveal the presence of perched aquifers in the same formations. As at Trail Mountain, this perching occurs where more-permeable strata (aquifers) overlie less-permeable strata (aquitards and aquicludes) (Lines, 1985; Appendix 7-16).

The distribution of seeps and springs among the formations present at both the Trail Mountain (Lines, 1985) and Crandall Canyon (Appendix 7-16) mines is very similar. At both mine areas the largest percentage of seeps and springs are found in the North Horn and Price River Formations. Similarly, in both mine areas the smallest percentage of seeps and springs are found in the Castlegate Sandstone Formation and Blackhawk Formation. Some springs and seeps discharge from the Star Point Sandstone in the South Crandall Lease area. Little Bear Spring, which

is a developed spring that provides municipal water to nearby towns, discharges from a fracture system in the Star Point Sandstone.

Because of its importance as a municipal water supply source and its proximity to proposed mining areas, Little Bear Spring has been extensively studied. These studies have shown conclusively that Little Bear Spring is recharged primarily through surface water and alluvial groundwater losses in Mill Fork Canyon. The recharge location in Mill Fork Canyon is approximately 1.5 miles southwest of the spring discharge location, which is well beyond the boundary of the South Crandall Lease area.

These scientific investigations, which are further discussed in the statement of Probable Hydrologic Consequences, include an investigation of the Little Bear Spring groundwater system and the groundwater systems encountered in the Crandall Canyon Mine (Appendix 7-52), a solute and isotopic investigation of groundwater from Little Bear Spring and the Star Point Sandstone and Blackhawk Formation groundwater systems the Crandall Canyon Mine (Appendix 7-53), an investigation of the hydraulic conductivity of the Star Point Sandstone in the vicinity of the Crandall Canyon Mine (Appendix 7-54), an investigation of the alluvial groundwater system in Mill Fork Canyon with implications for recharge to Little Bear Spring (Appendix 7-55), an investigation of the potential for Little Bear Spring recharge in Mill Fork Canyon (Appendix 7-56), and a fluorescent dye-tracing study that conclusively demonstrates the hydraulic connection between the stream/alluvial groundwater system in Mill Fork Canyon and Little Bear Spring (Appendix 7-57). Sunrise Engineering also performed a series of investigations using a proprietary geophysical technique that demonstrated a hydraulic connection between Little Bear Spring and the surface drainage in Mill Fork Canyon. These investigations are included as Appendix 7-59, Appendix 7-60, Appendix 7-61, and Appendix 7-62. Despite the conclusions of these studies the Forest Service still believes there may be a northerly component of flow recharging Little Bear Spring.

The low flow rates from most of the seeps and springs emitting from the Blackhawk Formation (Appendices 7-16, ~~and~~ 7-17, and 7-58) result from the low hydraulic conductivity of the formation where it remains unfractured. Laboratory permeability data from a core sample taken in T17S-R6E-Sec27 at Trail Mountain indicate an average horizontal hydraulic conductivity of 1.3×10^{-2} feet per day, and an average vertical hydraulic conductivity of 3.8×10^{-3} feet per day for sandstone units of the Blackhawk Formation (Lines, 1985).

Shale and siltstone samples of the Blackhawk Formation have maximum horizontal and vertical hydraulic conductivities of only 1.0×10^{-7} and 1.2×10^{-6} feet per day, respectively (Lines, 1985). These low hydraulic conductivities of the shales and siltstones indicate that these finer-grained sediments within the Blackhawk serve as barriers to the downward migration of water. As a result, water recharge into the Blackhawk, either from adjacent formations, snow melt, or rainfall is allowed to percolate vertically through sandstone beds until a siltstone/shale bed is encountered at which time the water is forced to travel laterally along the bedding plane to the surface.

Similarly, the majority of the seeps and springs in the Castlegate, Star Point and North Horn Formations observed in the field surveys in Crandall Canyon also issue from bedding planes. Due to the presence of these vertical permeability barriers, the aquifers in the North Horn, Price, River, Castlegate, as well as in the upper portions of the Blackhawk Formations are perched, with no direct

communication to the underlying regional Star Point aquifer. Consequently, any dewatering of the perched Star Point aquifer resulting from mining the Hiawatha Coal of the Blackhawk Formation has little potential of affecting seeps and springs in the area (Lines, 1985).

Most of the seeps and springs in and around the state lease areas, and the UTU-68082 leases principally drain perched aquifers in the North Horn and Price River Formations (Appendix 7-16). The North Horn and Price River Formation perched aquifers lie 470 to over 2410 feet above the top of the Hiawatha Coal Seam. These aquifers exist along bedding planes and are perched with no direct hydraulic connection to the existing or proposed mine workings in the Hiawatha coal bed. As a result, mine dewatering is anticipated to have minimal, if any effects on these seeps and springs.

Lesser numbers of seeps and springs drain the perched aquifers in the Blackhawk Formation and lie approximately 420 or more feet above the potentiometric surface of the regional Star Point aquifer. With no direct communication to the underlying regional aquifer these water sources should not be affected by mine dewatering, if it occurs.

Elevations of perched aquifers overlying the Hiawatha Coal Seam are evidenced by the occurrence of seeps and springs (Plate 7-12). The locations of seeps and springs suggest that perched aquifers may be present in the following areas:

Approx. Elev.	**Location**	**Geologic Formation**
10,160 feet	Sec. 12,T16S,R6E, SE	North Horn
9,440 feet	Sec. 12,T16S,R6E, NE	Price River - base
8,720 feet	Sec. 1,T16S,R6E, NW	Blackhawk - top
9,920 feet	Sec. 2,T16S,R6E, SW, NW SW	North Horn
10,240 feet	Sec. 2,T16S,R6E, SW	North Horn
10,480 feet	Sec. 35T,15S,R6E, SE	North Horn
10,240 feet	Sec. 35T,15S,R6E, NW	North Horn - base
9,280 feet	Sec. 31T,15S,R7E, SW	Price River
9,680 feet	Sec. 25T,15S,R6E,S ½	Castlegate

Seeps and springs northwest of the permit area discharge from the North Horn Formation or alluvium covering the North Horn Formation in Upper Joe's Valley. In contrast to other seeps and springs in the study area, flows from many of these water sources increased substantially between the spring/early summer surveys and the fall surveys (Appendix 7-17). This anomalous water flow trend is attributed to three factors:

First is the groundwater recharge from the Joe's Valley Fault Zone. These water sources lie in two linear positions parallel to the fault zone. Those springs occurring in the valley bottom directly east or immediately contiguous to Indian Creek, and those springs on the west hillslope above Indian Creek which also follows the trace of the fault zone.

Secondly, recharge from water in the colluvium and alluvium on the west-facing slope of East Mountain flows downhill toward Upper Joe's Valley and discharges into the valley alluvium. The relatively late arrival (mid-summer) of this water is due to the lag time created as this snow melt-derived water travels through the soil to the valley floor.

Thirdly, the seeps and springs in Upper Joe's Valley lie in a different drainage basin than those in the rest of the study area, a drainage basin which has a contrasting flow pattern to that present in the Huntington Creek tributaries on the east-facing slopes of East Mountain.

According to the approved current mine plans for the UTU-68082 (LBA No. 9) area (which is bounded at the east margin of the LBA by the north and south trending Joes Valley Fault Zone) mining will not occur within approximately 1000 feet of the fault zone.

During the period of March and April 1987, a monitoring well (MW-1) was installed at the Crandall Canyon Mine in the location indicated in Plate 7-13. MW-1 provides less than 1 gpm of water and is used to supplement the water withdrawn from Crandall Creek for in-mine usage. MW-1 was drilled using air-rotary methods to a total depth of 375 feet, and encountered Star Point Sandstone through its entire depth (Figure 7-1).

The driller indicated that the formation was relatively homogenous except in the zone from 290 to 335 feet, where the sandstone became coarser. It is from this zone that the well is producing water, with water first being encountered at a depth of about 315 feet. The static water level, approximately one week after completion of the well, was at a depth of 186.1 feet below ground surface, indicating the presence of a significant upward pressure component (approximately 130 feet) within the saturated zone.

After completion of the well, a slug test was performed on the well to determine the approximate hydraulic characteristics of the Star Point Sandstone at the mine site. This test was performed by inserting approximately 10 feet of drill stem below the water surface and allowing the water level to stabilize over a period of 3.75 hours. Although water level recovery was measured during this period, the data are not adequate for slug-test analysis since the drill stem was present within the zone of influence of the injection test, thus displacing additional water during the recovery period.

Following stabilization of the water level, the drill stem was rapidly removed from below the water level and the resulting recovery to static conditions was measured for a period of more than 2 hours. Data collected from this test have been provided to the Division in a letter addressed to Mr. Dave Cline from Richard B. White of EarthFax Engineering, Inc. and dated April 30, 1987. Data collected for the first 700 seconds of the test are provided in Figure 7-2.

In-mine monitoring wells MW-4 and MW-5 were installed, completed, and developed in January, 1992. Monitoring well MW-3 is located in an area that was sealed in 1979 and is now inaccessible. Water-level data collected in January, 1992 from MW-2, MW-4, and MW-5 were used to produce the potentiometric surface map depicted on Plate 7-13. Slug tests were also performed on MW-4 and MW-5. (See Appendix 7-24).

The slug test data were analyzed using a method developed by Bouwer and Rice (1976). According to this method:

$$K = \frac{r_c^2}{2L} \frac{\ln(R_e/r_w)}{t} \ln\frac{Y_o}{y_t} \qquad (7\text{-}1a)$$

where K = hydraulic conductivity (feet per day)

r_c = radius of the casing (feet)

r_w = radius of the well

L = length of the screened section (feet)

t = time since test began (seconds)

y_o = maximum drawdown during test of drawdown immediately following slug injection or withdrawal (feet)

y_t = drawdown at time t (feet)

$$\ln(R_e/r_w) = \frac{1.1}{\ln(H/r_w)} + \frac{C}{L/r_w}^{-1}$$

where H = depth from static water level to the base of the producing zone

C = a dimensionless coefficient as a function of L/r_w obtained from Figure 3 of Bower and Rice (1976, p.426)

For the slug test conducted at MW-1,

r_c = r_w = 0.25 ft (hole radius of 3 inches)

L = 335-290 = 45 ft (length of the producing zone according to the driller's records)

H = 335-187 = 148 ft (distance between the static water level and the base of the producing zone

y_o = 2.50 ft (see Figure 7-2)

y_t = 2.10 ft at t = 400 s (see Figure 7-2)

$$\ln(R_e/r_w) = \frac{1.1}{\ln(148/0.25)} + \frac{6.6}{45/0.25}^{-1} = 4.8$$

By means of equation (7-1a) and these data, a hydraulic conductivity of 0.1 foot per day was calculated. Assuming that the 45-foot producing zone accounts for the entire thickness of the aquifer at the location of MW-1, this value converts to a transmissivity of 4.5 square feet per day.

Slug tests from MW-4 and MW-5 were analyzed using the same equation and the hydraulic conductivity for MW-4 was determined to be 0.6 foot per day (2.3 square feet per day) and 2.5 foot per day (13.0 square feet per day) for MW-5. The data sheets for MW-4 and MW-5 slug tests are included in Appendix 7-24. These determined transmissivities are similar to those measured by Lines (1985) from pumping tests performed in the Star Point Sandstone near Trail Mountain approximately 10 miles southwest of Crandall Canyon.

According to Danielson et al. (1981), the flow of groundwater in the region is generally from high-elevation recharge areas toward major canyons. In most locations, the piezometric surface in the Star Point Sandstone is below the mine floor. Minor inflow to the existing mine workings has been from the roof ~~only~~, even though the floor of the mine within the western third of the mine area is below the elevation of Crandall Creek. Most groundwater inflow into the mine occurs from sandstone paleochannels in the mine roof, especially where these sandstone rocks are fractured. In the westernmost portion of the Crandall Canyon Mine, the piezometric surface in the Star Point is at or slightly above the elevation of the mine floor. In these areas, minor amounts of groundwater weeps into the mine from fractured sandstone in the mine floor. In addition, as noted above, the depth to groundwater at the mouth of the mine (at MW-1) is approximately 186 feet below ground surface. Thus, it is reasonable to assume that groundwater within the Star Point Sandstone beneath the mine does not discharge into Crandall Creek.

Although the regional stratigraphic dip is to the west (see Chapter 6), the local strata generally dip to the southeast. As shown on Plate 7-13, the direction of groundwater flow in the Star Point Sandstone beneath the mine is generally eastward, from East Mountain to Huntington Canyon.

In the area of Trail Mountain (located approximately 10 miles southwest of Crandall Canyon) the hydraulic gradient of groundwater in the Star Point Sandstone varies from about 0.11 foot per foot in the recharge area near the ridge line to about 0.03 foot per foot in the discharge area in Straight Canyon (Lines, 1985). Due to the similarity of the geologic conditions in the two areas (Waddell et al., 1981), similar hydraulic gradients are expected in the East Mountain recharge area and Huntington Canyon discharge area, respectively.

Usage of most seeps and springs within the survey area is confined to deer, elk, and other wildlife and limited seasonal usage by livestock. Flowing surface water within each watershed does contribute to downstream water users such as industry, domestic water supplies, and recreation (i.e., cold water fisheries). As would be expected, wildlife usage of the springs is most abundant where flows are greatest and the sources are most accessible. Little Bear Spring has been developed for municipal use by adjacent municipalities.

Data indicate that the specific conductance of water issuing from springs in June generally increased with increasing stratigraphic depth. This is in agreement with the findings of Danielson et al, (1981). Springs issuing from the Price River Formation typically had a specific conductance, during the June survey, that varied from 150 to 450 umhos/cm at 25°C while those issuing from the

Blackhawk Formation and Star Point Sandstone had a specific conductance varying from 500 to 1000 umhos/cm at 25°C.

The pH of water issuing from springs in the survey area showed no trends within or between formations. Values varied from 6.80 to 8.57, averaging 7.74. Hence, spring water in the study area is slightly alkaline.

In those springs with sufficient water to sample, pH generally increased slightly between June and October. Increases normally amounted to 0.1 to 0.5 pH unit. Specific conductance showed no consistent pattern between the June and October data, with approximately as many increases as decreases between June and October.

Water temperatures vary widely at the site. In general, water temperatures are lowest in springs issuing from fractures and highest in springs issuing from shallow colluvium over bedrock. Lower water temperatures generally occurred in the springs with relatively low specific conductances.

Appendix 7-42 contains water quality results for selected springs from 1988 through 1991. These water quality analyses generally have included pH, temperature, conductivity or TDS, total manganese (as Mn), and either total or dissolved iron (as Fe). Baseline discharge and water quality data from the South Crandall Lease area is included in Appendix 7-58. Baseline discharge and water quality data from the U-68082 lease mod area is included in Appendix 7-64.

Groundwater Development and Mine Dewatering

Water Supply

A few of the seeps or springs inventoried during the spring/seep surveys have been developed for beneficial use. No water wells used for consumption by humans or animals, other than MW-1, are known to exist within the study area of the spring inventory. However, groundwater which reaches the surface water within each watershed does contribute to downstream water users in Huntington Creek who have the water allocated for industry, domestic water supplies, agriculture, and recreation (i.e., cold water fisheries). Little Bear Spring has been developed as a municipal water source for adjacent municipalities.

Appendix 7-1 contains a listing of groundwater rights (and their associated seeps and springs) in and adjacent to the permit area (within a 1-mile perimeter boundary). This data was obtained from the files of the Utah Division of Water Rights. Locations of these water rights are denoted in Plate 7-14. Appendix 7-1 also shows what groundwater right corresponds to the seeps and springs observed in the field inventories.

Mine Dewatering

An underground water budget (amended August 23, 1994) appears in Appendix 7-21. Based on the water budget, current underground use of water for the mine equipment averages 14.3 gpm throughout the year. Infiltration along the mine floor and sumps totals 10 gpm and evaporation due to mine ventilation equals 50 to 60 gpm. Coal moisture content accounts for 68.5 gpm. The combined approximate total equals 150 gpm. The quantity of mine inflow that is lost to evaporation and infiltration are estimates based on experience at other mines, and the infrequent need to discharge into Crandall Creek. Additional water depletion analysis for Fish and Wildlife Service is porvided in Chapter 3.

Although worst-case estimates of mine inflow are greater than the present inflow rate, the actual inflow rate to be encountered is unknown. In order to effectively treat mine inflow an additional sump and pump house will be built in the southeastern corner of Lease ML-21569 (Appendix 7-22). This new sump will be equipped with a Worthington pump capable of pumping 150 gpm at 400 psi. This proposed sump will serve as the primary treatment facility for mine inflow, as well as the active water supply for mining operations. The existing sump will be maintained as a secondary water treatment facility. If discharge is required, water to be discharged will be initially treated in the proposed sump in Lease ML-21569, then pumped to the secondary (presently existing) sump, prior to discharge into Crandall Creek.

In the event mine inflow rates exceed the capacity of these treatment facilities to treat the mine inflow to meet the discharge limit criteria outlined in the NPDES Permit (UPDES Permit No. UT0024368, authorizing two discharge points), GENWAL commits to modifying these treatment facilities and/or constructing additional facilities in order to ensure compliance with the UPDES Permit. Treatment facilities to be considered include enlargement and/or construction of additional underground sumps and/or surface settling ponds. If excessive water volumes are encountered the

use of flocculants and gel-logs will be considered as stopgap measures until more permanent treatment facilities are in-place.

Make-up water for in-mine use is pumped from Crandall Creek into the main mine sump at no more than 75 gallons per minute (pump capacity). At its lowest recorded flow, at the lower flume, a minimum of 100 gallons per minute remains within Crandall Creek even when the mine is withdrawing water for in-mine use.

The majority of natural water inflow is occurring in the old mine workings (Leases U054762 and SL-062648). According to GENWAL personnel, natural mine inflow accounts for less than 400,000 gallons per year of the total water used in-mine. Only negligible mine inflow has been encountered in Lease UTU-68082 and State Lease ML-21569. Currently, water used in mining operations is being pumped to State Lease SL-21569 from the sump in the old mine workings. All inflow water is used in underground mining operations.

Effects of Mining Operation On Groundwater

Mine dewatering (resulting in removal of water from the aquifers) is the primary mechanism by which the groundwater system may be impacted. As previously stated, it is believed that the water emitting from seeps and springs in State Leases ML-21568 and ML-21569, as well as areas within and adjacent to UTU-68082 (LBA No.9) and groundwater supporting springs and seeps in the South Crandall Lease area (UTU-78953) , originate from perched aquifers with no direct communication with the regional Star Point aquifer. Although groundwater discharging from Little Bear Spring travels through a fracture system in the Star Point Sandstone, it is believed that the fracture system is the conveyance system for the the groundwater. Groundwater migrating through the pore spaces in the Star Point Sandstone near the spring likely does not contribute any significant quantity of groundwater to the spring. This conclusion is based on the very low hydraulic coductivity of unfractured Star Point Sandstone described in a subsequent section (see also Appendix 7-54). Thus, dewatering resulting from mining the Hiawatha Coal of the Blackhawk Formation has little potential for impact on the regional aquifer or for a diminution of flow from Little Bear Spring. This observation is in agreement with conditions present at Trail Mountain as reported by Lines (1985).

