ACT 007/038 #3

FEDERAL **Permit Number ACT/007/038** **April 23, 1996**

STATE OF UTAH
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF OIL, GAS AND MINING
355 West North Temple
3 Triad Center, Suite 350
Salt Lake City, Utah 84180-1203
(801) 538-5340

RECEIVED
JUN 21 1996
DIV. OF OIL, GAS & MINING

This permit, ACT/007/038, is issued for the state of Utah by the Utah Division of Oil, Gas and Mining (Division) to:

Cyprus Plateau Mining Corporation
P.O. Box PMC
Price, Utah 84501
(801-637-2875)

for the Willow Creek Mine. A Surety Bond is filed with the Division in the amount of $11,949,205 payable to the State of Utah, Division of Oil, Gas and Mining and the Office of Surface Mining Reclamation and Enforcement (OSM).

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

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

The area to be mined is contained on the USGS 7.5-minute quadrangle maps (Helper, Kyune, Standardville, Matts Summit.) The areas contained in the permit area, approximately 14,670 acres, involve all or part of the following federal, state, county, and fee coal leases:

Fee Surface - Cyprus Western Coal Company (CWCC)

Township 12 South, Range 9 East, SLM

Section 35: E/2 east of the Price River *

Less and Except:

1. **A tract in the NE/4 SE/4 containing 1.37 acres, more or less, described by metes and bounds; as conveyed to Castle Gate, a body politic, by Deed of Correction dated April 10, 1973, and recorded in Book 138 at page 156 of the official records of Carbon County;**

2. **A tract in the NW/4 NE/4 containing 5.25 acres, more or less, conveyed to The Utah Power and Light Company, as referenced and described by metes and bounds in Quitclaim Deed recorded on February 3, 1956, in Book 38 at page 158 of the official records of Carbon County;**

3. **A tract in the NW/4 NE/4 containing 2.61 acres, more or less, described by metes and bounds; as conveyed to the City of Price, a body politic, by Warranty Deed dated December 19, 1960, and recorded in Book 70 at page 416 of the official records of Carbon County.**

Section 36: Lots 1 and 2 (E/2 NE/4); W/2 NE/4; SE/4; NW/4; SW/4 east of Price River *

Less and Except:
A tract in the SE/4 SW/4 containing 0.057 acres, more or less, described by metes and bounds; as conveyed to Castle Gate, a body politic, by Deed of Correction dated April 10, 1973, and recorded in Book 138 at page 156 of the official records of Carbon County.

<u>Township 13 South, Range 9 East, SLM</u>

Section 1: Lots 1 and 2 (N/2 NE/4); Lots 3 and 4 (N/2 NW/4) east of the Price River; SE/4 NE/4; E/2 SW/4 NE/4;

Less and Except:
1. **A tract in Lot 3 containing 1.43 acres total , more or less, and a tract in the NE/4 SW/4 containing 9.48 acres, more or less, described by metes and bounds; as conveyed to The Utah Power and Light Company by Special Warranty Deed dated July 10, 1986, and recorded in Book 262 at page 309 of the official records of Carbon County;**

2. **A tract in the E/2 SW/4 containing 2.88 acres, more or less, as conveyed to The Utah Power and Light Company; as referenced and described by metes and bounds in Quitclaim Deed recorded on February 3, 1956, on Book 38 at page 158 of the official records of Carbon County;**

3. **A tract in Lot 3 containing 1.02 acres, more or less, described by metes and bounds; as conveyed to The Utah Power and Light Company by Quitclaim Deed dated May 28, 1953, and recorded in Book 20 at page 492 of the official records of Carbon County;**

4. **A roadway 30 feet wide in the NW/4 described by metes and bounds; as conveyed to Castle Gate Town, a municipal corporation, by Quitclaim Deed dated September 26, 1969, and recorded in Book 122 at page 400 of the official records of Carbon County.**

Township 12 South, Range 10 East, SLM

Section 29: S/2 NE/4; W/2 SE/4; E/2 SW/4; SW/4 SW/4
Section 30: SE/4 SE/4
Section 31: All

Less and Except:

1. **A tract in Section 31: SW/4 SW/4, and also in T. 13 S., R. 10 E., Section 6: Lot 4, containing 6.496 acres, more or less, as described by metes and bounds; as conveyed to Carbon County by Quitclaim Deed dated September 18, 1990, and recorded in Book 300 at page 134 of the official records of Carbon County (Castle Gate Cemetery).**

2. **A tract in Section 31: SE/4 SW/4, containing 0.92 acres, more or less, as described by metes and bounds; as conveyed to PacifiCorp by Quitclaim Deed dated November 21, 1995, and recorded in Book 364 at page 756 of the official records of Carbon County.**

Township 13 South, Range 10 East, SLM

Section 2: All
Section 4: Lots 1 and 2 (N/2 NE/4); S/2 NE/4; N/2 SE/4; SW/4 SE/4; S/2 SW/4
Section 5: All
Section 6: Lots 1, 2, 3, 4 (N/2 N/2); Lot 5 (SW/4 NW/4); S/2 NE/4; SE/4; SE/4 NW/4
Section 8: Lot 1 (NE/NE/4); SE/4 NE/4; NE/4 SE/4; S/2 S/2
Section 9: E/2; SW/4; N/2 NW/4; SE/4 NW/4

Section 10: SE/4; E/2 SW/4
Section 11: SW/4
Section 17: NE/4; N/2 NW/4
Section 18: N/2 NE/4

*** Subject to the surface rights only of AMAX Coal Company, as successor to Castle Gate Coal Company, under the Preparation Plant Facility Lease between Blackhawk Coal Company, Lessor, and Castle Gate Coal Company, Lessee, dated May 30, 1986, and affecting:**

Township 12 South, Range 9 East, SLM

Section 35: SE/4 NE/4; E/2 SE/4
Section 36: SW/4; SW/4 NE/4; NW/4 SE/4; SE/4 NW/4

Township 13 South, Range 9 East, SLM

Section 1: Lots 3 and 4 (N/2 NW/4) excluding Utah Power and Light Company coal stockpile.

Fee Coal - CWCC

Township 12 South, Range 9 East, SLM

Section 35: E/2 East of the Price River

Less and Except:
A tract in the NW/4 NE/4 containing 2.61 acres, more or less, described by metes and bounds; as conveyed to the City of Price, a body politic, by Warranty Deed dated December 19, 1960, and recorded in Book 70 at page 416 of the official records of Carbon County.

Section 36: SW/4 SW/4 east of Price River; E/2 NW/4; NW/4 NW/4; NW/4 SW/4; S/2 SW/4

Township 13 South, Range 9 East, SLM

Section 1: Lots 1 and 2 (N/2 NE/4); Lots 3 and 4 (N/2 NW/4) east of the Price River; SE/4 NE/4; E/2 SW/4 NE/4;

Less and Except:

1. **A tract in Lot 3 containing 1.02 acres, more or less, described by metes and bounds; as conveyed to The Utah Power and Light Company by Quitclaim Deed dated May 28, 1953, and recorded in Book 20 at page 492 of the official records of Carbon County;**

2. **A roadway 30 feet wide in the NW/4 described by metes and bounds; as conveyed to Castle Gate Town, a municipal corporation, by Quitclaim Deed dated September 26, 1969, and recorded in Book 122 at page 400 of the official records of Carbon County.**

Township 12 South, Range 10 East, SLM

Section 31: All

Township 13 South, Range 10 East, SLM

Section 2: All
Section 4: S/2 S/2
Section 5: Lots 1, 2, 3, and 4 (N/2 N/2)
Section 6: Lots 1, 2, 3, and 4 (N/2 N/2); Lot 5 (SW/4 NW/4); S/2 SE/4; SE/4 NW/4
Section 8: S/2 S/2
Section 9: E/2; SW/4; N/2 NW/4; SE/4 NW/4
Section 10: SE/4; E/2 SW/4
Section 11: SW/4
Section 17: NE/4; N/2 NW/4
Section 18: N/2 NE/4

CWCC Surface and Leased Coal

Federal Coal Leases:

1. **Federal Consolidated Coal Lease No. SL-048442-050115 dated November 2, 1930; covering the following lands:**

Township 13 South, Range 10 East, SLM

Section 1: SW/4
Section 3: S/2 N/2; S/2
Section 4: Lots 1, 2, 3, and 4 (N/2 N/2); S/2 N/2; N/2 S/2
Section 10: N/2; NW/4 SW/4
Section 11: E/2; NW/4

Less and Except:
A Partial Assignment dated September 17, 1991, effective May 1, 1992, to AMCA Coal Leasing, Inc., in:

Township 13 South, Range 10 East, SLM

Section 1: SW/4

2. Federal Modified Coal Lease No. SL-046652 dated December 1, 1962, effective August 3, 1921, as amended effective September 23, 1964, by a partial transfer to the State of Utah; covering the following lands:

Township 12 South, Range 10 East, SLM

Section 33: S/2
Section 34: S/2

Township 13 South, Range 10 East, SLM

Section 3: Lots 1, 2, 3, and 4 (N/2 N/2)
containing 802.36 acres, more or less

3. Federal Coal Lease No. U-0146345 dated November 1, 1965; covering the following lands:

Township 12 South, Range 10 East, SLM

Section 33: N/2
Section 34: NW/4 NE/4; S/2 NE/4; NW/4
Section 35: NE/4; S/2 NW/4; S/2
containing 1,160.00 acres, more or less

4. Federal Coal Lease No. U-0148779 dated August 1, 1966; covering the following lands:

Township 12 South, Range 10 East, SLM

Section 26: N/2; N/2 S/2; SE/4 SW/4; S/2 SE/4
Section 27: All
containing 1,240.00 acres, more or less

State Coal Leases:

1. **State of Utah Coal Lease No. ML-1892 dated June 5, 1947, as amended effective January 1, 1988; covering the following lands:**

Township 12 South, Range 9 East, SLM

Section 36: Lots 1 and 2 (E/2 NE/4); W/2 NE/4; SE/4; NE/4 SW/4; SW/4 NW/4
containing 389.84 acres, more or less

2. **State of Utah Modified Coal Lease No. SL-046652-ST dated December 1, 1962, effective August 3, 1921; as transferred from the United States of America to the State of Utah under the Dawson Act of April 22, 1954, (68 Stat 7) on April 7, 1965, effective September 23, 1964, (Patent No. 43-65-0072); as amended September 19, 1968; covering the following lands:**

Township 12 South, Range 10 East, SLM

Section 32: All
containing 640.00 acres, more or less

County Coal Lease:

1. **Carbon County, Utah, Consolidated Coal Lease dated April 22, 1985; covering the following lands:**

Township 12 South, Range 10 East, SLM

Section 28: NW/4 NW/4
Section 29: S/2 NE/4; W/2 SE/4; E/2 SW/4; SW/4 SW/4
Section 30: SE/4 SE/4

Township 13 South, Range 10 East, SLM

Section 5: S/2; S/2 N/2
Section 6: S/2 NE/4; N/2 SE/4
Section 8: Lot 1 (NE/4 NE/4); SE/4 NE/4; NE/4 SE/4
containing 1,119.97 acres, more or less

Fee Surface - AMAX Coal Company/AMAX Land Company

Crandall Canyon Facility Surface Area:

That part of the surface rights in the following described land located in Carbon County, Utah, conveyed by Franklin Real Estate Company to Blackhawk Coal Company by Quitclaim Deed dated November 3, 1981, of record in Record Book 219, pages 691-692, in the Office of the Recorder of Carbon County, Utah, to wit:

Township 12 South, Range 9 East, SLBM

Section 22: SW/4 SE/4; SE/4 SW/4 - excluding public highways and the D&RGW right-of-way
Section 27: S/2 NW/4; NE/4 NW/4; NW/4 SW/4 - excluding public highways and the D&RGW right-of-way
Section 28: S/2

Preparation Plant Facility Surface Area:

That part of the surface rights in the following described land located in Carbon County, Utah, conveyed by Franklin Real Estate Company to Blackhawk Company by Quitclaim Deed dated November 3, 1981, of record in Record Book 219, page 690 in the Office of the Recorder of Carbon County, Utah, to wit:

Township 12 South, Range 9 East, SLBM

Section 36: NE/4 SW/4; SW/4 NE/4; NW/4 SE/4

And, also, that part of the surface rights in the following described land located in Carbon County, Utah, conveyed by Franklin Real Estate Company to Blackhawk Coal Company by Warranty Deed dated November 3, 1981, of record in Record Book 215, pages 474-487, to wit:

Township 12 South, Range 9 East, SLBM

Section 35: SE/4 NE/4; E/2 SE/4
Section 36: SE/4 NW/4; W/2 SW/4; SE/4 SW/4

Township 13 South, Range 9 East, SLBM

Section 1: N/2 NW/4 - excluding Utah Power and Light coal stockpile

All of the Surface Rights described in Parts I, II, and III above, including without limitation, the "Preparation Plant Facility Area" and the "Crandall Canyon Facility Surface Area" are SUBJECT TO all liens, mortgages, encumbrances, covenants, restrictions, prior rights, claims, reservations, leases, royalties, easements, agreements and all matters legally existing, and all rights or claims of any kind affecting such property disclosed in those Warranty Deeds and Quitclaim Deeds forming a part of this Exhibit A, and in Chicago Title Insurance Company Commitment No. 1268, dated May 22, 1975, and in South Eastern Utah Title Company Preliminary Title Report No. 6408-C, dated May 15, 1975, and all exceptions set forth therein.

Fee Surface - Cyprus Western Coal Company:

Surface rights only in the following described lands located in Carbon County Utah conveyed by Warranty Deed dated June 29, 1994 from AMCA Coal Leasing Company, Grantor, to Cyprus Western Coal Company, Grantee, to wit:

Township 13 South, Range 10 East, SLM

Section 7: Lots 8, 9, 12, and 13
containing 160.54 acres, more or less

Note: The Warranty Deed was provided to the county for recordation on July 26, 1995.

Fee Coal - Cyprus Western Coal Company:

Coal rights only in the following described lands located in Carbon County, Utah conveyed by Warranty Deed dated June 29, 1994 from AMCA Coal Leasing Company, Grantor, to Cyprus Western Coal Company, Grantee, to wit:

Township 13 South, Range 10 East, SLM

Section 7: Lots 1, 2, 6-9, 12, and 13
Section 8: SW/4 NW/4; NW/4 SW/4
containing 401.77 acres, more or less

Note: The Warranty Deed was provided to the county for recordation on July 26, 1995.

Carbon County Coal - Cyprus Western Coal Company:

All those certain rights in the following described lands located in Carbon County, Utah and associated with Coal Mining Lease dated April 6, 1971 between Carbon County, a body corporate and politic of the State of Utah, Lessor, and AMCA Coal Leasing, Inc., Lessee; as extended by Notice of Extension of Coal Mining Lease dated December 28, 1992 from AMCA Coal Leasing, Inc., to the Carbon County Commission; and as assigned by Assignment and Assumption of Carbon County, Utah Coal Mining Lease dated effective June 29, 1994 from AMCA Coal Leasing, Inc., Assignor, to Cyprus Western Coal Company, Assignee, which assignment was consented to by the Carbon County Board of Commissioners by Consent to Assignment dated November 16, 1994, to wit:

Township 13 South, Range 10 East, SLM

Section 8: Lots 2 and 3; SW/4 NE/4, NW/4 SE/4; SE/4 NW/4; NE/4 SW/4 containing 239.74 acres, more or less.

ADDITIONAL LANDS TO BE AFFECTED BY MINING

This legal description is for the permit area of the Willow Creek Mine. The permittee is authorized to conduct underground coal mining activities and related surface activities on the foregoing described property subject to the conditions of all applicable conditions, laws and regulations.

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

Sec. 4 **PERMIT TERM** - This permit becomes effective on April 23, 1996 and expires on April 24, 2001.

Sec. 5 **ASSIGNMENT OF PERMIT RIGHTS** - The permit rights may not be transferred, assigned or sold without the approval of the Director, Division. Transfer, assignment or sale of permit rights must be done in accordance with applicable regulations, including but not limited to 30 CFR 740.13{e} and R645-303-300.

Sec. 6 **RIGHT OF ENTRY** - The permittee shall allow the authorized representative of the Division, including but not limited to inspectors, and representatives of the Office of Surface Mining Reclamation and Enforcement (OSM), without advance notice or a search warrant, upon presentation of appropriate credentials, and without delay to:

(a) have the rights of entry provided for in 30 CFR 840.12, R645-400-220, 30 CFR 842.13 and R645-400-110;

(b) be accompanied by private persons for the purpose of conducting an inspection in accordance with R645-400-100 and R645-400-200 when the inspection is in response to an alleged violation reported to the Division by the private person.

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

Sec. 8 **ENVIRONMENTAL IMPACTS** - The permittee shall take all possible steps to minimize any adverse impact to the environment or public health and safety resulting from noncompliance with any term or condition of the permit, including, but not limited to:

(a) Any accelerated or additional monitoring necessary to determine the nature and extent of noncompliance and the results of the noncompliance;

(b) immediate implementation of measures necessary to comply; and

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

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

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

(a) in accordance with the terms of the permit to prevent significant, imminent environmental harm to the health and safety of the public; and

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

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

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

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

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

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

Sec. 16 CULTURAL RESOURCES - If during the course of mining operations, previously unidentified cultural resources are discovered, the permittee shall ensure that the site(s) is not disturbed and shall notify the Division. The Division, after coordination with OSM, shall inform the permittee of necessary actions required. The permittee shall implement the mitigation measures required by Division within the time frame specified by Division.

Sec. 17 APPEALS - The permittee shall have the right to appeal as provided for under R645-300-200.

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

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

THE STATE OF UTAH

By: _____

Date: April 23, 1996

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

_____

Authorized Representative of the Permittee

Date: 4-30-96

Attachment A

SPECIAL CONDITIONS

1. Cyprus Plateau Mining Corporation (CPMC) is not authorized to conduct mining operations within the permit area on lands under federal jurisdiction until receiving the federal coal leases and obtaining federal mine approval.

2. Features 5, 10, 20, 61, and 65 of Cultural Resource Site 42 Cb 1000 must not be disturbed until the applicant has completed mitigation required by the Division of State History and until the Division and State History have accepted the results.

3. CPMC must amend the Mining and Reclamation Plan (MRP) within 14 days of receiving the 1996 Order-I soil survey laboratory data; both Section 3.1 SOILS INFORMATION and Exhibit 5 SOILS INFORMATION, must be amended with the 1996 Order -I soil survey data-resource discussion and chemical and physical analyses results, respectively. If analysis results indicate any departure from acceptance criteria as outlined in the Division Topsoil/Overburden Guidelines, CPMC must immediately cease soil salvage operations, consult Division for development and implementation of appropriate operation and remediation plans, and correct and update the MRP.

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

Cyprus Plateau Mining Corporation
Willow Creek Mine
ACT/007/038
Carbon County, Utah

April 23, 1996

#3

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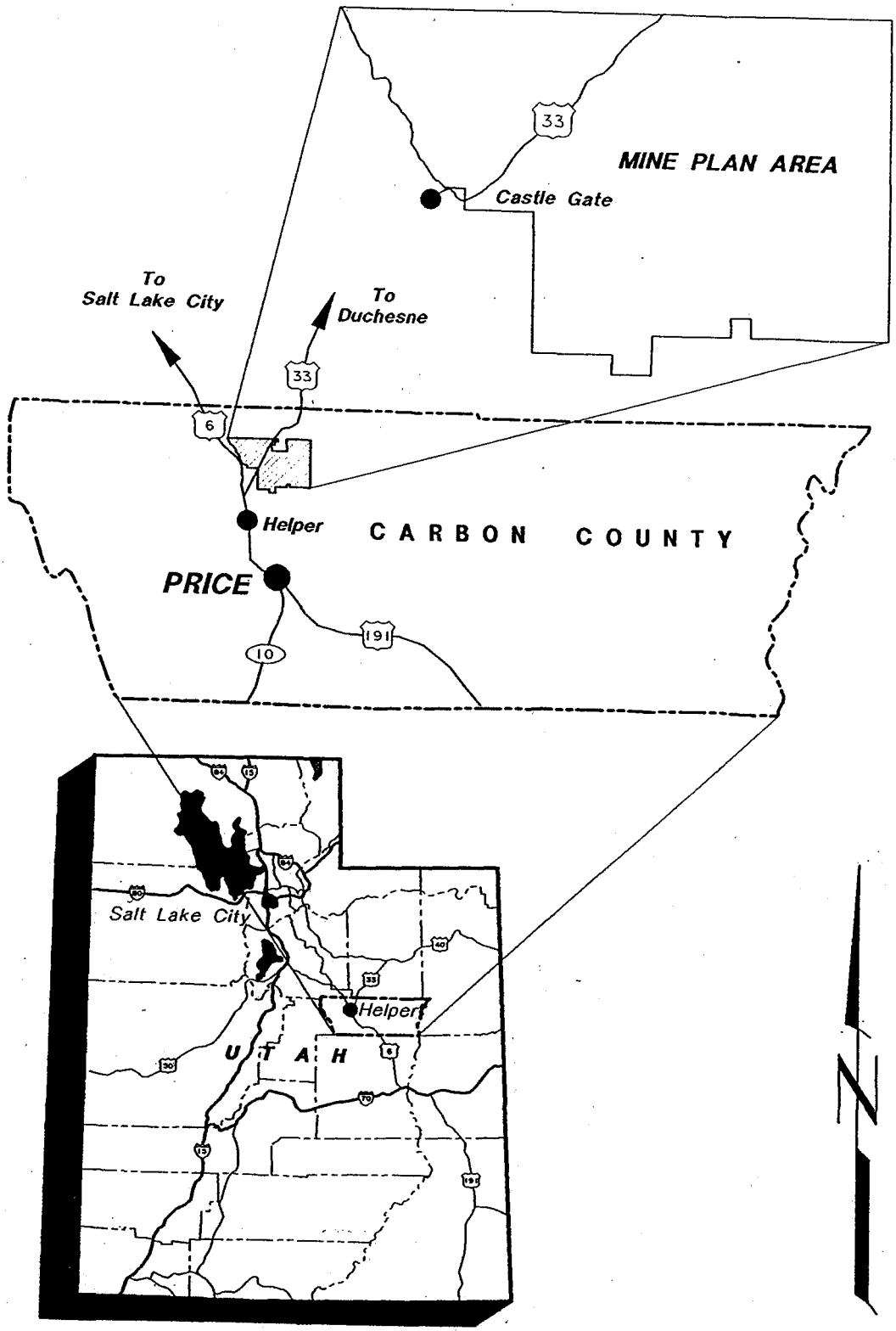

Project No.: 500-5000	Design By: J.NETTLETON	Scale: NOT TO SCALE	CYPRUS Plateau Mining
File: PLATGLOC.DWG	Drawn By: K.CONRATH	Date: MARCH 1994	
TerraMatrix Engineering & Environmental Services 1475 Pine Grove Road, P.O. Box 774018 Steamboat Springs, Colorado 80477	FIGURE 1.0-1		GENERAL LOCATION MAP

PERMITTING CHRONOLOGY

Cyprus Plateau Mining Corporation
Willow Creek Mine
Carbon County, Utah

April 23, 1996

May 3, 1995	Cyprus Plateau Mining corporation submits the permit application package for the proposed Willow Creek Mine.
May 11, 1995	Public Hearing held about proposal to conduct mining operations within 100 feet of the outside right-of-way line of Highway 191 in Willow Creek Canyon. No comments were received and a finding was made on May 12, 1995.
June 6 and June 27, 1995	The Division sent letters to the applicant Cyprus Plateau Mining Corporation, documenting that the application was not complete.
June 8 and June 12, August 8 and August 18 and September 12, 1995	Cyprus Plateau Mining Corporation responds to the administrative completeness concerns.
September 1, 1995	Division responds to GRAMA request from the United Mine Workers of America.
September 14, 1995	The application was determined complete. Published in the Sun Advocate September 21, 28 and October 5, and October 12, 1995.
October 6, 1995	Cyprus Plateau transmits ten (10) sets of the permit application package.
October 17, 1995	Division request for agencies to review.
November 6, 1995	Technical review of the Willow Creek Mine permit application sent to Cyprus Plateau Mining Corporation with a response date of December 22, 1995.
November 9, 1995	DWR submits concerns about the proposed PAP.
November 10, 1995	United Mine Workers of America object to the proposed Willow Creek Mine and request an Informal Conference.

November 13, 1995	Partnering session with Cyprus Plateau Mining corporation, Centennial Development Corporation, Wasatch Electric, CEntry and the Division.
November 15, 1996	Division of Water Rights submits concerns to the Division about the PAP.
November 21, 1995	Director notified the United Mine Workers of America that the information conference is scheduled for December 6, 1995 in Price, Utah.
December 6, 1995	Informal Conference held in Price, Utah.
December 12, 1995	Director, James Carter, extends supplementing the record of the informal conference of the United Mine Workers of America until the close of business on December 22, 1995.
December 20, 1995	Director, James Carter, extends time to supplement the record from December 22 to December 29, 1995.
January 23, 1996	Division staff visited proposed mine site.
February 5, 1996	OSM-WRCC notifies the applicant that prior to conducting any operation to extract Federal leased coal, a Mining Plan would need to be approved by the Assistant Secretary, Land and Minerals management in the U.S. Department of Interior.
February 9, 1996	The Division received responses to the November 6, 1995 technical review.
February 12, 1996	Division send OSM-WRCC copies of the environmental assessments for the federal coal leases.
February 26, 1996	Updated PAP information is transmitted to other agencies.
March 18, 1996	Partnering meeting at the Division.
April 2, 1996	Division receives Willow Creek Mine cost estimate.

April 4, 1996	Division transmits Technical Analysis review to Cyprus Plateau Mining Corporation.
April 9, 1996	Cyprus Plateau Mining corporation submitted a response to the March 28, 1996 Division Technical Adequacy Document.
April 12, 1996	Request for Consultation from Division to State History
April 16, 1996	Cyprus Plateau Mining Corporation faxed the Division copies of the Reclamation Agreement including the surety bond in the amount of $11,949,205.
April 19, 1996	Army Corps Engineers issue 404 permit.
April 22, 1996	State Preservation Office sent conditional concurrence letter.
April 23, 1996	Division issues permit with three conditions.