Laboratory permeability data reported by Lines (1985) on cores collected from the Blackhawk Formation indicate that the hydraulic conductivity of shale and siltstone units of this formation is typically four to six orders of magnitude lower than the hydraulic conductivity of the sandstone units. The relatively higher hydraulic conductivity of the sandstones of the Blackhawk Formation compared with the siltstones and shales indicates that the finer-grained sediments of the formation serve as barriers to the downward movement of water. As water recharges the Blackhawk Formation (either through snow melt, rainfall, or subsurface seepage from an adjacent formation) it percolates downward within the sandstone beds. However, upon reaching a less-permeable siltstone or shale layer, the water is forced to flow laterally to the surface, issuing at the interface between two units of contracting hydraulic conductivity.

Notable exceptions to the above generality concerning the Blackhawk Formation are present at springs that issue from fractured sandstone within the formation. Examples of this phenomenon

are present in springs SP-53 through SP-58 (Plate 7-12), where flow rates greater than 100 gallons per minute have been measured. Travertine deposits are common at these springs, which suggests that the recharge area for these springs is dominated by calcium carbonate. In areas, the upper portion of the Blackhawk Formation may serve more as a conveyance body rather than a significant source of water to these springs.

Results of slug tests on MW-1, MW-4 and MW-5 indicate that the Star Point Sandstone in the Crandall Canyon area has a hydraulic conductivity of 0.1 to 2.5 ft/day. Based on an average hydraulic conductivity of 1.0 ft/day, an average hydraulic gradient of 0.025 ft/ft (see Plate 1-8), an average Star Point porosity of 0.14 (Lines, 190\85) and the modified Darcy equation (Freeze and Cherry, 1979), the average linear velocity of groundwater flowing through the Star Point Sandstone beneath Lease #UTU-68082 and adjacent areas is approximately 0.2 ft/day.

Results of slug tests performed on the in-mine Star Point Sandstone wells MW-2, MW-6A, MW-7, and MW-6 by Mayo and Associates in 1997 (Appendix 7-54) indicated an average hydraulic conductivity of unfractured Star Point Sandstone of approximately 0.005 ft/day. Using information from these wells, the calculated average linear velocity of groundwater moving through the Star Point Sandstone is even less than 0.2 ft/day..

It is of note that laboratory permeability data provided by Lines (1985) from core samples collected approximately 10 miles south of Crandall Canyon indicate that the Star Point Sandstone has an average horizontal hydraulic conductivity of 2.3×10^{-2} ft/day and an average vertical hydraulic conductivity of 8.8×10^{-3} feet per day. With the range of slug test results at the mine and the lower values reported by Lines (1985), the velocity presented above is considered to be a maximum.

The potentiometric surface of the Star Point aquifer directly underlying the Hiawatha Seam (the coal bed mined at Crandall Canyon) is shown on Plate 7-13. The water table rises to the northwest under East Mountain at an average angle of 3 degrees, and lies from 50 to 115 feet below the Hiawatha coal seam. This regional water table is 150 feet below ground surface in the area of the mine portal, and up to 2220 feet below the surface under East Mountain in Sec. 2,T.16S.,R.6E.

Mitigation and Control Plan

Based on information presented in the preceding section, only minimal impacts on groundwater resources in the permit area may result. A probable hydrologic consequences determination that includes the South Crandall Lease area and the U-68082 lease mod area is included as a portion of this chapter and is located in Appendix 7-15. Installation of the main bypass culvert will not alter the Probable Hydrologic Consequences.

Should it be necessary to develop alternate water supplies due to unexpected diminution or interruption of flows as a direct result of mining activities, GENWAL will contact the Utah Division of Wildlife Resources, the U.S. Forest Service, the Utah State Engineer, and affected downstream users and develop plans to replace water supplies in quantity and quality, on a case-by-case basis. This would be augmented with water currently owned by GENWAL Resources, Inc. (See Appendix

7-14), and would be a 1 to 1 replacement through wells and diverting underground flows and or other mitigation determined to be appropriate.

Currently, treatment of mine water prior to discharge into Crandall Creek includes the use of two underground sumps. Discharge to Crandall Creek has occurred only 5 times prior to 1994 (UPDES Permit - Appendix 5-14).

7.24.2 Surface Water Information

Scope

This section presents discussion of surface water conditions within and adjacent to the permit area (lease areas SL062648 and U 054762, state leases ML21568 and ML21569, and UTU-68082) and in the South Crandall Lease area (UTU-78953) and the U-68082 lease mod area. Conclusions drawn herein are based upon a field reconnaissance of the area and a review of published hydrologic information.

Methodology

The U.S. Geological Survey established a gaging station at the mouth of Crandall Creek in 1978. The gaging station was maintained through water year 1984. Data collected from this station were obtained from the Water Resource Division of the USGS in Salt Lake City and used to determine seasonal variations in flows in areas adjacent to the mine plan area. Additional information is provided from Parshall flumes and instantaneous stream flow measurements by GENWAL in Blind Canyon, Horse Canyon, Indian Creek, Crandall Canyon, No Name Canyon, Little Bear Canyon, and several unnamed drainages in the South Crandall Lease area (Appendix 7-23, 7-58).

Regional Surface Water Hydrology

The region (including the existing permit area , the U-68082 lease mod area and the South Crandall Lease area is drained by a combination of ephemeral, intermittent and perennial streams. Two watersheds within the permit area have both intermittent and perennial sections within the stream drainage: Crandall Canyon and Horse Canyon. Two additional perennial streams occur adjacent to the permit area: Indian Creek (which drains to Joe's Valley Reservoir) and Huntington Creek. There are no perennial drainages in the South Crandall Lease area, although the Forest Service considers the Little Bear drainage a "perennially functioning stream".

Crandall Creek is an east-flowing tributary of Huntington Creek, one of the major tributaries of the San Rafael River. Huntington Creek had annual flows near the city of Huntington ranging from 25,000 to 150,000 acre-feet during the period of October 1931 through September 1973, averaging 65,000 acre-feet per year (Waddell et al., 1981). Variations in the annual flow of Huntington Creek near Huntington are depicted on Figure 7-6. Approximately 50 to 70 percent of

stream flow in the mountain streams of the region occurs during May through July (Waddell et al., 1981). Stream flow during this late spring/early summer period is the result of snow melt runoff.

Horse Canyon is also an east-flowing tributary of Huntington Creek. Instantaneous flow measurements collected during 1991 indicate that peak flow occurred during May and June with approximately 2500 gpm at station H-1 (see Plate 7-16). Minimal flow was observed during August, September, and October at approximately 15 gpm. No flow was observed at station HS-5 (located on the south fork of Horse Canyon near the fork) during September of 1992. Additionally, the main channel of Horse Canyon was observed to be dry approximately 340 feet above the fork. Stream flow and temperature measurements for Horse Canyon can be found in Appendix 7-23.

The quality of water in Huntington Creek and other similar streams in the area varies significantly with distance downstream. Waddell et al. (1981) found that concentrations of dissolved solids varied from 125 to 375 milligrams per liter in reaches of major streams above major diversions to 1600 to 4025 milligrams per liter in reaches below major irrigation diversions and population centers. The major ions at the upper sites were found to be calcium, magnesium, and bicarbonate, whereas sodium and sulfate became more dominant at the lower sites. They attributed these changes to (a) diversion of water containing low dissolved solids concentrations, (b) subsequent irrigation and return drainage from moderate to highly saline soils, (c) groundwater seepage, and (d) inflow of sewage and pollutants from population centers.

Average annual sediment yields within the Huntington Creek drainage basin range from approximately 0.1 acre-feet per square mile in the headwaters area to about 3.0 acre-feet per square mile near the confluence with the San Rafael River (Waddell et al., 1981). Increases in sediment yield with increasing distance downstream is generally the result of the water contacting increasing amounts of shale and sandstone in the downstream direction (Waddell et al., 1981).

Periodic instantaneous stream flow measurements for Indian Creek, collected by the U.S. Forest Service, are found in Appendix 7-44. These measurements were collected in Sec. 17,T.17S.,R.6E., during the period of July 1970 through April 1977. During seep and spring inventories conducted in the area by GENWAL in October and November of 1989, 1990, and 1991, the upper portion of Indian Creek was observed to be dry at elevations above 9120 feet in Sec. 34,T.15S.,R6.6E.

Observations of drainages located along the west facing slope of East Mountain in T15S R6E Section 35 W1/2 have been made during the seep and spring surveys from 1985 to 1990. The drainages have been found to be dry during all fall seep and spring surveys. Flow was observed during the fall 1991 survey; however, flow was not measured due to the existing field conditions (rain and melting snow) that would mask any natural perennial flow or lack of flow. Appendix 7-48 contains additional information concerning hydrologic conditions for the UTU-68082 (LBA No. 9) areas.

Mine Plan Area Surface Hydrology

The permit area (including the South Crandall Lease area and the U-68082 lease mod area) is drained by a combination of ephemeral, intermittent, and perennial streams. The watersheds are steep (with average slopes often exceeding 50 percent) and well vegetated (with percent covers also often exceeding 50 percent).

Within the South Crandall Lease area, no perennial streams have been identified. Based on the discharge data for these drainages (Appendix 7-58), the drainages in the South Crandall Lease would be considered ephemeral or intermittent. There are no perennial streams in the U-68082 lease mod area (see Appendix 64). The reaches of No Name Canyon creek would all be considered ephemeral or intermittent. The Forest Service considers parts of the Little Bear Canyon drainage as a "perennially functioning stream".

Flow measurements collected at the U.S. Geological Survey gaging station at the mouth of Crandall Creek can be found in Appendix 7-2. Flow measurements from a flume in Blind Creek, and estimated in Horse Creek are contained in Appendix 7-23. The Crandall Creek data are summarized in Figures 7-7 (monthly flow volumes) and 7-8 (monthly maximum and minimum flow rates) for the period of record (October 1978 - September 1984). Data collection from the Crandall Canyon gaging station was discontinued by the USGS in 1984.

As noted in Figures 7-7 and 7-8, the flow data for Crandall Creek are not complete for the winter months in most years, because of freezing conditions. Assuming an average flow of 30 acre-feet per month for the period of missing record, the average annual flow for the six-year period of data contained in Appendix 7-2 was 2740 acre-feet.

According to Figure 7-8, maximum flow rates in Crandall Creek normally occur in the months of May or June, while minimum recorded flows occurred during the months of September through November. During the period of record, the maximum recorded daily flow rate has been 88 cubic feet per second (on May 30, 1983). The minimum recorded daily flow rate was 0.28 cfs (on several days in September 1981). Lower minimum flows may have occurred during the winter months when data are lacking.

Plan and profile views of Crandall Creek adjacent to the surface facilities are shown on Plate 7-1. Selected cross sections are provided on Plate 7-2. As noted, Crandall Canyon is steep, with channel slopes normally exceeding 5 percent. The channel bottom is approximately 10 feet wide and side slopes are steep (generally greater than 100 percent).

Surface water-quality data collected from Crandall Creek by GENWAL are contained in Appendix 7-3 and summarized in Table 7-5A. These data, collected between June 1983 and November 1985, indicate that the dominant ions in Crandall Creek are calcium and bicarbonate. Total dissolved solids concentrations in the stream have varied from 180 to 286 milligrams per liter, with lower concentrations normally occurring during the high-flow season. Total suspended solids concentrations in Crandall Creek have varied during the period of record from <0.5 to 5.0

milligrams per liter (see Appendix 7-3). As expected, the highest suspended solids concentrations generally occur during periods of highest stream flow.

Parshall flumes were installed by GENWAL in Blind Canyon in July 1991 and in Crandall Canyon in May 1988. Locations of the lower and upper Crandall Canyon flumes (CF-1 and CF-1, respectively), and Blind Canyon flume (BF) are shown on Plate 7-16. Charts and tabulated flow data collected from the flumes are presented in Appendix 7-23.

Periodic instantaneous stream flow measurements collected in 1991 by GENWAL in Blind Canyon, Horse Canyon, and the north and south branches of Crandall Creek appear in Appendix 7-23. These measurements were collected from the locations shown on Plate 7-16. When the area was accessible, these measurements were collected monthly from January through June, bi-monthly from July through September, and monthly from October through December. During seep and spring surveys performed in the area by GENWAL in October 1989, the South Fork of Horse Canyon was observed to be dry above the forks (Plate 7-16). Blind Canyon was observed to be dry in October 1989 above the midpoint between stations B-2 and B-3 (Plate 7-16). See also Appendix 7-23 for additional evaluations on flow through September 1992.

Water quality data collected by the U.S. Forest Service from Indian Creek are summarized in Appendix 7-45.

Water quality and discharge data for streams in the South Crandall Lease area are presented in Appendix 7-58. Water quality and discharge data for seeps, springs, and streams in U-68082 lease mod area are presented in Appendix 7-64.

Table 7-5A
Concentrations of Selected Constituents in Crandall Creek

Constituent	Maximum (mg/1)	Date (mg/1)	Minimum (mg/1)	Date	Mean
Upper Station[a] 60 Samples					
Total Diss. Solids	320	11/24/87	180	4/08/85	255
Total Susp. Solids	1472	5/16/84	0	7/17/86	59.3
pH[b]	8.28	10/29/86	6.75	1/14/84	7.78
Total Iron	0.34	6/28/83	<0.05	Several	0.06
Diss Iron	<0.05	Several	<0.05	Several	<0.05
Total Manganese	0.03	Several	<0.01	Several	0.01
Lower Station[a] 52 Samples					
Total Diss. Solids	323	1/29/86	165	11/07/84	259
Total Susp. Solids	1468	5/16/84	0	7/17/86	57.8
pH[b]	8.66	11/20/86	6.95	11/01/84	7.75
Total Iron	0.25	6/28/83	<0.05	Several	<0.05
Diss Iron	<0.05	Several	<0.05	Several	<0.05
Total Manganese	0.03	Several	<0.01	Several	0.01

(a) See Figure 7-8
(b) In standard pH units solids concentrations generally occur during period of highest flow.

Analytical results are for samples collected from 1971 through 1978. Samples were collected from Sec. 17,T.17S.,R6E.

Laboratory analytical results of water samples collected by GENWAL at the Crandall and Blind Canyon flume locations appear in Appendix 7-3. Crandall Canyon water quality data have been collected from July 1983 to 1991. Blind Canyon water quality data represent the period of November 1990 to 1991.

Surface water-quality data contained in Appendix 7-3 indicate that the dominate constituents in Crandall Creek are calcium and bicarbonate. Total dissolved solids concentrations in the stream have generally varied from 200 to 300 milligrams per liter, with lower concentrations in the streams have generally varied from 200 to 300 milligrams per liter, with lower concentrations normally occurring during the high-flow season. The highest suspended solids concentrations generally occur during periods of highest flow and are a result of overgrazing in the upper Crandall Canyon Watershed.

Blind Canyon Drainage Study

In consultation with the Division of Oil, Gas and Mining, Utah State Lands, the Manti-La Sal National Forest, the U.S. Forest Service Intermountain Research Station, and the U.S. Bureau of Land Management, GENWAL Resources Inc. committed to participating in a scientific study in which the pillars beneath the unnamed drainage in Blind Canyon in Utah State Lands (T15S-R6E-Sec 36) will be retreat-mined to determine effects of retreat-mining produced subsidence on watershed erosion and stream flow. This study would monitor the actual effects of mining as proposed in Section 36. The U.S.F.S. Intermountain Research Station's research proposal appears in Appendix 7-25. This research proposal has been developed during close communication between the Intermountain Research Station and GENWAL Resources Inc. (Appendix 7-25). GENWAL Resources Inc. has committed to help finance the U.S.F.S. Intermountain Research Station's study, and perform subsidence monitoring, collection of Blind Canyon water quality and discharge data, as well as provide additional field support.

The approximate number and locations of cross-sections to be measured by the Intermountain Research Station personnel, and the current profile of the Blind Canyon Drainage from the Western Section Line of T15S-R6E-S36 to Route 31 appear on Plate 7-17. The locations and number of cross-sections may be modified by the researchers as ground conditions dictate. A final drainage profile and actual cross-section locations will be provided to DOGM when they are known. In addition to the cross-sections depicted on Plate 7-17, approximately 25 cross-sections in Crandall Canyon will be measured to serve as a control.

A timetable of research and mining to be conducted is found in Appendix 7-26. This timetable was developed in consultation with the U.S.F.S. Intermountain Research Station's Principal Investigator, to ensure that baseline data will be collected prior to retreat mining subsidence within the study area. As part of an agreement between GENWAL Resources Inc. and the above-referenced parties, pre- and post-mining erosion calculations for the Blind Canyon drainage have been calculated to determine the maximum worst-case amount of increased erosion that could occur as a result of

retreat mining. These calculations appear in Appendices 7-27 through 7-38. An overview of the erosion calculations is presented in Appendix 7-39. Final results of these calculations are presented in Appendix 7-38. Drawings applicable to the erosion calculations appear in Plates 7-8, 7-9, 7-10, 7-11, and 7-12.

Appendix 7-38 results indicate a worst-case erosion volume exiting State Lease ML-21569 (T15S-R6E-S36) that could potentially be transported onto Manti-La Sal National Forest land to be 0.145 ac-ft (one time event). Appendix 7-37 presents the pre-and post-SEDROUTE outputs. An increase of 0.006 ac-ft (annually) is calculated. This value is the sum of potential headcutting (Appendix 7-38) and SEDROUTE calculations (Appendix 7-37). In order to calculate a worst-case erosion value the following have been assumed:

1) all potentially erodible material is transported down the Blind Canyon drainage off of State Section 36 onto Manti-La Sal National Forest Service land,

2) headcutting erosion is calculated on rills (A, B, C, and D) (Plate 7-9), all ephemeral drainages,

3) headcutting is calculated for drainage "E" (Appendix 7-9), a drainage reach that also exhibits ephemeral flow, and

4) erosion is calculated at the eastern edge of Section 36 (stations 14.5 through 19) (Plate 7-9), over an area where a barrier pillar exists and erosion is extremely unlikely. Drainage erosion between stations 14.5 and 19 is extremely unlikely given the absence of a nick-point produced by retreat-mining (downward hydraulic jump), from which erosion can advance from in an upstream direction resulting in erosion. The more likely occurrence is for all but the smallest sizes of suspended sediment (colloidal) to be deposited upstream of station 14.5, and not reach Manti-La Sal Forest Service land further downstream.

The Manti-La Sal National Forest Service desires an equal or greater amount of sediment to be trapped elsewhere in the Manti-La Sal National Forest to offset potential increases of sedimentation on Forest Service land that could result from retreat-mining of State Section 36. As discussed with the U.S.F.S. Research Station personnel, and officials of the Manti-La Sal National Forest Service, erosion control measures cannot be implemented within the Blind Canyon drainage, on the State of Utah or Manti-La Sal National Forest Service lands, due to potential impacts on the U.S.F.S. Intermountain Research Station's study.

Consultations with Manti-La Sal National Forest Service personnel have resulted in identification of a site, Nuck Woodward Canyon where an erosion enhancement procedure can be conducted to reduce an equal or greater amount of sediment entering Huntington Creek. The enhancement procedure consists of graveling approximately 1/2 mile of the U.S.F.S road from the intersection of Route 31 to the trailhead area of the Nuck Woodward Canyon. An agreement whereby GENWAL donates $15,000 to the Manti-La Sal Forest to fund the Forest Service graveling of this road is provided in Appendix 7-49. This mutually agreed upon action by GENWAL Resources

Inc. and the Manti-La Sal National Forest, satisfies the U.S.F.S.'s "Net Beneficial Impact Policy." Additionally, GENWAL commits to remediating any adverse effects of retreat mining.

Thin-section microscopy and x-ray diffraction analyses of shales obtained from Crandall Canyon Mine overburden reveal the presence of a variety of bentonitic (swelling) clays. Moreover, carbonate cementation characteristics observed in thin-section and at outcrops, as well as groundwater analytical results, suggest pore-fluid chemistry conditions promote sealing of subsidence fractures (Appendix 7-41). This appendix also references a U.S. Forest Service study which indicates physical closure of subsidence fractures. The Crandall Canyon Mine overburden mineralogy, as well as physical closure of tension fractures, will aid in the protection of perched aquifers and surface waters.

SURFACE WATER DEVELOPMENT AND CONTROL

Water Supply

No extensive surface water development has occurred in the mine permit area or adjacent areas. GENWAL has historically pumped water from the stream near the sedimentation pond and from the sediment pond for use underground. GENWAL agrees to not pump from Crandall Creek at a rate that will cause the instream flow to decrease below 0.30 cfs. For the purpose to this determination, flow rates were measured using the flume at the "Lower Stream Station" indicated on Plate 7-7. No other points of development are known to exist on Crandall Creek or adjacent streams in the immediate vicinity of the mine plan area.

Appendix 7-1 presents a listing of surface water rights within the permitted and adjacent areas as obtained from the files of the Utah Division of Water Rights. Listing of these rights are noted on Plate 7-15 and summarized in Table 7-6.

Only one water-supply intake is known to exist on Crandall Creek. This intake is located immediately upstream from the sedimentation pond and is operated by GENWAL to obtain water for use at the mine. A search of records on file with the Utah Division of Water Rights and an examination of physical conditions along Crandall Creek and Huntington Creek indicate that no other water-supply intakes exist within one mile of the confluence of the two streams. It should be noted that an underground monitoring well (MW-1) drilled in 1987, currently serves as a water supply well for the mine. The use of this well supplements Crandall Creek for in-mine process water.

7.24.3 Geologic Information

Geologic information required for Sections 724.310 and 724.320 is provided in Chapter 6 and in this chapter under Sections 7.24.1 and 7.24.2.

7.24.4 Climatological Information

General

The Air Pollution Control Plan has been approved with conditions by the Department of Health letter of February 3, 1992. An amended Letter of Intent to Modify GENWAL's existing Air Pollution Control Plan was submitted to the Executive Secretary of the Division of Air Quality in September, 1995. Fugitive dust control measures to be used in connection with the GENWAL Mine facility are included within the remainder of this Section. The addition of the culvert expansion and a proposed increase in coal production has been included in the amended letter of intent.

The climatological information presented below is believed to be applicable to the South Crandall Lease area and the U-68082 lease mod area.

EXISTING ENVIRONMENT

Precipitation

Monthly Averages

Jan.	2.90"	Feb.	2.18"	Mar.	2.53"
Apr.	0.72"	May	1.67"	June	0.19"
July	0.96"	Aug.	2.29"	Sept.	0.32"
Oct.	0.40"	Nov.	2.66"	Dec.	3.18"

Yearly Average: 20.00"

Mean Monthly: 1.75"

TABLE 7-6

Surface Water Rights in the Crandall Canyon Mine Permit Area & Adjacent Areas

W.U. Claim No.	Owner	Claim Allotment	Use	Period of Use	Source
93-134	U.S. Forest Service	(d)	Stockwater	Jun 21 to Sept 30	Stream
93-175	U.S. Forest Service	(a)	Stockwater	July 6 to Sept 25	Stream
93-181	U.S. Forest Service	(b)	Stockwater	July 1 to Aug 30	Stream
93-182	U.S. Forest Service	(d)	Stockwater	May 21 to Aug 30	Stream
93-183	U.S. Forest Service	(a)	Stockwater	July 6 to Aug 25	Stream
93-184	UT State Lands&Forestry	(c)	Stockwater	Jan 1 to Dec 31	Stream
93-188	U.S. Forest Service	(d)	Stockwater	June 21 to Aug 30	Stream
93-190	U.S. Forest Service	(d)	Stockwater	June 21 to Sept 10	Stream
93-191	U.S. Forest Service	(a)	Stockwater	July 6 to Sept 25	Stream
93-192	U.S. Forest Service	(d)	Stockwater	June 21 to Sept 30	Stream
93-193	U.S. Forest Service	(E)	Stockwater	July 1 to Sept 30	
93-197	U.S. Forest Service	(d)	Stockwater	June 21 to Sept 30	Stream
93-198	U.S. Forest Service	(e)	Stockwater	July 1 to Sept 10	Stream
93-199	Pacificorp DBA UP&L	(j)	Stockwater	Jan 1 to Dec 31	Stream
93-201	U.S. Forest Service	(e)	Stockwater	July 1 to Sept 30	Stream
93-219	Huntington Clev. Irr. Co.	(i)	Varied*	Jan 1 to Dec 31	Stream
93-258	UT State Lands&Forestry	(c)	Stockwater	Jan 1 to Dec 31	Stream
93-336	U.S. Forest Service	(a)	Stockwater	July 6 to Sept 25	Stream
93-377	U.S. Forest Service	(f)	Stockwater	June 1 to Sept 30	Stream
93-383	UT State Lands&Forestry	(c)	Stockwater	Jan 1 to Dec 31	Stream
93-483	U.S. Forest Service	(a)	Stockwater	July 6 to Sept 25	Stream
93-606	U.S. Forest Service	(a)	Stockwater	June 6 to Sept 25	Stream
93-1180	U.S. Forest Service	(d)	Stockwater	June 21 to Sept 30	Stream
93-1590	U.S. Forest Service	(g)	Stockwater	June 21 to Sept 30	Stream
93-1673	U.S. Forest Service	(h)	Stockwater	June 6 to Sept 20	Stream

TABLE 7-6 (continued)

Surface Water Rights in the Crandall Canyon Mine Permit Area & Adjacent Areas

(a) Part of water right WUC 93-1403 on Crandall Canyon Allotment
(b) Part of water right WUC 93-507 on Horse Creek Allotment
(c) Part of water right WUC 93-500
(d) Part of water right WUC 93-116 on Gentry Mountain Allotment
(e) Part of water rights WUC 93-193, -198, -201, -1410, -1411, -1412, -1413, and -1414 on Crandall Canyon Allotment
(f) Part of water right WUC 93-377 on Little Joe's Valley Allotment
(g) Part of water right WUC 93-1588 on Trail Mountain Allotment
(h) Part of water rights WUC 93-985, -1632, and -1677 on Joe's Valley Allotment
(i) Part of water right WUC-93-219, a7941
(j) Claims 199, 1183

* Irrigation, stockwatering, domestic, power, industrial

Temperature

Summer Range:	+32 to +90 Degrees Fahrenheit
Winter Range:	-10 to +40 Degrees Fahrenheit

Evaporation

Potential evapotranspiration of 18 to 21 inches per year.

Wind

Average direction of prevailing winds from west and northwest. The average velocity of prevailing winds representative of the proposed mine plan area is 12 miles per hour as determined by the Utah State Climatological office.

EFFECTS OF MINING OPERATION ON AIR QUALITY

Estimate of Uncontrolled Emissions

The estimate of uncontrolled particulate emissions was determined by GENWAL and submitted to the State of Utah Department of Health for a coal production rate of 3,500,000 tons per year.

Description of Control Measures

Refer to Appendix 4-7 for measures that will be specifically committed to, for implementation. The air quality approval order authorizes the increase in coal production with the conditions noted therein.

A description of the controls and design features associated with the yard expansion can be found in Chapter 5 under section 5.26.

Climatological and Air Quality Monitoring

GENWAL does not require a continuous monitoring plan for the limited amount of dust, particuate emissions or diesel exhaust. (See State of Utah, Division of Health recommendations for monitoring letter included as Appendix 4-7).

7.24.5 Supplemental Information

Because GENWAL has an existing and approved permit it is not anticipated that any additional information will be required for the PHC.

7.24.6 Survey of Renewable Resource Lands

All renewable resource survey information is included in the Subsidence Control Plan in Section 5.25.

7.24.7 Alluvial Valley Floors

The permit area is located in a narrow V-shaped canyon with upland areas and steep hillslopes. The mine and permit area and the South Crandall Lease area and the U-68082 lease mod area are covered by a thin veneer of colluvial deposits and residual soils. The only alluvial materials are associated with the immediate stream channel which is less than 20 feet wide. These alluvial deposits are discontinuous as many portions of the stream are located directly on bedrock. As a result, the area is not underlain by an alluvial valley floor.

The area occupied by the surface facilities is a steep, narrow canyon hillslope and v-shaped narrow canyon bottom. No agricultural activities have been conducted in the area in the past nor will they be in the future due to the limited width of alluvium along the stream (less than 20 feet), to restrictive climatic conditions, and the limiting physical properties of the alluvial materials. Hence, the Crandall Creek area adjacent to the surface facilities is not an alluvial valley floor. This negative determination was also determined by the U.S. Soil Conservation Service (see Appendix 7-12).

7.25 Baseline Cumulative Impact Area Information

Sufficient information was provided by GENWAL during the initial permitting of the Crandall Canyon Mine for the Division to develop a Cumulative Hydrologic Impact Assessment (CHIA).

Geologic Information pertaining to Little Bear Spring

The Little Bear Spring is located close to the southern boundary of the South Crandall Lease area. This spring is an important source of culinary water for many residents of Emery County. In order to ensure that the spring would be protected from the effects of mining in the South Crandall lease area. the Forest Service and the BLM required a number of detailed hydrology studies to ascertain the source of the spring. Based on the result of these studies the federal government has concluded that the potential for mining this lease to alter the flow of Little Bear Spring is low and has issued a Finding of No Significant Impact (FONSI) regarding the proposal to conduct mining operations within the lease. The following studies were required by the Forest Service and BLM prior to leasing action and are included in this MRP as appendices in Chapter 7. Each report includes an extensive discussion of the geology of the South Crandall tract as relates to the occurrence of ground-water, aquifers, and recharge sources of the Little Bear Spring.

App 7-51 Little Bear Spring Water Replacement Agreement
App 7-52 Supplemental Hydrogeologic information for LBA 11
App 7-53 Summary of New Isotopic Information for LBA 11
App 7-54 Results of In-Mine Slug Tests
App 7-55 Investigation of Alluvial Ground Water System In Mill Fork Canyon

App 7-56 Investigation of Potential for Little Bear Spring Recharge
App 7-57 Determination of Recharge Location of Little Bear Spring (Dye Tracing)
App 7-58 Summary of Hydrologic Baseline Information, South Crandall Lease
App 7-59 Little Bear Spring Study (Initial study, 1998) AquaTrack
App 7-60 Little Bear Spring Study (Expanded Study, 1999) AquaTrack
App 7-61 Mill Fork Resistivity Study, 2001 AquaTrack
App 7-62 Little Bear Spring (2nd Expanded Study, 2001) AquaTrack

7.26 Modeling

No hydrologic model has been prepared or conducted at this site, nor is any planned.

7.27 Alternative Water Source Information

GENWAL recognizes the fact that the Division of Wildlife Resources, the U.S. Forest Service, the Division of Oil, Gas & Mining, and the State Engineer consider all seeps and springs to be important to wildlife and downstream users. If, during the monitoring of the springs, it is determined that over the course of time a spring has been dewatered, GENWAL will notify the Division of Wildlife Resources, the Division of Oil, Gas and Mining, the U.S. Forest Service, the State Engineer, and any affected downstream users. A determination as to the probable cause of diminished flow will **be** made and if mining activities are found to be the cause, work will begin on an acceptable mitigation plan involving the use of guzzlers or other replacement measures acceptable to GENWAL, DOGM, the U.S. Forest Service, the State Engineer, and affected downstream users. The Utah Division of State Lands and Forestry will also be conferred with in formulating any mitigation plans that will affect the lands in the State Leases.

These replacement measures will be designed in cooperation with the Division of Wildlife Resources, the Division of Oil, Gas and Mining and the U.S. Forest Service and placed in the area of the effected spring. No other sources of water, other than the springs located by the seep and spring survey, are known to exist in the mine plan area. GENWAL owns shares in the Huntington-Cleveland Irrigation Company that can be transferred if required, to meet the demands of an alternate water supply. A copy of the water share certificate which would be used as an alternative water source is included in Appendix 7-14.

Mitigation for potential disruption to the Little Bear Spring will be accomplished though the construction of a water treatment plant which will provide replacement water for the spring if mining activity in the South Crandall lease area affects the quality or quantity of the spring. Construction of this water treatment plant will be done under the provisions of a water replacement agreement between GENWAL Resources, Inc. and the Castle Valley Special Service District who maintain culinary water rights to Little Bear springs. A copy of this water replacement agreement is included in Appendix 7-51.

7.2 Probable Hydrologic Consequences Determination

The Probable Hydrologic Consequences (PHC) is included as a separate document in Appendix 7-15. Installation of the culvert expansion project does not change the conclusions presented in the current PHC.

7.29 Cumulative Hydrologic Impact Assessment

The Division has prepared a Cumulative Hydrologic Impact Assessment (CHIA) for this operation in the initial permit. A complete PHC is provided in Appendix 7-15 to aid in the determination as to whether a new CHIA is required for this renewal.

7.30 Operation Plan

7.31 General Requirements

This section describes the groundwater and surface water protection plan and water quality monitoring program implemented within the existing permit area and to be implemented for the refuse disposal site. The purpose of the groundwater and surface water protection plan is to minimize the potential for water pollution and changes in water quality and flow for surface and groundwater within and adjacent to disturbed areas. The purpose of the water quality monitoring program is to identify the potential impacts of coal mining operations on the hydrologic balance.

7.31.1 Hydrologic Balance Protection

Surface and Groundwater Protection Plan

GENWAL has included a plan to protect the surface and groundwater in the area of the mine facilities, topsoil storage site and refuse disposal site. The plan will ensure protection of the ground water and surface water resources of the sites by handling earth and refuse materials in a manner that prevents or controls, using the best technology currently available, the discharge of pollutants to the hydrologic system. Additionally, the GENWAL commits to handle acid- and toxic-forming materials, if encountered in the future, in a manner that will minimize acid- and toxic-forming discharge to surface or groundwater. The design details of the water protection plans are presented in Section 7.42 of this application.

In order to prevent material damage to the hydrologic balance and to protect the hydrologic systems possibly associated with the Joes Valley fault system, GENWAL plans to drill ahead before mining in the Incidental Boundary Change area adjacent to the Joes Valley fault in T. 16 S., R. 6 E. Sections 3 and 10.

When mining in the longwall gate entry nears the fault (between 200-300 feet away), an underground drill will be used to drill west toward the fault to determine its location. The drill will drill horizontally toward the fault up to 50 feet ahead of the entry face. If the fault is not encountered, the continuous miner will advance about 30-40 feet toward the fault, leaving at least 10 feet of coal between the entry and the end of the hole. The drill will again drill ahead. This sequence will continue until either water or fault gouge is encountered in the hole or the entry has been developed to its maximum extent (providing no fault was detected). If the fault is encountered prior to reaching the bleeder entries, then mining will stop and the bleeder entries will be relocated. At least 10 feet of solid coal will be left between the face of the entry and the fault.

Other indicators have been experienced during mining up next to Joe's Valley Fault. Any of these indicators being present will affect the above mining sequence. The indicators, which we have experienced are severe rib rashing in some cases; in others the ribs will stand up showing no rib rash. Severe water pressures have never been encountered. Large flows of water have occurred from cracks in the roof, but these flows have been associated with sand channels rather than the fault.

One horizontal hole will be drilled in the 10, 11 12 13 and 14th west panels. Should water be encountered by the drill hole, entry development would terminate at that point. Although large amounts of water and high pressure have not been previously encountered by mining near the fault, an emergency plan to handle water inundation from the fault has been developed. The plan consists of the following actions:

1. Pull equipment back from face
2. Erect two Kennedy stoppings at least 2 feet apart
3. Place appropriate sized de-water pipe w/valve at bottom of stoppings
4. Pump quick drying cement into the space between the stopping
5. After minimum drying time, close water valve

As a secondary measure of precaution, no longwall mining will take place in the 22 degree angle of draw projected from the Joes Valley fault. Therefore no subsidence from mining operations will intersect the fault or fault zone. Any hydrologic conditions specific to the Joes Valley Fault will not be impacted through mining or subsidence based on accessibility of the sites. Water monitoring reports will be submitted to the Division on a quarterly basis, and a summary report will be submitted yearly with the Annual Report for the mine.

All test and measurement instruments are operated, maintained and calibrated in accordance with the manufacturers instructions. The results of all field measurements are recorded and initialed by the sampler. When laboratory measurements are required, a specific set of sample bottles are pre-ordered from the laboratory. Bottles received from the laboratory are clean, pre-acidified and color-coded. Once the sample bottles are filled, they are individually labeled with water-proof, smudge-proof labels, placed in ice chests with ice packs and returned to the laboratory as soon as possible to insure proper holding times are met.

7.31.21 Groundwater Monitoring Plan

As noted in Section 7.24.1 only four springs were found during the June 1985 seep and spring survey within the area of potential subsidence with flow rates of one to two gallons per minute (SP-16, SP-17, SP-30, SP-36). By the time of the fall survey, all seeps and springs with the area of potential subsidence except SP-30 and SP-36 had dried up. Spring SP-30 was found to be dry during 1986 and in subsequent years to the present. The flow from SP-30 originally measured in 1985 is

most likely attributable to higher than normal precipitation during 1983-1985. SP-30 occurs as diffuse seepage from the Blackhawk Formation above the mine portals and is collected in a diversion pipe to avoid problems at the portal face. Flow at SP-36 issues from a sandstone-shale contact within the Blackhawk Formation and showed evidence of use by elk and deer. All major springs (flows of at least five gallons per minute) found during the June 1985 survey were located outside of the area of potential subsidence at that time.