ADMINISTRATIVE OVERVIEW

Cyprus Plateau Mining Corporation
Willow Creek Mine
ACT/007/038
Carbon County, Utah

April 23, 1996

PROPOSAL

Cyprus Plateau Mining Corporation submitted an application for the proposed Willow Creek Mine, an underground mine complex, on May 3, 1995. This permit area encompasses a block of approximately 14, 670 acres consisting of federal lands (BLM), county lands, and private lands.

BACKGROUND

The Willow Creek Mine area is located approximately 10 miles north of the town of Price, Utah in Carbon County, with the mine surface facilities located adjacent to and north of Willow Creek and State Highway 191 in Willow Creek Canyon approximately one mile northeast of the junction of Highway 191 with U.S. Highway 6 and 50. The Willow Creek Mine permit area covers an area of approximately 23 sections extending north and south approximately 2.5 miles from the junction of the two highway and six miles to the east for a total of 14, 670 acres.

This area is part of the Book Cliffs of Central Utah and is characterized by high plateaus to the north; steep narrow ridgelines cut by deep erosional drainages in the permit and adjacent areas to the east, west, and south; and the relatively flat, dry semi-desert areas of the Colorado Plateau to the south of the town of Price. Within the permit area, topographic relief ranges from 6200 feet, near the confluence of Willow Creek with the Price River, to over 8,600 feet along the ridgelines to the southeast.

There has been mining in this area since the late 1800's. Following initial settlement of this area, further settlement and development of the area occurred fairly rapidly with the discovery of extensive coal reserves in the late 1870's and construction of the railroad in the late 1870's and easily 1880's. Active underground mining operations continued from the 1870's through the 1940's, when coal demand and production began to decline due to reduced postwar industrial production and the shift to diesel railroad engines. The Castle Gate Mines Nos. 1,2, and 4, which were encompassed by the Willow Creek Mine permit boundary, were developed and operated from 1888 through 1972, when the last of the mines closed. Although extensive underground mine development and production occurred throughout the

proposed permit area, associated surface disturbance was generally limited to mine portal and surface facility areas in the valley bottoms and on natural bench areas adjacent to drainages.

The underground mining operation will target recovery of remaining recoverable coal reserves contained in the "A"., "C:, "D",. and "K" coal seams. This permit application includes mining of recoverable reserves in areas with less than approximately 2,500 feet of overburden cover. There are extensive reserves under areas with greater than 2,500 feet of overburden, however, recovery of these reserves is not included in this permit application.

Most of the initial and future mine development work will involve continuous underground methods using continuous miners and electric shuttle cars. The application plans to utilize high productivity longwall mining systems for actual coal production, with coal haulage from the mine using a high speed main conveyor fed by several face conveyors from each of the active development areas, continuous minor sections, or longwall panels. The mine is being designed for a nominal annual production rate of 5.0 millions tons of coal.

RECOMMENDATION

The Division, along with federal and state agencies, have reviewed and analyzed the permit application for the Willow Creek Mine. The Division approves mining to begin in the fee areas and conditions the permit for mining into the federal leases when the mining plan approval from the Secretary of the Interior is obtained. Additionally, the permit conditions that disturbances may not commence in 42CB1000 (Features 5, 10, 61, 65) until the recording is completed. A surety bond in the amount of $11,949,205 (year 2001 dollars)has been posted with United Pacific Insurance Company for this project.

FEDERAL

Permit Number ACT/007/038

April 23, 1996

STATE OF UTAH
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF OIL, GAS AND MINING
355 West North Temple
3 Triad Center, Suite 350
Salt Lake City, Utah 84180-1203
(801) 538-5340

This permit, ACT/007/038, is issued for the state of Utah by the Utah Division of Oil, Gas and Mining (Division) to:

Cyprus Plateau Mining Corporation
P.O. Box PMC
Price, Utah 84501
(801-637-2875)

for the Willow Creek Mine. A Surety Bond is filed with the Division in the amount of $11,949,205 payable to the State of Utah, Division of Oil, Gas and Mining and the Office of Surface Mining Reclamation and Enforcement (OSM).

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

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

The area to be mined is contained on the USGS 7.5-minute quadrangle maps (Helper, Kyune, Standardville, Matts Summit.) The areas contained in the permit area, approximately 14,670 acres, involve all or part of the following federal, state, county, and fee coal leases:

Fee Surface - Cyprus Western Coal Company (CWCC)

Township 12 South, Range 9 East, SLM

Section 35: E/2 east of the Price River *

Less and Except:

1. **A tract in the NE/4 SE/4 containing 1.37 acres, more or less, described by metes and bounds; as conveyed to Castle Gate, a body politic, by Deed of Correction dated April 10, 1973, and recorded in Book 138 at page 156 of the official records of Carbon County;**

2. A tract in the NW/4 NE/4 containing 5.25 acres, more or less, conveyed to The Utah Power and Light Company, as referenced and described by metes and bounds in Quitclaim Deed recorded on February 3, 1956, in Book 38 at page 158 of the official records of Carbon County;

3. A tract in the NW/4 NE/4 containing 2.61 acres, more or less, described by metes and bounds; as conveyed to the City of Price, a body politic, by Warranty Deed dated December 19, 1960, and recorded in Book 70 at page 416 of the official records of Carbon County.

Section 36: Lots 1 and 2 (E/2 NE/4); W/2 NE/4; SE/4; NW/4; SW/4 east of Price River *

Less and Except:
A tract in the SE/4 SW/4 containing 0.057 acres, more or less, described by metes and bounds; as conveyed to Castle Gate, a body politic, by Deed of Correction dated April 10, 1973, and recorded in Book 138 at page 156 of the official records of Carbon County.

Township 13 South, Range 9 East, SLM

Section 1: Lots 1 and 2 (N/2 NE/4); Lots 3 and 4 (N/2 NW/4) east of the Price River; SE/4 NE/4; E/2 SW/4 NE/4;

Less and Except:
1. A tract in Lot 3 containing 1.43 acres total , more or less, and a tract in the NE/4 SW/4 containing 9.48 acres, more or less, described by metes and bounds; as conveyed to The Utah Power and Light Company by Special Warranty Deed dated July 10, 1986, and recorded in Book 262 at page 309 of the official records of Carbon County;

2. A tract in the E/2 SW/4 containing 2.88 acres, more or less, as conveyed to The Utah Power and Light Company; as referenced and described by metes and bounds in Quitclaim Deed recorded on February 3, 1956, on Book 38 at page 158 of the official records of Carbon County;

3. A tract in Lot 3 containing 1.02 acres, more or less, described by metes and bounds; as conveyed to The Utah Power and Light Company by Quitclaim Deed dated May 28, 1953, and recorded in Book 20 at page 492 of the official records of Carbon County;

4. A roadway 30 feet wide in the NW/4 described by metes and bounds; as conveyed to Castle Gate Town, a municipal corporation, by Quitclaim Deed dated September 26, 1969, and recorded in Book 122 at page 400 of the official records of Carbon County.

Township 12 South, Range 10 East, SLM

Section 29: S/2 NE/4; W/2 SE/4; E/2 SW/4; SW/4 SW/4
Section 30: SE/4 SE/4
Section 31: All

Less and Except:

1. A tract in Section 31: SW/4 SW/4, and also in T. 13 S., R. 10 E., Section 6: Lot 4, containing 6.496 acres, more or less, as described by metes and bounds; as conveyed to Carbon County by Quitclaim Deed dated September 18, 1990, and recorded in Book 300 at page 134 of the official records of Carbon County (Castle Gate Cemetery).

2. A tract in Section 31: SE/4 SW/4, containing 0.92 acres, more or less, as described by metes and bounds; as conveyed to PacifiCorp by Quitclaim Deed dated November 21, 1995, and recorded in Book 364 at page 756 of the official records of Carbon County.

Township 13 South, Range 10 East, SLM

Section 2: All
Section 4: Lots 1 and 2 (N/2 NE/4); S/2 NE/4; N/2 SE/4; SW/4 SE/4; S/2 SW/4
Section 5: All
Section 6: Lots 1, 2, 3, 4 (N/2 N/2); Lot 5 (SW/4 NW/4); S/2 NE/4; SE/4; SE/4 NW/4
Section 8: Lot 1 (NE/NE/4); SE/4 NE/4; NE/4 SE/4; S/2 S/2
Section 9: E/2; SW/4; N/2 NW/4; SE/4 NW/4

Section 10: SE/4; E/2 SW/4
Section 11: SW/4
Section 17: NE/4; N/2 NW/4
Section 18: N/2 NE/4

*** Subject to the surface rights only of AMAX Coal Company, as successor to Castle Gate Coal Company, under the Preparation Plant Facility Lease between Blackhawk Coal Company, Lessor, and Castle Gate Coal Company, Lessee, dated May 30, 1986, and affecting:**

Township 12 South, Range 9 East, SLM

Section 35: SE/4 NE/4; E/2 SE/4
Section 36: SW/4; SW/4 NE/4; NW/4 SE/4; SE/4 NW/4

Township 13 South, Range 9 East, SLM

Section 1: Lots 3 and 4 (N/2 NW/4) excluding Utah Power and Light Company coal stockpile.

Fee Coal - CWCC

Township 12 South, Range 9 East, SLM

Section 35: E/2 East of the Price River

Less and Except:
A tract in the NW/4 NE/4 containing 2.61 acres, more or less, described by metes and bounds; as conveyed to the City of Price, a body politic, by Warranty Deed dated December 19, 1960, and recorded in Book 70 at page 416 of the official records of Carbon County.

Section 36: SW/4 SW/4 east of Price River; E/2 NW/4; NW/4 NW/4; NW/4 SW/4; S/2 SW/4

Township 13 South, Range 9 East, SLM

Section 1: Lots 1 and 2 (N/2 NE/4); Lots 3 and 4 (N/2 NW/4) east of the Price River; SE/4 NE/4; E/2 SW/4 NE/4;

Less and Except:

1. **A tract in Lot 3 containing 1.02 acres, more or less, described by metes and bounds; as conveyed to The Utah Power and Light Company by Quitclaim Deed dated May 28, 1953, and recorded in Book 20 at page 492 of the official records of Carbon County;**

2. **A roadway 30 feet wide in the NW/4 described by metes and bounds; as conveyed to Castle Gate Town, a municipal corporation, by Quitclaim Deed dated September 26, 1969, and recorded in Book 122 at page 400 of the official records of Carbon County.**

Township 12 South, Range 10 East, SLM

Section 31: All

Township 13 South, Range 10 East, SLM

Section 2: All
Section 4: S/2 S/2
Section 5: Lots 1, 2, 3, and 4 (N/2 N/2)
Section 6: Lots 1, 2, 3, and 4 (N/2 N/2); Lot 5 (SW/4 NW/4); S/2 SE/4; SE/4 NW/4
Section 8: S/2 S/2
Section 9: E/2; SW/4; N/2 NW/4; SE/4 NW/4
Section 10: SE/4; E/2 SW/4
Section 11: SW/4
Section 17: NE/4; N/2 NW/4
Section 18: N/2 NE/4

CWCC Surface and Leased Coal

Federal Coal Leases:

1. **Federal Consolidated Coal Lease No. SL-048442-050115 dated November 2, 1930; covering the following lands:**

Township 13 South, Range 10 East, SLM

Section 1: SW/4
Section 3: S/2 N/2; S/2
Section 4: Lots 1, 2, 3, and 4 (N/2 N/2); S/2 N/2; N/2 S/2
Section 10: N/2; NW/4 SW/4
Section 11: E/2; NW/4

Less and Except:
A Partial Assignment dated September 17, 1991, effective May 1, 1992, to AMCA Coal Leasing, Inc., in:

Township 13 South, Range 10 East, SLM

Section 1: SW/4

2. Federal Modified Coal Lease No. SL-046652 dated December 1, 1962, effective August 3, 1921, as amended effective September 23, 1964, by a partial transfer to the State of Utah; covering the following lands:

Township 12 South, Range 10 East, SLM

Section 33: S/2
Section 34: S/2

Township 13 South, Range 10 East, SLM

Section 3: Lots 1, 2, 3, and 4 (N/2 N/2)
containing 802.36 acres, more or less

3. Federal Coal Lease No. U-0146345 dated November 1, 1965; covering the following lands:

Township 12 South, Range 10 East, SLM

Section 33: N/2
Section 34: NW/4 NE/4; S/2 NE/4; NW/4
Section 35: NE/4; S/2 NW/4; S/2
containing 1,160.00 acres, more or less

4. Federal Coal Lease No. U-0148779 dated August 1, 1966; covering the following lands:

Township 12 South, Range 10 East, SLM

Section 26: N/2; N/2 S/2; SE/4 SW/4; S/2 SE/4
Section 27: All
containing 1,240.00 acres, more or less

State Coal Leases:

1. **State of Utah Coal Lease No. ML-1892 dated June 5, 1947, as amended effective January 1, 1988; covering the following lands:**

Township 12 South, Range 9 East, SLM

Section 36: Lots 1 and 2 (E/2 NE/4); W/2 NE/4; SE/4; NE/4 SW/4; SW/4 NW/4
containing 389.84 acres, more or less

2. **State of Utah Modified Coal Lease No. SL-046652-ST dated December 1, 1962, effective August 3, 1921; as transferred from the United States of America to the State of Utah under the Dawson Act of April 22, 1954, (68 Stat 7) on April 7, 1965, effective September 23, 1964, (Patent No. 43-65-0072); as amended September 19, 1968; covering the following lands:**

Township 12 South, Range 10 East, SLM

Section 32: All
containing 640.00 acres, more or less

County Coal Lease:

1. **Carbon County, Utah, Consolidated Coal Lease dated April 22, 1985; covering the following lands:**

Township 12 South, Range 10 East, SLM

Section 28: NW/4 NW/4
Section 29: S/2 NE/4; W/2 SE/4; E/2 SW/4; SW/4 SW/4
Section 30: SE/4 SE/4

Township 13 South, Range 10 East, SLM

Section 5: S/2; S/2 N/2
Section 6: S/2 NE/4; N/2 SE/4
Section 8: Lot 1 (NE/4 NE/4); SE/4 NE/4; NE/4 SE/4
containing 1,119.97 acres, more or less

Fee Surface - AMAX Coal Company/AMAX Land Company

Crandall Canyon Facility Surface Area:

That part of the surface rights in the following described land located in Carbon County, Utah, conveyed by Franklin Real Estate Company to Blackhawk Coal Company by Quitclaim Deed dated November 3, 1981, of record in Record Book 219, pages 691-692, in the Office of the Recorder of Carbon County, Utah, to wit:

Township 12 South, Range 9 East, SLBM

Section 22: SW/4 SE/4; SE/4 SW/4 - excluding public highways and the D&RGW right-of-way
Section 27: S/2 NW/4; NE/4 NW/4; NW/4 SW/4 - excluding public highways and the D&RGW right-of-way
Section 28: S/2

Preparation Plant Facility Surface Area:

That part of the surface rights in the following described land located in Carbon County, Utah, conveyed by Franklin Real Estate Company to Blackhawk Company by Quitclaim Deed dated November 3, 1981, of record in Record Book 219, page 690 in the Office of the Recorder of Carbon County, Utah, to wit:

Township 12 South, Range 9 East, SLBM

Section 36: NE/4 SW/4; SW/4 NE/4; NW/4 SE/4

And, also, that part of the surface rights in the following described land located in Carbon County, Utah, conveyed by Franklin Real Estate Company to Blackhawk Coal Company by Warranty Deed dated November 3, 1981, of record in Record Book 215, pages 474-487, to wit:

Township 12 South, Range 9 East, SLBM

Section 35: SE/4 NE/4; E/2 SE/4
Section 36: SE/4 NW/4; W/2 SW/4; SE/4 SW/4

Township 13 South, Range 9 East, SLBM

Section 1: N/2 NW/4 - excluding Utah Power and Light coal stockpile

All of the Surface Rights described in Parts I, II, and III above, including without limitation, the "Preparation Plant Facility Area" and the "Crandall Canyon Facility Surface Area" are SUBJECT TO all liens, mortgages, encumbrances, covenants, restrictions, prior rights, claims, reservations, leases, royalties, easements, agreements and all matters legally existing, and all rights or claims of any kind affecting such property disclosed in those Warranty Deeds and Quitclaim Deeds forming a part of this Exhibit A, and in Chicago Title Insurance Company Commitment No. 1268, dated May 22, 1975, and in South Eastern Utah Title Company Preliminary Title Report No. 6408-C, dated May 15, 1975, and all exceptions set forth therein.

Fee Surface - Cyprus Western Coal Company:

Surface rights only in the following described lands located in Carbon County Utah conveyed by Warranty Deed dated June 29, 1994 from AMCA Coal Leasing Company, Grantor, to Cyprus Western Coal Company, Grantee, to wit:

Township 13 South, Range 10 East, SLM

Section 7: Lots 8, 9, 12, and 13
containing 160.54 acres, more or less

Note: The Warranty Deed was provided to the county for recordation on July 26, 1995.

Fee Coal - Cyprus Western Coal Company:

Coal rights only in the following described lands located in Carbon County, Utah conveyed by Warranty Deed dated June 29, 1994 from AMCA Coal Leasing Company, Grantor, to Cyprus Western Coal Company, Grantee, to wit:

Township 13 South, Range 10 East, SLM

Section 7: Lots 1, 2, 6-9, 12, and 13
Section 8: SW/4 NW/4; NW/4 SW/4
containing 401.77 acres, more or less

Note: The Warranty Deed was provided to the county for recordation on July 26, 1995.

Carbon County Coal - Cyprus Western Coal Company:

All those certain rights in the following described lands located in Carbon County, Utah and associated with Coal Mining Lease dated April 6, 1971 between Carbon County, a body corporate and politic of the State of Utah, Lessor, and AMCA Coal Leasing, Inc., Lessee; as extended by Notice of Extension of Coal Mining Lease dated December 28, 1992 from AMCA Coal Leasing, Inc., to the Carbon County Commission; and as assigned by Assignment and Assumption of Carbon County, Utah Coal Mining Lease dated effective June 29, 1994 from AMCA Coal Leasing, Inc., Assignor, to Cyprus Western Coal Company, Assignee, which assignment was consented to by the Carbon County Board of Commissioners by Consent to Assignment dated November 16, 1994, to wit:

Township 13 South, Range 10 East, SLM

Section 8: Lots 2 and 3; SW/4 NE/4, NW/4 SE/4; SE/4 NW/4; NE/4 SW/4 containing 239.74 acres, more or less.

ADDITIONAL LANDS TO BE AFFECTED BY MINING

This legal description is for the permit area of the Willow Creek Mine. The permittee is authorized to conduct underground coal mining activities and related surface activities on the foregoing described property subject to the conditions of all applicable conditions, laws and regulations.

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

Sec. 4 **PERMIT TERM** - This permit becomes effective on April 23, 1996 and expires on April 24, 2001.

Sec. 5 **ASSIGNMENT OF PERMIT RIGHTS** - The permit rights may not be transferred, assigned or sold without the approval of the Director, Division. Transfer, assignment or sale of permit rights must be done in accordance with applicable regulations, including but not limited to 30 CFR 740.13{e} and R645-303-300.

Sec. 6 **RIGHT OF ENTRY** - The permittee shall allow the authorized representative of the Division, including but not limited to inspectors, and representatives of the Office of Surface Mining Reclamation and Enforcement (OSM), without advance notice or a search warrant, upon presentation of appropriate credentials, and without delay to:

(a) have the rights of entry provided for in 30 CFR 840.12, R645-400-220, 30 CFR 842.13 and R645-400-110;

(b) be accompanied by private persons for the purpose of conducting an inspection in accordance with R645-400-100 and R645-400-200 when the inspection is in response to an alleged violation reported to the Division by the private person.

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

Sec. 8 **ENVIRONMENTAL IMPACTS** - The permittee shall take all possible steps to minimize any adverse impact to the environment or public health and safety resulting from noncompliance with any term or condition of the permit, including, but not limited to:

(a) Any accelerated or additional monitoring necessary to determine the nature and extent of noncompliance and the results of the noncompliance;

(b) immediate implementation of measures necessary to comply; and

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

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

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

(a) in accordance with the terms of the permit to prevent significant, imminent environmental harm to the health and safety of the public; and

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

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

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

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

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

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

Sec. 16 CULTURAL RESOURCES - If during the course of mining operations, previously unidentified cultural resources are discovered, the permittee shall ensure that the site(s) is not disturbed and shall notify the Division. The Division, after coordination with OSM, shall inform the permittee of necessary actions required. The permittee shall implement the mitigation measures required by Division within the time frame specified by Division.

Sec. 17 APPEALS - The permittee shall have the right to appeal as provided for under R645-300-200.

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

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

THE STATE OF UTAH

By: _____

Date: April 23, 1996

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

_____
Authorized Representative of the Permittee

Date: _____

Attachment A

SPECIAL CONDITIONS

1. Cyprus Plateau Mining Corporation (CPMC) is not authorized to conduct mining operations within the permit area on lands under federal jurisdiction until receiving the federal coal leases and obtaining federal mine approval.

2. Features 5, 10, 20, 61, and 65 of Cultural Resource Site 42 Cb 1000 must not be disturbed until the applicant has completed mitigation required by the Division of State History and until the Division and State History have accepted the results.

3. CPMC must amend the Mining and Reclamation Plan (MRP) within 14 days of receiving the 1996 Order-I soil survey laboratory data; both Section 3.1 SOILS INFORMATION and Exhibit 5 SOILS INFORMATION, must be amended with the 1996 Order -I soil survey data-resource discussion and chemical and physical analyses results, respectively. If analysis results indicate any departure from acceptance criteria as outlined in the Division Topsoil/Overburden Guidelines, CPMC must immediately cease soil salvage operations, consult Division for development and implementation of appropriate operation and remediation plans, and correct and update the MRP.

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

Willow Creek Mine

Analysis and Findings

April 22, 1996

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ADMINISTRATIVE FINDINGS

IDENTIFICATION OF INTERESTS, VIOLATION INFORMATION, AND RIGHT OF ENTRY INFORMATION

Regulatory Reference: UCA R645-301-112; R645-301-113; R645-301-114

Analysis:

Identification of Interests

Cyprus Plateau Mining Corporation (hereafter referred to as "Cyprus") submitted this mining and reclamation permit application. Cyprus is a wholly-owned subsidiary of, in ascending order, Cyprus Western Coal Company, Cyprus Amax Coal Holding Company, Cyprus AMAX Coal Company, Amax Energy, Inc., and Cyprus Amax Minerals Company. Cyprus, as the Applicant, is authorized to do business in Utah. All of the corporations were incorporated under the laws of the State of Delaware.

The application shows the Applicant's address, telephone number, and employer identification number. Cyprus will be responsible for payment of the abandoned mine land reclamation fees. The resident agent is CT Corporation System of Salt Lake City, Utah. The main MSHA number will be 42-02113; some facilities will have separate MSHA numbers.

Figure 2.1-1 is an organizational chart for Cyprus Amax Minerals Company. Exhibit 1 contains lists of operations affiliated with the Applicant and with G. R. Spindler, an officer or director of Cyprus and companies that own or control Cyprus. The information in this section of the application is complete.

Table 2.1-1 is a summary of corporate information and shows addresses, telephone numbers, and employer identification numbers for Cyprus Amax Minerals Company, Amax Energy Company, Cyprus AMAX Coal Company, Cyprus Amax Coal Holding Company, Cyprus Western Coal Company, and Cyprus Plateau Mining Corporation. This table also shows the names, most social security numbers, titles, and dates positions were assumed for the officers and directors of these companies.

Surface and mineral ownership information is presented in Section 2.1.2.4 and on Maps 1 and 2. The surface of the disturbed area at the proposed mine site is owned by Cyprus, and the surface of the preparation plant, Gravel Canyon, and Crandall Canyon is owned by Blackhawk Coal Company and leased to AMAX Coal Company. Cyprus will manage the lands for mining use under operating agreements with Cyprus Western Coal Company and AMAX Coal Company.

According to Map 1 and the text, Harry C. and Alda M. Edwards own land contiguous to the proposed permit area, but the application does not include their address. It says the address is not in Carbon County records. It should be provided if it becomes available.

The list of surface and mineral owners in Section 2.1.2.4 indicates Carbon County owns surface land both within and contiguous to the proposed permit area. The area contiguous to the proposed permit area is apparently in the southwest quarter of Section 6, Township 13 South, Range 10 East. In the most recent version of this map, there is no ownership symbol in this piece of land.

Map 2 shows regional coal ownership. The text has a list of legal and equitable owners of record of the coal to be mined within the proposed permit area. These are Cyprus Western Coal Company, Blackhawk Coal Company, Carbon County, the Bureau of Land Management, and the Utah Department of Natural Resources Division of State Lands and Forestry. Owners of coal rights contiguous to the proposed permit area are the Bureau of Land Management, Blackhawk Coal Company, Carbon County, the State of Utah, PacifiCorp, Dennis Bettino et al., Mathis Land, Inc., and Harry and Alda Edwards.

Violation Information

Compliance information is presented in Section 2.1.4 and Exhibit 2. Neither the Applicant nor any affiliate, subsidiary or persons controlled by or under common control with the Applicant has had a federal or state mining permit suspended or revoked in the five years prior to the date of the application, and these entities have not forfeited a mining bond or similar security deposited in lieu of bond.

R645-301-113.300 requires a list of all unabated cessation orders and air and water quality violation notices received by the Applicant or any operation owned or controlled by either the Applicant or any person that owns or controls the Applicant. The status of some violation notices in Exhibit 2 is listed as "pending." It is believed that the various operations are working within required schedules to complete abatement of any outstanding enforcement action.

Right of Entry

Cyprus's application says right of entry for surface lands and coal extraction is based on operating agreements with Cyprus Western Coal Company and AMAX Coal Company. AMAX Coal Company holds leases for the Castle Gate Preparation Plant, Gravel Canyon, and Crandall Canyon areas from Blackhawk Coal Company. In addition, Cyprus Western Coal Company has purchased surface entry and coal extraction rights for mining areas and the Willow Creek surface facilities area from Blackhawk under the terms of a sales agreement dated December 14, 1995.

Section 2.1.5.1 has legal descriptions for fee surface and coal and for coal leases held by Cyprus Western Coal Company.