The Federal Lease #UTU-68082 and State Leases have since been added to the permit area, and the area of potential subsidence has therefore expanded. Additional spring and seep surveys were conducted in 1987, 1989, through 1993. The proposed groundwater monitoring program described below is based on the results of those surveys and is designed to evaluate impacts from the entire permit area, including the State Leases and Lease #UTU-68082 (LBA 9). A table clarifying the groundwater monitoring program is shown in Table 7-10 at the end of Chapter 7 text.

Previous to August 1994, groundwater monitoring for the Crandall Canyon Mine area included collection of water quality and quantity data from eleven springs as well as points of significant inflow to the underground workings. Based on the permit modification to include UTU-68082 (LBA #9), GENWAL conducts the monitoring of fourteen seeps and springs:

SP-30 and SP-36 are monitored to determine potential impacts in the immediate vicinity of the mine. SP-58 is monitored as an indicator of long-term changes in groundwater issuing from the Blackhawk Formation in a area that will not be affected by mining operations. The magnitude of these changes will be useful when interpreting changes at SP-30 and SP-36.

SP2-24, SP2-9, SP-47A, and SP1-3 are monitored since a water right has been filed on the springs by the U.S. Forest Service. Springs SP1-19 and SP1-22 are monitored as indicators of the water supply in the upper reaches of Blind Canyon and the North Fork of Crandall Canyon.

SP1-33, SP1-47, and SP2-1 are monitored as an indicator of changes in groundwater emanating near the western border of East Mountain, contiguous to Joe's Valley Fault.

SP1-9 (also SP1-19 mentioned above is located within this state lease) located in Lease ML-21569 and SP1-24 in lease ML-21568 are monitored to evaluate the effects of potential subsidence in the state leases. Plate 7-12 shows the location of each spring.

Samples were collected from each of the fourteen seeps/springs listed above, plus seeps SP2-14 and SP2-23, during the spring of 1994 and analyzed for both quantity and quality. Based on the information collected during 1994 and the past seep and spring surveys, springs SP-36, SP-58, SP2-9, SP2-24, SP1-33, and SP1-9 are monitored quarterly for quantity and quality. The remaining springs (SP-30, SP2-1, SP1-47, SP1-24, SP1-19, SP-47A, SP1-3, and SP1-22) are monitored for quantity and field chemical parameters only. Springs SP2-14 and SP2-23 have been removed from the list of springs to be monitored due to extremely low or no flow over the past few years and SP2-9, which is contiguous to these two springs, is a good indicator of the water quality and quantity for that area of the mine permit. Monitoring at the fourteen seeps/springs will continue on a quarterly basis.

Following reclamation the samples will be collected semiannually until the surety bond is released. At least one of these samples will be collected during the low-flow period (normally the

fourth quarter). These samples are collected as close as possible to the point of issuance of the springs. Samples are analyzed according to the list of parameters in Table 7-4 which includes, flow, pH, conductivity or TDS, total iron, and total manganese as required by R645-301-724.1.

Samples collected during the low-flow period of the year (fourth quarter) will be analyzed according to the list of parameters contained in Table 7-5 (as requested in guidelines from DOGM) in the years 1990, 1995, 2000, and at 5-year intervals thereafter until the surety bond is released.

Even though SP-30 has been dry since the original measurement in 1985, monitoring at SP-30 will continue. By continuing to monitor SP-30, flow trends, as they relate to precipitation patterns, can be observed. Substitution of another spring in the vicinity was considered and dismissed due primarily to the long term monitoring correlation stated above and because there exists a lack of flowing springs in the vicinity of old mine workings. Additionally, when the physiographic location of the mine portal is compared with similar locations in adjacent canyons (ie; Blind Canyon, Horse Canyon, Little Bear, and Mill Fork) there are an apparent absence of springs on these mid to upper south facing hill slopes (Plate 7-12). The apparent absence of seeps and springs in these areas is primarily related to the geologic nature and limiting hydrologic characteristics of the Blackhawk Formation in its upper strata.

In conjunction with the South Crandall Lease (UTU-78953) and the SITLA/PacifiCorp sublease GENWAL will monitor four springs. The monitoring plan for the South Crandall Lease is described below. Monitoring site locations are shown on Plate 7-18. The monitoring protocols for each of the monitored springs are presented in Table 7-10.

The monitoring plan for springs includes springs in the Castlegate Sandstone, Blackhawk Formation, and Star Point Sandstone. As demonstrated in the PHC, it is believed that the potential for diminution of flow or degradation of the water quality of springs discharging from the Price River or North Horn Formations is remote.

Little Bear Spring will be regularly monitored to verify that impacts to not occur and to document the relationship between climatic variability and discharge from the spring. Quarterly water quality sampling at the spring will occur and the samples will be analyzed for the parameters listed in Table 7-4. Discharge from the spring is monitored by the Castle Valley Special Service District.

Spring LB-2 discharges from the Castlegate Sandstone in the southernmost portion of the South Crandall Lease area. Although the potential for mining-related impacts to this spring is negligible due to its location relative to proposed mining areas and to the thickness of the mining overburden, this spring will be monitored to verify that mining-related impacts do not occur and to document the climatic variability in groundwater systems in the area. LB-2 will be monitored for Table 7-4 water-quality parameters including flow and field water-quality parameters.

Spring LB-5A discharges from a sandstone channel in the upper Blackhawk Formation overlying proposed mining areas. To monitor for potential impacts to groundwater systems in the Blackhawk Formation, LB-5A will be monitored quarterly for Table 7-4 parameters including flow and field water-quality parameters.

Spring SP-79 discharges from the Star Point Sandstone in the northeast portion of the South Crandall Lease area. To monitor for potential impacts to Star Point Sandstone groundwater systems (stratigraphically below the mined coal seam) quarterly monitoring of this spring will occur. SP-79 will be monitored according to Table 7-4 parameters including flow and field water-quality parameters.

SP-18 and SP-22 are located in the Shingle Canyon (aka No Name Canyon) area in the northeast part of the permit area. SP-18 issues from the contact between the Blackhawk formation and the Star Point sandstone near the confluence of the drainage. SP-22 is located higher in right fork of Shingle Creek in the Blackhawk above the elevation of the coal seam to be mined. These springs will be monitored to verify that effects of mining in the U68082 lease modification area. These springs will be monitored for flow and field parameters quarterly.

TABLE 7-4

Abbreviated Groundwater Analysis List

Field Measurements:

Water level or flow
pH
Specific conductance (umhos/cm)
Temperature (°C)

Laboratory Measurements:

Total dissolved solids
Total hardness (as $CaCO_3$)
Total Alkalinity
Bicarbonate (as HCO_3)
Carbonate (as CO_3)
Calcium (as Ca)
Chloride (as Cl)

Dissolved iron (as Fe)
Total Iron (as Fe)
Magnesium (as Mg)
Total Manganese (as Mn)
Potassium (as K)
Sodium (as Na)
Sulfate (as SO_4)

TABLE 7-5

Extended Groundwater Analysis List

Field Measurements:

Water level or flow
pH
Specific conductance (umhos/cm)
Temperature (°C)

Laboratory Measurements:

Total dissolved solids
Total hardness (as $CaCO_3$)
Total Alkalinity
Acidity
Aluminum (as Al)
Arsenic (as As)

Barium (as Ba)
Bicarbonate (as HCO_3)
Baron (as B)
Carbonate (as CO_3)
Cadmium (as Cd)(Dissolved)
Calcium (as Ca)(Dissolved)

Chloride (as Cl)
Copper (as (Cu)(Dissolved)
Dissolved Iron (as Fe)
Total Iron (as Fe)

Lead (as Pb)(Dissolved)
Magnesium (as Mg)(Dissolved)
Dissolved Manganese
Total Manganese (as Mn)
Molybdenum (as Mo)(Dissolved)

Nitrogen-Ammonia (as NH_3)
Nitrite (as NO_2)
Nitrate (as NO_3)
Potassium (as K)(Dissolved)
Phosphate (as PO_4)

Selenium (as Se)(Dissolved)
Sodium (as Na)(Dissolved)
Sulfate (as SO_4)
Zinc (as Zn)

All samples are preserved as soon as practicable after collection. Samples are collected and analyzed according to the methodology in the current edition of "Standard Methods for the Examination of Water and Wastewater" or the methodology in 40 CFR Parts 136 and 434.

On a quarterly basis an inventory will be conducted of the active portion of the mine to identify the location and geologic occurrence of mine inflows that exceed three gallons per minute. In consultation with DOGM, certain of these inflows (if they occur) will be selected for continued monitoring. Previously, only one such inflow existed, flowing from the roof of the mine from an exploratory hole (DH-1) that was vertically drilled from within the permit area at the location shown on Plate 3-2 (listed as "DRILL HOLE"). Flow from this hole was originally controlled with a valve. However, the overlying perched aquifer no longer produces a flow sufficient to monitor.

After selection of the inflow points to be monitored, data will be collected on a quarterly basis and analyzed according to Table 7-4. Samples collected during the low-flow period (normally the fourth quarter) will be analyzed according to Table 7-5 in the years 1990, 1995, 2000, and at 5-year intervals thereafter. Monitoring and sampling of the selected mine inflow points will continue, according to this schedule, in safely accessible portions of the mine.

Water rights apparently have been filed for two additional springs in the area surrounding the lease areas (93-1407 and 93-1408 on Plate 7-14). As noted in Section 7.24.1 the source at 93-1407 was not discovered until the fall of 1990. Until this time it was surmised to exist as only a seep (similar to 93-1408 (SP-47). Since its discovery GENWAL has committed to monitoring and sampling SP-1407 (SP-47a) in the groundwater monitoring plan submitted with the Right-of-Way application. Source 93-1408 existed as a seep in June but was dry in October, 1985. Hence, it was decided not to monitor 93-1408 on a long-term basis since it does not flow at a sufficient rate to permit sample collection. SP-47 was observed to be dry in October, 1989 and in June of 1990.

GENWAL installed monitoring wells near the mine portal (MW-1), and in the East Mains near their junction with the North Mains (MW-2) (Plate 7-13). Monitoring well MW-3 is located in an area sealed in 1979, and is now inaccessible. Monitoring wells MW-4 and MW-5 were installed in January 1992. These locations were chosen in areas where access will be maintained as long as possible.

Each underground monitoring well was drilled using air-rotary techniques (see Appendix 7-46 for completion diagrams). MW-1 was drilled to a total depth of 375 feet (Figure 7-1). As 6 5/8-inch diameter steel casing was cemented within a 10-inch diameter hole to a depth of 100 feet. A 6-inch diameter open hole completion exists from 100 to 375 feet. MW-2 was drilled to a total depth of 134 feet. Four-inch casing was set to 5 feet. A 3-inch open hole completion exists from 5 to 134 feet. Drilling of a larger diameter hole at greater depth was precluded by the inability of a larger drill rig to mobilize underground.

Monitoring well MW-4 was drilled to a depth of 111.5 feet. The hole has a 5" casing set to a depth of 4 feet, and a 1.5 inch PVC casing for the remainder, with a slot screen in the bottom 10 feet. MW-5 was drilled to a depth of 116.8 feet. It has a 5" casing to a depth of 4 feet, and a 2 inch PVC casing for the remainder, with a slot screen in the bottom 40 feet.

After drilling, each hole was surged with air to remove fines that had accumulated in the holes. Surging continued until the water discharging from the holes was visibly clear. A cap was placed over the surface casing to allow closure of each well when not in use.

Construction and initial sampling of the underground monitoring wells was completed in June, 1989 and June, 1992. Lithologic/completion logs of the wells have been submitted to DOGM along with the results of analyses of the first samples collected from the wells. An interpretation of the hydrogeology of the Star Point Sandstone beneath the mine appears in Section 7.24.1.

Water-level measurements and water-quality samples will be collected from the monitoring wells on a quarterly basis following completion during the first two years following completion of the in-mine wells and in the years 1990, 1995, 2000 and in 5-year intervals thereafter. During the operational period of the mine, water-quality samples collected from all wells will be analyzed according to the list provided in Table 7-4. Monitoring will continue according to this schedule in accessible wells until two years after the completion of surface reclamation activities.

Each monitoring well will be pumped prior to sampling to purge it of stagnant water standing in the hole. In the case of M-1, purging will be accomplished using a submersible pump. A bailer will be used for purging and sampling MW-2, MW-4 and MW-5. In each case, purging will continue until at least 3 times the volume of water standing in the well has been pumped. Samples will be collected directly from the discharge line of the pump. Samples will be preserved and stored in accordance with U.S. Environmental Protection Agency guidelines.

Groundwater monitoring data collected from the area will be submitted to DOGM on a quarterly basis. On an annual basis, a report will be submitted to DOGM summarizing all data collected during the year and containing an analysis of the mine water balance, accounting for mine inflows, outflows, consumptive uses, and sump storage (a copy of the annual report will also be given directly to the Price office of the U.S. Forest Service).

After the completion of mining activities and during the post-mining/reclamation period, water-level and quality samples will be collected annually from the designated springs and MW-1 until the termination of bonding. In-mine wells will be inaccessible following reclamation. Samples will be collected during the latter portion of the summer to represent low-flow conditions. Samples thus collected will be analyzed for the parameters listed in Table 7-4. A report will be submitted to DOGM on an annual basis summarizing the results and assessing mining impacts and system recovery since mining ceased.

7.31.22 Surface Water Monitoring Plan

Two 36-inch Parshall flumes were installed in July 1985 on Crandall Creek (one upstream from the surface facilities and one downstream (see Plate 7-16). A 12-inch Parshall flume has been installed in Blind Canyon to monitor possible effects of mining in State Lease ML-21569. These flumes are equipped with Stevens Type-F water-level recorders to allow the collection of continuous flow data. Charts will be changed and the flumes inspected on a monthly basis. Flume location and stream monitoring stations are shown on Plate 7-16.

Water quality samples will be collected from the flume locations quarterly, and analyzed according to the list contained in Table 7-8. In the years 1990, 1995, 2000 and every fifth year thereafter the samples collected during the low-flow period (normally fourth quarter) will be analyzed according to Table 7-9. All samples will be analyzed for total and dissolved constituents according to the indicated lists. Sampling and analysis will be conducted quarterly until the surface areas are reclaimed, at which time sampling will be conducted semiannually until the surety bond is released. For perennial streams, those samples will be collected during high-flow (normally second quarter) and low-flow (normally fourth quarter) periods. Discharges from the sedimentation pond will be analyzed in accordance with the NPDES permit for the facility.

Stream flow observations made during drilling operations as well as seep and spring surveys suggest that large portions of the south fork of Horse Creek, and both the north and south forks of Crandall Creek have only ephemeral and intermittent flows within State Leases ML-21568 and ML-21569 and portions of UTU-68082. Plate 7-16 shows the points of transition between perennial and intermittent flow for Horse Creek, Blind Creek, the north and south forks of Crandall Creek, and Indian Creek. Blind Creek has been determined to be intermittent.

Stream channel monitoring stations have been established along both the north and south forks of Crandall Creek, and the south branch of Horse Creek to determine what stream reaches exhibit perennial flow. Stream flow and water temperature were measured twice monthly from May through July, and monthly during the remainder of 1991 when the area was accessible. Stream monitoring results are found in Appendix 7-23. Stream monitoring was again done on September 28, 1992. These results are also contained in Appendix 7-23. Stream monitoring ceased at the end of 1992.

To provide for proper monitoring of Indian Creek (in Upper Joe's Valley) a 36-inch Parshall flume was installed. This flume is equipped with a Stevens Type-F water-level recorder to allow the collection of continuous flow data. Charts will be changed and the flumes inspected on a monthly basis. The location of this flume is depicted on Plate 7-16. Because of its higher elevation and limited access this flume is typically operational from June 1 through November 1 of any given year. If seasonal variations and access allow, this station will be operated for longer periods.

Water quality samples will be collected from the Indian Creek flume location quarterly (weather permitting), and analyzed according to the list contained in Table 7-8. In the years 1995, 2000 and every fifth year thereafter the samples collected during the low-flow period (normally fourth quarter) will be analyzed according to Table 7-9. All samples will be analyzed for total and dissolved constituents according to the indicated lists. When flumes or other monitoring devices are no longer required, they will be removed and the affected areas will be restored.

No retreat mining will be conducted within the designated stream channel buffer zones. Horse Canyon is located hydraulically upgradient and north of the UTU-68082 (LBA No. 9) north boundary line. Current mine plans show that because of limited coal height that neither development mining or retreat mining will occur beneath Horse Canyon and the stream channel buffer zones. Since mining has already occurred under Blind Canyon, Crandall Canyon, and beneath the upper

reaches of the left fork (South Fork) tributary of Horse Canyon, any adverse effects to the respective streams should manifest as reduced stream flow and a continuous high volume inflow into the mine workings. If it is found that stream flows in Blind Canyon and Crandall Canyon have been impacted by mining, then a decision to monitor Horse Canyon on a continuous basis will be made.

In conjunction with the South Crandall Lease (UTU-78953) and the SITLA/PacifiCorp sublease GENWAL will monitor four creeks. The monitoring plan for the South Crandall Lease is described below. Monitoring site locations are shown on Plate 7-18. The monitoring protocols for each of the monitored creeks are presented in Table 7-10.

Little Bear Canyon Creek will be monitored quarterly for Table 7-8 parameters including flow and field water-quality parameters. The creek will be monitored approximately 100 feet above the confluence with Huntington Creek (Plate 7-18). Based on the range of discharge anticipated at the creek (see Appendix 7-58) discharge measurements at Little Bear Canyon Creek will likely be performed using a 90° v-notch weir or a portable 3-inch Parshall flume.

The ephemeral drainage in SW 1/4 of Section 4 T16S R7E will be monitored quarterly for Table 7-8 parameters including flow and field water-quality parameters. No discharge was observed in this drainage during drought conditions in 2003. If flow occurs in this drainage, the discharge will be measured using appropriate portable discharge measuring devices.

Monitoring station IBC-1 monitors the drainage located along the border of Sections 5 and 6, T16S, R7E. This drainage will be monitored quarterly for Table 7-8 parameters including flow and field water-quality parameters. Discharge in this drainage has been meager (Appendix 7-58) and discharge will likely be measured using a stopwatch and a calibrated bucket. The potential for impacts to this drainage are considered remote because only a small region in the extreme northwestern portion of the South Crandall Lease area is drained by this drainage. However, to verify that no impacts to this drainage occur, and to document the effects of climatic variability on stream discharge in the region, this creek will be monitored.