The description of Federal Consolidated Lease SL-048442-050115 includes an exception for a partial assignment to Amca Coal Leasing. The exception is for the SW¼ of Section 1, Township 13 South, Range 10 East. Since Amca Coal Leasing has acquired rights to mine all coal seams in this area, the partial assignment is interpreted to mean that a portion of the lease was assigned to them. This parcel is outside the proposed permit area.

Right of entry information is considered complete and accurate with one exception. Cyprus has applied with the Bureau of Land Management for leases in the northern part of the proposed permit area. Right of entry for these areas is contingent on approvals which the application says are anticipated in the first quarter of 1996. The Division cannot allow mining in these areas without right of entry information. The Division will need to require Cyprus to restrict mining to those areas for which Cyprus has right of entry.

For all other parts of the permit area, Cyprus presents information describing the specific lands where they claim right of entry. The application also describes the documents granting the rights to enter and begin mining and reclamation operations.

There are also a few anomalies in the legal descriptions that Cyprus should correct. Under the heading "Fee Surface - CWCC," the application gives a description for portions of Township 13 South, Range 9 East, Section 1. The first exception under this description indicates Cyprus does not have right of entry for a portion of the NE/4 SW/4. The NE/4 SW/4 is not within the portion of Section 1 described.

The same section of the application mentions an exception for the Castle Gate Cemetery. The exceptions would be better listed following descriptions of the sections in both Township 12 South, Range 10 East, and Township 13 South, Range 10 East.

Not all land described in the application is within the proposed permit area. Some of it is in the Castle Gate permit area. The reason for including these descriptions in this application is unknown.

Findings:

The application is complete and accurate. However, the following stipulation must be met:

1. **Stipulation:** There are two proposed federal leases in the northern part of the proposed permit area. Cyprus states in the application that they are in the process of obtaining rights to mine these leases, but, until they obtain the right to enter and begin mining and reclamation operations, the Division cannot approve mining in these areas.

UNSUITABILITY CLAIMS

Regulatory Reference: UCA R645-301-115

Analysis:

To the best of the Applicant's knowledge, the permit area is not within and does not include any area designated or under current study for designation as unsuitable for mining. No operations are proposed within 300 feet of an occupied dwelling, but portions of the mine surface

facilities would be within 100 feet of a public road. The application says this road is State Highway 191, but it is a U. S. Highway.

In compliance with R645-103-234.100 through 400, Cyprus has obtained approval from the Utah Department of Transportation for an encroachment on the highway. On May 11, 1995, a public hearing was held in the Carbon County Courthouse concerning the operations within 100 feet of the public road. The application includes a copy of a letter requesting that the Division hold a public hearing and a copy of the Division's notice. The hearing was attended by Lowell Braxton of the Division who documented it in a Division memorandum. No comments were made concerning conduct of mining within 100 feet of Highway 191. Based on appropriate notice and lack of adverse public comment, the Division found on July 6, 1995, that the interests of the public and affected landowners will be protected from the mining activities proposed for within 100 feet of the highway right-of-way.

The Division is unaware of any designation of the area as unsuitable for mining.

Findings:

This portion of the application is complete and accurate.

PERMIT TERM, INSURANCE, PROOF OF PUBLICATION, FACILITIES OR STRUCTURES USED IN COMMON, FILING FEE, NOTARIZED SIGNATURE

Regulatory Reference: UCA R645-301-116; R645-301-117; R645-301-118; R645-301-123

Analysis:

Permit Term

The application is for an initial permit term of five years beginning from the date of permit approval and issuance. It says Cyprus has submitted complete information for the entire anticipated life of the Willow Creek Mine to support future permit renewals.

In meetings with the Division, Cyprus and its consultant's personnel have indicated that, depending on market and mining conditions, they intend to eventually reopen the Crandall Canyon shafts and mine in this area. Although the plans are tentative, the blanket statement that this application is for the entire anticipated life of the mine is not entirely correct. It would be more accurate to qualify this statement with a comment that Cyprus may seek to add additional areas to the permit area in the future.

Insurance

A copy of the certificate of insurance is in Exhibit 12 and in the Division's files. The policy number is GL1212703. The company affording coverage is the National Union Fire Insurance Company of Pittsburgh PA, and the policy expires July 1, 1996.

American Electric Power Company ("AEP") has also submitted an insurance policy for the area which they formerly permitted, the Willow Creek Mine, INA/007/002. The policy is retroactive to July 1, 1990, and expires July 1, 1996. Companies affording coverage are the United State Fire Insurance Company and Energy Insurance (Bermuda) Ltd. The policy includes general aggregate coverage for $1,000,000 and $250,000 for each occurrence. This policy does not meet requirements for a coal mining and reclamation operation, but AEP is not proposing any operations.

Proof of Publication

A copy of the proof of publication has been included for insertion in Exhibit 3. The legal description in the advertisement is correct, and it includes other information required by R645-300-121.100.

Facilities or Structures Used in Common

Cyprus plans to use the Castle Gate Preparation Plant, associated loadout, and may use the Crandall and Gravel Canyon areas to meet potential ventilation and reclamation needs. These areas are included in the approved Castle Gate mining and reclamation plan. Plans for these facilities are included in the Willow Creek application. The application says that, during an interim period following review and approval of the Willow Creek application and during development of the Willow Creek Mine, the shared facilities may be included in and bonded under both the Willow Creek and Castle Gate permits. Cyprus anticipates that a permit revision will be submitted to eliminate the shared facilities from the Castle Gate permit.

These commitments satisfy the requirements of R645-301-117.300.

Filing Fee

The Division has on file a copy of the check paid for the filing fee.

Notarized Signature

The application says the required notarized signature of a responsible Cyprus official that the information in the application is true and correct to the best of the official's information and belief was included in the transmittal which accompanied the permit application submittal. The required statement was included with the transmittal letter and is in the application before the table of contents.

ADMINISTRATIVE FINDINGS

Findings:

These sections of the application are complete and accurate.

TECHNICAL ANALYSIS

INTRODUCTION

The Division has conducted a thorough review of the Willow Creek permit application plan (PAP). The first round of the review was completed in November 1995 and resulted in a list of plan deficiencies. These deficiencies were responded to by Cyprus Plateau Mining Company (Cyprus) in February 1996. This Technical Analysis (TA) provides information derived from the Division's review of the February 1996 submittal, and resulted in a finding of technical inadequacy. No permit will be issued at this time because of the outstanding technical deficiencies listed below. Cyprus may submit information that properly answers these deficiencies to complete the application process.

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

Often the first technical review of an application finds that the application contains some deficiencies. The deficiencies are discussed in the body of the TA and are identified by a regulatory reference which describes the minimum requirements. In this Technical Analysis we have summarized the deficiencies at the beginning of the document to aid you in responding to them. Once all of the deficiencies have been adequately addressed, the TA will be made final.

Some sections of the PAP are currently approved under the Castle Gate Mine permit. These sections were thoroughly reviewed when they were approved under that permit and the technical analysis is included within the Castle Gate Mine TA.

SUMMARY OF PERMIT STIPULATIONS

The following are stipulations to the Willow Creek permit.

1. There are two proposed federal leases in the northern part of the proposed permit area. Cyprus states in the application that they are in the process of obtaining rights to mine these leases, but, until they obtain the right to enter and begin mining and reclamation operations, the Division cannot approve mining in these areas.

2. Features 5, 10, 20, 61, and 65 of cultural resource site 42Cb 1000 must not be disturbed until the Applicant has completed mitigation required by the Division of State History, and until the Division and State History have accepted the results.

3. CPMC will amend the MRP, both section 3.1 SOILS INFORMATION and Exhibit 5 SOILS INFORMATION, with the chemical and physical analysis results from the 1996 Order-I soil survey.

ENVIRONMENTAL RESOURCE INFORMATION

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

GENERAL

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

Analysis:

The Permit Application Package (PAP) uses text along with maps, cross sections, and plans to describe the lands in the proposed permit area and adjacent areas that may be affected or impacted by the proposed coal mining and reclamation operations; the existing or premining land uses; the baseline ground and surface water resources; and the geologic and climatological information.

Rugged terrain; low precipitation and seasonally harsh weather conditions; thin, marginal soils; limited vegetative cover; restricted water resources; and significant reserves of high quality coal have determined land use in the permit and adjacent areas. Underground coal mining and related activities, the railroad in Price Canyon, PacifiCorp's Carbon Generating Station at the mouth of Willow Creek, scattered oil and gas production, and limited timber harvesting are historic and current commercial uses of land in the permit and adjacent areas. Highways and utilities follow Willow Creek and Price Canyons through the rugged terrain. Undeveloped lands are used for low-intensity grazing, wildlife habitat, and dispersed recreation such as hunting, fishing, and hiking.

The Castle Gate (Willow Creek) cemetery is located within the permit area. There are abandoned townsite but no occupied residential land in the permit area. The nearest residences are in Helper and the adjacent community of Martin, located approximately two miles down Price Canyon from the Carbon Generating Station.

Regional and premining land-use information in Section 3.4, Exhibit 8, and on Maps 9, 10, and 11 includes: land use capability and condition; locations of structures and facilities and surface disturbances from previous mining activities; location and extent of underground workings; existing land uses; land use designations, classifications and zoning restrictions; land use constraints due to environmental factors; and locations of the Castle Gate cemetery and other identified cultural, historic, and paleontological resources.

Section 4.5 contains information on the affected areas and timing of disturbance for the Castle Gate preparation plant, Schoolhouse Canyon refuse disposal area, Castle Gate loadout area, Gravel Canyon soil stockpile area, Crandall Canyon shaft area, and Willow Creek Mine surface facilities. Information on Maps 1, 2, 9, and 18 includes surface and mineral ownership; right of entry; and previous mining and related disturbances.

Existing configuration, conditions, structures, and surface and subsurface facilities are shown on Maps 11, 18A, and 18B and Exhibit 20. The pipes carrying water through the

proposed permit area from the Price water treatment plant to Price are shown on Maps 18A and 18B. Map 11 shows both existing and projected surface facilities, contours, etc. on one map to highlight potential conflicts between existing resources and proposed disturbance. Map 18A shows the Mine Surface Facilities - Premining Configuration and Map 18B shows the Mine Surface Facilities - Proposed Configuration and Facilities.

The baseline hydrologic monitoring plan is in Exhibit 12. Baseline data collected to date (05/02/95) and a description of the hydrogeology of the area are in Section 3.7 of the PAP.

Findings:

The Permit Application Package contains descriptions, or refers to locations where the descriptions may be found, of the existing premining environmental resources within the proposed permit area and adjacent areas that may be affected or impacted by the proposed coal mining operation.

HISTORIC AND ARCHEOLOGICAL RESOURCE INFORMATION

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

Analysis:

Section 3.4.3 contains limited cultural and historic resource information. Abbreviated and full reports about cultural resources in the area are in Volume 15 and are considered confidential. Map 11, also in the confidential file, shows facilities area cultural resources.

Three cultural resource areas were previously identified, and these were reclaimed as part of the Abandoned Mines Reclamation Program work in the area in 1990. Three additional sites were located as part of the work done for the Willow Creek Mine. Site 42Cb1027 is in Castle Canyon and consists of a series of six historic features. It was not considered eligible for listing in the National Register of Historic Places. Site 42Cb1001 is a series of three pictograph panels. Site 42Cb1000 includes 65 features associated with the Castle Gate Mines and the Castle Gate townsite. Both of these latter sites were considered potentially eligible for listing in the National Register of Historic Places.

Four new paleontological sites were found, each consisting of one or more trace fossils. These were not considered unique or unusual. However, the consultant recommended that any unusual fossil remains, especially fossil bone materials, encountered during mining be evaluated if possible.

The application also includes a cultural resources survey for a turn lane on the highway. The Applicant no longer intends to build the turn lane.

Following the field investigations, site listing forms were prepared and submitted to the State Historic Preservation Office (SHPO). The Applicant met with the SHPO to review cultural resource considerations and potential mitigation requirements. The application says the results of

this meeting and subsequent discussions were incorporated in the mining and reclamation planning process in order to minimize or mitigate potential mining related impact.

Exhibit 8 contains a letter from the Division of State History dated October 24, 1995. It says the background information material is accurate and well done and that their office concurs with the accuracy of the material. It also says a determination of no adverse effect can be reached if sensitive treatment of the mine property is considered during the opening of the mine and that the Castle Gate explosion would be a focus of their concern. This was confirmed in a telephone conversation with Mr. James Dykman. He said the areas about which State History is most concerned are the Castle Gate Cemetery and the Castle Gate No. 2 Mine portal.

Most potential effects are being avoided simply by not proposing disturbance in critical areas. The mine portal and cemetery would not be disturbed under the current proposal. In addition, the Applicant commits in Section 4.5.2.1 to mitigate any known significant cultural or historic resource sites prior to site disturbance.

On April 17 and 22, 1996, the Division received correspondence from State History concerning the various sites that might be affected by the mine. They concurred that there would be no effect for sites 42Cb 1001 and 1027. Site 42Cb 1027 is not significant, and 42Cb 1001 would not be disturbed.

Site 42Cb1001 is within the proposed disturbed area, and the closest proposed disturbance is the conveyor and a steep cut adjacent to the conveyor. It appears the cut slope forms about a 20-foot difference in elevation between the conveyor and the site. For this reason, there would probably be no damage to the pictographs from coal fines originating on the conveyor. It is important that the site not be disturbed without specific consent from the Division and State History.

Several features associated with site 42Cb 1000 would be affected by the proposed mine. Five important features of this site would be affected, but the effects would be mitigated in accordance with a plan submitted to the Division and State History.

Until the data recovery discussed in State History's April 22, 1996, letter is completed and the Division and State History have reviewed and accepted the results, the sites must not be disturbed.

Findings:

This portion of the application is considered complete and accurate. The Division should make the following stipulations:

1. **Stipulation:** Features 5, 10, 20, 61, and 65 of cultural resource site 42Cb 1000 must not be disturbed until the Applicant has completed mitigation required by the Division of State History, and until the Division and State History have accepted the results.

CLIMATOLOGICAL RESOURCE INFORMATION

Regulatory Reference: 30 CFR Sec. 783.18; R645-301-724.

Analysis:

Climatological information is found in Sections 3.7.1.4, and 3.7.4. Information specific to temperatures, precipitation and wind is located in Sections 3.7.4.1, 3.7.4.2, and 3.7.4.3, respectively. More climatological information is found on Page 3.7-28, Section 3.7.3.1. Table 3.7-7 is the summary of climatological data.

Average monthly temperatures are listed in Table 3.7-7. The frost free period ranges from 60 to 120 days, depending on elevation and exposure. Temperatures can change rapidly when fast moving storm fronts pass. Annual precipitation is 14.8 inches. Rainfall frequently comes in brief, high-intensity storms. Average monthly precipitation is lowest in June, 0.65-inches, and highest in September, 1.86-inches.

Table EXDS-5 and Table 3.7-13 provide return periods for short duration storms at three stations near the permit area. The final duration-frequency values for the permit area were derived by taking the simple mean of the three stations with record.

Prevailing summer wind are from the West and Northwest, usually blowing less than 20 mile per hour. Winter wind tend to be more variable, blowing frequently from the Northeast. Diurnal flow tend to be upslope in the daytime and downslope at night.

Findings:

Cyprus has included sufficient climatological information to make the necessary determinations about hydrologic designs and air quality.

VEGETATION RESOURCE INFORMATION

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

Analysis:

Section 3-2 contains the results of vegetation surveys done for the proposed Willow Creek Mine. The application says three plant community types were surveyed for this study: 1) Disturbed Plant Community; 2) Reclaimed Plant Community; and 3) Riparian Plant Community. This classification is also mentioned in Section 3.2.2.2. This is inconsistent with information provided later in the application which shows previously undisturbed, non-riparian areas that would be disturbed. In addition, under the heading "Vegetation Mapping," the application says data for the water tank and fan area disturbances will be collected in 1995. This data has been collected and the commitment is no longer appropriate.

The application gives general summaries of vegetation information for vegetation types found in the proposed permit area. This information is from a 1981 study by Mariah Associates. According to their classification, there were six vegetation types within the proposed permit area.

In this section under the heading "Mixed Brush Vegetation Type," the application says more "xeric" sites frequently support wolfberry and other species. In this sentence, "xeric" should probably be "mesic."

In Section 3.2.2.3, the application indicates only generalized summaries of the original Mariah Associates data could be found. The Division's files contain complete copies of raw data for the Mariah Associates report.

Vegetation sampling was done in 1994 for disturbed, reclaimed, and riparian areas. Sampling was done in 1995 for the reclaimed Royal Refuse Pile, areas not previously disturbed by mining, and for the pinyon-juniper reference area. 1994 had below average precipitation, but precipitation in 1995 was much above average with an unusually wet spring.

Total vegetation cover in the disturbed plant community was 26.72%. Ground cover, including vegetation cover and litter, was 46.92%. Dominant plants included Indian ricegrass, downy brome, Salina wild rye, and rubber rabbitbrush. Relative cover by species commonly classified as weeds was 15.4%. Production was estimated at 472 pounds of air dry forage per acre based on 22 transects.

The Reclaimed Plant Community had 28.73% vegetation cover and 48.13% ground cover. Dominant species included pubescent wheatgrass, western wheatgrass, kochia, yellow sweet clover, prostrate summer cyprus, rubber rabbitbrush, and fourwing saltbush. Relative cover from plants usually classified as weeds was 19.2%. Production was estimated at 926 pounds per acre. Fifty transects were sampled for cover. The application indicates a maximum sample size was used, but the regulations do not have a maximum sample size. For final bond release, this would be important, but for initial information, the application contains the data the Division needs.

The Royal Refuse Pile was sampled as a site similar to reclaimed areas at Willow Creek. Total plant cover averaged 31.0%. Fourwing saltbush was the dominant plant in this area comprising 45% of the relative cover. Crested wheatgrass was next at 30% followed by downy brome at 12% and rubber rabbitbrush at 6%. Seven samples were taken in this area, and the minimum sample size was calculated at 5.5 samples. While this is adequate for initial vegetation information, it is not adequate for a baseline revegetation success standard since the "Vegetation Information Guidelines" Appendix B, referenced in the regulations, requires a minimum of 15 samples for the sampling method used. Production was estimated at 926 pounds per acre based on 50 samples. The minimum sample size should have been 66 samples. As with production information for the reclaimed plant community, this suffices for initial information but would not be adequate as a final bond release success standard.

About six acres of undisturbed native vegetation would be affected by the mine. The application says comparison of disturbance area and vegetation mapping and field evaluation of

the areas of native vegetation to be disturbed resulted in a determination that all of the new disturbance corresponds to the pinyon-juniper community.

The pinyon-juniper reference area is located near the mouth of Eagle Canyon and is shown on Map 5. The reference area boundaries have been marked in the field with steel fence posts. Total plant cover averaged 20.08%. Salina wild rye comprised 67% of the total cover followed by basin big sage. Fourteen cover transects were sampled.

Woody plant density in the reference area was 1482 per acre. Basin big sagebrush, broom snakeweed, and fourwing saltbush were the most common woody plants. Forage production was estimated at between 450 and 600 pounds per acre for 1994 and 1995.

Range condition of the reference area was judged as being fair according to methods used by the Natural Resources Conservation Service. It received an ecological rating of 38. The corresponding range site is the Upland Very Steep Shallow Loam (Pinyon-Juniper) ecological site.

The undisturbed area that compares to the pinyon-juniper reference area had 22.33% cover, and a t-test indicates this is not significantly different than the reference area. There was also no significant difference in woody plant density.

Sampling methods used for the riparian area were different from those used for the other areas. These methods allow the percentage to be greater than 100%. Four layers of the canopy were measured separately. The total cover from these layers was 70.43%. Nearly half of this total was from coyote willow and redtop. Other important species included Fremont cottonwood, narrowleaf cottonwood, and yellow sweet clover.

For the requirements of R645-301-321, the application's vegetation information is considered adequate. However, the Applicant is proposing to use some of the baseline information as a revegetation success standard. As discussed under "Revegetation," the information is not adequate for this purpose with the exception of the vegetation data for the riparian area.

Findings:

The baseline vegetation information meets the requirements of R645-301-321.

FISH AND WILDLIFE RESOURCE INFORMATION

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

Analysis:

Fish and Wildlife

About 312 species of vertebrate wildlife could exist within the proposed permit area. Of these, 60 are known to live in the area, 23 are likely inhabitants, 95 could occur in the area but may be just transients, and 134 are unlikely to be in the permit area based on known range or habitat preference.

Three amphibian species are considered potential residents of the mine plan area. Of these, the tiger salamander is the only species classified as having high interest to the State.

Three species of reptiles are known, based on observations, to exist in the proposed permit area, but eleven species are considered potential inhabitants. Two high interest species may be in the proposed permit area, the milk snake and the collared lizard. The application discusses habitat where these species are normally found.

Site reconnaissance surveys in 1994 found 40 bird species although 104 species are considered potential inhabitants of the proposed permit area. Several raptor species are known or believed to nest in the area, and raptor surveys have been done in various parts of the proposed permit area intermittently since 1979. Map 7 shows known nest sites. At least six golden eagle nests are within one-half mile of the proposed surface facilities. Future verification of nesting activity will occur prior to construction in 1996/1997, and appropriate mitigation measures will be implemented in consultation with the Division and Wildlife Resources.

The application discusses habitat requirements for thirteen other bird species. The reasons for singling out some of these species is unknown. Some of the thirteen are not known to occur in the West Tavaputs Plateau and are unlikely to inhabit the mine plan area.

In Section 4.3.3.4, the application says that where full extraction mining is conducted beneath exposed cliff faces or potential habitat for tree-nesting raptors, field reconnaissance will be completed for mining areas at least two years prior to mining to evaluate the presence of any sensitive species such as canyon sweetvetch, golden eagle nests, or goshawk nests. If sensitive species are found in areas having the potential for significant subsidence-related impacts, a mitigation plan will be formulated in consultation with appropriate State and federal agencies. The plans may include leaving buffer zones of coal, obtaining take permits for golden eagle nests, or other plans.

It is extremely unlikely subsidence would affect canyon sweetvetch. This species does not normally grow on cliffs such as could potentially fail during subsidence. Even in the unlikely event there were subsidence cracks in the area of some plants, they would probably not be damaged.

In other areas eagle nests have been lost as a result of subsidence, and the plans to check potential habitat for nesting activity in advance of mining are appropriate. Where the application only gives the examples of golden eagles, goshawks and canyon sweetvetch, it is assumed there will be checks for other cliff- and tree-dwelling species.

The application uses the term "sensitive species" in referring to canyon sweetvetch and golden eagles. This term is used by the Bureau of Land Management and Forest Service to refer to specific groups of uncommon species, often candidate threatened or endangered species. Canyon sweetvetch is actually on the list for these agencies, but golden eagles are not. The Applicant should consider using a different term.

Fifty mammal species are classified as potential residents of the proposed permit area. Of these, ten have been observed in the area. Seventeen species of high interest to the State are known, likely, or possible residents of the area.

According to the application, nearly all of the proposed permit area contains critical elk winter range. Most of the proposed permit area also has either high priority or critical deer winter range. Several other mammal species are known or suspected to inhabit the area, but the application does not show important habitat for these species.

The Division of Wildlife Resources considers the proposed surface facilities area to be marginal critical deer winter range. The area may not produce as much forage as adjacent undisturbed areas, but because of the terrain, water availability, and other factors, deer tend to congregate there. Correspondence from Wildlife Resources indicates the habitat would be of better quality if the area was properly reclaimed.

Fish surveys were conducted in Willow Creek in October 1994 and June 1995. Willow Creek is considered a class 4 fishery with low recreational fishing potential. The application says the portion of Willow Creek in the proposed mine area has poor spawning habitat and that this section of the stream is used more as a migration route for spawning fish. The only game species found in the electroshocking surveys was rainbow trout.

The Price River has a greater diversity of fish, but it is still considered a class 4 fishery. Most game fish found in a 1987 electroshocking study in Helper in 1987 were rainbow trout, but there were some cutthroat and brown trout,

Non-game fish species in Willow Creek are speckled dace and mountain sucker. Section 3.3.3.1 and Table 3.3-2 show results from 1994 and 1995 surveys including numbers of each species found. Wildlife Resources has collected nine species of fish from the Price River downstream of its confluence with Willow Creek.

Tables 3.3-3 through 3.3-9 have results of October 1994 macroinvertebrate sampling in Willow Creek. According to the application both the numbers of individuals and the numbers of taxa found at each sampling site were considered relatively low. Diversity values ranged from 1.15 to 1.66 at lower sites and 1.78 to 2.31 at upper sites. The application says values less than two are considered to indicate a possible stressed macroinvertebrate community.

Threatened and Endangered Species

The application describes the Applicant's and others' efforts to locate threatened, endangered, and candidate species. In 1989, the AMR program requested information about what species could be affected by their project in the area of the proposed mine, and they were given a list of six listed and three candidate species. The application says Cedar Creek Associates will request from the Fish and Wildlife Service an updated list of species potentially occurring the proposed permit area. This list has not been submitted.

The application says, based on current listings and information from Wildlife Resources, there is potential for thirteen candidate and five listed terrestrial wildlife species to occur in the proposed permit area. Of the five listed species, only two, the peregrine falcon and bald eagle, have much likelihood of being the area. No peregrine falcon nests or resident falcons are known to exist in the vicinity of the proposed permit area.

Bald eagle critical wintering areas exist a few miles southwest of the proposed permit area, but there are no known high priority concentration areas or critical roost trees actually in the area. The application says in Section 3.3.2.2 there is minimal potential for incidental use of the permit area by bald eagles and peregrines falcons. Wildlife Resources commented that there would be much greater potential for bald eagle roosting sites if Willow Creek supported a healthy riparian area with large cottonwood trees.

There is potential habitat for two candidate fish species in Willow Creek. These are the roundtail chub and the leatherside chub. The application says these species occurred historically in the Price River and its tributaries, but neither has been observed recently in Willow Creek. However, leatherside chub has been collected recently in the Price River upstream of the Willow Creek confluence.

Six other listed or candidate species could potentially occur in the Price River below the confluence with Willow Creek, but most of these live primarily in the Green River.