The creek in Section 5 T16S, R7E will be monitored quarterly for Table 7-8 parameters including flow and field water-quality measurements. This creek drains most of the northeastern portion of the South Crandall Lease area, where the initial mining in the lease area will occur. Additionally, the upper forks of this drainage will be monitored for flow and field water-quality measurements will be performed. Flow at each of the monitoring sites on this drainage has been meager. Thus, flow measurements will likely be performed using a stopwatch and a calibrated bucket.

In conjunction with mining in the U-68082 lease modification area GENWAL will monitor surface flow in Shingle Canyon (aka No Name Canyon), for flow and field parameters quarterly. This site is located immediately down stream from the confluence of the right and left forks of the canyon, and is shown on Plate 7-18.

TABLE 7-8

Abbreviated Surface Water Analysis List

Field Measurements:

Water level or flow
pH
Specific conductance (umhos/cm)
Temperature (°C)
Dissolved oxygen (ppm)

Laboratory Measurements:

Total dissolved solids
Total suspended solids
Total settleable solids
Total hardness (as $CaCO_3$)
Total Alkalinity
Bicarbonate (as HCO_3)

Carbonate (as CO_3)
Calcium (as Ca)
Chloride (as Cl)
Dissolved Iron (as Fe)
Total Iron as (Fe)
Magnesium (as Mg)

Dissolved Manganese
Total Manganese (as Mn)
Potassium (as K)
Sodium (as Na)
Sulfate (as SO_4)
Oil and Grease
Cation - Anion balance

TABLE 7-9

Extended Surface Water Analysis List
(Baseline Parameters)

Field Measurements:
Flow
pH
Specific conductance (umhos/cm)
Temperature (°C)
Dissolved oxygen (ppm)

Laboratory Measurements:

Total dissolved solids
Oil and Grease
Cation - Anion balance
Total suspended solids
Total settleable solids
Total hardness (as $CaCO_3$)
Total Alkalinity

Acidity as ($CaCO^3$)
Aluminum (as Al)
Arsenic (as As)
Bicarbonate (as HCO_3)
Boron (as B)
Carbonate (as CO_3)

Cadmium (as Cd)
Calcium (as Ca)
Chloride (as Cl)
Copper (as Cu)(Dissolved)
Dissolved iron (as F)
Total iron as (Fe)
Lead (as Pb)(Dissolved)
Magnesium (as Mg)(Dissolved)

Dissolved Manganese
Total Manganese (as Mn)
Molybdenum (as Mo)(Dissolved)
Nitrogen-Ammonia (as NH_3)
Nitrite (as NO_2)

Nitrate (as NO_3)
Potassium (as K)(Dissolved)
Phosphate (as PO_4)
Selenium (as Se)(Dissolved)
Sodium (as Na)(Dissolved)

Sulfate (as SO_4)
Zinc (as Zn)(Dissolved)

Table 7-10 Water Monitoring Program

Ground Water

Springs

1	SP-30	No Side Lower Crandall	Flow and field parameters quarterly
2	SP-36	No Side Lower Crandall	Flow, field parameters, and Table 7-4 parameters quarterly
3	SP-58	Forks of Crandall Creek	Flow, field parameters, and Table 7-4 parameters quarterly
4	SP2-24	Top of East Mountain	Flow, field parameters, and Table 7-4 parameters quarterly
5	SP2-9	Top of East Mountain	Flow, field parameters, and Table 7-4 parameters quarterly
6	SP47A	Pt No of Crandall Mine	Flow and field parameters quarterly
7	SP1-3	Top of East Mountain	Flow and field parameters quarterly
8	SP1-19	Top of East Mountain	Flow and field parameters quarterly
9	SP1-22	Top of East Mountain	Flow and field parameters quarterly
10	SP1-33	Upper Joe's Valley	Flow, field parameters, and Table 7-4 parameters quarterly
11	SP1-47	Upper Joe's Valley	Flow and field parameters quarterly
12	SP2-1	Upper Joe's Valley	Flow and field parameters quarterly
13	SP1-9	Top of East Mountain	Flow, field parameters, and Table 7-4 parameters quarterly
14	SP1-24	Top of East Mountain	Flow and field parameters quarterly
15	LB-2	Little Bear Canyon	Flow, field parameters, and Table 7-4 parameters quarterly
16	LB-5A	Little Bear Canyon	Flow, field parameters, and Table 7-4 parameters quarterly
17	SP-79	Huntington Canyon trib.	Flow, field parameters, and Table 7-4 parameters quarterly
18	Little Bear Spring		Flow, field parameters, and Table 7-4 parameters quarterly
19	SP-18	Shingle Canyon	Flow, field parameters quarterly
20	SP-22	Shingle Canyon	Flow, field parameters quarterly

In-Mine Monitoring Wells

1	DH-1	Main North (Dry)	Flow, field parameters, and Table 7-4 parameters quarterly
2	DH-2	In Sealed Area	Flow, field parameters, and Table 7-4 parameters quarterly
3	MW-1	At Portals	Flow, field parameters, and Table 7-4 parameters quarterly
4	MW-2	At Mouth of Main East	Flow, field parameters, and Table 7-4 parameters quarterly
5	MW-3	In Sealed Area	Flow, field parameters, and Table 7-4 parameters quarterly
6	MW-4	In Sealed Area	Flow, field parameters, and Table 7-4 parameters quarterly
7	MW-5	Destroyed	Flow, field parameters, and Table 7-4 parameters quarterly
8	MW-6	Main South (DEEP)	Flow, field parameters, and Table 7-4 parameters quarterly
9	MW-6a	Main South (No of Dike)	Flow, field parameters, and Table 7-4 parameters quarterly
10	MW-7	Main West	Flow, field parameters, and Table 7-4 parameters quarterly
11	MW-8	Main South (So of Dike)	Flow, field parameters, and Table 7-4 parameters quarterly

Table 7-10 Water Monitoring Program (continued)

Surface Water	
Streams	
1 Upper Flume Crandall Creek	Flow, field parameters, and Table 7-8 parameters quarterly
2 Lower Flume Crandall Creek	Flow, field parameters, and Table 7-8 parameters quarterly
3 Horse Canyon Creek	Flow, field parameters, and Table 7-8 parameters quarterly
4 Blind Canyon Creek	Flow, field parameters, and Table 7-8 parameters quarterly
5 Indian Creek	Flow, field parameters, and Table 7-8 parameters quarterly
6 IBC-1	Flow, field parameters, and Table 7-8 parameters quarterly
7 Section 4 Creek	Flow, field parameters, and Table 7-8 parameters quarterly
8 Section 5 Creek (lower)	Flow, field parameters, and Table 7-8 parameters quarterly
9 Section 5 Creek (Upper Right Fork)	Flow and field parameters quarterly
10 Section 5 Creek (Upper Left Fork)	Flow and field parameters quarterly
11 Little Bear Creek	Flow, field parameters, and Table 7-8 parameters quarterly
12 Shingle Creek	Flow, field parameters quarterly
UPDES	
1 001 – Sed Pond Discharge	Flow, field parameters, and UPDES parameters per occurrence
2 002 – Mine Water Discharge	Flow, field parameters, and UPDES parameters monthly

Note: See Plate 7-18 for Locations

Baseline water quality samples will be collected quarterly from the stream monitoring station below the forks in Horse Canyon at location H-1 (Plate 7-16) and analyzed according to the list contained in Table 7-8. Instantaneous flow estimates will be made for stations H-1, HS-5, and HN-1 during the spring and summer water quality sampling event. This monitoring will continue for a period of three years at which time the need for continued monitoring of Horse canyon will be evaluated.

Surface-water monitoring data will be submitted to DOGM on a quarterly basis. At the end of each calendar year, an annual summary will be submitted. This annual summary will analyze and describe variations in flows and quality during the year and will include tables, graphs, hydrographs, etc. as appropriate.

If available data (testing within 24 hours of proposed discharge) indicate that the water in the pond meets the effluent limitations contained in R614-301-751 and any applicable UPDES permits, this water will be pumped directly to Crandall Creek. Any direct discharges will be monitored at the beginning and end of pumping from the pond. The pump inlet will be placed on a floating spring to avoid pulling excess sediment into the discharge table during pumping. Water will be pumped from below the water surface to avoid introduction of oil to the discharge water.

During the post-operational period, surface-water data will be collected from the upper and lower stations shown in Plate 7-7 and the inflow to the sedimentation pond as indicated on Plate 5-16. Flow data will be collected continuously from the flumes at the upper and lower Crandall Creek stations and twice annually (during the high- and low-flow seasons) from the sedimentation pond inflow during the post-mining period. In addition, water-quality samples will be collected from each station during the high- and low-flow seasons following mining. These samples will be analyzed for the parameters listed in Table 7-8. Data thus collected will be submitted to DOGM on a quarterly basis.

The post-mining reports will contain not only the laboratory and field data but also an assessment of current impacts from mining on surface-water systems and the amount of recovery of the system since mining. Surface-water monitoring following mining will continue until the termination of the bonding period.

7.31.3 Acid- and Toxic- Forming Materials

As discussed in Section 5.28.30, waste rock is not produced during mining operations. When incidental quantities of rock are encountered, the rock is left in the mine and will not be removed at any time in the future; thus, no negative effects are expected from the acid-forming potential of strata which overlie and underlie the Hiawatha seam. However, to further characterize the acid-forming potential of strata immediately above and below the Hiawatha seam, GENWAL collected additional roof- and floor-rock samples from three locations within the current mine workings (including the state lease and Lease #UTU-68082 areas). These new data also show the materials to be non-acid/non-toxic forming. Analytical results from these three sets of samples are contained in Appendix 6-2.

The presence of acid- or toxic-forming materials has been determined by laboratory testing (as defined in "Guidelines for Management of Topsoil and Overburden for Underground and Surface Coal Mining"). These data are contained in Appendix 6-2. If waste material is generated it will be tested for acid- or toxic-forming materials on a yearly basis or prior to disposal. If such material is identified, it will be stored in an enclosed area (i.e. dumpster) or within a containment (bermed) area until such time as it can be disposed of.

7.31.4 Transfer of Wells

Before final bond release, exploratory or monitoring wells will be sealed in a safe and environmentally sound manner in accordance with Sections 7.38 and 7.65.

7.31.5 Discharges

The Applicant will not discharge into the underground mine, unless specifically approved by the Division and/or meets the approval of MSHA. Discharges will be limited to the following:

1. Water
2. Coal processing waste
3. Fly ash from a coal-fired facility
4. Sludge from an acid-mine-drainage treatment facility
5. Flue-gas desulfurization sludge
6. Inert materials used for stabilizing underground mines
7. Underground development waste.

7.31.51 Gravity Discharges

The angle at which the coal bed is inclined from the horizontal (dip) prevents any gravity discharge of water from the surface entries.

7.31.6 Stream Buffer Zones

The disturbed area is drained by ephemeral "streams" which are tributaries to Crandall Creek. The undisturbed drainages will enter Crandall Canyon above and below the culvert. Stream buffer zones will be maintained above and below the culvert. Portions of the road lie within 100' of Crandall Creek. The sediment pond outslope is contiguous to Crandall Creek, a perennial stream at the mine facility area.

Crandall Creek water quality is protected from the impacts of the mine by the use of revegetation, silt fences and/or straw bales, and rip-rapped channels. In addition, buffer zone signs have been installed to indicate the area beyond which no disturbance shall take place. For additional information concerning stream buffer zone protection see pages 3-9 and 3-10 of this permit.

7.31.7 Cross Sections and Maps

Cross sections and maps, as required for R645-301-731.700, are presented within this application.

7.31.8 Water Rights and Replacement

In the event that the monitoring program identifies an impact to the water source in the permit and adjacent areas, the replacement of water rights will be addressed as described in Section 7.27 of this application.

7.3 Sediment Control Measures

The sediment control measures for the Crandall Canyon Mine operations are discussed in Section 7.42 of this application. This includes design, operation and maintenance of applicable siltation structures, sedimentation pond, diversions, and road drainage, as required.

7.33 Impoundments

There are no permanent impoundments associated with GENWAL's operations. Temporary impoundments of water collected for runoff control will occur in the sediment ponds and containment berms. The design of these structures is presented in Section 7.42 and 7.43 of this application.

7.34 Discharge Structures

Discharge from the sediment ponds will be conveyed by a 18-inch CMP culvert and an open channel acting as the principal and emergency spillways. The outlets of these spillways are protected by riprap. This design complies with R645-301-744.

7.35 Disposal of Excess Spoil

No significant excess spoil has been or will be developed by operating the underground mine. The only anticipated excess material will be from the sediment ponds. This limited volume of material will be removed from the ponds transported to an approved refuse disposal site, disposed of underground or sold with the coal.

7.36 Coal Mine Waste

Any refuse will be disposed of in accordance with the designs presented in Chapter 5 and Section 7.46 of this application.

7.37 Noncoal Mine Waste

Noncoal mine waste will be stored and final disposal of noncoal waste will comply with R645-301-747.

7.38 Temporary Casing and Sealing of Wells

Each well which has been identified in the approved permit application to be used to monitor ground water conditions will comply with R645-301-748 and be temporarily sealed before use. Drilling and Sealing of such wells will be done according to the procedure described in Chapter 6, Section 6.41.

7.40 Design Criteria and Plans

7.41 General Requirements

The runoff control plans for the Crandall Canyon Mine facilities includes the diversion of the undisturbed runoff from areas contributing to the facilities, the collection of all runoff from disturbed areas associated with the sites and the containment and treatment of this disturbed runoff through the use of sediment ponds, strawbales, silt fence, riprap, mulches and revegetation.

7.42 Sediment Control Measures

7.42.10 General Requirements

Appropriate sediment control measures will be designed, constructed and maintained using the best technology currently available to:

1. Prevent, to the extent possible, additional contributions of sediment to stream flow or to runoff outside the permit area.

2. Meet the effluent limitations under R645-301-751.

3. Minimize erosion to the extent possible.

Sediment control measures include practices carried out within and adjacent to the disturbed area. The sedimentation storage capacity of practices in and downstream from the disturbed areas will reflect the degree to which successful mining and reclamation techniques are applied to reduce erosion and control sediment. Sediment control measures consist of the utilization of proper mining and reclamation methods and sediment control practices, singly or in combination. Sediment control methods include, but are not limited to:

1. Retaining sediment within disturbed areas;

2. Diverting runoff away from disturbed areas;

3. Diverting runoff using protected channels or pipes through disturbed areas so as not to cause additional erosion;

4. Using straw dikes, riprap, check dams, mulches, vegetative sediment filters, dugout ponds and other measures that reduce overland flow velocities, reduce runoff volumes or trap sediment;

5. Treating with chemicals/paving;

6. For the purposes of UNDERGROUND COAL MINING AND RECLAMATION ACTIVITIES, treating mine drainage in underground sumps.

7.42.20 Siltation Structures

7.42.21 General Requirements

Additional contributions of suspended solids and sediment to stream flow or runoff outside the permit area will be prevented to the extent possible using the best technology currently available.

Alternate Sediment Control Areas and Small Area Exemptions

The Alternate Sediment Control Areas (ASCAs) at the Crandall Canyon Mine are shown on Plates 7-5 and Plate 2-3. Previously 8 areas existed as ASCA's or Small Area Exemptions (SAE's). However, under this proposed culvert expansion 3 of the eight areas will be eliminated from the MRP. They are SAE 1, SAE 3, and ASCA 4. ASCA's 2, 5, 6, 7, and 8 will remain. Three new ASCAs (ASCA 9, 10 and 11) will be added due to the culvert expansion project.

ASCA-2 (consisting of 0.34 acre) exists at the northwest corner of the site. This area was initially constructed as a substation pad and associated access road. Because the substation has not been installed and may not be installed in the future, SAE-2 was reclaimed. Of the total area, 0.15 acre received final reclamation treatment and 0.19 acre received interim reclamation treatment (see Chapter 5, Plate 7-16 and Plate 7-5C). An additional 0.90 acres of undisturbed area drains onto ASCA-2 from above.

ASCA-2 was reclaimed (interim and final) as outlined in Section 525.300. A 12-inch CMP culvert was installed to act as a discharge into UD-1. A silt fence and strawbale dike have been placed to trap the sediment and prevent erosion.

ASCA-5, ASCA-6, ASCA-7 and ASCA-11 consist of the topsoil stockpiles that are located on the north and south side of the access road east of the mine site in the areas indicated on Plate 2-3. Disturbed areas associated with the topsoil stockpiles are 0.20 acres, 0.22 acres, 0.62 acres and 0.65

acres for ASCA-5, ASCA-6, ASCA-7, and ASCA-11, respectively. All topsoil stockpiles have been protected from erosion by a combination of dikes, silt-fencing, berms, and a vegetative cover. ASCA-11 is the lower-north side topsoil stockpile area which will be used to store soil material from the culvert expansion project.

ASCA-8 consists of the Forest Service parking area west of the mine surface facilities (see Plate 7-16). This parking area was constructed by GENWAL for the Forest Service during the latest surface expansion. Although it is not part of the surface facilities, it is a disturbed area within the permit boundaries.
Sedimentation control will, therefore be provided. The disturbed area associated with ASCA-8 is 0.29 acre.

Sedimentation control for ASCA-8 will be provided by a silt fence installed in accordance with Figure 7-12 between the parking area and Crandall Creek. The silt fence will be periodically inspected and repaired as required to ensure that its integrity is maintained.

ASCA 9 & 10 are the pad slope areas at both ends of the culvert expansion project. The drainage from these areas can not be directed to the sediment pond and are too close to the creek to construct separate sediment ponds. Therefore GENWAL will use alternate sediment control methods such as silt fences, straw bale dikes and vegetative filters. Once vegetation has been successful and lasting GENWAL will submit evidence supporting a request for Small Area Exemption.

ASCA-11 is the new topsoil storage area located at the mouth of Crandall Canyon immediately across the road from the existing topsoil pile, ASCA-7. The topsoil storage area is bounded by the Crandall Canyon road on the southwest, the bluffs of Huntington Creek on the east and a sloping hillside onthe northwest. A silt fence will be constructed below the downstream toe of the stockpile to prevent sediment loss and treat runoff. The topsoil pile will cover an area of approximately 0.65 acres. The pile will be constructed using end-dump trucks and a front-end loader and will be blended into the existing hillside. The pile will be revegetated in accordance with the approved interim reclamation seed mix specified in Chapter 3 under 3.31 Disturbance and Interim Stablization.

7.42.22 Sedimentation Pond

Design

The sedimentation pond located in Crandall Canyon has been redesigned to control the additional storm runoff from the pad extension and from the designated undisturbed drainage areas above the pad extension associated with the proposed culvert expansion. The topography and watershed boundaries are shown on Plate 7-5 and 7-5C. Cross sections of the pond design are shown on Plate 7-3.