Threatened, endangered, and sensitive plant species are discussed in Section 3.2.3. In 1989 correspondence with AMR, the Fish and Wildlife Service mentioned two sensitive plant species that could occur in the area. These are canyon sweetvetch (*Hedysarum occidentale* var. *canone*) and Creutzfeldt catseye (*Cryptantha creutzfeldtii*). Neither species was found by AMR biologists.

The Applicant spent several days in August 1994 looking for canyon sweetvetch, but no plants were found in the project area. Two populations were found in the mouth of Cordingly Canyon about one-half mile south of the proposed permit area. The application says it is possible that additional plants occur in the proposed permit area but not in areas currently proposed for disturbance.

According to the *Utah Endangered, Threatened and Sensitive Plant Field Guide*, Creutzfeldt catseye grows in shadscale and mat atriplex communities on the Mancos Shale Formation between 5250 and 6495 feet elevation. Portions of the proposed disturbed area are

barely within this elevational range; however, the area does not have the right kind of habitat for this species. Also, Bob Thompson of the U. S. Forest Service said he has seen no plants even in what he considers potential habitat in the Helper area. He has searched and found no plants west of Price.

The Division needs to request a list of potentially-affected species from the Fish and Wildlife Service. The Office of Surface Mining, Reclamation and Enforcement will need to consult with the Fish and Wildlife Service about any species of concern.

Findings:

This portion of the application is considered complete and accurate. However, the application says in Section 3.3.4.2 that Cedar Creek Associates will request from the Fish and Wildlife Service an updated listing of threatened, endangered, or candidate species potentially occurring within the proposed permit area. This list could not be found within the application and should be submitted if it is available.

Although the Applicant has committed to obtain a list of threatened, endangered, and candidate species from the Fish and Wildlife Service, the Division should do the same. Based on recent conversations with the Fish and Wildlife Service, the only list they may provide is of species that may occur within the county. It is believed the Applicant and the Division have considered all species with potential habitat in the area or that could be affected by the operation. The only effects the Division believes could occur are with threatened and endangered fish of the Upper Colorado River as discussed under "Fish and Wildlife Protection."

SOILS RESOURCE INFORMATION

Regulatory Reference: 30 CFR Sec. 783.21, 817.200(c); R645-301-411, -301-233.

Analysis:

Section 3.1, SOILS INFORMATION, discusses in detail the existing types and characteristics of soil, refuse and roof/floor materials. The information is collected and condensed from various published resources, Castle Gate Mine area operation records and current soil surveys. Adequate soil survey information is provided for those portions of the Willow Creek Mine permit area to be affected by surface operations.

Regional soils conservation information is taken from a Order-III soil survey, Soil Survey of Carbon Area, Utah, published by the Soil Conservation Service, United States Department of Agriculture (USDA-SCS) in June 1988. In addition to the published soil conservation data, soils information from previous sampling programs in the immediate Willow Creek and extended Castle Gate areas is extracted and reviewed from past mining activity. These include 1979 Soil Investigations (Price River Coal Co.), 1981 Soil Investigations for Crandall Canyon (Price River Coal Co.), 1988 Soil Sampling and Characterization (Blackhawk Coal Co.), 1989 Soil Sampling (Blackhawk Coal Co.), 1990 Soil Sampling (Castle Gate Coal Co.) and 1991 Soils Mapping (Castle Gate Coal Co.). The 1979

soil investigations include complete soil profile descriptions for 10 soil pits excavated in Crandall Canyon, Willow Creek and Castle Gate Preparation Plant areas. Finally, 1994, 1995 and 1996 supplemental site-specific soil investigations were conducted by CPMC for the proposed Willow Creek area and includes both disturbed and undisturbed soils.

The 1996, Order-I soil survey for the Willow Creek area supplies the critical information that is necessary for accurately assessing the site-specific soil resources available for salvage. Twelve additional soil pits were evaluated and soil samples collected according to the Division's "Guidelines for Management of Topsoil and Overburden." CPMC accepted the stipulation that the Mine Reclamation Plan (MRP) will be amended when the laboratory soil results from the 1996 Order-I soil survey are completed. Four of the examined soil pits are in undisturbed soils and eight are located in disturbed soils. The undisturbed soils correspond to USDA-SCS soil mapping Unit 107 Shupert-Winetti Complex. Detailed soil profile descriptions include site description, horizon/layer identification, depth, color, texture, structure and fragment/rock descriptions. The 1996 soil survey complies with the standards of the National Cooperative Soil Survey.

Two soil maps are presented for those areas potentially affected by the mining and reclamation activities. These include a Regional Soils Map (Map 3) and a Facilities Area Soils Map (Map 4). The Regional Soils Map shows the USDA-SCS Soil Survey mapping units for the entire mine permit area. This regional map reflects an Order-III soil survey. The Facilities Area Soils Map is a more detailed map which includes the site-specific soil sampling and surveys from the historical Castle Gate preparation plant and the proposed Willow Creek surface facilities.

A total of 6.7 acres of new ground will be impacted by construction in the Willow Creek Mine area with 4.7 acres in Soil Mapping Unit 107 Shupert-Winetti Complex, 1.5 acres in Unit 121 Travessilla-Rock Outcrop-Gerst Complex, and 0.5 acres in Unit 72 Pathead-Curecanti Family Association. According to the USDA-SCS Soil Survey, the Winetti soils correspond to the Loamy Bottom ecological or range site. Forage production of this soil is reported to be 1,000, 1,500 and 2000 pounds of air dry forage per acre for unfavorable, average and favorable precipitation years, respectively. Travessilla-Rock Outcrop soils corresponds to the Upland Very Steep Shallow Loam (Pinyon-Utah Juniper) woodland site. Potential production of wood products for this soil type are reported to be 1 to 2 cords of wood per acre with a potential forage production of 300, 500 and 700 pounds of air dry forage per acre for unfavorable, average and favorable precipitation years, respectively. Pathead soils occupy the undisturbed valley bottom areas along Willow Creek and correspond to the Mountain Valley Steep Loam (Salina Wildrye) range site. The potential forage production of this range site is reported as 1,000, 1,200 and 1,400 pounds of air dry forage per acre for unfavorable, average and favorable precipitation years, respectively.

Past prime farmland investigations for Price River Coal Co. and Castle Gate Coal Co. have concluded that soils within this area are excluded from consideration as important farmland. These conclusions are based upon the excessive amount of rock fragments, high

erodibility and lack of reliable irrigation water within the Castle Gate mining permit area. Exhibit 5, SOILS INFORMATION, includes Prime Farmland Investigation correspondence, soil profile descriptions, soil field notes and soil laboratory data.

An evaluation of soil availability and suitability is made using the Divisions "Guidelines for Management of Topsoil and Overburden Materials." A comparison of the existing surficial soil materials is made for evaluation of reclamation suitability. In addition, the comparison includes the separate evaluations of coal refuse materials and mine development wastes. Since the implication is given that coal refuse materials and mine development waste may be used as substitute topsoil, CPMC has stated the following: "CPMC is not proposing to use coal or coal waste material as substitute topsoil material. Since the Willow Creek Mine area has been extensively disturbed in the past, there is coal waste material in many locations. This material has been covered in many locations by soil materials that are usable as growth medium. The growth medium has been demonstrated in this MRP to be adequate for reclamation. In areas where coal waste material will be covered with growth medium, the demonstrations made in this MRP show that reclamation can be achieved with less than four feet of cover. The final topsoil depth for reclamation will depend on the final salvaged volume of growth medium."

Selected overburden materials and disturbed soils may be used as supplement or substitute topsoil as referenced by R645-301-224, Substitute Topsoil, and R645-301-233, Topsoil Substitutes and Supplements. The Division recognizes that some contamination by coal materials of disturbed soils has occurred, is inevitable and does not present a reclamation hazard. The Willow Creek disturbed soils are an acceptable substitute topsoil as shown by their physical and chemical analyses, section 3.1.2.4 Soil Availability and Suitability. However, prior to approval of selected disturbed soils and overburden materials containing high amounts of coal, refuse, and/or waste rock, the Division requires the positive demonstration results of field-site trials and/or greenhouse tests (R645-301-233, Topsoil Substitutes and Supplements). In addition, the Division will not allow the use of coal, coal refuse materials and mine development waste as substitute topsoil or as potential growth media materials. Handling and disposal of coal refuse materials and mine development waste is regulated by 30 CFR 817.81, Coal Mine Wastes: General Requirements, and R645-301-528, Handling and Disposal of Coal, Overburden, Excess Spoil, and Coal Mine Waste.

Findings:

This portion of the permit application is considered complete and accurate with the stipulation that CPMC will amend the MRP, both section 3.1 SOILS INFORMATION and Exhibit 5 SOILS INFORMATION, with the chemical and physical analysis results from the 1996 Order-I soil survey.

LAND-USE RESOURCE INFORMATION

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

Analysis:

Current Uses

Land uses of the proposed permit area are discussed in Section 3.4.2. Maps 9 and 10 show regional land use information and previous mining activity.

According to the application, the primary constraints relative to the condition and capability of lands within the proposed permit area and adjacent areas to support various land uses are the rugged terrain of the area, the lack of significant precipitation, and the lack of available water for irrigation or stock on a large portion of the area. The topography is composed primarily of high plateaus intersected by deep drainages with steep-walled canyons and high rocky cliffs.

Topography and resource constraints limit land uses on the plateaus to wildlife habitat, low intensity grazing, undeveloped recreation, and scattered timber production. These areas have limited assess because of the surrounding rugged terrain and harsh climatic conditions during part of the year. Soils on the plateaus are generally more developed than in the canyons, and higher precipitation and lower runoff because of the gentler terrain allow growth of some conifers.

Land use is even more limited in the narrow canyons and on ridge lines. In many areas, assess is extremely difficult except in the very bottoms of some canyons. Reasonably feasible land uses are wildlife habitat, low intensity grazing, and occasional undeveloped recreational use. The potential for alternative postmining land uses is limited by shallow, poorly-developed soils with low water holding capacity, and a lack of surface or ground water sources.

Extensive historical mining and related activities have occurred in the Price River and lower Willow Creek valleys in the permit area. Several other canyons have dirt roads but are otherwise nearly undisturbed. Existing and potential uses in the valley bottom areas include mining, transportation, wildlife habitat, grazing, and undeveloped recreation.

In Section 3.4.2.2, the application describes existing land uses within the proposed permit area. These are divided into the categories in R645-100-200 and further subdivided. The primary uses listed are industrial/commercial, undeveloped lands, and forestry. Under industrial/commercial, the application includes underground coal mining, scattered oil and gas production, transportation and utilities, and electrical power generation. Under undeveloped lands, the application includes low intensity grazing, fish and wildlife habitat, and dispersed recreation. The only forestry use shown is limited timber production. Grazing and wildlife habitat are the dominant uses for undeveloped lands, and mining is the main industrial use.

According to the application, small cattle and sheep grazing operations utilize some of the high plateau areas on a seasonal basis. Typical stocking rates are about eight acres per animal unit month. There will be no surface disturbances on areas used for grazing.

A wide variety of fish and wildlife species use the area. In areas where more recent mining has occurred, such as the proposed surface facilities area, reclamation efforts over portions of the areas have resulted in effective vegetative reestablishment and general restoration of many of the premining habitat values.

The application says wildlife habitat is the primary land use for the proposed permit and adjacent areas. These areas are subject to low-intensity management for wildlife use by the responsible land management agencies.

Although the proposed permit area is used for grazing, information in the plan indicates there is very little grazing use, particularly in the west part of the area. The Division of Wildlife Resources indicates its wildlife section surveys big game populations in the area and works with landowners to issue landowner or depredation permits. The area provides habitat for numerous wildlife species, including deer, elk, bobcat, bear, cougar, passerine birds, red-tailed hawks, and golden eagles.

Most of the area consists of critical elk winter range and critical and high value deer winter range. These habitats are considered vital to maintenance of local elk and deer populations, and, to the degree possible, the Division of Wildlife Resources is concerned about managing these lands for wildlife habitat.

The postmining land use for the formerly permitted Willow Creek site, permit number INA/007/002, was light industrial. This use was terminated with Blackhawk Coal Company's decision to lease the property to Cyprus Western Coal Company.

The permit and adjacent areas are zoned by the Carbon County Planning Department as mining and grazing or critical environmental. The critical environmental designation is for areas above 7000 feet elevation and includes grazing, wildlife habitat, and some recreation activities. The application says the designated land use classifications and related zoning restrictions are consistent with both existing land uses and proposed mining activities.

The proposed permit area includes no public parks, components of either the National River or Trail Systems, renewable resource lands, areas designated unsuitable for mining, or other restricted use areas. It is assumed the application refers to the Wild and Scenic Rivers System where it says there are no components of the National River System in the proposed permit area.

It appears Section 3.4.2.4 is referring to unsuitability criteria when it says there are no renewable resource lands in the proposed permit area or adjacent areas. This needs to be clarified. The proposed permit area does contain renewable resource lands, but it probably does not contain areas that contribute significantly to the long-range productivity of water supply or of food or fiber products including aquifers and aquifer recharge areas. The significance criterion is used to designate areas unsuitable for coal mining and reclamation activities.

Previous Mining Activity

The earliest recorded mining activity in the area was the development of the Castle Gate No. 1 Mine in 1888. Extensive mine development and operations continued in the area through World War II, but mining gradually decreased until the last of the Castle Gate Mines closed in 1972.

Essentially all of the previous historical mining operations have been conventional room and pillar mines extracting coal reserves from one or more of the known coal seams in the Blackhawk Formation. Table 3.4-1 summarizes available information on previous historical mining operations, including mine names, seams mined, period of mining, and mining methods. Map 10 shows the extent of underground and known surface operations.

Section 5.3.1.2 indicates the mine surface facilities area and the Castle Gate Preparation Plant were in all probability undeveloped lands utilized for wildlife habitat prior to the introduction of mining. This statement is probably correct since it is assumed there was little wildlife management in the area before 1888. There may have been some limited grazing, however.

The information in the portion of the application describing previous mining activity fulfills regulatory requirements.

Findings:

This portion of the application is considered complete and accurate.

ALLUVIAL VALLEY FLOORS

Regulatory Reference: 30 CFR Sec. 785.19; R645-302-320.

Analysis:

The permit application refers to a decision document by the Division of Oil Gas and Mining (DOGM) in 1982. At that time, a multi-disciplinary team studied the vicinity of the Castle Gate Preparation Plant. The team determined that the site was in an alluvial valley, but that there were no effects on the soils or water quality by the adjacent mining activity. This document is reprinted in Exhibit 10.

The Price River is impacted by the power plant; the Dept of Transportation road salt storage facility; highway activity and abandoned coal refuse piles along the river banks. Both the Willow Creek Mine site and the Castle Gate Preparation Plant have remained idle for most of the last decade.

Findings:

The plan is considered technically adequate with regard to the Alluvial Valley discussion.

GEOLOGIC RESOURCE INFORMATION

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

Analysis:

Descriptions of the stratigraphy and lithology of strata from the Mancos Shale up to the North Horn Formation are in Section 3.6.1.3. Section 3.6.2.2 contains more detailed descriptions of strata from the Aberdeen Sandstone, the strata/aquifer immediately below the lowest coal seam to be mined, up through the coal bearing strata of the Blackhawk Formation. Characteristics of the overburden, interburden, and coal are described in Section 3.6.3. Regional hydrostratigraphy, including the Flagstaff Limestone, is discussed in Section 3.7.2.1. Structural geology is discussed in Section 3.6.2.1. Alluvial/colluvial, perched, stored mine water, and regional aquifer systems occur in the permit and adjacent areas. These systems and hydraulic characteristics based on aquifer testing are identified and discussed in Section 3.7.2.2. Ground water occurrence is characterized in Section 3.7.2.3. Ground water movement is generally limited by low transmissivities and lack of secondary permeability, and recharge is limited due to low precipitation rates, brief high intensity runoff, and steep outcrop exposures. Ground water occurrences in bore holes and in the mines are discussed in Section 3.6.2.3.

Most of the 179 bore holes drilled on or around the permit area since the beginning of the century and prior to 1994 were cored from near-surface to total depth. Detailed logs from these bore holes were used to construct the cross sections (Maps 13A-13D) and isopachs (Maps 14A-14E). However data from the historical drilling and exploratory programs varied considerably in completeness and uniformity. There are few geophysical logs, incomplete cutting logs, generalized core descriptions, very few coal analyses, and little or no information on material physical characteristics.

The primary purpose of the 1994-1995 drilling program was completion of ground water monitoring wells. Ground water was intercepted in each of these bore holes. In addition, a full data collection and analysis program provided valuable information to address existing data deficiencies. The 1994 program produced eleven coal and forty roof and floor spot core samples with complete core descriptions and photographs plus:

- Collection and description of cuttings during rotary drilling
- Documentation of penetration rates using a geolograph and notation of drilling conditions
- Notation of any water or gas encountered in the drillholes and measurement of discharge flow rates
- Geophysical logging of drillholes
- Laboratory analysis of coal core samples
- Suitability analysis of roof and floor samples for each coal seam.

Exhibit 9 contains well completion reports, cutting logs with information on ground water occurrences, and core logs for W94-5-1 (B51), W94-12-1 (B121), and W94-33-1(B331); well completion reports and core logs for BN251, BN301; analysis reports for the roof and floor cores from W94-5-1, W94-12-1, and W94-33-1 plus W94-31-1 (BW311); and coal analysis reports for

BN251, BN301, W94-5-1 and W94-33-1. There is no comparable information for, drilled in 1995.

No potentiometric surface map has been made: Cyprus asserts that no consistent, uniform, stable potentiometric surface exists in the permit area because of extensive underground disturbance from historic mining, deeply eroded canyons, discontinuous nature of perched aquifers, relatively low permeability of the rock units overlying the regional aquifer, and slow recharge/discharge capabilities. Hydrographs of available water level elevations for wells B51, B121, BW311, B331, B331A, BN251, BN301, and BW361 (Figure 3.7-1) show short term stability of the potentiometric surface(s), with little seasonal variation. These potentiometric data indicate that Willow Creek Canyon is the principal influence on the potentiometric surface(s) within the proposed permit area. On the Geologic Cross Sections (Maps 13A through 13D), ground water intercepts are indicated in only two bore holes.

In addition to the water monitoring wells, fifteen shallow boreholes were drilled in 1994 for geotechnical investigation of foundation conditions in the alluvial/colluvial aquifers along Willow Creek and the Price River. Locations of are shown on Map 16. Bore hole logs are in Exhibit 11. Bore holes TH-02 and TH-17 were completed as piezometers. An additional four roof and floor samples for smaller non-minable seams were obtained from a geotechnical hole drilled near the proposed portal area, for a total of 44 roof and floor rock samples collected in 1994.

Other information on chemical and physical properties of the coals and adjacent strata comes from a variety of sources dating back to 1979. Chemical characteristics of coal and other materials to be disturbed in the Willow Creek Mine are discussed in Section 3.6.3.2. Cyprus evaluations of all available chemical analyses indicate that the sampled materials are not potentially acid- or toxic-forming.

Of the forty core samples of roof and floor rock collected in 1994, three had acid-base potentials below -5 tons $CaCO_3$/1,000 tons of material, the minimum acceptable under the Division's Guidelines for the Management of Topsoil and Overburden, but the average value was 45.91.

Although the average SAR value from the 44 rock and roof core samples was 14.14, numerous samples of soil, mine waste, and coal refuse already at the surface (Soils - Section 3.1.2.3) indicate there is no significant potential for sodium toxicity relative to revegetation.

Boron levels from the forty rock and roof core samples averaged 1.29 mg/kg but two samples exceeded 5 mg/kg and are therefore "unacceptable" under the UDOGM guidelines. Selenium levels from the forty rock and roof core samples averaged 0.04 mg/kg but three samples exceeded 0.1 mg/kg, the UDOGM guideline's suitability limit. The manner in which waste materials are typically handled during mining will most likely result in the smaller volumes of unacceptable materials being mixed with larger volumes of acceptable materials and the resulting buffering or dilution will probably leave material that falls within acceptable values. On page 3.6-27 is a statement that where mine waste rock or coal refuse materials are placed in

surface stockpiles, testing these materials for suitability may be appropriate as part of the reclamation program.

Coal extraction thickness will range from 5 to 13 feet and projected maximum subsidence is therefore 3.5 to 9.1 feet, based on the assumption that the surface will subside up to 70% of the thickness of the extracted coal. Nature, depth, and thickness of the coal seams and overlying strata are described in Section 3.6.2 and physical properties of the coal and roof and floor materials are described in Section 3.6.3. Overburden will be greater than 700 feet in most areas mined and massive sandstone units lie between the coal seams and the surface, so subsidence can be expected to be less than the assumed maximum.

Findings:

The permit application includes geologic information in sufficient detail to assist in determining all potentially acid- or toxic-forming strata down to and including the stratum immediately below the coal seam to be mined; determining whether reclamation as required by R645-301 and R645-302 can be accomplished; and preparing the subsidence control plan.

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

The Division has not determined it to be necessary to require the collection, analysis, and description of additional geologic information to protect the hydrologic balance, to minimize or prevent subsidence, or to meet the performance standards.

Cyprus has not requested that the Division waive in whole or in part the requirements of the borehole information or analysis required of this section.

HYDROLOGIC RESOURCE INFORMATION

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

Analysis:

Sampling and Analysis

Cyprus's Baseline Hydrologic Monitoring Plan for the Willow Creek Mine is Exhibit 12 of the PAP. Collection of baseline data began in June 1994.

Sampling and analysis for environmental resource information is covered in Exhibit 12 and Sections 3.7.2.4 and 3.7.3.4. These sections are titled Ground Water Quality and Surface

Water Quality, respectively. Both sections discuss the type of data that is available from previous sampling projects and the sampling that was undertaken as part of this permitting project. All monitoring locations are shown on Figure 2 of Appendix 12.

Field measure including surface water flow, groundwater depth, temperature, pH, electrical conductivity, and dissolved oxygen will be collected according to methods described in section 3.4 of Exhibit 12. Flow will be measured according to one of several methods, including using weirs and flow meter measurements as described in U.S. Geological Survey, Water Supply Paper 2175.

Over the preparation and mining periods of the mine water samples for chemical analysis will be taken from springs, streams and wells as described in Section 3.5 of Appendix 12. Dip samples will be periodically taken from springs and streams for chemical analysis. Three monitoring wells have been installed to depths of 400 feet, 1000 feet, and 1800 feet which had chemical samples taken when they are drilled. Because of the great depth and associated costs, these wells will only be used to define the water surface elevation after their construction. Sample water taken for analysis of dissolved cations and trace elements will be filtered and preserved in the field. Duplicate samples will be taken and analyzed in the laboratory and field equipment will be decontaminated as part of the quality control/quality assurance plan.

A comprehensive seep and spring survey resulted in the establishment of 11 spring/seep monitoring locations. The occurrence of ground water and hydraulic characteristics of the aquifers are to be determined through testing and monitoring of 8 wells. Flow and quality of all springs and seeps and ground water wells will be monitored. Monitoring stations are listed in Table 3.7-1 and their locations are shown on the Regional Hydrology Map (Map 15). During 1994 and early 1995 four additional springs/seeps were added, and during 1995 two additional groundwater monitoring wells were installed in conjunction with supplemental exploration drilling.

Information characterizing the ground water flow regime and hydraulic parameters of the regional aquifer comes from wells MC-205, MC-206, and MC-207 located in the western coal reserves area and wells B51, B331, B331A, and B121 recently installed in the Willow Creek Mine area as part of the Baseline Hydrologic Monitoring Plan. The locations of wells B51, B331, B331A, and B121 are shown on the Regional Hydrology Map (Map 15).

The purpose of the plan is to collect and evaluate baseline hydrologic data specific to the Willow Creek Mine. Data collected under the plan will be used to characterize existing ground water flows, water quality conditions, and any seasonal variations in these characteristics, and to evaluate potential impacts to these resources from mining and reclamation activities. Additionally, baseline hydrologic data will be compared to regional data and data from adjacent areas to evaluate spatial and temporal relationships.

Applicable ground water quality standards are summarized in Table 3.7-5 for comparison to water quality data from the site. Ground water monitoring locations where average concentrations of an analyte exceed a water quality standard for at least one use category are presented in Table 3.7-6.

Water quality parameters include field measurements for pH, specific conductance, and temperature, and laboratory measurements for general water characteristics such as total dissolved solids, nutrients, major ions, and trace metals. Available water quality information is summarized in Table 3.7-4. Ground water quality data are presented in Exhibit 10, Hydrologic Information. Available ground water quality data for wells B51, B121, B331, and B331A are presented in Figure 3.7-3.

Ground water quality samples will be collected, labeled and transported to a qualified analytical laboratory for analyses. Proper sample collection, preservation, handling, and storage methods will be utilized at all times to preserve the integrity of the samples and ensure validity of analysis results. Water quality samples will be analyzed for the specific parameters listed on Table 3.7-9 and Table 3A of Exhibit 12, and sampling frequency is listed in Table 2 of Exhibit 12. All water monitoring analysis results will be recorded, reviewed to identify potential problems or trends, and filed at the mine so as to be available for future inspection and review. In addition, Cyprus will file copies of both field data and laboratory analysis sheets on a quarterly basis with the UDOGM. At the end of each annual water year, Cyprus will tabulate all water monitoring data for the year, review the data with respect to changes in groundwater hydrology systems, and provide a summary Annual Hydrology Report in compliance with the UDOGM schedule.

Approximately one year of baseline hydrologic data for most stations were available at the time of the draft technical adequacy review of this permit application. Monitoring to establish baseline conditions will continue with updated analyses and discussions submitted to UDOGM before permit approval.

Baseline Information -- Ground Water

A discussion of regional ground water conditions is provided in Section 3.7. Ground water resources are found in shallow alluvial/colluvial valley-fill deposits along drainages; in perched, thin, laterally discontinuous strata in the Blackhawk, Price River, North Horn, and Flagstaff Formations; ground water which has accumulated over time in extensive existing underground mine workings; and in a regional Blackhawk-Star Point-Mancos aquifer.

Ground water rights are held on numerous small springs or seeps, wells in alluvium/colluvium in drainages, shallow wells that intercept perched drainages, and ground water that is discharged into or stored in mines. Water rights are marked on Map 17 and summarized in Exhibit 10. Price River Water Improvement District's pending municipal water rights in Sec's. 23 and 24, T. 12 S., R. 10 E. are marked on Map 17, but similar pending municipal water in nearby areas are not shown on that map. These municipal rights are for water extracted from the Cockrell methane extraction wells. Quality of the water extracted from these wells is poor and it is unlikely this water will ever be appropriated for municipal use. Large volume ground water use in the region is for municipal water, power generation, and irrigation. This water is primarily from the alluvial/colluvial aquifer along the Price River. However, there are several wells in Emma Park, the flatter area north of the permit area, that have rights to large volumes of ground water. These wells probably produce water from the Flagstaff and North Horn Formations. Small volume use from all sources is primarily for stock watering.

No potentiometric surface map has been made. Cyprus asserts that no consistent, uniform, stable potentiometric surface exists in the permit area because of the extensive underground disturbance from historic mining, the discontinuous nature of the perched aquifers, the relatively low permeability of the rock units overlying the regional aquifer, and slow recharge/discharge capabilities. Because of these factors Cyprus has requested an exemption from any requirement to create a potentiometric surface map and cross sections depicting regional aquifer water levels across the permit area. However, hydrographs of available water level elevations for wells B51, B331, B331A, B121, BN205, and BN301 are shown on Figure 3.7-1 show short term stability of the potentiometric surface(s), with little seasonal variation.

Locations of fifteen shallow boreholes, drilled in 1994 for geotechnical investigation of foundation conditions in the alluvial/colluvial aquifers along Willow Creek and the Price River, are shown on Map 16 and Figure 2 of Exhibit 11.. Bore hole logs are in Exhibit 11. Bore holes TH-02 and TH-17 were completed as piezometers..

Wells completed in the alluvial/colluvial deposits along the Price River can reportedly yield up to 500 gpm at a sustained rate. Ground water movement in the perched and regional aquifers is limited by low transmissivities, lack of secondary permeability, and limited recharge due to arid conditions and limited outcrop exposure of potential recharge zones.

Flows and water levels for seeps, springs, and wells that are monitored by Cyprus for baseline information are summarized in Table 3.7-4 of the PAP. Field data sheets are in Exhibit 10. Locations of seeps, springs, and wells are on Map 15. Spring B321 is identified as "Willow Creek Spring" in Table 3.7-4 and on Map 15 but as "Sulphur Spring" on Map 17 (and perhaps other places in the PAP) , which is confusing, not clear and concise.

Area ground water is typically a weak calcium sulfate or sodium sulfate type. Exhibit 10 contains water analysis reports for September 1994 through March 1995 for the four wells drilled in 1994 and for other ground and surface water sampling sites being monitored by Cyprus. Exhibit 10 also contains summaries of analysis results, some dating back to 1977, for ground water samples collected by PRCC and CGCC from mines, springs and seeps, and various bore holes. Water quality data are summarized in Table 3.7-4.

In ground water samples, field measured pH values range from 7.6 to 9.3 indicating neutral to moderately alkaline conditions typical of the arid western United States.

Electrical conductivity (EC) ranges from 1,200 to 3,350 μmhos/cm. Total Dissolved Solids (TDS) values range from 1,270 to 2,450 mg/L, and elevated TDS values correlate directly with high EC values. Cyprus relates the observed variability in TDS and EC values to the highly variable lithologic composition of area bedrock. Lower TDS and EC are generally associated with alluvial/colluvial and perched ground water sources and more permeable sandstones with limited cementation and few soluble components. Higher TDS and EC are associated with relatively deep regional sources, permeable marine sediments, or more highly consolidated marine shales and fine-grained siltstones: low permeabilities result in longer residence times, and greater concentrations of salts and other soluble materials result in greater potential for dissolution and salt loading.

Concentrations of dissolved and total iron range from less than 0.01 to 0.39 and 0.17 to 15.7 mg/L, respectively. Cements that bind the sedimentary grains in many lithologic units in this area commonly include iron compounds, so it is reasonably assumed that the observed iron concentrations are related to such natural sources.

Concentrations of magnesium range from 19 to 140 mg/L, which are consistent with natural concentrations in sedimentary sequences in the region.

Oil and grease concentrations for the four 1994 wells range from 1 to 6 mg/L. These values are at or slightly above the detection limit and may indicate residue from the construction and installation of the monitoring wells. However, during the 1992 - 1993 evaluation of the coal reserves, two to three inch thick skims of natural crude oil were found floating on ponded water in both the C Seam works and in the East Mains of the Kenilworth Seam. A sample was collected but no analyses were completed. The oil is apparently seeping up out of the thin interbedded sandstones, siltstones, and mudstones which form the immediate floor in these areas. Oil has been reported to drip from roof strata at other sites in both the K and A Seams, particularly in the eastern extent of the mining. Oil seeps have also been reported from the Castle Gate property west of the Price River. The oil and grease detected in the four wells may therefore represent natural crude oil from the Blackhawk Formation.

There is some potential that ground water and surface water quality in the permit and adjacent areas may be affected by a coalbed methane degassification project located north of the lease and adjacent areas. The Cockrell Oil Company is extracting water from approximately 25 coalbed methane wells in the Blackhawk Formation to desorb methane from the coal matrix. Water removed from the Blackhawk Formation comes primarily from the Aberdeen sandstone. Following extraction from the wells, the methane is removed and the remaining water stream is treated by reverse osmosis and evaporation to reduce TDS and volume, respectively. The remaining water, "concentrate" in Cockrell's terminology, is injected into the Price River Formation. Injected water may increase the discharge rate from springs and seeps down gradient of the degassification project, quality of spring and seep discharges may be degraded by the injected concentrate, and quality of water in the Price River may eventually be affected. Additionally, concentrate injected into the Price River formation may encroach on the permit area and the resulting degradation of ground water quality due to the coalbed methane project could be misinterpreted as being related to Willow Creek mining activities.

Baseline Information -- Surface Water

Surface-water baseline information is found in Section 3.7.3. Section 3.7.3.1 is the description of the in which surface water exist in the permit and surrounding areas. Section 3.7.3.2 is the list and description of the surface water bodies in the permit area including ponds, lakes, perennial streams, etc. Section 3.7.3.3 talks about the quantities and occurrences of surface water and Part 3.7.3.4 is the surface water-quality information. Figures and tables within these two part reveal the data from monitoring in this permitting project and previous water monitoring projects. Water rights information is presented in Section 3.7.3.5, Exhibit 10 and on Map 17. Section 3.7.3.6 describes how surface water and ground water interact.

The surface water environment is formed by an arid to semi-arid climate, rugged topography, predominately sedimentary rock, and soils formed from sedimentary rocks. Surface

water flow usually results from snowmelt and from thunderstorm runoff. Thunderstorm can be very intense over short periods which, combined with the rugged, rocky topography, can result in very large increases in surface water flows. The Price River and Willow Creek are the major, perennial drainages in the permit area. Other perennial drainages within a 2 mile radius of the permit area are Sulphur Canyon, Mathis Canyon, Deep/Buck Canyon, the main stem of Antone Creek. There are several ephemeral drainages in the two mile radius of the permit area. Drainage specific information for many of the permit area drainages is located in Table 3.7-8, Surface Drainage - Watershed Characteristics found on page 3.7-31.

Many data are available on stream flows in the Price Rive and Willow Creek, but there is very little historical data available for the smaller drainages in the permit area. Available surface water flow records are represented in Figures 3.7-4A through 3.7-4I in graphical form.

Several small man-made sedimentation ponds associated with coal mining activities and several stock watering ponds are the only stationary surface water bodies in the permit area. The are no lakes or reservoir. The stock watering ponds are frequently associate with springs.

General water quality information is found in Section 3.7.3.4, Surface Water Quality. Data show that pH is natural to basic, pervious activities have contributed to increase phenols in some samples, natural sulfur springs result in some water having elevated sulfate levels, TSS tends to be elevated during storm runoff, and elevated iron has been found due to natural sources. Table 3.7-10 shows the type of samples taken in multiple sampling projects and Table 3.7-10 is a summary of sampling. Some data show that water quality standards have been exceed prior to mining by CPMC. These data, located in Table 3.7-12, show that nitrates have exceeded the standard of 0.02 mg/L in Willow Creek, Price River and Mathis Canyon. Phosphate have exceeded the 0.05 mg/L standard in Willow Creek, Price River, and Sulphur Canyon. Copper has exceeded the standard of 0.01 mg/L in Willow Creek, and Crandall Canyon. Phenols have exceeded a 0.01 mg/L standard in Willow Creek, Price River and Sulphur Canyon. Finally, Crandall Canyon sampling has exceeded the zinc standard of 0.05 mg/L. All water quality standards are located in Table 3.7-5. Figures 3.7-6A through 3.7-9I where included in the permit application to show the relationship between stream flow and the concentration of an assortment of water quality constituents. A statement on page 3.7-52 says that "Specific conductivity, total dissolved solids (TDS), and sulfate concentrations all appear to decrease during high-flow conditions and increase during low-flow conditions." They go on to say, "Iron concentrations appear to be flow independent. Concentrations tend to increase with higher flows and decrease under low flow conditions." This statement is inaccurate because, the data show that there is a relationship between flow and iron concentration.

Beneficial uses of water in the permit area are domestic water supply, industrial, and limited agricultural. Price City water treatment plant is located on the Price River just above the permit area, but some of the tributary are within the permit area. Price River water is used in limited irrigation project down stream. Surface water owner ship information is provided in Exhibit 10 and shown on Map 17.

Baseline Cumulative Impact Area Information

A CHIA (Cumulative Hydrologic Impacts Assessment) has been done for the proposed Willow Creek Mine. Hydrologic and geologic information necessary to assess the probable

cumulative hydrologic impacts of the proposed operation and all anticipated mining on surface- and ground-water systems in the cumulative impact area has been obtained from appropriate federal or state agencies and provided by the Applicant. No adverse impacts on surface- and ground-water systems are anticipated from the proposed operations.

Survey of Renewable Resource Lands

Renewable Resource lands information is included in Section 3.7.5. Part 3.7.5.1 on page 3.7-91 identifies the occurrence of aquifers and recharge areas within the permit and adjacent areas. Part 3.7.5.2 on page 3.7-92 defines the potential for disruption of aquifers or changes in recharge due to subsidence. The permit application says, "the area does not provide significant recharge to any regional ground water aquifers and is relatively more important as a watershed area for area surface drainages. There has been no significant historical nor any recent agricultural activity within the permit or adjacent areas and the USDA-SCS has issued a negative determination for prime farmlands for the area as discussed and documented in Section 3.1.3, Prime Farmlands."

Alluvial Valley Floors

Section 3.7.6 on page 3.7-92 addresses the potential impacts to alluvial valley floors. This section cites a study undertaken by the Division in 1982 as part of permitting the Castle Gate mine which found that mining in the study area would not affect the alluvial valley floors that are present. This study is presented in Exhibit 10.

Modeling

Cyprus' plans and methodology for hydrologic modeling are stated in Section 3.7.8 on page 3.7-94. Cyprus will model runoff calculations, Part 3.7.8.1, and precipitation events used for runoff calculations, Part 3.7.8.2. Calculations for these models are located in Exhibit 13. Cyprus does not plan to create any ground water models.

Modeling techniques, interpolation, or statistical techniques have not been used as part of the ground water baseline information in the proposed permit.

Alternative Water Source Information

Alternative water source information is located in Section 3.7.9 beginning on page 3.7.96. Part 3.7.9.1 covers the potential impacts on surface and ground water sources, and Part 3.7.9.2 provides information on alternate water sources.

Probable Hydrologic Consequences

To accurately characterize the existing surface and ground water environments and to assess the probable hydrologic consequences of the planned mining and related activities, Cyprus reviewed and evaluated all available information on baseline hydrologic conditions as presented and described in Section 3.7 of the PAP. Cyprus then considered potential hydrologic impacts that could occur as a result of the planned mining and related activities based on the operation and reclamation plans presented in Sections 4.0 and 5.0. Both direct and indirect mining related impacts were identified and evaluated. The effectiveness of operational protection and control

measures and reclamation activities in mitigating potential impacts were considered. The following summarizes the probable hydrologic consequences of the planned Willow Creek mining and related activities as determined by Cyprus.

Ground Water Consequences

Cyprus' planned mining, processing, and related activities have the potential to cause localized and temporary impacts to ground water. These probable ground water hydrologic consequences include:

- Alterations of ground water flow patterns
- Drainage of seeps/springs
- Alterations of recharge/storage/discharge relationships
- Increases in concentrations of TDS and certain individual chemical constituents

Mining related probable hydrologic consequences for ground water resources in the Willow Creek permit area will be limited by the lack of significant ground water recharge, a thick sequence of low permeability bedrock between the coal seams to be mined and the ground surface, the general lack of significant regional ground water movement due the absence of well defined regional aquifers, and limited beneficial ground water use in the permit and adjacent areas.

Alterations to Ground Water Flow Patterns - Historic coal mining in the area has produced extensive underground mine workings. In areas where those workings intercept ground water systems or connect to them through fractures the abandoned mine workings serve as sinks in the ground water systems. Seepage into the mines is extremely slow but inflows have gradually accumulated in significant quantities in the underground workings. In the western coal reserves area, mine inflows appear to be greatest where extensive retreat mining has produced substantial subsidence. However, regardless of subsidence conditions or mining method, the overall inflow rate is low, ranging from less than 5 gpm up to a maximum of about 35 gpm. Mine inflow monitoring by Price River Coal Company indicated inflow rates of 2.9, 12, 30, and 30 gpm for the Aberdeen, Utah Fuels No. 1, Royal, and Kenilworth mines, respectively. Similar monitoring by Castle Gate Coal Company for the No. 3 and No. 5 Mines resulted in measured inflow rates of 33 gpm (0.04 gpm/acre) and 3.5 gpm (0.015 gpm/acre).

The total volume of ground water storage in the old mine workings in the eastern coal reserves is unknown, although it is probably substantial. Water accumulates predominantly in the down-dip workings. Most abandoned mine workings in the area have been sealed, and there are few known instances of mine water being discharged from old workings. Generally, the volume of ground water stored in old mine workings increases until the local ground water system establishes equilibrium between inflow and outflow as recharge into the aquifer or as discharge to the surface.

Ground water flow patterns will be altered further as the Willow Creek Mine opens new underground workings. As the new mine workings are dewatered the potentiometric surface in the immediate vicinity will be lowered and a cone of depression created, and additional ground water will be deflected toward the mine workings. Mine inflow rates in the eastern coal reserves are expected to be similar to those observed in the western coal reserves. Based on an average

recharge rate to ground water of 0.44 inches per year and an area of approximately 9 square miles of existing mine workings, the amount of ground water intercepted annually by the mine is estimated to be 131 gpm (0.3 cfs). At the end of operations for the Willow Creek Mine, assuming that the area mined is 19.8 square miles (i.e., old and new mine workings extending beneath approximately 90% of the permit area), the amount of ground water intercepted annually by the mine is estimated to be 183 gpm (0.4 cfs). If average yield per acre of 0.023 gpm per acre is used, the volume is 470 acre-feet per year or approximately 290 gpm. This amount of water is stated as being relatively small compared to the overall flow of the regional ground water system, although the criteria used to make such a determination are not given in the PAP.

Depression of the potentiometric surface near the mine is expected to be both minor and localized due to the relatively low permeability of the stratigraphic units. Additionally, ground water in overlying perched aquifers may leak downward along subsidence fractures, resulting in partial or full drainage of the perched aquifers that may in turn affect the discharge of springs and seeps. However, impacts to perched aquifers and associated springs and seeps are not expected to be significant because the perched aquifers are very limited in areal extent, areas potentially affected by subsidence represent a relatively small portion of the permit area, and beneficial use from perched systems within areas to be subsided is limited to a single spring (B41) in the eastern portion of the permit area.

After operations at the Willow Creek Mine cease, the underground workings will gradually fill with water and a stable potentiometric surface will be reestablished, which should be approximately the same as the potentiometric surface that existed prior to mining. Changes in the potentiometric surface are not expected to be significant because the overall hydrologic balance within the ground water basin will not be affected. Reductions in quantity and availability of ground water are expected to be minor, limited in areal extent, and temporary in nature.

Reductions in ground water flow are not expected to adversely impact ground water use in adjacent areas, such as the municipal water wells of the Price River Water Improvement District in Sec's. 23 and 24, T. 12 S., R. 10 E. because strata that yield water in these areas are hydraulically isolated from the coal seams by a significant thickness of low permeability bedrock and subsidence is not projected to occur near enough to affect these areas.

Drainage of Seeps and Springs - Perched ground water above the Willow Creek mine may drain or seep downward through subsidence fractures. Perched aquifers may be partially or fully dewatered and springs and seeps that discharge from stratigraphic units that contain perched ground water may be affected. Impacts due to subsidence are not expected to be significant because the perched aquifers are limited in areal extent and potential subsidence areas represent a relatively small portion of the total permit area. Subsidence fractures are expected to gradually fill by sloughing, plastic flow, and mineral deposition. Only one identified ground water source, Jack Spring (B41), is within an area where subsidence is projected. Cyprus will attempt to minimize subsidence while maximizing recovery of available coal resources by the use of longwall mining methods, maintenance of barrier pillars, limiting extraction in critical areas, and proper mining and roof control design and operations practices. Effective control of subsidence will limit fracturing of overlying strata and the consequent potential for drainage through subsidence fractures.

Drainage of perched ground water aquifers is not anticipated to affect the regional potentiometric surface because the perched systems are isolated from the regional aquifer by low permeability interbedded siltstones and shales. Storage volumes in the isolated perched aquifers are minor compared to the regional system.

If discharge from seeps or springs is documented as having decreased below baseline conditions as a result of mining related activities, Cyprus has committed to mitigate those impacts through augmentation of effected water rights, monetary compensation, development of alternative watering facilities such as guzzlers, or other appropriate mitigation measures.

Alterations to Recharge/Storage/Discharge Relationships - Cyprus's planned mining, processing, and related activities are not expected to have any significant long-term effect on recharge, storage, or discharge relationships. Recharge occurs primarily along outcrops by infiltration of direct precipitation and runoff. Cyprus's operations are limited in areal extent and are not located within any major recharge area. Drainage of ground water presently stored in abandoned mine workings and the surrounding rock will be localized and temporary. Upon closure of the Willow Creek Mine, ground water will again accumulate in the mine workings and ground water storage relationships will be reestablished. There will be localized alterations to ground water flow, and discharges down gradient of the mine may be temporarily reduced until the underground mine workings fill. The quantity of ground water discharge which will be effected is a relatively small percentage of the total volume within the ground water basin, but neither volume has been quantified in the PAP.

Increases in Chemical Constituents - Ground water in both the Willow Creek permit and adjacent areas is a weak calcium-sulfate or sodium-sulfate chemical type. As ground water encounters freshly exposed materials in the mine, oxidation and weathering will cause changes in ground water chemistry including increases in TDS and concentrations of individual chemical constituents. Due to the limited volume of ground water drainage relative to total flows within the ground water basin, minor changes in ground water chemistry and in specific constituents are not expected to significantly effect overall ground water quality or use. Over time these increases will stabilize and then decrease as available soluble chemical constituents are depleted and concentrations in mine water and exposed rock reach equilibrium. Gradual flooding of abandoned mine workings will also have a beneficial water quality effect by displacing oxygen and reducing the oxidation potential.

Based on available information, Cyprus does not anticipate that the existing coalbed methane degassification project located down gradient of the planned mine workings and outside of the permit area will have any effect on ground water resources within the permit area. The water used to force methane from the recovery wells is of low quality and is reinjected into the Price River Formation following gas recovery. In the unlikely event that ground water impacts extend further than projected by the environmental analysis for the project, water quality impacts could be locally significant within the permit area.

Page 4.7-25 state that ground water resources are limited to: "1) shallow alluvial/colluvial valley fill deposits in area drainages; 2) perched ground water occurring in thin laterally discontinuous sedimentary units associated with the Price River, North Horn, and Flagstaff Formations; 3) ground water which has accumulated over time in extensive existing underground mine workings; and 4) a regional water table aquifer occurring in the deeper portions of the

Blackhawk Formation and extending into the underlying Star Point and Mancos Formations." Groundwater movement is limited by low transmissivities and other factors. These limitations should result in relatively low mine inflow rates. Groundwater quality is reflective of the different lithologic composition of the area bedrock units. Baseline data shows that "area ground water is typically a weak calcium sulfate or sodium sulfate type with neutral to moderately alkaline pH, relatively high TDS concentrations and slightly elevated levels of iron." Some perched groundwater supplies are used for stock watering, but surface water is more accessible, and, therefore, more often used.

Surface Water Consequences

The Probable Hydrologic Consequences Determination can be found in Section 4.7.4. The baseline conditions are summarized in Section 4.7.4.1. Potential adverse impacts are discussed in Section 4.7.4.2. Presence of acid- and toxic-forming materials is discussed in Section 4.7.4.3. Sediment yield; acidity, total suspended and dissolve solids and individual chemical constituents; changes in stream flow; and ground- and surface-water availability are addressed in Section 4.7.4.2.

There are several perennial drainages located within or adjacent to the permit area listed on page 4.7-25. They are: "1) Price River, the principal drainage in this area; 2) Sulphur Canyon, which is tributary to the Price River near the northern edge of the permit boundary; 3) Willow Creek, which is tributary to the Price River and drains the majority of the permit area; and 4) Summit Creek, which is tributary to Willow Creek upstream of the permit area, but drains the extreme eastern portion of the permit area." Surface water quality is typical of arid regions with chemical characteristics such as "calcium bicarbonate, calcium sulfate, and sodium bicarbonate water types with neutral to moderately alkaline pH, high TDS and TSS values, and elevated sulfate, iron, and phenols."

Cyprus has determined on page 4.7-26 that the potential hydrologic consequences for ground water are: 1) Alterations of ground water flow patterns; 2) Drainage of seeps/springs; 3) Alterations of recharge/storage/discharge relationships; and 4) Increases in concentrations of TDS and certain individual chemical constituents. However, the effect of these consequences "will be limited by the lack of significant ground water recharge in the area, the existence of a thick sequence of low permeability bedrock layers between the coal seams to be mined and the ground surface, the general lack of significant regional ground water movement due the absence of well-defined regional aquifers, and very limited beneficial ground water use in the permit and adjacent areas."

Cyprus has determined on page 4.7-28 that the potential hydrologic consequences for surface water are: 1) Temporary increases in runoff from surface disturbance areas; 2) Minor reductions in surface flows and alteration of surface flow patterns due to operation of sedimentation structures and flow reductions due to mine water supply withdrawals; 3) Changes in surface water chemistry; and 4) Increases in the levels of TDS, TSS, and certain individual chemical constituents. However, the effects of these consequences "will be limited by the relatively small surface disturbance area, and will be effectively mitigated by operation of the drainage and sediment control system and ultimate reclamation of mine disturbance areas."

Removal of vegetation and other disturbances "will reduce infiltration potential and evapotranspiration due to elimination of vegetation and will increase surface runoff and erosion potential." Cyprus will divert undisturbed drainage around disturbed areas and grade disturbances such that removed vegetation will not greatly increase the amount of erosion. Cyprus will further decrease the effects of increased runoff by minimizing the amount of surface disturbance area and implementing a drainage and sediment control plan (Exhibit 13). Prompt reclamation after completion of mining operation will insure time limited effects of increased runoff rates.

Reductions in surface flows and alteration of surface flow patterns will likely occur due to operations of sediment structures and mine water supply withdrawals. Sedimentation ponds will collect water during periods of runoff resulting from large storm events and snow melt. Cyprus says that retention of water in the ponds followed by slow release "will actually represent a positive impact, potentially extending the period of active flow" in ephemeral and intermitted areas. They go on to say that perennial drainages will only be impacted when runoff is retained in low-flow periods. Any runoff retained will be a small percentage of normal flows. Cyprus does not consider the amount of water lost to evaporation from within the sediment ponds that would not be lost if allowed to flow naturally into their respective drainages; however, the sediment ponds are designed to detain water no longer than 3.4 days.

Cyprus will withdrawal water from the Price River for mine water supply at a rate of 730 acre-feet per year (pages 4.7-10 and 11). Cyprus holds active senior water rights for the water that they will withdrawal; however, they are responsible for and recognize the concern to flow depletion. Plans will be put into place to recycle water used in mining operations to limit the need to withdrawal water from the Price River. Cyprus does not include in this PHC any information about how much water will be withdrawn from the Price River.

Mining activities at the Willow Creek Mine may cause some changes in surface water chemistry by exposing surficial materials to runoff. Cyprus says that "the most probable potential change in runoff water chemistry would be a shift from a strong calcium bicarbonate type toward a sodium sulfate type due to the weathering and leaching of exposed surface materials." The proposed surface drainage and sediment control plan will protect the surface materials by limiting the exposure of these material to surface runoff. Examination of the materials that will be expose show that they are not likely to be acid and toxic forming in nature; therefore, limited exposure with will result in a low potential for significant changes in surface water chemistry. Surficial materials are described on page 4.7-35.

Increased exposure of materials to water is also a potential cause of changes in the levels of TDS and other individual chemical constituents. The potential for erosion to increase in unvegetated disturbed areas will increase the potential for increase sediment load, TSS, in storm and snowmelt runoff. Cyprus predicts that mining activities will not cause changes in pH, but "TDS, TSS, and sulfate levels may increase slightly in the disturbed area runoff."

Willow Creek stream alterations are covered in the PHC on pages 4.7-34 and 36. Section 4.7.2.2 describes how the surface water resources will be preserved during the construction of the alternate flow paths.

Findings:

Sampling and Analysis

The information about the baseline hydrologic monitoring plan is accurate and fulfills the requirements of the regulations. According to R645-301-723, Cyprus must perform all mining activities according the current edition of "Standard Methods for the Examination of Water and Wastewater" or the methodology in 40 CFR Parts 136 and 434.

Groundwater Information

The name, location, and description of streams, existing wells, springs, and other surface and ground water resources are given. Ownership and location for rights to surface and ground water are given. The PAP data on ground water quality and quantity to not indicate seasonal variation and usage. Ground water quality descriptions include baseline information on total dissolved solids or specific conductance corrected to 25 degrees C, pH, total iron, and total manganese and additional water quality parameters. Ground water quantity descriptions include water levels for monitoring wells and flow rates for seeps and springs. Alkalinity has been determined for most water samples. Acidity has not been measured, but the potential for acid drainage from the proposed mining operation is minimal.