Stability Analyses

The stability of the embankment outslope for the revised sedimentation pond is presented in Appendix 7-6 Addendum. The existing sedimentation pond is being expanded to accommodate expansion of the surface facilities and the disturbed areas. The existing pond embankment stability analysis is presented in Appendix 7-6.

Runoff- and Sediment-Control Facilities

Results of analyses to determine the required size and hydraulics of the sedimentation pond are included in Appendix 7-4. Details of the sedimentation pond required for compliance with 30 CFR 77.216-1 and 30 CFR 77.216-2 are contained in Appendix 7-8. Permanent disposal of the sediment removed during cleanout will be in accordance with Section 535.

Prior to any discharges through the decant system on the sedimentation pond, a sample will be collected to determine total suspended solids, settleable solids, total dissolved solids, oil and grease, total iron, total manganese concentrations, and pH. The sample will be collected by opening the gate valve on the dewatering device, allowing water to flow from the pond through the primary spillway for a sufficient time to collect a sample of the water, and then immediately shutting the gate valve to prevent further dewatering. This sample will then be submitted to a laboratory for analyses of the indicated parameters.

After receipt of analytical results from the laboratory, if the pH and concentrations of total suspended solids, settleable solids, total dissolved solids, oil and grease, total iron, and total manganese are within the acceptable limits, water will be discharged from the pond through the dewatering device. If the parameters of concern are not within the acceptable limits, no water will be discharged through the device.

During discharge of water to Crandall Creek from the sedimentation pond, samples of the water will be collected at the discharge point at the beginning and end of the discharge time. These samples will be sent to a laboratory following the discharge period for analyses of total suspended solids, settleable solids, total dissolved solids, total iron, total manganese, oil and grease, and pH. Analytical results will be submitted to the Division with the subsequent quarterly report.

As noted on Plate 7-4, the emergency spillway discharges onto the boulder-covered slope adjacent to the sedimentation pond. Boulders that cover this slope were blasted from the cut above the pond during construction of the mine-access road. Due to the large size of the boulders, laboratory size-fraction analyses could not be conducted. However, the boulders are visually estimated to range in size up to at least 10 feet in diameter. It is further estimated that approximately 80 percent of the coarse rock on the slope is finer than 8 feet in diameter, 30 percent is finer than 5 feet in diameter, and 10 percent is finer than 3 feet in diameter.

The blasted rock has an approximate thickness of 15 to 20 feet at the top of the slope and 5 to 6 feet at the bottom of the slope. The soil that underlies the rock is a silty sand. Size-fraction

analyses presented by Delta Geotechnical Consultants (1982) indicate that this soil is 70 percent sand and 30 percent silt and clay (the latter being minus 200 mesh).

The emergency spillway is lined with riprap and a filter blanket to reduce erosion potential. A concrete cutoff has also been installed immediately downstream of the inlet. The concrete cutoff ensures that the emergency spillway will not erode during a discharge event. Grading of the riprap, filter blanket, and embankment materials are shown in Figure 7-10. The spillway will discharge directly onto the boulder-covered slope. Due to the extreme thickness of the boulders and cobbles on the slope, additional erosion protection below the emergency-spillway outflow will not be required.

All new fill required to modify the embankment will be placed in 6-inch lifts. This new fill will be compacted in place by repeated passes of a front-end loader or equivalent prior to placing the next lift. Compaction will continue until the density of the material is at least 90 percent of Proctor density (as determined by sandcone density tests in the field).

As included in the original design, the interior of the pond will be lined with a 12-inch thick local, compacted clay to reduce seepage from the pond and, thereby, increase the stability of The embankment. The clay liner will be placed in 6-inch lifts and compacted during placement by at least four passes of a front end loader or equivalent. The initial layer will be disk-harrowed into the bottom of the pond prior to completion.

After pond cleanout, the thickness of the clay liner will be sampled by means of a bucket auger at 8 locations. Three holes will be placed along the ingress/egress route and five additional holes will be randomly selected from the remaining pond area. If any of the holes penetrate less than 10 inches of clay, additional clay will be compacted into the deficient areas of the pond.

All new construction on the revised sedimentation pond will be supervised by a Professional Engineer who is licensed in the State of Utah. An initial certification report will be prepared and certified by the supervisory PE for submission to DOGM following completion of construction activities. Plate 7-4a shows as-built drawings of the existing pond and riser detail. Plate 7-6a shows as-built cross sections through the existing pond. Appendix 7-10 contains as-built calculations for the existing sedimentation pond and the initial certification report. The initial certification report previously submitted to DOGM included:

- Existing and required monitoring procedures and instrumentation,
- The design depth and elevation of any impounded waters at the time of the report,
- Existing storage capacity of the dam or embankment,
- A discussion of any fires occurring in the construction material up to the date of certification, and
- A discussion of any other aspects of the dam or embankment affecting stability.

Flow conditions in Crandall Creek adjacent to the sedimentation pond were examined to determine if flood flows may erode the downstream toe (see Appendix 7-5). As noted, the peak flow from the 100-year, 24-hour precipitation event will encroach 0.6 foot above the toe of the embankment. Thus, a riprap protective layer (with a median rock diameter of 12.5 inches) was placed along the lower 2.0 feet of the embankment as shown in Plate 7-4. Placement of this riprap will serve an incidental purpose of increasing the stability of the dam by placing additional weight on the downstream toe (Figure 7-10).

Following construction of the sedimentation pond as designed herein, all disturbed areas associated with pond construction (with the exception of the interior of the pond) will be revegetated with the temporary seed mixture. This mixture was developed in consultation with Lynn Kunzler of the Division and Walt Nowak of the U.S. Forest Service. This mixture provides rapid growth species, sod-forming species, and species that are compatible with other plants.

Seeding will be done in the late fall, just prior to the first heavy snowfall of the year (Plummer et al., 1968). Seeding will be accomplished by hydroseeder. Mulch will be placed after seeding. The mulch, which consists of two tons of straw or grass hay per acre of disturbed area, will be spread over the area to be planted by hydromulcher.

Following seeding, the revegetated outslopes of the pond will be inspected during normal pond inspections to determine the effectiveness of the seeding. Straw-bale dikes will be added as necessary to control excessive gullying on the dam face. These dikes will be installed as noted by Figure 7-11.

7.42.30 Diversions

Diversion UD-1 was placed along the western edge of the site at the location shown on Plate 7-5A to divert water from a 95-acre undisturbed watershed around the yard area. Analyses and design information associated with this and other diversions associated with the site are contained in Appendix 7-4.

Two additional diversions were designed to convey water from undisturbed areas away from the disturbed site. One (UD-2) was constructed in the northwest portion of the site along the proposed substation pad. The other was constructed in the northeastern portion of the site to convey water away from the portal area. Details of diversion design are presented in Appendix 7-4.

Existing and proposed culverts in the mine yard were examined to determine their adequacy with respect to passing the peak flow. Details of these designs are provided in Appendix 7-4.

Similarly, ditches within the disturbed area are designed to pass the peak flow from the 10-year, 6-hour storm. Typical cross sections and design calculations are contained in Appendix 7-4 for these ditches. Ditches have been evaluated for adequacy in passing the 10 year-24 hour storm and found to be of adequate size (see Appendix 7-4).

A berm was placed around the proposed power substation to prevent runoff water that accumulates thereon from flowing across the remainder of the site. A small channel on the

substation pad collects water from the pad and adjacent undisturbed areas. A stilling basin was placed at the downstream end of this diversion to trap sediment prior to discharging into UD-1.

Proposed Expansion Area Surface Water Drainage and SedimentControl

Water on the extended mining pad associated with the proposed culvert expansion comes from two sources. The pad itself and two watershed areas located in undisturbed terrain to the south of the proposed pad. Runoff from the pad and watersheds will be collected and controlled by the use of drainage ditches and culverts. All runoff diverted through the drainage ditches and culverts will eventually go into a sediment pond. The watersheds are shown on Plate 7-5 and 7-5A. The location of drainage ditches and culverts can be also be found on plate 7-5.

All diversion ditches have been designed to have a triangular channel with a minimum depth of one foot and side slopes of 1H:1V. During the periods of peak flow at least 3" of the channel depth will be freeboard. The calculations associated with drainage ditch design can be found in Appendix 7-4.

7.42.40 Road Drainage

All of GENWAL's roads have been designed, located and constructed as required by the regulations R645-301-742.410 through R645-301-742-423.5.

7.43 Impoundment

There are no permanent impoundments associated with the GENWAL facilities. Temporary impoundments of water collected for runoff control will occur in the sediment pond. The physical design of the sediment pond are certified designs as required in R645-301-512 and are presented in Section 5.33 and Appendix 7-4 of this application. The sediment pond does not meet the criteria for MSHA regulations. The hydrologic design for the sediment pond is presented in Section 7.42.20 and Appendix 7-4. On cessation and reclamation of mining and disposal activities, the sediment pond will be removed.

7.44 Discharge Structures

The sediment pond is equipped with a decant, a riser pipe (cmp) principle overflow and a rip-rapped open-channel emergency spillway. Sediment pond details are covered under Section 7.42.20 and in Appendix 7-4.

7.45 Disposal of Excess Spoil

No significant excess spoil will be developed by the underground mine. In the event spoil is generated during the mining operations, this will be transported to an approved disposal site. The handling of these materials will comply with R645-301-745.

7.46 Coal Mine Waste

The disposal and placement of any refuse materials will be conducted in accordance with the plans presented in Chapter 5 of this application.

7.47 Disposal of Noncoal Mine Waste

Garbage

Solid waste generated from mining activities, such as garbage and paper products, is disposed of in large trash "dumpsters" located near the portal. A contract garbage hauling service, empties the contents of the dumpsters on a weekly basis and hauls the garbage to an approved dump or landfill.

Unusable Equipment

All salvageable mining equipment is sold to local scrap dealers: items such as broken bolts, worn out engine parts, and items which might be recycled. Any machinery or large parts are placed in a stockpile near the material storage area for periodic salvage by local scrap dealers. No mining equipment will be merely abandoned.

Petroleum Products

Oil and grease wastes are collected in tanks and returned to distributors for refining or used as heating fuel. In case of spills, a spill control plan has been developed and is located at the mine site.

7.48 Casing and Sealing of Wells

Following completion of reclamation, the monitoring wells for the mine site will be plugged and abandoned in accordance with R645-301-631 and R645-301-748. This will prevent the potential for disturbance to the hydrologic balance.

7.50 Performance Standards

All coal mining and reclamation operations will be conducted to minimize disturbance to the hydrologic balance within the permit and adjacent areas, to prevent material damage to the hydrologic balance outside the permit area and support approved postmining land uses in accordance with the terms and conditions of the approved permit and the performance standards of R645-301 and R645-302. For the purpose of SURFACE COAL MINING AND RECLAMATION ACTIVITIES, operations will be conducted to assure the protection or replacement of water rights in accordance with the terms and conditions of the approved permit and the performance standards of R645-301 and R645-302.

The following sections, 7.51 through 7.55 provide a commitment to meet the requirements of the applicable laws. Specific plans for accomplishing compliance are provided under the applicable, referenced sections of this Mining and Reclamation Plan.

7.51 Water Quality Standards and Effluent Limitations

Discharges of water from areas disturbed by coal mining and reclamation operations will be made in compliance with all Utah and federal water quality laws and regulations and with effluent limitations for coal mining promulgated by the U.S. Environmental Protection Agency set forth in 40 CFR Part 434.

7.52 Sediment Control Measures

Sediment control measures will be located, maintained, constructed and reclaimed according to plans and designs given under R645-301-732, R645-301-742 and R645-301-760. Refer to sections 7.32, 7.42 and 7.60 of this plan.

7.52.10 Siltation Structures

Siltation structures and diversions will be located, maintained, constructed and reclaimed according to plans and designs given under R645-301-732, R645-301-742 and R645-301-763. Refer to sections 7.32, 7.42 and 7.63 in this plan.

7.52.20 Road Drainage

Roads will be located, designed, constructed, reconstructed, used, maintained and reclaimed according to R645-301-732.400, R645-301-742-400, and R645-301-762. Refer to sections 7.32, 7.40 and 7.62 in this plan.

7.52.21 Erosion Control or Prevention

Control or prevent erosion, siltation and the air pollution attendant to erosion by vegetating or otherwise stabilizing all exposed surfaces in accordance with current, prudent engineering practices.

7.52.22 Suspended Solids

Control or prevent additional contributions of suspended solids to steam flow or runoff outside the permit area.

7.52.23 Effluent Standards

Neither cause nor contribute to, directly or indirectly, the violation of effluent standards given under R645-301-751. Refer to section 7.51 in this plan.

7.52.24 Surface and Groundwater Systems

Minimize the diminution to, or degradation of, the quality or quantity of surface and groundwater systems.

7.52.25 Normal Water Flow

Refrain from significantly altering the normal flow of water in streambeds or drainage channels.

7.53 Impoundments and Discharge Structures

Impoundments and discharge structures will be located, maintained, constructed and reclaimed to comply with R645-301-733, R645-301-734, R645-301-743 and R645-301-745 and R645-301-760. Refer to sections 7.33, 7.34, 7.43, 7.45 and 7.60 in this plan.

7.54 Disposal of Excess Spoil, Coal Mine Waste and Noncoal Mine Waste

Disposal areas for excess spoil, coal mine waste and noncoal mine waste will be located, maintained, constructed and reclaimed to comply with R645-301-735, R645-301-736, R645-301-745, R645-301-746, R645-301-747 and R645-301-760. Refer to sections 7.35, 7.36, 7.45, 7.46 7.47 and 7.60 in this plan.

7.55 Casing and Sealing of Wells

All wells will be managed to comply with R645-301-748 and R645-301-765. Water monitoring wells will be managed on a temporary basis according to R645-301-738. Refer to sections 7.38, 7.48, and 7.65 in this plan.

7.60 Reclamation

Sealing of Mine Openings

The Applicant has drilled from the Hiawatha seam upwards to the Blind Canyon seam as described in Chapter 6. The drilling occurred in areas that pillar extraction will occur and no provisions were made to seal the bore hole.

Temporary sealing of the portals, if needed, will be accomplished by the construction of protective barricades or other covering devices, fenced and posted with signs indicating the hazardous nature of the opening. Permanent closure plans will include sealing the portals as per the request of the U.S.G.S. (See Section 5.29).

Upon cessation of mining operations all drift openings to the surface from underground will be backfilled, regraded and reseed as per Section 5.40 of this plan. Prior to final sealing of any openings, the U.S.G.S. will require an on site inspection and a submission of formal sealing methods for approval. The formal sealing methods will be presented as a plan including cross sections demonstrating the measures taken to seal or manage mine openings will comply with R645-301-529.

Removal of Surface Structures

All waste material generated from the removal of the structures will be removed from the property and sold as scrap or disposed of in the appropriate approved state land fill. The only structures to remain after the mining operation will be the sedimentation system and all necessary diversions required to insure routing of disturbed area drainage to the pond and diversions to maintain the integrity of the pond until the requirements are met. The diversion ditch is shown on Plate 5-16.

Upon cessation of mining operations, the water supply well (MW-1) will be permanently abandoned in accordance with regulations promulgated by the Utah Division of Water Rights. This will include filling of the well with a neat cement grout in accordance with the regulations.

Disposition of Dams, Ponds and Diversions

Upon final cessation of mining the area will be reclaimed. Upon completion of the reclamation earthwork the sediment pond will be cleaned out and the material disposed of in the approved method. Once it is determined that the pond is no longer required for sediment control of the reclaimed area and Phase I reclamation has been deemed complete, the pond will be cleaned out again. The pond will only be reclaimed after vegetation has been established on the site and Phase I reclamation has been approved. The material in the pond should only be topsoil that has eroded from the reclaimed site, (care will be taken not to mix the pond liner with this topsoil). This topsoil will be stockpiled and allowed to dry at the edge of the pond. Once the topsoil has been dried, the sediment pond will be reclaimed and the topsoil spread on top of the pond area.

Recontouring

All areas affected by surface operations will be graded and restored to approximate original contour that is compatible with natural surroundings and postmining land use. For approximate contours prior to GENWAL's surface disturbance refer to the topography south of the road on Plate 5-20. The final regraded contours can be found on Plate 5-17.

Removal or Reduction of Cut Slopes & Highwalls

Backfilling and grading will proceed so as to eliminate the cutslopes and highwalls. This can be done by recontouring as per Section 5.40 of this Plan. The portals will be backfilled with soil and two rows of solid concrete blocks placed across each entry and then backfilled to the surface and recontoured as shown on Plate 5-17. The cut slope above the coal stockpile will be backfilled with material from the culvert expansion project.

Terracing and Erosion Control

No terracing will be done. All final grading, preparation of overburden before replacement of topsoil will be done along the contour to minimize erosion and instability unless this operation becomes hazardous to equipment operators in which case the grading, preparation and placement in a direction other than generally parallel to the contour will be used.

Final Reclamation

All areas affected by surface operations will be graded and restored to approximate original contour. All final grading will be done along the contour to minimize erosion and instability unless this operation becomes hazardous to the equipment operators. Backfilling and grading will proceed so as to eliminate the cut slopes and highwalls. Refer to Plates 5-16 and 5-17. Backfilling and grading will be done according to the reclamation timetable as originally submitted.

If possible, the topsoil will be redistributed in the late fall (late September or early October) just prior to the seeding to keep the seedbed free of weeds and annual grasses. Should weeds and annual grasses become established before seeding, they will be removed prior to seeding, refer to Chapters 2 and 3 for additional information.

Typical cross sections and topographic maps which adequately represent the existing land configuration of the area affected by surface operations are shown on Plates 3-7, 3-8 and 3-9 for existing ground as well as Plate 5-20 for premining topography and the geotextile-covered area. Postmining reclamation cross sections and surface topography will be as near to premining as is possible and practical, as noted on Plate 5-17.

A reclamation map showing post construction interim reclamation areas and final reclamation accompanies this document as Plates 7-16 and 5-17. Slope rounding on Plate 5-3 has been revised to meet the required slope of 1.5:1 at the specified reclaimed cross sections. Two distinct areas showing post construction interim reclamation and final reclamation can be found on Plates 7-5.

Reclamation hydrology is discussed in Appendix 7-4.

7.70 References

Anderson, A.G., A.S. Paintal, J.T. Davenport. 1970. Tentative Design Procedure for Riprap-Lined Channels. National Cooperative Highway Research Program Report No. 108. Highway Board, Nation Academy of Sciences. Washington, D.C.

Arabasz, W. J., R. B. Smith, and W. D. Richins (Ed.). 1979. Earthquake Studies in Utah 1850 to 1978. University of Utah Seismograph Stations, Department of Geology and Geophysics, University of Utah, Salt Lake City, Utah.