Probable Hydrologic Consequences

Probable Hydrologic Consequences ground water baseline information is complete and accurate.

The PHC for surface water is complete and accurate. Cyprus has met all applicable regulations dealing with the probable hydrologic consequences.

MAPS, PLANS, AND CROSS SECTIONS OF RESOURCE INFORMATION

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

Analysis:

The engineering information that needs to be addressed in the environmental resource information is to identify and describe the lands that will be subjected to coal mining and reclamation operations over the estimated life of mine. The specific information required in Sections R645-301-521.111, 112, 121, 122, 123, 124, 132, 141, 150, 151, 152, 190 deals with the types of maps and cross section that must be included in the PAP.

The maps and cross sections in the PAP meet the minimum regulatory requirements as listed under R645-301-521.111, 112, 121, 122, 123, 124, 132, 141, 150, 151, 152, 190. Other regulations apply to maps and cross sections. Those requirements will be addressed in the appropriate sections of this technical analysis.

Subsurface Water Resource Maps

Occurrences of subsurface water within and adjacent to the permit area are shown on Maps 15 and 16.

Surface Water Resource Maps

Lakes, streams, ponds, and springs within and adjacent to the proposed permit area are shown on Maps 15 and 16.

Monitoring Station Map

Ground-water and surface-water monitoring stations are shown on Figure 2 in Exhibit 12 and Map 15 in Volume 15.

Well Maps

Wells within and near the permit area are shown on Map 15 in Volume 6. Elevations (to the nearest 40 feet) and locations of test borings are also shown on Maps 12 and 16 of the PAP and Map 2 of Exhibit 11. The location of one gas well is shown on Map 15.

There is some potential that ground water and surface water quality in the permit and adjacent areas may be affected by a coalbed methane degassification project located north of the lease and adjacent areas. The Cockrell Oil Company is extracting water from approximately 25 coalbed methane wells in the Blackhawk Formation to desorb methane from the coal matrix. Methane is removed from the water, the water stream is treated to reduce TDS and volume, and the remaining water is injected into the Price River Formation. Injected water may increase the discharge rate from springs and seeps downgradient of the degassification project, quality of spring and seep discharges may be degraded by the injected concentrate, and quality of water in the Price River may eventually be affected. In the unlikely event that ground water impacts extend further than projected by the environmental analysis for the project, water quality impacts could be locally significant within the permit area and the resulting degradation of ground water quality due to the coalbed methane project could be misinterpreted as being related to Willow Creek mining activities. The injection wells are outside the permit and adjacent area. Locations are shown on Figure 3.7-3A.

Contour Maps

Maps 4, 6 and 8 show the premining topography in the facilities areas. Maps 3, 5 and 7 show the regional topography.

Coal Resource and Geologic Information Maps

Surface geology for the region is shown on Map 12, a certified map. Elevations (to the nearest 40 feet) and locations of test borings are also shown on Map 12. The crop lines for the coal seams are shown on Maps 14-A to 14-E. Strike and dip shown on Map 12. Locations of the fifteen test borings of the alluvial/colluvial aquifers associated with Price River and Willow Creek are on Map 16 and Map 2 of Exhibit 11, Geotechnical Investigations.

Water Quality

Elevations (to the nearest forty feet) and locations of monitoring stations used to gather data on water quality and quantity are on certified Map 15, Regional Hydrology Map.

Subsurface Water Resource Maps

Geologic Cross Sections AA' to FF', Drawings (Maps) 13A to 13D, provide one piece of information on the location and extent of subsurface water within the proposed permit or adjacent areas. There is no map of the potentiometric surface for the regional or other aquifers. Figure 3.7-1 indicates there is little seasonal difference of heads.

Affected Area Boundary Maps

Maps 19A to 19D show the boundaries of all areas proposed to be affected over the estimated total life of the underground mining activities. They describe the size, sequence, and timing of the mining activities over the mine life.

Existing Structures and Facilities Maps

The areas where the surface facilities for the Willow Creek Mine will be located have been previously disturbed by coal mining activities. The premining topography and existing surface facilities are shown on Map 18A. The proposed topography and facilities are shown on Map 18B.

Mine Workings Maps

The location of known mine workings in the permit area are shown on Map 10, Previous Mining Activities. The proposed mine workings are shown on Maps 19A to 19D.

Permit Area boundary Maps

The permit boundaries are shown on several maps. They include Maps 1, 2, 3, 5, 7, 9, 10, 12, 15, 17, 19A-19D, and 20.

Surface and Subsurface Manmade Features Maps

The location of the surface and subsurface manmade features are shown on Maps 18A and 18B. While the maps show the locations of these features, they are not labeled.

Findings:

Coal Resource and Geologic Information Maps

Stratigraphy and structure of the proposed permit and adjacent areas are portrayed on maps and cross sections. Cross Sections, maps, and plans show elevations and locations of test borings. Coal crop lines and information on the nature, depth, and thickness of the coal seams and overburden and underburden are shown on maps and cross sections. Strike and dip are shown on Map 12. Locations of the fifteen test borings of the alluvial/colluvial aquifers

associated with Price River and Willow Creek are on Map 16 and Map 2 of Exhibit 11, Geotechnical Investigations.

Monitoring Sampling Location Maps

Elevations (to the nearest 40 feet) and locations of wells test borings are shown on Maps 12, 15, and 16 and Map 2 of Exhibit 11.

Subsurface Water Resource Maps

The location and extent of subsurface water within the proposed permit and adjacent areas are not portrayed on maps (potentiometric surface). Geologic Cross Sections AA' to FF' (Maps 13A to 13D), provide some information on the location and extent of subsurface water. Hydrographs in Figure 3.7-1 indicates there is little seasonal difference of heads. Maps show elevations and locations of monitoring stations used to gather baseline data on the quality and quantity of ground water, and location of water wells.

Well Maps

Locations of the one gas well within the proposed permit area and water wells in the permit area and adjacent areas are shown on maps and plans in the PAP.

Wells that extract gas from the coal seams and inject waste water from the gas stripping process are located near the proposed permit area. Locations of the injection wells in relation to the proposed permit area is shown on a map in the PAP.

Surface and Subsurface Man-made Features Maps

The Operator did not label the manmade features outside the permit area such as PacifiCorp Carbon Generating Station, State Highway 191 and U.S. Highway 6 & 50. Such features need to be labeled on both the Maps 18A and 18B.

OPERATION PLAN

GENERAL REQUIREMENTS

Regulatory Reference: 30 CFR Sec. 784.2, 784.11, R645-301-523

Analysis:

The Operator provided a general operational plan in the PAP. The specific of the plan will be discussed in the following subsection.

Findings:

The Operator has met the minimum regulatory requirements.

EXISTING STRUCTURES

Regulatory Reference: 30 CFR Sec. 784.12; R645-301-526.

Analysis:

As described in Section 3.4.4, Previous Mining Activity, extensive historic mining activity has occurred throughout the proposed permit area with resulting development of underground mine workings in many areas. Surface disturbance from coal mining consists of mine portals, coal and waste stockpiles, coal handling, processing, and loadout facilities; and mine support facilities. In Castle Gate, surface disturbance included residential and commercial development tied to the historic mining operations. Both mining related underground and surface disturbance are shown and labeled on the Previous Mining Activity Map (Map 10) Table 3.4-1 shows the chronology of the underground mining and surface activities that have occurred in the proposed permit boundaries.

One reason for determining the prior disturbance is to determine what areas are pre-SMCRA sites. If the pre-SMCRA sites are not used in for during mining and reclamation then those areas need not be reclaimed by the Operator. The Operator has not identified any areas within the proposed permit area that will meet the pre-SMCRA reclamation exemption. The Division has determined that the pre-SMCRA exclusion rule will not apply to this site.

Findings:

The Operator has met the minimum regulatory requirements.

RELOCATION OR USE OF PUBLIC ROADS

Regulatory Reference: 30 CFR Sec. 784.18; R645-301-521, -301-526.

Analysis:

Information on the relocation or use of public roads is listed in Section 2.1.6.2. Disturbance associated with development and operation of the mine surface facilities will, however, occur within 100 feet of State Highway 191 which is a public road. In compliance with the applicable regulatory provisions of Rules R645-103-234.100 through 400, the Operator has contracted and obtained approval from the Utah Department of Transportation and initiated a formal request for public hearing with UDOGM. Copies of public notice and hearing documentation and written findings relative to mining within 100 feet of a public road were submitted to UDOGM on receipt of insertion in Exhibit 3, Public Notice and Proof of Publication, Hearing Notices and Documentation.

Findings:

The Permittee has met the minimum regulatory requirements.

AIR POLLUTION CONTROL PLAN

Regulatory Reference: 30 CFR Sec. 784.26, 817.95; R645-301-244.

Analysis:

Air quality information is presented in Sections 3.5 and 4.4. These sections contain information about air quality in the general area and about methods to be used to control emissions. Exhibit 4 contains a copy of the Notice of Intent submitted to the Division of Air Quality.

The Division of Air Quality is the primary regulatory authority for this regulation and will be responsible for reviewing the Applicant's commitments. The Applicant will need to obtain an approval order before beginning construction. However, for the present, the Applicant has complied with the requirements of these regulations.

Findings:

For the present, the Applicant has complied with the requirements of these regulations. Before beginning construction, the Applicant will need to obtain an approval order from the Division of Air Quality.

COAL RECOVERY

Regulatory Reference: 30 CFR Sec. 817.59; R645-301-522.

Analysis:

Maximum resource recovery has always been and will continue to be one of Cyprus's primary objectives in compliance with applicable USDI-BLM regulations and as a matter of sound resource management and efficient mining and economic practice. Conservation and maximum utilization of the available coal resource will involve mining to the minimum practical seam thickness, maximizing overall coal recovery consistent with sound engineering and mining practices. Resource conservation and protection have been addressed in some detail in the Resource Recovery and Protection Plans (R2P2) previously submitted to and approved by the USDI-BLM as part of the Blackhawk Logical Mining Unit Report in April 1992.

When a proposed permit will include mining federally owned coal, the Division usually relies on the R2P2 in their evaluation. A copy or summary of the R2P2 was not included in the PAP. Lack of the R2P2 will hammer the Division's in determining if maximum coal recovery will occur. The Division recommends that the Operator include a copy of the R2P2 in the PAP. (In the 02/06/96 revisions the Operator states that he is in the process of revising the R2P2. As soon as the R2P2 has been revised, the Operator will submit information from the revised plan.)

The Division has evaluated the coal recovery plan and has determined that the Operator could mine the southwest corner of Section 32 Township 12 South, Range 10 East in the A seam.

Findings:

The Operator failed to meet the requirements of R645-301-522 by excluding coal recovery from the southwest corner of Section 32 Township 12 South Range 10 East in Seam A. The Division will wait until the Operator includes a copy of the R2P2 before evaluating coal recovery on federally controlled lands.

SUBSIDENCE CONTROL PLAN

Regulatory Reference: 30 CFR Sec. 784.20, 817.121, 817.122; R645-301-521, -301-525, -301-724.

Analysis:

Renewable Resources Survey

The Operator identified the following as structures or areas as renewable resource lands that could be affected by mining related subsidence. The structures and renewable resource lands identified in the subsidence survey are:

- High plateau areas and ridge lines that have the potential for low-intensity seasonal grazing
- Limited recharge areas generally associated with the relatively flat high plateaus and exposed ridge lines, and small basins where runoff or snow accumulations may provide supplemental ground water recharge

- State Highway 191
- Willow Creek
- Several power transmission lines that cross the proposed permit area
- Several unimproved dirt roads
- Several fence lines

The Division agrees with the Operator's findings that subsidence could damage structures and renewable resource lands. According to R645-525.100 if the Division determines that the potential exists for subsidence to damage structures or renewable resource lands then the PAP must have a subsidence control plan. A copy of the subsidence control plan was submitted to the Division in the PAP and will be evaluated in the following section of the technical assessment.

Subsidence Control Plan

Coal Removal Method

Cyprus currently projects an annual production rate of 0.3 to 6.0 million tons of coal from the Willow Creek Mine over the 20 year mine life. Annual production may fluctuate dependent on changes in coal market conditions and other factors. A relatively rapid build-up in production to the full production capacity of 6.0 million tons of coal per year will occur over a period of approximately 4 years.

Mine development involves excavation and construction of the underground openings, or entries, required to access the minable coal reserves, provide for efficient production of those reserves, facilitate haulage of both coal and mine waste, and provide for effective ventilation of the mine workings. Development activities will include development of mine portals, main entries, sub-mains, slopes and rises, and longwall panels. All mine development activities including both development methods and actual physical dimensions of development entries have been designed to provide for long-term stability during active mining operations and to effect full compliance with all applicable regulatory provisions.

Cyprus plans to utilize the longwall mining method as the primary coal production technique. There are, however, certain areas where longwall mining will not be feasible due to limited seam thickness, the configuration of the remaining coal reserves (inadequate width or length to justify the costs associated with longwall development and set-up), geologic conditions, or potential subsidence concerns. In these areas, conventional room and pillar mining methods will be utilized with continuous miners, shuttle cars, and roof bolters as the primary production equipment.

The Division has determined that the Operator described the methods of coal removal, the projected amount of coal mined, and the sequence and timing for the development of underground workings. The minimum regulatory requirements have been met.

Underground Workings Map

Map 19A to Map 19D show the location of the mine workings and projected subsidence for each seam. Map 20, Subsidence Monitoring Plan, shows the areas of planned subsidence for the entire project.

Physical Conditions Description

Coal extraction thickness will range from approximately 5 to 13 feet resulting in potential maximum subsidence of 3.5 to 9.1 feet assuming the projected maximum subsidence rate of 0.7 times extraction thickness. It is important to note that this is the maximum potential subsidence with full extraction. In reality, practical operational limitations on coal extraction, increased mining depth, and the massive sandstones previously discussed will probably result in actual subsidence which is considerably less than this maximum value.

Given that most of the proposed mining will occur at depths of 700 to over 2,000 feet, averaging approximately 1,800 feet and the occurrence of several relatively massive high-strength sandstone units in the overlying stratigraphic sequence which will probably limit vertical deformation, surface subsidence is expected to be minimal. Use of the proposed longwall mining method inherently provides the greatest amount of control over the area and rate of subsidence. Associated subsidence is typically uniform consistent with a relatively uniform coal recovery thickness and occurs progressively with panel extraction minimizing potential differential settlement. Experience indicates that approximately 90 percent of longwall related subsidence occurs within 2 to 3 years following completion of mining.

Exhibit 11 contains a report by Agapito Associates, Inc. entitled "Measures for Controlling Subsidence from Minable Coal Seams in the Willow Creek Area". The study examines the geologic and geotechnical environment, subsidence parameters and stability evaluations.

The Division has examined the information about the lithology, topography and mining activities that will affect subsidence. The Division has determined that there is enough information to support the Operator's claims about subsidence. The Operator's claims about the extent of subsidence are consistent with other subsidence studies in the Utah and Colorado coal fields.

The Operator has met the minimum regulatory requirements physical conditions description.

Monitoring Description

Once development and mining operations begin, Cyprus will implement an ongoing subsidence monitoring program to determine when mining related subsidence commences and the amount of actual surface subsidence. This information will be reviewed and evaluated to determine the accuracy of the original subsidence projections. The subsidence monitoring data will also be the basis for any appropriate modifications in mining plans, mine sequencing, or ground control measures in order to minimize or provide for controlled surface subsidence. By providing for ongoing review and evaluation of actual subsidence response, Cyprus can make any design or operational adjustments necessary to prevent significant subsidence related material damage or diminution of use. The proposed subsidence monitoring plan has been developed in compliance with applicable regulatory provisions of Rules R645-301-525.140 and 632, and will include periodic visual observations, field surveys of permanent subsidence monuments, review and evaluation of monitoring field data, and development of summary tables showing any changes

in elevation or horizontal position (for sensitive structures only) of the subsidence monuments and subsidence profiles.

The periodic visual observations will be conducted on at least an annual basis and will involve a visual field inspection of potential subsidence areas for any visible evidence of subsidence including surface cracks, slumping, displacement, structural damage, or other observable changes. Any observed evidence of potential subsidence related surface impacts will be noted on a field report form and the location of any documented observations will be tied to existing subsidence monuments to the extent reasonably feasible.

Subsidence monuments will be established in each potential subsidence area before any subsidence actually occurs in that area, normally during the summer prior to initiation of mining. The timing for installation of monitoring points will be determined by projecting the angle of draw from the line of mining advance based on the following formula:

$$\text{Distance} = \text{Overburden} (\tan 22\tfrac{1}{2}^{\circ})$$

Based on available information, as documented by Exhibit 11 the anticipated maximum angle of draw for the proposed operations is 22.5 degrees. The anticipated subsidence limits and corresponding boundaries for subsidence monitoring activities are based on the projected maximum angle of draw. Given, however maximum draw angles of up to 45 degrees for similar operations, Cyprus will establish an expanded subsidence boundary corresponding to the theoretical maximum draw angle of 45 degrees for initial mining operation in the D Coal Seam to verify the projected angle of draw. Since the D Coal Seam is the uppermost coal seam to be mined, it is associated with the minimal depth of cover and maximum subsidence potential and so represents the worst-case subsidence condition. If initial monitoring indicates an angle of draw greater than the projected maximum of 22.5 degrees, subsidence limits and the subsidence monitoring network will be reevaluated and expanded if necessary to address the maximum area of potential surface subsidence effects.

Detailed Description of the Subsidence Control Measures

Subsidence control for the corridor containing the highway and creek will be provided by a barrier pillar extending under this corridor. The barrier pillar is defined by the angle of draw extending from the limit of any mining areas adjacent to the highway/creek corridor as shown on the Mine Plan Maps (Maps 19A through 19D) and, with the exception of the K Seam main entry crossing, no mining will occur within this defined boundary. The K Seam main entry crossing has been designed based on specific recommendations presented in the Agapito Report which is included in Exhibit 11, Geotechnical Investigations. The K Seam main entries will be developed at a depth of approximately 900 feet beneath Willow Creek as 20 foot wide entries with 70 x 100 foot pillars. This configuration will result in an effective extraction ratio of only 37.5 percent, there will be no retreat mining in this area, and the coal remaining in the support pillars will provide for effective long-term stability to prevent subsidence of overlying areas.

The Operator provided protection to Highway 191 and Willow Creek by excluding those areas from planned subsidence. Mining beneath the structures will be limited to main entry in the K seam. That entry is needed for access to coal east of the highway/road corridor.

Description of the Anticipated Effects of Planned Subsidence

Low-Intensity Seasonal Grazing Areas - Some of the relatively flat high plateau and broad upper ridgeling areas in the northwest portion of the proposed permit area are utilized on a seasonal basis for low-intensity cattle ranching and sheep grazing. Use is limited by the generally rugged terrain, arid conditions, and lack of significant ground water resources for stock watering. Due to the natural dip of the coal seams, these areas are near the effective cover limit for proposed mining operations and correspond to cover thicknesses of 1,800 feet or more. Given effective cover depths and the proposed ground control measures noted above, potential subsidence in these areas should be limited and is not expected to result in any significant diminution of the existing grazing use.

In the unlikely event that subsidence was to result in surface cracks which could pose a hazard to livestock or ground water source Cyprus would take redial action. If any significant surface cracks were to occur fences or grading would be used to protect the public and livestock. If ongoing monitoring results in a determination that mining has resulted in reduction of changes in the flow or quality of a stock watering source which will significantly diminish potential grazing use, remediation may involve replacement of augmentation of any effected water rights, monetary compensation, development of alternative watering facilities.

Limited Recharge Areas - Ground water recharge in the area is limited by the arid climate, rugged terrain, and relatively low permeability of most of the geologic units. Effective ground water recharge occurs only where potential water bearing members outcrop on the relatively flat high plateau areas, on exposed ridge lines, and in small basins where runoff or snow accumulations may provide a supplemental ground water recharge and in these areas limited outcrop exposures preclude a significant recharge. As discussed in Section 3.7.2.2, Ground Water Aquifers, transmission of the minimal recharge that does occur to either perched aquifers or the regional water table aquifer is effectively limited by the low overall permeability of the overlying stratigraphic units. The regional water table aquifer is not generally utilized for water supply due to its relative depth and low water storage and transmission capacity and perched aquifers are typically of such limited extent that use is limited to occasional small volume stock watering from the few developed springs and seeps that exist in the area as shown on the Regional Hydrology Map (Map 15). There are no ground water supply wells within the area of potential subsidence which would be affected by mining related subsidence.

Unimproved Dirt Roads - Several unimproved dirt roads exist in the area as shown on the Subsidence Control Plan Map (Map 20). These roads have limited access, are not maintained on a regular basis, and are generally used only by private property owners in the area for grazing or other occasional access

Fence Lines - Several fence lines exist within the area of potential subsidence as shown on the Subsidence Monitoring Plan Map (Map 20). The existing fence lines are typically three-wire barbed fences strung on wooden posts which are utilized to delineate and confine livestock use to specific areas. It is anticipated that potential subsidence related impacts on existing fence lines will be minimal and will be limited to isolated instances of fence wire being broken or separated from the supporting posts.

State Highway 191 and Willow Creek - State Highway 191 parallels Willow Creek, bisecting the proposed permit area along a diagonal corridor running from southwest to northeast. Both the highway, as a major structure, and the creek, as an important resource value, will be protected from potential mining related subsidence effects. Cyprus does not plan to develop either longwall panels or room and pillar sections under the highway and creek, but will drive main entries in the K Seam under the highway/creek corridor to access minable K, C, and A Seam reserves to the south and east.

Subsidence control for the corridor containing the highway and creek will be provided by a barrier pillar extending under this corridor. The barrier pillar is defined by the angle of draw extending from the limit of any mining areas adjacent to the highway/creek corridor as shown on the Mine Plan Maps (Maps 19A through 19D), and with the exception of the K Seam main entry crossing, no mining will occur within this defined boundary. The K Seam main entry crossing has been designed based on specific recommendations presented in the Agapito Report which is included in Exhibit 11, Geotechnical Investigations. The K Seam main entries will be developed at a depth of approximately 900 feet beneath Willow Creek as 20 foot wide entries with 70 x 100 foot pillars. This configuration will result in an effective extraction ratio of only 37.5 percent, there will be no retreat mining in this area, and the coal remaining in the support pillars will provide for effective long-term stability to prevent subsidence of overlying areas.

The power poles in Barn Canyon will not be damaged by subsidence since the Operator will either make arrangements to move the lines outside the subsidence area or not mine the coal under Barn Canyon.

The Operator assumes that State Highway 191, Willow Creek and the powerlines that parallel them are in a protected corridor that will not be affected by subsidence. The assumption is based on the 22.5° angle of draw, which is the average angle of draw for Utah and Colorado. It is possible that the angle could be much larger than 22.5° and subsidence would occur in the corridor. In such an event the stream, highway or powerlines could be damaged. The Operator needs to address this situation.

In the unlikely event that Willow Creek, State Highway 191, or the nearby powerlines are impacted by surface subsidence, Cyprus would immediately notify UDOGM, UDOT, PacifiCorp, and any other appropriate jurisdictional agencies or other entities. In consultation with the effected or responsible parties, Cyprus would develop and implement any necessary and appropriate control and mitigation measures. Control and mitigation measures would focus first on any immediate safety or environmental concerns and then address repair and mitigation of any related subsidence damage.

The Operator has committed to mitigate all damages caused to manmade structures. Since specific remediation plans cannot be developed until after the event the Division considers this commitment adequate.

Measure for Mitigation or Remedy of Any Subsidence-related Material Damage

In the unlikely event that subsidence damage was to occur in the low-intensity seasonal grazing areas, it would most likely be in the form of surface cracks which could pose a hazard to livestock or in interruption of any perched ground water sources supplying water for stock

watering purposes. If this occurred, Cyprus would implement appropriate remedial measures. Generally, the areas which are grazed are not susceptible to surface cracking since developed soils exist in these areas which would inherently buffer any tensile stresses; however, if any significant surface cracking were to occur remediation would involve fencing any areas that pose a potential hazard to livestock, limited surface grading or plowing, and reseeding to fill the cracks, minimize erosion and reestablish vegetation. As appropriate and with documentation of any actual loss, Cyprus will compensate the surface land owner/grazing lessee for any direct livestock losses and any significant loss of use resulting from mining related subsidence. Cyprus currently, and will continue to, monitors all known springs and seeps in the area during the period of active mining operations. If ongoing monitoring results in a determination that mining has resulted in reduction or changes in the flow or quality of a stock watering source which will significantly diminish potential grazing use, remediation may involve replacement or augmentation of any affected water rights, monetary compensation, development of alternative watering facilities such as guzzlers, or a negotiated agreement with the affected surface owner/grazing lessee providing for substitution or replacement of grazing areas.

The potential subsidence effects on the unimproved roads should be limited, and are not expected to result in any significant diminution of existing road conditions or access. In the unlikely event that subsidence was to result in surface cracks which could affect road conditions or use, remediation would involve limited surface grading to fill and eliminate the cracks and to provide a smooth, passable road surface.

If Willow Creek, State Highway 191, or the nearby powerlines are impacted by surface subsidence, Cyprus would immediately notify UDOGM, UDOT, PacifiCorp, and any other appropriate jurisdictional agencies or other entities. In consultation with the effected or responsible parties, Cyprus would develop and implement any necessary and appropriate control and mitigation measures. Control and mitigation measures would focus first on any immediate safety or environmental concerns and then address repair and mitigation of any related subsidence damage.

Other Subsidence Control Information Specified by the Division

The Operator must obtain an agreement with the Utah Department of Transportation (UDOT) to mine beneath State Highway 191. The agreement is needed to insure that the public is protected from the potential effects of subsidence on a public road. The Operator must also agree to notify UDOT six months prior to any mining under state highways.

In the February 2, 1996 submittal, the Operator stated that an agreement with PacifiCorp and Boyd Marsing are pending and copies will be provided to UDOGM on receipt. The Division cannot approve the subsidence plan until they have obtained documentation that UDOT has approved the mine plan.