Barfield, B.J., R.C. Warner , and C.T. Haan, 1981. Applied Hydrology and Sedimentology for Disturbed Areas. Oklahoma Technical Press. Stillwater, Oklahoma.

Bouwer, H. and R.C. Rice. 1976. A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells. Water Resources Research. 12(3):423-428.

Danielson T.W., M.D. ReMillard, and R.H. Fuller, 1981. Hydrology of the Coal-Resource Areas in the Upper Drainages ofHuntington and Cottonwood Creeks, Central Utah. U.S.Geological Survey Water-Resources Investigations Open-File Report 81-539. Salt Lake City, Utah.

Doelling, H.H. 1972. Central Utah Coal Fields: Sevier-Sanpete, Wasatch Plateau, Book Cliffs, and Emery. Utah Geological and Mineral Survey Monograph Series No. 3. Salt Lake City, Utah.

Dunrud, C.R. 1976. Some Engineering Geologic Factors Controlling Coal Mines Subsidence in Utah and Colorado. U.S. Geological Survey Professional Paper 969. Washington, D.C.

EarthFax Engineering Report on Mine Plan Aquifers and Seep and Spring Surveys (1985a, 1985b)

EarthFax Engineering, Inc. 1990. Storage Pad Slope Stability Analysis at the Crandall Canyon Mine, Emery County, Utah. Project Report Prepared for GENWAL Resources Inc., Huntington, Utah.

Hawkins, R.H. and K.A. Marshall, 1979. Storm Hydrograph Program. Final Report to the Utah Division of Oil, Gas and Mining. Utah State University. Logan, Utah.

Lines, G.C. 1985. The Ground-Water System and Possible Effects of Underground Coal Mining in the Trail Mountain Area, Central Utah. U.S. Geological Survey Water-Supply Paper 2259.

Plummer, A.P., D.R. Christensen, and S.B. Monson. 1968. Restoring Big-Game Range in Utah. Utah Division of Wildlife Resources. Publication No. 68-3. Salt Lake City, Utah.

R645-301-728 Probable Hydrologic Consequences Determination

This document has been prepared in accordance with requirements of the State of Utah R645 Coal Mining Rules. The format follows the regulations R645-301-718.100 through R645-301-728.400. This Probable Hydrologic Consequences evaluation of the coal mining and reclamation operations has been prepared by GENWAL Resources, Inc. to provide a description of the potential impacts of the mining operation on the hydrologic systems and the means to prevent or mitigate those identified impacts.

R645-301-728.100 Determination

This determination section presents a brief summary of the surface water, groundwater, and geologic resource descriptions of the permit area and the South Crandall Lease area and the U-68082 lease mod area and a description of the possible impacts of the coal mine on the hydrologic resources.

The geologic and hydrologic data and their associated appendices are contained in Chapter 6 and Chapter 7, respectively. The potential sources of contamination to the hydrologic resources in the area of the mine were identified through site visits, knowledge of the working operations of the mine and discussions with GENWAL Resources personnel. These potential contamination sources and impacts include:

Water Quantity
- Interception of groundwater and surface water
- Water consumption within the mine
- Seepage from mine sumps
- Pumping from Crandall Creek

Water Quality
- Additional sediment contribution
- Fugitive dust
- Oil and grease
- Mine water discharge
- Acid-toxic materials
- Flooding or Streamflow Alteration

Each of these potential sources of contamination or impact and their associated mitigating measures or circumstances are discussed in the following sections.

Water Quantity Impacts

Possible impacts to the surface and groundwater systems from the mining operation could affect the quantity of water in the mine area. Interception, consumption, and seepage of surface or groundwater are possible mechanisms which could affect the water systems.

Interception.

A limited potential exists for interception of groundwater or surface water due to subsidence which may affect the perched aquifers (springs and seeps), and stream flows in Crandall Canyon, Blind Canyon, Horse Creek, ~~and~~ the upper headwaters of the Indian Creek drainage (Upper Joes Valley), and the streams and springs of the South Crandall Lease area and the U-68082 lease mod area. The potential for hydrologic impacts may result from creating subsurface interconnections from the more permeable zones in the strata as a result of mine subsidence. This can be expressed by the potential interrelated occurrences of intercepted groundwater flow in the overlying perched aquifers, the interruption or lessening of flow to springs, or the interception of surface water flow from ephemeral streams.

Groundwater Interception.

Typically, groundwater interception and translocation of that water is the primary mechanism by which the groundwater system may be impacted. As indicated in Section 7.24.1 of this permit, the regional groundwater system, located in the Blackhawk-Starpoint aquifer at the Crandall Canyon Mine, is below the Hiawatha Coal.

Monitoring of in-mine and surface wells indicate that the potentiometric surface of the regional Blackhawk-Star Point aquifer in the mine area lies approximately 50 to 60 feet below the top of the Star Point Sandstone over most of the mine. In the westernmost portion of the mine, near the Joes Valley Fault system, the potentiometric surface of the Star Point Sandstone is at or slightly above the elevation of the floor of the mine. In these areas, minor amounts of groundwater weep from the floor of the mine. In the remainder of the mining areas, because mining is being conducted in the Hiawatha seam of the Blackhawk Formation, which overlies the Starpoint Sandstone, dewatering of the Blackhawk-Starpoint aquifer by the Crandall Canyon Mine is not possible.

Historically, the springs within the permit area which are monitored on a quarterly basis, in the perched aquifer of the Blackhawk Formation above the mine, have not been affected by operating the Crandall Canyon Mine. Because of the tightness of the joints and the presence of aquicludes, significant mine in-flows from the overlying strata have not occurred and nor are they anticipated.

A reconnaissance of field information and data available from the old Huntington #4 permit indicates that Little Bear Spring located in T16S-R7E-Sec9 (see Plates 7-12, 7-13, and 7-14) emanates from the Panther (lowest member) of the Star Point Formation. Previous drilling within the mine area has shown that the three members of the Starpoint Sandstone are vertically isolated

from one another. The Spring Canyon member is located within the upper 100 feet of the Starpoint Sandstone. This member has been found to contain water in some areas of the mine. The Storrs member was isolated from the Spring Canyon member by interbedded shale and siltstone. It did not appear to contain any appreciable water. The Panther member was found to be about 36 feet thick at a depth of 315 to 351 feet. Flow from this bed varied from about 2.1-7.0 gallons per minute. Although Little Bear spring emanate out of the Panther member, age dating showed the water to be of recent age (<50 years old). Age dating of water from the Starpoint Sandstone shows it to be of an age greater than 10,000 years old. It appears that Little Bear Spring emanates from a fault zone which may be serving as a conduit for diversion of recent water intercepted in some of the larger drainages in the area. It is doubtful that mining activities would have any affect on flow from Little Bear Spring due to the large age difference between the water encountered underground and the water flowing out of Little Bear Spring.

Meetings with the Castle Valley Special Service District officials and their representatives, as well as the other water user districts of the area, was held on 10 June 1993. The concern of the Castle Valley Special Service District regarding diminution and mitigation of the Little Bear Spring flow that could result from future mining were discussed. Given the elevations of the Starpoint potentiometric surface, in relation to that of the Hiawatha Coal Seam, it was shown that the present and future mine workings would not interfere with the Starpoint aquifer.

Little Bear Spring is a developed spring that provides municipal water to nearby municipalities. It emanates from a fracture system in the Panther Member of the Star Point Sandstone that trends in an approximate northeast-southwest direction.

Because of its importance as a municipal water supply source and its proximity to proposed mining areas, Little Bear Spring has been extensively studied.

These scientific investigations include an investigation of the Little Bear Spring groundwater system and the groundwater systems encountered in the Crandall Canyon Mine (Appendix 7-52), a solute and isotopic investigation of groundwater from Little Bear Spring and the Star Point Sandstone and Blackhawk Formation groundwater systems the Crandall Canyon Mine (Appendix 7-53), an investigation of the hydraulic conductivity of the Star Point Sandstone in the vicinity of the Crandall Canyon Mine (Appendix 7-54), an investigation of the alluvial groundwater system in Mill Fork Canyon with implications for recharge to Little Bear Spring (Appendix 7-55), an investigation of the potential for Little Bear Spring recharge in Mill Fork Canyon (Appendix 7-56), and a fluorescent dye-tracing study that conclusively demonstrates the hydraulic connection between the stream/alluvial groundwater system in Mill Fork Canyon and Little Bear Spring (Appendix 7-57). Sunrise Engineering also performed a series of investigations using a proprietary geophysical technique that demonstrated a hydraulic connection between Little Bear Spring and the surface drainage in Mill Fork Canyon. These investigations are included as Appendix 7-59, Appendix 7-60, Appendix 7-61, and Appendix 7-62.

These studies, taken as a whole, have shown conclusively that Little Bear Spring is possibly recharged primarily through surface water and alluvial groundwater losses in Mill Fork Canyon,

located well beyond the boundary of the South Crandall Lease area, approximately 1.5 miles southwest of the spring. The basis for this assumption is discussed briefly below. The reader is referred to the above mentioned appendices for a more rigorous discussion of the recharge of Little Bear Spring.

The conclusion that Little Bear Spring is recharged from surface-water and alluvial groundwater losses in Mill Fork Canyon is based on several findings. These include:

1) the finding that, from a water budged standpoint, there is sufficient water available in Mill Fork Canyon to account for the recharge to Little Bear Spring and any surface water drainage that leaves the Mill Fork drainage and flows into Huntington Creek,

2) the finding that there is a chemical and isotopic match (or a plausible chemical evolutionary pathway) between surface waters and alluvial groundwaters in Mill Fork Canyon and groundwater at Little Bear Spring, and

3) the finding that there is a demonstrated hydraulic connection between Mill Fork Canyon and Little Bear Spring and the hydraulic gradient and flow volume through the connection is sufficient to provide Mill Fork water to the spring.

These findings are discussed below.

An investigation was performed in 2001 to determine the quantity of water available in Mill Fork Canyon to recharge Little Bear Spring (Appendix 7-56). It is the finding of this investigation that there is an excess of approximately 300 gpm in the Mill Fork drainage that is available for recharge to the spring. Indeed, it is difficult to explain the loss of approximately 300 gpm from the drainage basin without taking the recharge to Little Bear Spring into account. This finding is based on a comparative analysis of baseflow in the Crandall Creek drainage, which is very similar in geology, topography, aspect, and elevation to the Mill Fork Creek drainage. The baseflow in Crandall Canyon Creek during most years is approximately 300 gpm greater than that in Mill Fork.

Another investigation examined the capacity of the alluvial groundwater system in Mill Fork Canyon to transmit sufficient groundwater to sustain the baseflow of Little Bear Creek during periods when there is not surface flow in the Mill Fork drainage (Appendix 7-55). This investigation was based on a quantitative determination of the flow of groundwater migrating through the alluvial groundwater system above the spring recharge location compared to that flowing through the alluvial deposits below the spring recharge location in Mill Fork Canyon. It is the conclusion of this investigation that there is appreciably more groundwater flowing through the alluvial deposits above the spring recharge location as compared to that flowing in the alluvial deposits below the spring recharge location (approximately 300 gpm more).

Investigations regarding the solute and isotopic compositions of groundwater at Little Bear Spring and other shallow groundwater systems in the vicinity have been performed. These investigations have also examined the solute and isotopic compositions of Star Point Sandstone groundwater systems encountered in the Crandall Canyon Mine. These studies are included as Appendix 7-52 and Appendix 7-53. It is the findings of these investigations that groundwater

discharging from Little Bear Spring is modern in origin (>50 years old), while groundwater from deep Star Point Sandstone groundwater systems in the Crandall Canyon Mine have a mean groundwater age of many thousands of years. Shallow Groundwater systems (that provide baseflow to upper Mill Fork Creek) are modern in origin. The solute composition of groundwater in Little Bear Spring and that of surface water and shallow alluvial groundwater in Mill Fork Canyon are similar.

The fact that the discharge in Little Bear Spring shows rapid seasonal variations in discharge rate suggests that the recharge is related to a shallow recharge source that is closely tied to seasonal recharge. The ancient groundwater systems encountered in the Star Point Sandstone in area coal mines do not exhibit seasonal variability.

Finally, in order to verify the conclusion that Little Bear Spring is recharged from Mill Fork Canyon, a fluorescent dye tracing study was performed in 2001 (Appendix 7-57). In this investigation, fluorescent dye was placed in the upper Mill Fork drainage immediately above the spring recharge location. A positive dye recovery occurred at Little Bear Spring within 40 days of the dye placement. Thus, a hydraulic connection between the alluvial system in upper Mill Fork Canyon was positively confirmed.

The elevation of the spring recharge location in upper Mill Fork Canyon is approximately 7710 to 7790 feet, while the elevation of Little Bear Spring is approximately 7475 feet. Thus, there is a substantial hydraulic gradient between the Mill Fork recharge location and Little Bear Spring. It is important to note that the recharge location for Little Bear Spring in Mill Fork Canyon is outside the boundaries of the South Crandall Lease area. Likewise, the groundwater flowpath connecting Mill Fork Canyon and Little Bear Spring is outside of the area of potential coal mining by GENWAL Resources.

Thus, the potential for mining-related impacts to Little Bear Spring is considered extremely remote.

In conclusion, because mining occurs above the Panther Member of the Star Point Formation, the source of water of the Little Bear Spring; because the mine is relatively dry; and because age dating has shown that the water sampled underground from the Starpoint Sandstone and from Little Bear Springs are not the same age (: there is little, if any chance, that current or proposed future mine workings of the Crandall Canyon Mine could affect the Little Bear Spring. Operation of the mine should not adversely impact the Star Point aquifer or Little Bear Spring.

Mitigation for potential disruption to the Little Bear Spring will be accomplished though the construction of a water treatment plant which will provide replacement water for the spring if mining activity in the South Crandall lease tract affects the quality or quantity of the spring. Construction of this water treatment plant will be done under the provisions of a water replacement agreement between GENWAL Resources, Inc. and the Castle Valley Special Service District who maintain culinary water rights to Little Bear Springs. A copy of water replacement agreement is included in Appendix 7-51.

Spring and Seep Interception.

There is a potential for impact to overlying seeps and springs through interception of the perched aquifers as a result of subsidence. Seeps and springs throughout the mine area and the South Crandall Lease area and the U-68082 lease mod area have been identified through intensive field and aerial surveys. These survey results are presented in Chapter 7, Section 7.24.1, associated appendices, and are shown on Plate 7-12. Water rights have also been researched and are provided in Chapter 7, Table 7-6.

Genwal is currently monitoring the water flow rates and quality of representative springs and seeps as indicated in section 7.31 within and adjacent to the current mine permit area (including LBA No. 9 and the South Crandall Lease area). The springs which are monitored cover both the proposed aerial extent of the mine and also are located within each of the major lithologic units from the Blackhawk (above the regional aquifer) to the North Horn Formation (which caps the highest portions of the top of East Mountain).

As stated in Section 7.24.1, the water emitting from seeps and springs which overlie the coal seam originates from perched aquifers. These perched aquifers appear to have no direct communication with the Star Point Sandstone, or with the mine. Isotopic sampling has shown the chemistry of these springs to be substantially different than water from underground sources or the Starpoint Sandstone. These springs do not appear to have any vertical communication with the Blackhawk or Star Point Sandstone formations even when subsidence has occurred. This is due to the extensive interbedded shale in the intervening strata. Also, during the drilling conducted for the LBA No. 9 only one hole, DH-7, intercepted any groundwater. These data indicate that a significant zone of non-saturated, low-permeability strata (aquitard or aquiclude) are present between the Star Point Sandstone and the overlying perched aquifers .

Natural groundwater inflow to the Crandall Canyon Mine is limited. Inflows tend to be of short and limited duration. Most of the natural inflows are from mined-out areas of the longwall. Less frequently, natural inflows occur from bolt holes in the roof and from very limited sections at the face. Genwal has an operational monitoring plan which includes monitoring surface flows from Crandall, Blind Canyon and Indian Creeks using flumes and continuous recorders. In addition, Genwal has committed to monitor Horse Canyon at station H-1 on a quarterly basis. Genwal is currently monitoring 14 springs on a quarterly basis across their potential area of influence (see Chapter 7 for additional details).

Due to the dryness of the mine, water from Crandall Creek had been pumped into the mine to provide dust control water and water for the mining equipment. A water supply well provides shower water for the bathhouse. Based on the 1992 mine water records, approximately 6.9 million gallons of water were used in the mining operation. Of this volume, it is estimated that approximately 6.2 millon gallons of water were pumped into the mine from either the water supply well MW-1 or from Crandall Creek. These volumes, indicate that the water collected from natural inflow underground was approximately 700,000 gallons, which is about 10 percent of the 1992

water usage. This amounts to a 1.3 gpm inflow rate. Much of the natural inflow water is used in the mining operation. Discharge from the mine had occurred only 3 times prior to 1990.

In the event that a subsidence fracture did reach the surface or intercept one of the overlying perched aquifers, it is likely that the affect would be temporary in nature. As indicated in Appendix 7-41, the clays within the Blackhawk Formation have a tendency to swell when exposed to water. Therefore, if the fracturing from subsidence did intersect a saturated, perched aquifer and conveyed water, the clays within the formation would swell and seal the fracture. This self-healing condition has been identified within the headwaters of the Huntington Creek drainage (DeGraff, 1978) and at other mines in the area.

An alternative water source plan has been developed in the event any water rights or springs/seeps impacted in a long-term manner by the mining operation or reclamation activities. This plan is detailed in Chapter 7, Section 7.27.

Surface Water Interception.

The possible surface water interception impacts may affect stream flows in Crandall Canyon, Blind Canyon, Horse Creek, the headwaters of Indian Creek, and drainages in the South Crandall Lease area and in the U-68082 lease mod area. These impacts would likely be the result of subsidence fractures intersecting the ground surface. If these fractures occur within or across a surface drainage channel, then a potential is created for the surface flow within the drainage to be temporarily intercepted. For the drainages within and adjacent to the Crandall Canyon Mine, all sections of the streams that are perennial will be protected from subsidence by limiting retreat mining activities within the area of the stream buffer zones as discussed in Section 5.25 of this permit.

The potential for significant water loss for these drainages is minimal. This conclusion is based on the existing hydrologic and geologic information presented in Section 7.24 and Appendices 7-2 and 7-23 and past mining experience within the Huntington Creek drainage. In addition, the streams in the majority of the surface area which overlies the current or proposed mine workings are ephemeral. However, due to the concerns raised by the U.S. Forest Service, regarding their uncertainty in supporting this conclusion, Genwal Resources Inc. has initiated extensive studies of within Blind and portion of Crandall Canyon to determine if mining through these drainages have an adverse affect on the surface or groundwater resources within the drainage. Until the results of these studies are determined, Genwal will continue to protect the those portions of the streams that have been proven to be perennial.