Performance Standards for Subsidence Control

The Operator has committed to repair or replace any material damage caused by subsidence. The Operator does not show any public buildings and facilities, churches, schools, and hospitals; or impoundments with a storage capacity of 20 acre-feet or more or bodies of water with a volume of 20 acre-feet or more with in the area of planned subsidence. When the

Operator determined the areas planned subsidence he assumed that the angle of draw would be 22.5° and no subsidence will occur in the corridor beneath Willow Creek. The angle of draw is based on the average angle of draw in Utah and Colorado. While that assumption may be the best estimate for the angle of draw it is possible the angle of draw could be much larger and affect Willow Creek, the powerlines and the state highway.

The Division usually accepts the 22.5° angle of draw until field measurements demonstrate that another angle should be used. There is no reason for the Division to reject the 22.5° at this time. However, if subsidence monitoring data indicates that subsidence could occur outside of the approved subsidence control areas then the Operator must modify the mining plans so that subsidence only occurs in the approved areas. Should subsidence cause damage to State Highway 191, powerlines, or Willow Creek the Operator must commit to repair the damage.

Notification

Prior to initiation of mine development or other mining activities which could result in potential surface subsidence, Cyprus will notify the affected surface landowners as well as the owners or Operator's of any potentially affected utilities or structures. Notification will occur at least 6 months prior to initiation of the mining activities and will consist of a written notice identifying the area(s) of proposed mining, the schedule for when mining will occur, and the location(s) where a copy of the subsidence control plan is available for public review. In order to protect the rights of the owners or Operator's of specific structures and lands which could potentially be affected by mining related subsidence, Cyprus is either proceeding with, or has obtained, subsidence agreements giving Cyprus the right to undermine the subject lands or structures provided that any subsidence related impacts are properly mitigated. Where appropriate, subsidence agreements will be secured prior to initiation of any mining related activities which may potentially affect the structure or lands covered by the agreements. Existing subsidence agreements are included in Exhibit 16, Subsidence Information, and copies of any agreements obtained in the future will be provided to UDOGM for insertion in this exhibit. The following summarizes the need for, and status of, any subsidence agreements for mining and related operations:

Surface Landowners - Subsidence agreements have been obtained from the private property owners of surface lands within potential subsidence areas as indicated by comparison of the Surface Ownership Map (Map 1), and the Subsidence Monitoring Plan Map (Map 20). These agreements document Cyprus's right to undermine the private property holdings addressed by the agreements provided that any subsidence related material damage is effectively mitigated. Mitigation may include, but is not limited to purchase of affected lands, substitution or replacement of grazing areas, monetary compensation, or repair of any surface damage.

Water Rights

Subsidence agreements have been obtained from owners of water rights that lie within potential subsidence areas as indicated by comparison of the Water Rights Map (Map 17), and the Subsidence Monitoring Plan Map (Map 20). The agreements document Cyprus's right to mine beneath the surface or ground water sources associated with the water right(s) and Cyprus's commitment to mitigate any subsidence related impacts. Mitigation may include, but is not limited to purchasing the water right, replacement or augmentation of any affected water rights, monetary compensation, development of alternative watering

facilities such as guzzlers, construction of retention ponds, and substitution or replacement of grazing areas. There are no domestic drinking water sources within the proposed mining and potential associated subsidence areas.

Highway 191 and Willow Creek

Areas beneath State Highway 191 and Willow Creek were extensively mined in Sections 31 and 32, T12S, R10E, as shown on the Previous Mining Activities Map (Map 10). The historic mining in this area consisted of extensive development mining with retention of support pillars in most areas, although retreat mining with pillar recovery is known to have occurred in two areas, one area directly beneath and the other very close to the highway and creek. There is no evidence that the historic mining resulted in any significant surface subsidence impacts to either the highway or the creek. Given this directly applicable historic mining precedent and Cyprus's plans to retain a barrier pillar beneath the highway/creek corridor and limit extraction in the K Seam main entry crossing, no significant subsidence is anticipated and subsidence agreements with UDOT for the highway are not considered necessary.

Powerlines

Although no subsidence impacts to electrical transmission lines are anticipated, in order to protect PacifiCorp's interests Cyprus is also proceeding with negotiation of a subsidence agreement which will be secured before initiating any mining activity which could affect the existing power lines. The agreement will give Cyprus the right to undermine in the vicinity of the power lines provided that any subsidence related impacts are appropriately mitigated.

The Operator has committed to notify all surface owners at east six months prior to mining under their property.

Findings:

The Operator has met the minimum regulatory requirements for renewable resources survey.

The Operator has met the minimum regulatory requirements for describing the coal removal method. The minimum regulatory requirements have been met for the underground workings map. The Operator has met the minimum regulatory requirements physical conditions description. The Operator has met the minimum regulatory requirements for a monitoring description. The Operator has met the minimum regulatory requirements for a detailed description of the subsidence control measures. The Operator has met the minimum regulatory requirements for a description of the anticipated effects of planned subsidence. The Operator has met the minimum regulatory requirements for Measure for mitigation or remedy of any subsidence-related material damage.

The Operator has met the minimum regulatory performance standards for subsidence.

The Operator has met the minimum regulatory requirements for subsidence notifications.

SLIDES AND OTHER DAMAGE

Regulatory Reference: 30 CFR Sec. 817.99; R645-301-515.

Analysis:

Certain situations involving accidents, emergencies, or unforeseen circumstances may require immediate or timely reporting to provide for appropriate coordination of required control and mitigation measures. Under applicable regulatory requirements, these situations are specifically identified as including the following:

- Slides which may have potential adverse effects on public health and safety, property, or the environment
- Impoundment hazards
- Accidental release of potentially hazardous or toxic materials including petroleum products
- Temporary cessation of mining operations

Reporting and emergency measures for potential slides are specifically addressed in Section 4.6, Geologic Protection; for impoundment hazards and accidental releases of potentially hazardous or toxic materials in Section 4.7, Hydrologic Resource Protection; and for temporary cessation of mining operations in Section 4.5.2.5, Temporary Cessation.

In Section 4.6, Geologic Protection, the Operator states:

At any time that a slide or similar earth movement occurs and is identified by mine personnel which poses an immediate hazard or may have potential adverse effects on health, safety, property or the environment it will be immediately reported to UDOGM. Notification would typically involve a telephone call with follow-up written documentation. Based on an assessment of site-specific conditions and circumstances, Cyprus will then coordinate with UDOGM to develop and implement appropriate remedial measures.

Findings:

The Operator has met the minimum regulatory requirements.

OPERATIONAL TOPSOIL AND SUBSOIL

Regulatory Reference: 30 CFR Sec. 817.22; R645-301-232, -301-233, -301-234, -301-242, -301-243.

Analysis:

Section 4.2, SOIL HANDLING PLANS, describes the soil handling practices, related environmental control and environmental mitigation measures associated with the Willow Creek Mine Facilities. Soil materials will be recovered from any disturbance area where natural soils exist and from previously disturbed areas where suitable disturbed soils exist. The majority of the existing Willow Creek area's surface materials represent disturbed soils which are intermixed with overburden and coal waste. Potential disturbance areas where

natural undisturbed soils remain will generally be very small, typically occurring on the perimeter of previous disturbance areas where steep slopes and shallow soils limit practical soil availability.

Soil recovery will focus on removal and salvage of all reasonably recoverable soils to a maximum depth of 3 feet or until highly consolidated, coarse fragment content or clayey materials are encountered at a shallower depth. No effort will be made to segregate individual soil horizons. Where disturbed soils are to be recovered, recovery depths will range from a minimum of 12 inches to a projected maximum of 30 inches. To the extent operationally feasible, significant coal or coal refuse zones will be avoided during recovery. Any significant coal or coal waste deposits and accumulation will be excavated and disposed in the Schoolhouse Canyon Refuse Pile.

Table 4.2-1, Soil Recovery and Storage Plans, summarize soil material recovery areas and volumes for proposed mining and related surface disturbances. Table 4.2-1A, Justification for Soil Salvage Assumptions, provides supportive documentation for soil recovery. Existing topsoil stockpile volumes include Gravel Canyon at 87000 cy, Crandall Canyon at 18000 cy and Willow Creek Mine Facilities at 21200 cy. An additional 106270 cy of topsoil removal is projected at the Willow Creek Mine Facilities. Total surface disturbance at the Willow Creek Mine Facilities is approximately 55.8 acres. With a grand total of 127470 cy of salvaged topsoil over the 55.8 acres of surface disturbance, an average of 17 inches of soil removal is projected for the Willow Creek Mine Facilities. Willow Creek Mine Facilities disturbance subtotals include 31 acres previously disturbed areas, 6.7 acres undisturbed soils, 1.6 acres riparian soils and 16.5 acres reclaimed sites.

Soil removal volumes and quality are estimates based on extensive field sampling of both disturbed and undisturbed soils in the proposed surface disturbance areas. However, actual recovery and resulting soil quality will be dependent on site-specific conditions and practical operating limitations. CPMC commits to the following:

- CPMC plans to sample soil materials prior to removal and placement in temporary stockpiles to verify suitability and optimize reclamation success. Samples will be analyzed for all suitability parameters defined by the Division's Topsoil and Overburden Guidelines. Sampling results will be reviewed, summarized, and provided to DOGM.

- Soil recovery operations will be supervised and monitored by a qualified and experienced reclamation specialist/soil scientist. Actual soil recovery depths, surface area and resulting volumes will be documented and any site-specific limitations on soil recovery will be noted. Following completion of soil removal operations, a narrative description of soil recovery operations along with appropriate supporting documentation will be prepared and incorporated into the next Annual Reclamation Monitoring Report for submittal to DOGM. Any variations between actual and projected soil recovery as outlined by Table 4.2-1 will be identified and explained.

Soil and substitute topsoil will be salvaged and placed in stockpiles for storage. Existing soil stockpiles include one located in Gravel Canyon and two in the Crandall

Canyon area. One new soil stockpile is located in the Willow Creek area on the west side of an existing rock outcrop known as "Devil's Slide." Soil stockpiles will be protected from erosion, contamination, and soil loss by establishing sideslopes at 3H:1V or less, providing roughened surface conditions, seeding with vegetative cover, posting, and using appropriate drainage control measures. Seeding will normally occur as soon as reasonably feasible once active soil stockpiling operations cease for a given stockpile area. Stockpile areas will be inspected periodically and any significant erosion or other problems will be noted and repaired.

Findings:

This portion of the permit application is complete and accurate.

INTERIM STABILIZATION

Regulatory Reference: R645-301-331

Analysis:

Requirements of this regulation are addressed primarily in Section 5.3.2.3. Table 5.3-1 is a temporary seed mixture comprised of four introduced and two native species. Most of these species are rhizomatous or spread above ground to effectively protect soil from erosion.

The amount of seed the Applicant plans to use is adequate but minimal. The *Interagency Forage and Conservation Planting Guide for Utah* recommends drill seeding at a rate of 25 to 75 seeds per square foot and broadcast seeding at a rate of 50-100 seeds per square feet. If the Applicant uses the mix as shown, they would drill seed at the rate of 31 seeds per square foot or broadcast at the rate of 62 per square foot. While these are within the recommended rates, a 50% increase in the amount of seed would better assure interim revegetation.

The application says the planting time for most areas is in the fall, but prompt revegetation of small disturbances may be desirable to minimize erosion potential. In these cases, revegetation could occur at any time if site and climatic conditions are reasonable. Fall is recognized as the best time to seed in this area of Utah, but spring and early August planting may also be successful depending on the weather. If the Applicant seeds at times other than the fall, there is a risk of needing to prepare the surface again and to reseed.

The application does not specifically say what other revegetation methods will be used on interim revegetation sites. However, because it does not differentiate, it is assumed the Applicant will use the same methods for both final and interim revegetation. These techniques are discussed under "Revegetation." Seedbed preparation techniques discussed in this section apply to both interim and final revegetation. In particular, gouging is highly recommended and has been used with very good success at several sites in Utah. Gouging is where a trackhoe or similar equipment makes pits in the soil about one to two feet deep and about two to four feet across. These pits are not conducive to drill seeding, but they are very effective at trapping moisture, reducing erosion, and increasing plant establishment.

Findings:

The Applicant has complied with the requirements of this section.

It is recommended the Applicant increase the amount of seed for interim revegetation by 50%. Revegetation techniques other than the species mixture and timing of planting are discussed under "Revegetation," and the Division makes recommendations to improve these methods.

FISH AND WILDLIFE PROTECTION

Regulatory Reference: R645-301-333.

Analysis:

Potential Effects and General Comments

Section 4.3.2.1 of the application includes a list of potential effects on fish and wildlife. These include disturbance of 55.8 acres of land together with displacement of wildlife from the mine area, direct mortality of non-mobile wildlife, indirect disturbance from increased human activity, a potential for losses from electrocution and traffic-related mortality, the potential for altering vegetation in subsided areas, and possible disruption of water sources due to interruption of ground water flow.

While revegetation efforts have been largely successful in establishing potential wildlife habitat, actual use is limited by the surrounding terrain and nearby disturbances. The application indicates these factors preclude significant long-term use by large mammals, raptors, and many other terrestrial wildlife species.

The application's characterizations of the significance of the site for wildlife are questionable. Although the amount of vegetative cover in the proposed disturbed area is not as great as in undisturbed areas, the vegetation in reclaimed areas is generally more palatable and has greater nutritional value for wildlife than vegetation in undisturbed areas. Division of Wildlife Resources personnel indicate the area proposed for disturbance is suitable deer habitat although use has been limited by previous disturbances. Division personnel have observed numerous deer in the AMR areas. The area has good structural diversity. Many of the rocks have whitewash indicating they are used as perches by raptors.

While opinions differ as to how important the site is for local wildlife populations, it does not appear there are any factors which would preclude granting a permit to conduct mining and reclamation operations. The Applicant will still be responsible to use the best technology currently available to protect fish and wildlife and to enhance related values, such as wildlife habitat.

According to the application, the greatest potential for significant territorial impacts would be associated with displacement of large raptors during the nesting season. At least six golden eagle nests are within one-half mile of the proposed surface facilities area, and some have been tended or used within the past few years. Construction during crucial periods could disrupt nesting activities.

Potential effects to aquatic species include increased sedimentation, especially during construction, temporary loss of habitat during realignment of the stream, and possible changes in water quality and flow rates. The length of the creek, and thus the length of the riparian area, would be shortened from about 1210 to 1100 feet.

Although the Applicant considered prevailing wind directions when locating the coal stockpiles, some windborn coal fines will probably enter the creek.

On page 4.3-5 is the statement, "The use of construction equipment near the Willow Creek stream channel represents a minor potential risk since a petroleum spill or leak could result in stream contamination and potential toxic effects from petroleum products, on fish and macroinvertebrates." The latter part of this sentence does not explain why using construction equipment near the stream constitutes a minor risk for oil spill contamination.

Maximum anticipated water withdrawals from the Price River will be limited to 730-acre feet annually. These withdrawals would be based on existing water rights, and the application indicates the Applicant does not believe this should be considered a new depletion subject to mitigation requirements for threatened and endangered fish of the Upper Colorado River. This determination will be made by the Fish and Wildlife Service after consulting with the Office of Surface Mining, Reclamation and Enforcement.

No areas were identified as potential jurisdictional wetland areas during the baseline field surveys of surface disturbance areas.

Protection Measures

The Applicant intends to minimize disturbance through the use of existing facilities at the Castle Gate Preparation Plant and by using conveyors instead of trucking coal to the preparation plant. Little of the proposed disturbed area is on undisturbed land. All facilities are consolidated in a limited area near existing transportation routes.

The application says disturbances to the creek, including removal of a series of five man-made pools below the culvert crossing, would be mitigated by building designed channel segments and revegetation with riparian and other suitable vegetation species. The realigned sections will incorporate specific designs resulting in overall enhancement of aquatic habitat values and increases in the extent of riparian vegetation. The application gives some details of the designs, including approximate pool and riffle locations, meander locations along with placement of large rocks on the outsides of meanders, and revegetation plans.

Work in the stream will be done during low flows and will include alternative sediment control to keep excavated material out of the creek and to control runoff from the disturbed areas. A series of silt fences will be installed to catch sediment in the new channel after it is first opened. New stream crossings will be seeded with a quick-growing temporary seed mix and mulched or protected with synthetic slope stabilization materials.

The conveyor system will be covered to minimize dispersion of coal fines, and all transfer points will be partially or fully enclosed to minimize fugitive coal fines. Most sections of the conveyor will be at least 200 feet from the stream, but a few will be within 150-180 feet.

Accumulations of coal fines will be cleaned up and disposed of when they reach a depth of one inch or greater.

Section 4.3.3.7 says the Applicant does not plan to use, store, or generate potentially hazardous or toxic materials. This is apparently in reference to materials defined in these categories by regulations which exclude most petroleum products. The next sentence says materials potentially hazardous to wildlife, such as petroleum products, will be within closed areas or containers.

Fueling and maintenance of construction equipment will not occur in the immediate vicinity of Willow Creek, and no fuel or lubricants will be stored within the stream buffer zone. Decant structures on the sedimentation ponds have oil skimmers to minimize the potential of discharge of oil products from the ponds.

Longwall equipment will be operated, inspected, and maintained to minimize potential fluid loss. Longwall fluids that leak or spill will mix with mine drainage within the underground mine workings. The mine water handling system will be a closed loop that will not discharge to surface systems or drainages. Any mine water that needs to be discharged to the surface will be first sampled and will be routed to sediment control structures to ensure it meets effluent limitations.

Major pollution events have occurred at other mines in the area that use longwall miners. The procedures included in the application should protect the stream from potential environmental damage from longwall fluids. If a petroleum event was to reach Willow Creek, it would be reported immediately. The Spill Prevention, Control, and Countermeasure (SPCC) plan should contain specific provisions for preventing, cleaning up, and reporting spills.

Equipment use and operations in stream buffer zones will be restricted to the construction activities required for placement of bridge abutments, replacement of the culvert crossing, and stream channel realignment. No fuel or lubricants will be stored within the buffer zone, and fueling and lubrication of equipment will not occur in the immediate vicinity of Willow Creek. A full length berm will separate operating areas from the stream channel.

Aquatic monitoring will continue for two years after construction of the realigned portion of Willow Creek. Benthic macroinvertebrates and fish will be sampled in one location in each relocated portion, and this will be compared to data from a reference location. If the results of sampling during the first year after construction indicate effective recovery of aquatic communities, no additional sampling will be required in the second year. However, if the initial monitoring indicates significant continuing adverse effects, the Applicant will provide the Division with recommendations about continued monitoring and mitigation. The commitments to monitor macroinvertebrate populations in the creek satisfy regulatory requirements. However, unforeseen effects of the mine may necessitate additional monitoring in the future.

The Applicant commits to design and construct mine-related power transmission lines to protect raptors from electrocution hazards in accordance with applicable guidelines.

The application says in Section 4.3.3.6 that site-specific evaluation of the facilities area by a professional biologist resulted in the conclusion that the proposed conveyor location at the base

of the natural canyon walls does not represent a barrier to large animal movements since such movements would typically involve more favorable access routes. Although sides of the canyons are not generally used for major migrations, big game use them for foraging and for daily movements, such as to the creek. The conveyor is a potential obstacle. However, the conveyor was designed with a minimum clearance of 40 inches. Several sections of the conveyor will be elevated more than 40 inches. Literature sources indicate most deer and elk have no problem going under conveyors elevated at least one meter. Portions of the conveyor will be elevated more than this and should allow large bucks and bulls to pass.

The application says in Section 4.3.4.2 that the permit area does not provide suitable nesting habitat for bald eagles but that there is some potential for golden eagle nesting. The Applicant will either not initiate new activities within one-half mile of active golden eagles nests during the spring breeding season, or it will, in consultation with the Division and Wildlife Resources, initiate appropriate mitigation measures. Observed golden eagle nesting activity within the permit area will be reported to Wildlife Resources. The Applicant will conduct periodic raptor surveys in areas of concern if proposed mining activities have significant potential to adversely affect raptor breeding.

Three golden eagle nests are in Eagle Canyon, and at least three are in Castle Canyon. Construction activities within one-half mile of nest sites, particularly when the nests are within line of site of the activities, are normally restricted to a period outside the nesting season, approximately February 15 to July 15. The Applicant intends to install water tanks near the mouth of Castle Canyon and does not anticipate having a conflict with the nesting season. However, fans would be installed near the mouth of Eagle Canyon, and it is anticipated this will take about six months. This construction schedule could conflict with the nesting season for any birds nesting in Eagle Canyon.

To resolve this problem, the Applicant's officials met with the Fish and Wildlife Service. They agreed the Applicant would evaluate visibility of the proposed facilities from the nests, check the elevation difference, evaluate the possibility of scheduling some construction outside the nesting periods, look at the potential for obtaining take permits and using nesting deterrents, and propose a plan for addressing the nests in the mining and reclamation plan application. In addition, after a firm construction schedule is established, mitigation plans will be developed in consultation with the Division, Wildlife Resources, and the Fish and Wildlife Service before beginning construction. These commitments satisfy regulatory requirements. Wildlife Resources has concurred that the Applicant's monitoring and protective measures will be adequate.

During operations, significant wildlife observations from the permit area will be reported to Wildlife Resources. Personnel will be instructed to report accidental wildlife mortality or eagle sightings to the mine environmental coordinator. If mining activities have significant potential to adversely affect raptor breeding, the Applicant will perform periodic raptor monitoring surveys.

Enhancement

Habitat enhancement plans are contained in Section 5.3.3. In correspondence dated November 9, 1995, the Division of Wildlife Resources recommended that lost habitat be mitigated by an enhancement project that will encourage deer and elk to use areas other than the

canyon bottom. The application lists four potential habitat enhancement alternatives. These include retreatment of chained areas on Bureau of Land Management land, seeding one or two areas on Division of Wildlife Resources' land in the Gordon Creek area, placing sources of water for wildlife on the Applicant's land near the mine, and enhancing portions of Willow Creek. The first and last of these proposals have problems that may be difficult to overcome, but the Applicant commits to select and implement one or more of the projects.

The measures discussed in the application are the types of measures the Division seeks. While details of these projects still need to be decided, and while some may not be feasible, the commitments in the application satisfy the requirements of this regulation. The projects appear to have the potential of being useful and actually achieving an increase in habitat quality.

Findings:

This portion of the application is considered complete and accurate.

The Applicant has committed to several wildlife protection and habitat enhancement measures that constitute the best technology that is now available. Four potential wildlife habitat enhancement measures have been included. Any of these should achieve the objective of improved habitat conditions.

Although the proposed disturbed area is not on federal property, portions of the proposed permit area have Bureau of Land Management land. Therefore, the Division will need to receive concurrence from the Fish and Wildlife Service. Although the Division does not anticipate adverse effects to threatened, endangered or sensitive species in the immediate area, the Fish and Wildlife Service may determine water depletions from the mine to have potential adverse effects on threatened and endangered fish of the Upper Colorado River. If so, the Applicant will need to pay a mitigation fee.

ROAD SYSTEMS AND OTHER TRANSPORTATION FACILITIES

Regulatory Reference: 30 CFR Sec. 784.24, 817.150, 817.151; R645-301-521, -301-527, -301-534, -301-732.

Analysis:

Road Classification System

In conjunction with the proposed mining and related operations Cyprus will construct, operate and maintain a number of new roads and will operate and maintain several existing roads. Both new and existing roads will be utilized to access existing and proposed facilities and for transportation of personnel, equipment, and supplies. All roads were classified as primary on or before April 4, 1996. Given that both coal and mine development waste will be transported by conveyor, the only road to be utilized for transportation of mine waste or coal processing waste will be Road PR-4 from the Castle Gate Preparation Plant to the Schoolhouse Canyon coal refuse stockpile. There are, however, several other roads which will be utilized on a frequent, long-term basis to support the proposed mining and related operations. Existing and proposed roads which will be used in conjunction with the proposed mining and related operations include the following:

Proposed Roads in Willow Creek Facilities Area

PR-1 Primary mine access road for the proposed surface facilities area
PR-2 Primary mine access road to the Willow Creek run-of-mine coal stockpile area
AR-1 Ancillary access road to the mine water and firefighting reserve tank installation
AR-2 Ancillary access road to the mine ventilation fan area
AR-3 Ancillary access road to Sedimentation Pond 001 and Conveyor SC-4
AR-4 Ancillary access road to the Willow Creek soil/substitute stockpile and explosive storage area

Existing Roads in Castle Gate Preparation Plant and Loadout Areas

PR-3 Primary access road for the preparation plant and loadout areas
PR-4 Primary access road to the Schoolhouse canyon coal refuse facility
AR-5 Ancillary access road to the west end of Rock Tunnel No. 2 and the transfer point between Conveyors SC-5 and SC-6
AR-6 Ancillary access road to the truck dump grizzly

Existing Road in Gravel Canyon Soil Stockpile Area

AR-7 Ancillary access road to the Gravel Canyon soil stockpile

Existing Road in Crandall Canyon Facilities Area

AR-8 Ancillary access road to Crandall Canyon facilities area

All existing and proposed roads are shown on the Mine Surface Facilities Map (Map 18) and in Exhibit 20, Crandall Canyon Operations Plans.

The Operator has listed and classified all the proposed and existing roads as primary.

Plans and Drawings

Road Maps, Appropriate Cross Sections, Design Drawings

Map 18, Mine Surface Facilities, shows the location of the primary and ancillary roads in the Willow Creek area. Cross sections for the primary roads are shown in Figure 4.5-9. The cross sections show the road widths, gradients and surfacing materials.

The Operator has stated in the PAP that:

Primary roads have been or will be located and constructed to the extent operationally feasible in the most stable areas available and outside of the channel of intermittent or perennial streams. Road design and construction plans will prevent damage to public or private property; minimize the potential for downstream flooding or sedimentation; reflect consideration of the size of vehicles which will be using the road, traffic volume, and normal speeds; and to the extent possible, using the best technology currently available, minimize adverse impacts on fish, wildlife and related environmental values. All roads have been designed to provide for effective drainage, long-term stability, and safe vehicle operations

under varying weather conditions. Design and construction of all primary roads will be certified by a qualified Registered Professional Engineer as meeting these criteria.