It is important to note that the geologic units located in the formations stratigraphically above the Blackhawk Formation and the Hiawatha coal seam at the Crandall Canyon mine are hydrologically isolated from the contiguous area. East Mountain is bounded on the north by the South (Left) Fork of Huntington Creek; on the west by Upper Joes Valley; on the south by Cottonwood Canyon; and on the east by Huntington Canyon. Data show that the regional aquifer

is located below the Hiawatha Coal. Field data indicate that Blind Canyon is ephemeral and that Horse Canyon is perennial only in that area where it intersects or is below the regional aquifer. Based on the baseline data (Appendix 7-58), it is apparent that all of the surface-water drainages in the South Crandall Lease area are likely ephemeral or intermittent in nature. The drainages in the U-68082 lease mod area are all ephemeral or intermittent.

The perennial portion of Crandall Canyon extends above the regional aquifer. This occurs because the perched Price River and North Horn Formation cover a broader area of this watershed and because Crandall Canyon has a larger drainage area (and thus, more potential for recharge and increased runoff) than the other two canyons.

Consumption.

The consumption of water by the mining operation is a combination of moisture added to the mined coal through the mining process and that which is extracted with the coal as well as evaporation due to ventilation of the mine workings. It is estimated that mining extraction and the mining process utilize approximately 200 gpm during the two 8-hour mining shifts per day. The volume of water extracted by ventilation is estimated to be approximately 50 gpm.

Seepage from Mine Sumps.

Underground sumps are utilized to store water pumped underground or collected from groundwater inflows until the water is used as mine process water. During the period that water is stored in these sumps it is probable for some seepage to occur to the underlying formation (Spring Canyon member). For the Crandall Canyon Mine, the potential volume of such seepage is expected to be quite low because of the presence of a fine grained mudstone strata underlying the Hiawatha seam within the Blackhawk Formation. This layer limits the downward movement of seepage to a very slow rate.

Pumping from Crandall Creek.

Due to the past need for supplemental water underground, there is also potential for decreased surface flows in Crandall Canyon due to pumping from Crandall Creek. Surface water availability could only be impacted by excessive pumping of water from Crandall Creek for the operation. This is not expected to occur since Genwal has committed to not pump from Crandall Creek at a rate that will dewater the stream (Chapter 7, Section 7.24.2). (Genwal will have determined the baseline water flow which needs to remain within Crandall Creek to sustain the existing flora and fauna by August 31, 1995).

Water Quality Impacts.

The quality of the surface and groundwater in the mine area may potentially be affected by increased sediment loading, dust from the operations, mine water discharges, hydrocarbons used in the mining operations, and seepage losses from within the mine. The following sections discuss these potential impacts and mitigating measures.

With the installation of the main diversion culvert during the expansion of the mine yard facility area it is possible that additional sedimentation could occur. Genwal will install a pair of silt fences downstream in Crandall Canyon to collect any suspended material that may occur as a result of the installation of the 18" drain pipe bedded in drain rock or the 72" culvert. The silt fences will be checked periodically and cleaned out as needed to maintain maximum efficiency.

Once the culvert is in place and operable, the creek will be diverted through the culvert thus bypassing the disturbed area and minimizing the potential for runoff from the disturbed area accidentally flowing directly into the creek. The sediment pond may experience an increase in sediment loading during the construction process and until the construction has been completed. This would be a short term effect. The sediment pond will also be enlarged during the construction process to accomodate the increase in disturbed area. The net result will be that the pond will be better suited to handle runoff from the disturbed area once it has been reconstructed and enlarged. Drainage from the Forest Service parking area will now report directly to the sediment pond. All drainage from the disturbed area will report directly to the sediment pond and the potential for drainage to bypass the sediment pond and flow into the creek untreated will be virtually eliminated.

Flow in Crandall Creek will be temporarily (during the remainder of the life of the mine) diverted through the 72" culvert. However, when reclamation occurs, the channel will be replaced exactly in the same location as it existed prior to the culvert placement. Genwal will lay a geotextile over the existing channel to preserve the channel morphology prior to installation of the drain rock and 18" drain pipe. The drain rock and drain pipe will serve to allow any drainage from the channel bed or adjacent seepage from colluvial materials to flow downstream. Then, the 72" diversion pipe will be placed over this drain. The drain will preserve the integrity of the fill, thus minimizing the potential for problems from settling of the 72" pipe and ensuring the successful operation of the bypass culvert.

Increased Sediment Loading.

As discussed in Section 7.24.2, the permit area is drained by ephemeral, intermittent, and perennial watersheds. These watersheds are steep (with average slopes 50 percent) and well vegetated (with vegetative cover also often exceeding 50 percent). The primary potential for impact to surface water is in the form of increased sedimentation from the operations.

Sediment yield will naturally increase (on a temporary basis during construction and revegetation) from areas disturbed for the operation. A runoff control plan, required by the Division of Oil, Gas, and Mining, provides for the containment or treatment of all runoff and sediment produced from the disturbed areas. Based on this plan, described in Chapter 7, Section 7.42.22, the majority of the disturbed area runoff is directed to the sediment pond. The designed sediment storage for the pond is 1.02 acre feet, including 0.084 acre feet from disturbed areas and 0.018 acre feet from undisturbed and reclaimed areas, over a 10 year period. Storm runoff was determined to be 1.98 acre feet. The pond is designed with a total storage volume of 3.27 acre feet, which allows for complete containment of sediment.

There are 7 small areas (ASCA 2, 5, 6, 7, 8, 9, & 10) which do not drain to the sediment pond, as shown on Plate 7-5, and described in Chapter 7, Section 7.42.21. Sediment yield from these areas is minimized through the use of sediment traps, straw bale dikes, silt fences, and vegetation as described in Section 7.42.21. Sediment yield from the facility and the disturbed areas is minimized through the installation and maintenance of the above described controls.

A secondary potential source may exist due to subsidence creating surface irregularities which would be more susceptible to erosion. Calculations presented in Appendices 7-27 to 7-40 indicate a very small potential for increased sedimentation reaching a perennial stream. A study has been conducted by Genwal and the U.S. Forest Service in Blind Canyon to measure the amount of subsidence, erosion, and the associated sediment yield which may be produced as a result of current mining operations. (Refer to Appendices 7-38 and 7-39).

Fugitive dust.

The potential impacts of fugitive dust from the Crandall Canyon Mine includes reduced air quality in the facilities area and a small decrease in the surface water quality of Crandall Creek. The air quality degradation result from particulate emissions from the paved road and pad, reclamation activities, and from coal loading operations. The water quality degradation and sediment loading increase would result from the settlement of dust within the waters of Crandall Creek. Placement of the stream within the culvert under the expanded mine yard will serve to minimize the possiblity of coal dust settling in Crandall Creek.

These impacts are mitigated by sweeping the paved access roads and portions of the pad, water sprays in the coal handling process, and contemporaneous reclamation. These actions minimize the dust production from the facilities area.

Oil and grease.

The use of oil, grease, and flammable hydrocarbon-based products in the mine facilities area creates the possibility of contamination within and adjacent to the facilities area. Contamination could result from spillage of these products during maintenance of the mine equipment, accidental spillage during filling of fuel tanks, or leakage from equipment during operations. Such contamination could impact the soils, groundwater, and possibly surface waters downstream of the facility.

The impacts from spillage during maintenance activities and during filling of tanks will be mitigated by the implementation of the SPCC plan. Additionally, the runoff from all areas of the site where equipment will be operating is drained to the sedimentation pond. The pond is equipped with an oil and grease skimmer to prevent the release of hydrocarbons.

Mine water discharge.

A potential impact to water quality would be from mine water discharges. Currently there is no discharge from the Crandall Canyon Mine. However, when the underground sumps are full and mining consumption is minimal, such as during a longwall move or vacation, discharges may occur. Prior to 1990, there were only three discharges from the mine and these discharges were of a limited nature in both duration and quantity. The mine has an UPDES discharge permit. The quality of the discharge water is good, and meets the requirements of the discharge permit.

Acid-toxic materials.

As discussed in Section 5.28.30, waste rock is not normally produced during mining operations. When incidental quantities of rock are encountered, the rock is left in the mine and will not be removed in the future; thus, the strata which overlie and underlie the Hiawatha seam are not expected to cause any negative effects or create acid-forming potential. Additionally, the mine is currently considered to be a "dry-mine" and the minimal volume of water that is encountered underground does not exhibit any acid or toxic characteristics. All waters encountered have had a slightly alkaline chemistry. Laboratory data have shown that no materials are present within the coal, underburden, overburden, etc. which are of an acid or toxic nature.

Further, handling plans have been implemented for earth, refuse, and acid-toxic forming materials (if encountered), which, if needed, will prevent or control discharge of pollutants to the hydrologic system (Section 7.31.3). This will be accomplished using the best technology currently available.

However, to further characterize the acid-forming potential of strata immediately above and below the Hiawatha seam, the applicant has collected roof-, floor-rock, and coal samples from locations within the current mine workings. Analytical results from these sets of samples, Appendix 6-2, indicate that acid and toxic forming materials are not present within the overburden or underburden.

Flooding or Streamflow Alteration.

The potential for flooding is minimized by the design and installation of adequately sized diversions, sediment pond and velocity control structures as described in Chapter 7, Section 7.40. All diversions are sized for a 25 year - 24 hour storm event. Ditches, culverts and sediment pond are designed for a 10 year - 24 hour storm event. Ditches, culverts and sediment pond are designed for a 10 year - 24 hour storm event.

Crandall Creek will be culverted for a distance of about 1,100 feet through the expanded mine yard area. While a minimal short term impact will occur as the culvert is being installed, the long term affect will be to reduce the potential for sediment to flow from the disturbed area into the creek. It will also reduce the potential for flow within Crandall Creek to impinge upon the sediment pond embankment due to their close proximity. The slopes of the sediment pond will be 2:1 on the outslope. The toe of the sediment pond has been fortified with an additional 2 feet of 12.5 inch D-50 rip-rap for protection and stabilization. The culvert outlet downstream from the pond will minimize the potential for impact from running water to damage the sediment pond embankment. An analysis of the Crandall Creek flow and pond protection measures indicates that these measures are adequate for a return period in excess of 10,000 years (Section 7.42.22). A slope stability analysis has also been performed on the pond embankment, indicating it meets the required slope-stability safety factors (Chapter 7, Table 7-7).

R645-301-728.200 Basis for Determination

The PHC Determination for this operation is based on baseline hydrologic, geologic, and other information gathered specifically for this site and the surrounding area by the permittee. This includes information from the South Crandall Lease area and from the U-68082 lease mod area. Additionally, regional information has been provided through various published reports as noted in the plan.

Specific groundwater information is provided in Section 7.24.1 and Appendices 7-16, 7-17, 7-18, 7-19, 7-21, 7-24, 7-40, 7-41, 7-43, 7-46, 7-47, and 7-48 of Chapter 7. Surface water data is presented in Section 7.24.2 and Appendices 7-14, 7-23, 7-25, 7-26, 7-27 through 7-39, 7-43, 7-44, 7-45, and 7-48 of Chapter 7. Geologic information is provided in Chapter 6 and Section 7.24.3, while climatic information is provided in Section 7.24.4.

R645-301-728.300 Findings

7.28.310

Chapter 7, Sections 7.24.1 and 7.24.2, indicate the potential for adverse impacts to the hydrologic balance to be minimal in both the existing permit area and in the South Crandall Lease area, and in the U-68082 lease mod area. The basis for this determination is through extensive

studies, past and on-going groundwater and surface water monitoring, past history, and performance of the on-going operation, and various protection plans for operations and reclamation. A summary of potential impacts is provided in Table 1 of this PHC.

7.28.320

Waste rock is produced in limited quantities on a very infrequent basis during mining operations. When incidental quantities of rock are encountered, the rock is left in the mine and will not be removed in the future. These conditions, coupled with the fact that the waste rock does not have acid or toxic characteristics indicate that little potential exists for any impacts from toxic- or acid-forming materials.

Further, handling plans have been implemented for earth, refuse, and acid-toxic forming materials, which, if needed, will prevent or control discharge of pollutants to the hydrologic system (Section 7.31.1). This will be accomplished using the best technology currently available.

7.28.330

The following are expected impacts from the coal mining and reclamation operation:

7.28.331

Sediment yield does naturally increase on a temporary basis from areas disturbed for the operation. However, the majority of the disturbed area runoff is directed to the sediment pond. The pond is designed with a total storage volume of 0.98 acre feet, which allows for complete containment of sediment. The 7 small areas which do not drain to the sediment pond, as shown on Plate 7-5, are treated through the use of sediment traps, straw bale dikes, silt fences, and vegetation.

Genwal, in cooperation with the U.S. Forest Service, is conducting detailed sedimentation and erosion studies in the Blind Canyon watershed to determine the exact impact of mining and subsidence. To date, negative impacts to intermittent and perennial streams by sediment loading and increased turbidity has not been observed in the permit area.

7.28.332

Water quality parameters, including acidity, total suspended solids and total dissolved solids, are not expected to be impacted by the mining or reclamation operations. This determination is based on information provided in Chapter 7, Sections 7.24.1 and 7.24.2, and by results of the on-going water monitoring program detailed in Section 7.31.2.

It is unlikely that groundwater quality or quantity will be affected by the underground mining operation (as discussed in Section 7.24.1 and associated appendices, and Section 7.28.100). There exists a potential for impacts to the surface water. However, these potential impacts are expected to be minimal for the following reasons:

(1) Sediment controls are in place and maintained to minimize sediment loading to drainages;

(2) All discharges from the sediment pond (or mine) are conducted in accordance with requirements of a U.P.D.E.S. Permit;

(3) Historical data from this site (which is summarized in the Annual Report and Appendices 7-16, 7-17, 7-18, 7-19, 7-21, 7-24, 7-40, 7-41, 7-43, 7-46, 7-47, and 7-48) show no indication of mine related impacts on the hydrology of the area;

(4) The water monitoring program will continue to be followed as described in Chapter 7, Section 7.31.2. Results will continue to be analyzed and any problem areas noted will be corrected to prevent further impacts to the hydrology.

728.333

The potential for flooding of the surface facilities is minimized by the design and installation of adequately sized diversions, sediment pond and velocity control structures as described in Chapter 7, Section 7.40.

728.334

The Crandall Canyon Mine is expected to have little impact on groundwater. As mentioned earlier, the mine does not appear to have any hydrologic connection to surface water above the mine nor any connection to groundwater in the Star Point Sandstone below.

Monitoring of in-mine and surface monitoring wells drilled within and adjacent to the Crandall Canyon Mine, and completed in the regional Blackhawk-Starpoint aquifer indicate the potentiometric surface of this aquifer generally lies 50 to 60 feet below the top of the Star Point Formation in all but the westernmost portion of the mine. Thus, mining of the Hiawatha Coal Seam at the base of the Blackhawk Formation, overlying the Star Point Formation, will not intersect and drain any water from the regional aquifer. Nor would water from underground mining enter the Star Point Sandstone due to the relatively impermeable shale zone that lies between the Hiawatha seam and the sandstone below.

There may be some potential for impact to seeps and springs through subsidence. Genwal is currently monitoring the water flow rates and quality of the water rights associated with seeps and springs within and adjacent to the current mine permit area. No evidence of impacts have been identified; however, an alternative water source plan has been developed in the event any water rights or springs/seeps are adversely affected by the mining operation or reclamation activities.

The groundwater system that supports discharge at Little Bear Spring will not be subsided. As discussed above, the groundwater discharging from the spring is NOT derived from a regional Star Point aquifer. Rather, it is recharged from surface-water and alluvial groundwater losses in Mill Fork Canyon outside of the permit area. The significant fracture in the Star Point Sandstone from which the spring discharges serves primarily as a conduit for the conveyance of the Mill Fork water to the spring. Groundwater in the Star Point Sandstone that is not within the fracture system does not contribute appreciable quantities of groundwater to the spring. For these reasons, the potential for impacts to Little Bear Spring resulting from mining operations in GENWAL's permit area is considered extremely unlikely..

Impacts to the surface water quality and quantity are minimized through the installation and maintenance of surface runoff and sediment control structures, and a commitment (Section 7.24.2) to not pump from Crandall Creek at a rate that will cause the in-stream flow to decrease below the minimum required rate.

In addition, groundwater and surface water quantity and quality are monitored on a quarterly basis to determine seasonal flow conditions for the permit and adjacent areas. Further, handling plans have been implemented for earth, refuse, and acid-toxic forming materials, which will prevent or control discharge of pollutants to the hydrologic system. Implementation of these plans will be accomplished using the best technology currently available.

Based on the above, there is some potential for the operation to have an impact on the groundwater and surface water resources of the area; however, the impacts are expected to be minimal due to natural geologic and hydrologic conditions, and the implementation of control and protection systems. Therefore, the "Probable Hydrologic Consequences" of this operation are expected to be minimal, if not negligible.

7.28.335

Additional information will be provided if deemed necessary by the Division.

R645-301-728.340 N/A

This is an underground operation.

R645-301-728-400 **Updated PHC**

This document is provided as an up-dated PHC for the permit renewal in accordance with the State of Utah R645-Coal Mining Rules.

TABLE 1
POTENTIAL HYDROLOGIC IMPACTS

POTENTIAL IMPACT	POTENTIAL EFFECT	POTENTIAL MAGNITUDE OF IMPACT	PROBABILITY OF OCCURRENCE	MITIGATION MEASURES
Leaching of acid or toxic forming materials	Degradation of surface and groundwater quality	Low (no such materials present)	Low	Monitoring materials handled by approved methods
Groundwater Availability	Decrease in spring flow due to subsidence	Low to moderate depending on location	Low (No history of impact)	Monitoring
Groundwater Availability	Interception of groundwater by mine workings	Low	Low (on-going)	Monitoring
Groundwater Availability	Removal of water with coal	Low	Moderate (on-going)	Monitoring
Groundwater Quality	Decrease in quality due to hydrocarbons	Low	Low	SPCC Plan, monitoring inspections and maintenance
Sediment Yield	Increase in TSS	Moderate	Low	Sediment pond, diversions, sediment control, monitoring
Flooding	Damage to downstream area	Low	Low	Sediment ponds, diversions, and monitoring
Streamflow Alteration	Damage to streams due to subsidence	Low	Low	Protection of perennial streams, monitoring
Surface Water Quality	Decrease in quality due to hydrocarbons	Low	Low	SPCC plan, inspections, monitoring, maintenance
Surface Water Quality	Increase in TSS due to coal fines and dust	Low	Low	Sweeping of access road and pads, misting of coal
Surface Water Quantity	Decrease in flow in Crandall Creek below mine	Moderate	Low	Monitoring, maintaining baseflow

APPENDIX 7-64

BASELINE INFORMATION FOR THE U-68082 LEASE MOD AREA