Design and construction practices for specific roads will be dependent primarily on site conditions and the nature and frequency of anticipated use. The primary mine access road (PR-1) will provide access to most of the mine surface facilities and will be utilized for transportation of personnel, equipment, and supplies. Because it will handle a relatively heavy traffic volume and must provide safe operating conditions year-round, Road PR-1 will be a paved asphalt road with an all-weather travel surface. The other primary roads will also be utilized on a year-round basis but the associated traffic levels will be significantly lower so these roads have been designed and either are or will be constructed with an adequate compacted road base and gravel or similar durable granular surfacing.

Road construction will involve cut and fill earthwork operations using tractor scrapers, tracked dozers, and motor graders. Cut and fill slopes will be established at maximum grades of 2.5H:1V except in rock where slopes may be as steep as 0.5H:1V dependent on the characteristics of the rock. Typical road construction practices, road configuration, and dimensions for the two road classifications are illustrated by Figures 4.5-9 and 4.5-10, Typical Primary Road Configuration, and Typical Ancillary Road Configuration, respectively. Road gradients will vary from flat to a maximum of approximately 10 percent and any required road embankments will be constructed and compacted in a controlled manner to provide a minimum static factor of safety of 1.3. All roads cut and fill slopes will be revegetated as soon as reasonably practical following construction using the temporary revegetation seed mixture to stabilize the slopes and minimize erosion potential. Road surfaces will be graded or crowned to prevent accumulations of water on the road surface and adequately sized ditches and culverts will be installed and maintained to effectively carry road and other disturbed area drainage. Adequate cover will be provided over all culvert crossings to prevent damage or collapse of the culverts and culverts have been designed and will be installed to prevent plugging, erosion at the culvert inlet or outlet, and any drainage over the road surface. The locations of all proposed ditches are shown on the Drainage and Sediment Control Plan Maps, (Maps 23A through 23F) and ditch designs are included in Exhibit 13, Drainage and Sediment Control Plan.

Alteration or Relocation of a Natural Stream Channel

Road PR-1, Willow Creek Stream Buffer Area and Stream Protection Berm, Main Road Culvert Crossing, and Main Access Road Bridge - The main mine access road (Road PR-1) will cross Willow Creek in two locations and will parallel the creek for almost the entire length of the proposed surface facilities area. Because construction of this road will involve crossing, alteration, and relocation of portions of a natural drainage way, specific UDOGM approvals under applicable provisions of Rules R645-301-527.220 and 742.412. It should be noted that much of the Willow Creek channel through the proposed mine surface facilities area has

previously been relocated and modified and so does not represent a natural undisturbed stream channel. Where Road PR-1 parallels Willow Creek, a stream protection berm approximately three feet high with 3H:1V side slopes will be constructed along the edge of the road or any associated roadside ditch on the side nearest the stream. This berm will provide a means of physically separating the proposed mining and related activities from the stream and will serve as one edge of a restricted access stream buffer zone.

The Division has given tentative approval for the stream alteration. There are no outstanding engineering issues involved with the stream relocation.

Removal and Reclamation of Roads Not Retained under an Approved Postmining Land Use

Certain roads within the mine facilities area will continue to provide access to specific areas during both reclamation and the extended liability period, although most roads will be removed and reclaimed during final site reclamation. Generally, the primary access roads will be removed and reclaimed in two phases. The first phase will involve ripping of these roads and removal of the associated road surfacing materials. This phase will occur in conjunction with facility demolition and removal and the surfacing materials removed will be placed in the designated solid waste disposal areas as previously discussed. The second phase of road removal for primary roads and removal and reclamation of all other roads will be sequenced to coincide with backfilling and grading of the areas that the roads either provide access to or pass through. When roads are no longer needed, they will be removed and the associated disturbance areas will be regraded and reclaimed.

Road reclamation will generally involve the use of tracked dozers to rip the road surface and grade any surfacing material into piles which will normally be recovered by wheel loader and either hauled directly or loaded into trucks for haulage to one of the designated disposal areas. Road surfaces will then be ripped to alleviate any compaction and the road area will be graded to blend with surrounding reclaimed areas. During final grading, any culverts will be removed and transported to a temporary steel debris storage site for either salvage or disposal off-site. Cut/fill areas will be reclaimed by pulling the fill material up slope into the cut and grading any remaining cut slope, the fill material, and disturbed down slope areas to a stable configuration consistent with natural drainage patterns and blending with the surrounding terrain. Any major road cuts will be reclaimed by partially backfilling the cut and grading any remaining cut slope exposures so that they are stable as described in the backfilling and grading plan discussion. Any major road fills which would interfere with postmining drainage will be removed and the associated disturbance areas regraded in conjunction with overall site grading activities.

Performance Standards

In the PAP the Operator states:

> *Operation and maintenance procedures for all mine roads are designed to provide a smooth operating surface, assure safety, and minimize dust emissions. Road maintenance will involve periodic grading to provide a smooth surface, remove rocks or debris, and maintain effective drainage; repair and resurfacing as necessary; inspection, clean-out; and repair of ditches and drainage structures; and watering or application of surfactants to control dust during dry periods.*

Generally, speeds on roads and in active operating areas will be limited to 25 miles per hour by posted speed limits both as a safety consideration and to minimize dust emissions from unpaved roads. In the unlikely event that any road is damaged by a catastrophic event such as an earthquake or flood, Cyprus will make appropriate repairs as soon as reasonably practicable and will limit the use of the road or provide an alternate access if unsafe conditions exist.

Findings:

The Permittee has met the minimum regulatory requirements.

SPOIL AND WASTE MATERIALS

Regulatory Reference: 30 CFR Sec. 701.5, 784.19, 784.25, 817.71, 817.72, 817.73, 817.74, 817.81, 817.83, 817.84, 817.87, 817.89; R645-100-200, -301-210, -301-211, -301-212, -301-412, -301-512, -301-513, -301-514, -301-521, -301-526, -301-528, -301-535, -301-536, -301-542, -301-553, -301-745, -301-746, -301-747.

Analysis:

Disposal of Noncoal Mine Wastes

Noncoal wastes generated in conjunction with mining and related activities will include, but not be limited to, waste oil and lubricants, garbage, paper waste, machinery parts, tires, cable, wood waste, and other miscellaneous debris. All smaller noncoal solid wastes will be collected and stored in dumpsters or similar closed containers. Larger solid waste materials including such items as used equipment, machinery parts, tires, and cable will be temporarily stored in a designated scrap yard located in the equipment storage area as shown on the Mine Surface Facilities Map (Map 18). Most of the waste oil from the maintenance shop facility will be collected in a waste oil sump and recycled to one of two waste oil storage tanks for use in the shop facility waste oil heater. The waste oil will be mixed with fuel oil only after sampling and analysis to verify that the waste oil meets strict EPA requirements. Waste oil and fuel oil feed rate and mixture will be adjusted as necessary based on waste oil availability and shop heating requirements. Any waste other waste oil and lubricants and any waste oil not meeting the applicable EPA requirements will be collected and stored in either closed drums or in the waste oil storage tank located in the maintenance shop building. Temporary storage areas for waste oil and lubricants will provide full containment to prevent accidental release of petroleum products to the surface drainage system.

A contract disposal service will regularly collect and haul the noncoal solid wastes from the dumpsters to the permitted Carbon County municipal landfill. Dependent on the market for scrap materials, the larger noncoal solid waste and scrap will be collected periodically either by a salvage contractor for salvage and recycling or by a contract disposal firm which will haul these material off-site and dispose of it in a suitable disposal site. Any waste oil, lubricants, or other potentially combustible materials will be collected and either recycled or disposed of by a licensed disposal contractor in accordance with all applicable Utah and EPA regulations. No noncoal wastes will be disposed of on site during active operations except for mining waste generated in the mining process. As described in the previous section, this material will be disposed of in the Schoolhouse Canyon coal refuse stockpile.

Cyprus does not currently plan or anticipate that any materials classified as "hazardous waste" will be utilized or generated in conjunction with the proposed mining and related operations. In the unlikely event that hazardous material's storage or disposal becomes necessary, Cyprus will comply with all applicable storage, labeling, and documentation requirements, and disposal will occur off-site at a licensed hazardous waste disposal facility.

Coal Mine Waste

Mine development, ongoing mining operations, and ancillary operations such as development of overcasts for mine ventilation and coal haulage will result in production of mine waste including waste rock, carbonaceous shale, weathered coal, floor clay, and parting material. Where it is operationally feasible to separate these material from the coal during development and mining, the mine waste will be removed and handled separately from the coal. Where separation is not operationally feasible, mine waste will be handled with the coal and will be removed in the coal preparation plant.

Generally, the same mining equipment and haulage systems used for coal production will be used to remove and handle mine waste. Continuous miners, electric shuttle cars, and LHD scoops will be used to load and haul mine waste to the mine conveyor system. Normally waste haulage will occur on a scheduled waste handling shift when the conveyor belt system will be cleared of coal. Typically, any waste produced during periods other than on a scheduled waste handling shift will be temporarily stockpiled in an inactive area underground for later handling and haulage from the mine. Once the mine waste is placed on a belt at the loading point, it will be transferred to the main haulage belt running from the mine. From the main haulage belt, the mine waste will transfer to the surface coal haulage system which will carry the waste to the primary crusher building.

The surface coal haulage system and preparation plant have been designed to facilitate waste handling. The stacking tube at the run-of-mine coal stockpile can be emptied by a direct feed chute in its base allowing waste to bypass the coal stockpile and feed directly to Conveyor SC-1. In the primary crusher building a flop-gate and diversion chute will allow mine waste to bypass the primary crusher and feed directly to the mine waste temporary stockpile. From this stockpile Cyprus will use a wheel loader and rear dump trucks to load and haul the mine waste to the existing permitted Schoolhouse Canyon refuse stockpile. In the refuse stockpile area, mine waste will be handled and placed in essentially the same way as coal refuse material as discussed in the subsequent subjection titled Coal Processing Waste Handling and Disposal.

The Operator proposes to dispose of coal mine waste in sites already permitted for this activity. To avoid confusion the Operator should show that the Schoolhouse Canyon refuse stockpile has been permitted to accept material from the Willow Creek Mine.

On September 15, 1995, the Division approved a permit revision to the existing approved Castle Gate Mine Permit involving placement of materials from the Willow Creek area in the existing Schoolhouse Canyon Refuse Facility.

Refuse Piles

Refuse will be stored at the existing and permitted Schoolhouse Canyon facility.

Impounding Structures

The Operator's designs for pond construction are:

Pond construction will follow the regulatory guidelines as outlined in R645-301-533. The initial step in embankment construction is the removal of all organic materials from the foundation area. This will occur in conjunction with topsoil recovery operations as described in Section 4, Engineering Design and Operation Plans. Foundation areas will be graded to achieve maximum 1:1 slopes.

On-site borrow materials will be utilized for fill for the construction of pond embankments. Fill material shall be selectively handled to exclude organic material, frozen soils, and other unsuitable materials. Coal processing wasters may be used as embankment fill material

Fill materials for pond embankment construction will be placed in horizontally continuous lifts beginning at the base of the structure. In using fin-grained soils, lift thickness should not exceed 12 inches. Material should be compacted to at least 95% of the maximum dry density as defined by the standard Proctor test, with the placement of water content not exceeding the range of -2 to +3% of optimum.

At a minimum, the top width of each pond will not be less than 20% of the sum of the height, in feet of the embankment measured at the upstream toe plus 10 feet. The embankment cross sections are shown on the Sedimentation Pond Designs Maps 24, 25 and 26.

Design specifications for embankment height provide for a minimum of 1.0 feet freeboard between the top of the embankment and the emergency spillway flow level, and an additional 5% factor of safety to offset any settling which might occur. The 5% settling factor is conservative, because construction plans specify compaction of the horizontally continuous lift embankment fills. The compaction should all but eliminate settling.

Tests need to be performed during the construction of pond embankments to determine compliance with moisture-density specifications. At a minimum, one field test for every 2,000 cubic yards of compacted structural fill, with at least one test per lift; one field test for every 200 cubic yards of compacted backfill in trenches or around structures with at least one test per lift; supplementary laboratory compaction curves for at least every 20 field density tests.

Burning and Burned Waste Utilization

The Operator stated that:

In the unlikely event that any burning waste is found during regular inspection of waste stockpile areas, it will be separated and extinguished either by burying the burning material or by using water sprays from the mine water truck. Once extinguished, the material will be placed, compacted, and buried on an active waste stockpile bench. All future material placement,

stockpile construction, and stockpile monitoring activities will be conducted in accordance with the currently permitted plans presented in Section 3.4 of the approved Castle Gate Permit.

Return of Coal Processing Waste to Abandoned Underground Workings

The existing approved Castle Gate permit includes an approval for injection of process water and coal fines to abandoned underground workings. The Operator may use this method for disposal of coal fines from the Willow Creek site. All wells will be used for disposal of coal processing waste into the abandoned Utah Fuels #3 Mine (D Seam).

Coal fines from the Willow Creek mine should have the same chemical characteristics as those from the Castle Gate mine. Both mines extract coal from the same seams and there is no reason to suspect that there would be a significant difference in chemical composition. The Division has no reason at this time to deny the injection of coal fines from the Willow Creek mines.

Excess Spoil

The Operator has stated that:

As an underground mining operation, the proposed mining and related activities will not result in generation of spoil materials. In addition, all related surface disturbance required for construction of the necessary surface support facilities has been carefully planned to balance material cuts and fills so that no excess material is generated. Since no excess spoil will be generated as a result of the proposed construction or operations activities, regulatory provisions relating to handling and disposal of excess spoil are not applicable.

Excess Spoil: Valley Fills/Head-of-Hollow Fills

Valley fills using excess spoil will not be used in this operation.

Excess Spoil: Durable Rock Fills

No durable rock fills have been proposed for this project.

Excess Spoil: Preexisting Benches

No excess spoil will be used in connection with preexisting benches.

Findings:

The Operator has met the minimum regulatory requirements for disposal of noncoal mine wastes. The Operator has met the minimum regulatory requirements for Coal Mine Waste. The Operator has met the minimum regulatory requirements for refuse piles. The Operator has met the minimum regulatory requirements for Impounding Structures. The Operator has met the minimum regulatory requirements for Burning and Burned Waste Utilization. The Operator has met the minimum regulatory requirements for Return of Coal Processing Waste to Abandoned Underground Workings. The Operator has met the minimum regulatory requirements for Excess Spoil.

OPERATIONAL HYDROLOGIC INFORMATION

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

Analysis:

Hydrologic resource protection in the operational phase of mining is addressed in Section 4.7, and Exhibits 10, 12, and 13. In Part 4.7.1.1 a cross reference shows the specific location in which each regulation is addressed. Part 4.7.1.2 provides further information on the general hydrologic protection plan. This part outlines general methods that Cyprus Plateau Mining Corporation (Cyprus) will use to protect the environment during the operational phase of activity. More specific information is found in later part of Section 4.7. Part 4.7.1.3 is a breakdown of the specific components of the hydrologic protection plan, and Part 4.7.1.4 identifies resources that require special protection measures.

Surface-water Protection

Surface-water protection measures are addressed in Section 4.7.2.2, page 4.7-7 with other pertinent information found in the introduction to Section 4.7.2 on page 4.7-3. This section contains subsections on removal of vegetation and soil materials from disturbance areas, realignment of the Willow Creek channel, surface placement of coal, mine waste, and coal refuse material, discharge of mine water to surface drainages, mine water supply withdrawals, coal preparation activities, and operation of drainage and sediment control structures.

Vegetation and soil will be removed for the disturbed area to preserve the growth medium. This practice will increase the erosion potential on the materials left exposed. To prevent erosion, flow from the undisturbed areas upslope will be routed around disturbances. Cyprus will provide and maintain effective drainage from all disturbed areas that will be included a sediment control network. Specific information about the drainage and sediment control system are found in Section 4.5.2.3. Disturbed areas will be reclaimed when operationally practical to further limit erosion and sediment contribution into the off site drainage.

The Willow Creek channel will be realigned in two reaches to make room for necessary operational facilities. The disturbance associated with the realignment will likely increase total suspended solids (TSS) in the flow of Willow Creek. Measures provided in Section 4.5.2.3 and Exhibit 14 will be used to minimize degradation to water quality. The sediment control plan during construction and operation of the facilities is not well defined in the permit application.

Cyprus has addressed the effects that placement of coal, mine waste and coal refuse will have on surface water. Measure, described on page 4.7-9, will be implemented to protect water quality when these materials are stored on the surface. Upgradient drainage will be routed around the refuse storage area. Coal refuse pile ditches are designed to convey the 25-year, 24-hour storm event. Runoff from both the coal refuse pile and coal stockpile will be routed to sediment ponds where the water will be treated before being released off the permit area. UPDES permits will be held on these sediment ponds to assure compliance with applicable water quality regulations.

Discharge of mine water to the surface may become necessary in the life of the mine. This mine water may have elevated TDS concentrations and lower pH levels and will be treated in the surface drainage and sediment control system and Pond 001. Discharges will be minimal and should not greatly affect the surface water quality. Water encountered in the mine will be transferred into abandoned mine workings or temporary storage areas. Some mine water, if found in significant quantities, may be used in place of or as supplement to the operational mine water supply.

A 750,000 gallon water storage tank will be constructed to contain mine processing water. The water will be taken out of the Price River and is included in water rights currently held by Cyprus. Water will be recycled in the processes to minimize the amount of water taken from the river. Cyprus anticipates using 730 acre-feet of Price River water per year.

Coal preparation activities will have the potential of increasing TSS, TDS and some chemical constituent in the processes. Process water will be recycled in a close, zero discharge, system. The design of the process plant includes measure that will retain accidental process water discharges.

The drainage and sediment control structures proposed by Cyprus will be used as the primary mitigation of water quality effects. The drainage and sediment control system is covered in Section 4.7.2.1 of the permit application, and later in this analysis.

Groundwater Monitoring

Ground-water monitoring will be conducted according to the ground-water monitoring plan. Ground-water monitoring data will be submitted every 3 months to the Division. The operator will promptly notify the Division and immediately provide for any accelerated or additional monitoring necessary to determine the nature and extent of noncompliance and the results of the noncompliance. Plans and hydrologic information to evaluate and mitigate the noncompliance situation and information relevant to the PHC shall be submitted to the Division as required.

Cyprus's Baseline Hydrologic Monitoring Plan for the Willow Creek Mine is Exhibit 12 of the PAP. Collection of baseline data began in June 1994.

Information characterizing the ground water flow regime and hydraulic parameters of the regional aquifer comes from wells MC-205, MC-206, and MC-207, located in the western coal reserves area and B51, B331, B331A, B121, BN251, and BN301 recently installed in the Willow Creek Mine area as part of the Baseline Hydrologic Monitoring Plan. The locations of wells B51, B331, B331A, B121, BN251, and BN301 are shown on the Regional Hydrology Map (Map 15).

In order to obtain maximum benefit from exploration drilling efforts and expenditures and more accurately define ground water conditions in the area, Cyprus may complete some future exploration drill holes as ground water monitoring wells.

The operational water monitoring plan is summarized in Exhibit 12. It consists of routine monitoring of flow and quality of 12 springs and 3 seeps and water levels in 8 piezometers to

evaluate the occurrence of ground water and the hydraulic characteristics of the aquifers. Monitoring stations are listed in Table 3.7-1 of the PAP and Table 1 of Exhibit 12. Locations are shown on the Regional Hydrology Map (Map 15).

Water quality parameters include field measurements for pH, specific conductance, and temperature, and laboratory measurements for general water characteristics such as total dissolved solids, nutrients, major ions, and trace metals. Sampling frequency is outlined in Table 2 of Exhibit 12. Ground water quality samples will be analyzed for the specific parameters listed on Table 3.7-9 and Table 3A of Exhibit 12, and sampling frequency is listed in Table 2 of Exhibit 12.

Ground water quality samples will be collected, labeled and transported to a qualified analytical laboratory for analyses. Proper sample collection, preservation, handling, and storage methods will be utilized at all times to preserve the integrity of the samples and ensure validity of analysis results. All water monitoring analysis results will be recorded, reviewed to identify potential problems or trends, and filed at the mine so as to be available for future inspection and review. In addition, Cyprus will file copies of both field data and laboratory analysis sheets on a quarterly basis with the UDOGM. At the end of each annual water year, Cyprus will tabulate all water monitoring data for the year, review the data with respect to changes in groundwater hydrology systems, and provide a summary Annual Hydrology Report in compliance with the UDOGM schedule.

Baseline monitoring data are to characterize pre-Willow Creek Mine ground water flows, water quality conditions, and any seasonal variations in these characteristics. Additionally, baseline hydrologic data will be compared to regional data and data from adjacent areas to evaluate spatial and temporal relationships. Available water quality information is summarized in Table 3.7-4, Ground Water Quality Summary. Ground water quality data are presented in Exhibit 10, Hydrologic Information. Available ground water quality data for wells B51, B121, B331, and B331A are presented in Figure 3.7-3, Ground Water Quality Hydrographs.

The proposed mining and related operations have been designed and will be operated and maintained to effect full compliance with all applicable Federal, State, and local laws and regulations. Structures and facilities from existing and proposed mining and related surface are not generally compatible with the proposed postmining land use of wildlife habitat and will be removed following completion of mining. Equipment, structures, and other devices used in conjunction with monitoring the quality and quantity of ground water onsite and offsite are not specifically mentioned but would be covered by the general commitments to properly design, maintain, operate, and remove all mining related structures and facilities.

Surface-Water Monitoring

Surface-water monitoring is covered in Section 4.7.2.3 and Exhibit 12, Hydrologic Monitoring Plan. The locations of monitoring wells are found on Map 16, Regional Hydrology. Groundwater will be analyzed for the parameter found in Table 3.7-9 and Section 3.7. At this time Cyprus has only a generalized surface water monitoring plan for the operational mining. They have not yet developed the specific plan.

Acid- and Toxic-forming Materials

Drainage from acid- and toxic-forming materials and underground development waste into surface water and ground water will be avoided by identifying and burying and/or treating materials that may adversely affect water quality or be detrimental to vegetation or to public health and safety if not buried and/or treated. Materials will be stored in a manner that will protect surface water and ground water by preventing erosion, the formation of polluted runoff, and the infiltration of polluted water.

Storage of acid- and toxic-forming materials and underground development waste will be limited to the period until burial and/or treatment first become feasible. Storage will not result in any risk of water pollution or other environmental damage. Storage, burial, or treatment practices will be consistent with other material handling and disposal provisions of the regulations.

Chemical characteristics of coal and other materials to be disturbed in the Willow Creek Mine are discussed in Section 3.6.3.2. Of the 44 core samples of roof and floor rock collected in 1994, there were a few samples that exceeded DOGM Guideline values for SAR, boron, selenium, and acid-base potential. However, values from numerous samples of weathered and oxidized soil, mine waste, and coal refuse that have been at the surface a number of years offer a probably more accurate perspective of potential water quality impacts than analysis results from fresh coal, roof, and floor samples. Weathered mine waste and coal refuse samples show no significant acid, alkaline, or toxicity potentials.

The manner in which waste materials are typically handled during mining will most likely result in the smaller volumes of unacceptable materials being mixed with larger volumes of acceptable materials and the resulting buffering or dilution leaving material that falls within acceptable values. On page 3.6-27 is a statement that where mine waste rock or coal refuse materials are placed in surface stockpiles, testing these materials for suitability may be appropriate as part of the reclamation program. Cyprus commits to handling and disposing of any potentially acid or toxic forming materials encountered or exposed in compliance with the coal mining rules.

Leaching of mine waste and coal refuse materials has the potential to shift the ground water chemical type towards a sodium sulfate water type and may also cause minor increases in concentrations of iron, manganese, and TDS. These potential impacts are expected to be minimized by controlled placement and compaction; effective routing of surface drainage around stockpile areas; establishment of an underdrain system (refuse pile only); grading or regrading of pile surfaces, including the completed refuse pile areas, to provide effective surface drainage including stable postmining diversion channels; topsoil replacement (refuse pile only); reclamation of the completed refuse pile utilized during construction; and reclamation of the coal stockpiles and permanent coal refuse pile, which will also contain mine waste materials.

Stockpile areas will be constructed to provide effective drainage of runoff from stockpile surfaces and infiltration through coal stockpiles. Runoff from stockpile areas will be collected and routed to nearby sedimentation ponds. Cyprus will also limit stockpiled coal inventory for operational and environmental reasons, resulting in rapid stockpile turnover and minimal potential for weathering or leaching of coal materials. Infiltration and other effects will be minimized by

limiting detention time in the sedimentation structures, by compaction of the pond base during construction, and by accumulation of fine solids at the bottom of the basins. Regular periodic removal of sediment accumulations from the sedimentation ponds will minimize TDS and buildup of chemical constituents.

It is anticipated that infiltration to the coal refuse pile and subsequent leaching will be minimal given the relatively arid conditions and engineering controls that will be implemented. Rock underdrains will tend to collect the majority of any leachate which does percolate through the pile. Leachate collected in the underdrains is routed in diversion channels to existing sedimentation ponds where it is retained and sampled prior to release to natural drainages. Under the UPDES permit for the existing ponds, any discharge of leachate from the refuse pile or mixed leachate and stormwater is subject to the same discharge effluent standard as normal stormwater discharges from the pond.

Direct mining related ground water impacts will be limited by the lack of significant ground water aquifers, low overall permeability of the effected geologic sequence, relatively slow rate of ground water movement, and the absence of any significant quantities of acid- or toxic-forming materials. If groundwater quality impacts do occur in the coal refuse pile area, they are expected to be limited due to the relatively small areal extent of the refuse pile and the factors previously noted. Any leachate from the coal refuse pile, which is not captured by the underdrain system, will infiltrate to the colluvial/alluvial deposits, mix with groundwater resulting from natural surface infiltration, and discharge to the surface water system. Under these conditions, it is anticipated that the minimal volume of resulting leachate will be significantly diluted by both groundwater and subsequent surface water mixing and will not significantly affect surface water quality. Stratigraphic units which underlie the alluvial/colluvial deposits consist of relatively impermeable siltstones and shales which limit vertical permeability and effectively minimize the potential for ground water impacts to deeper aquifers.

Water Rights

Information about water rights in the operational mine phase is included in Section 4.7.2.7. Background information is found in Section 3.7.9.1 of the Environmental Resource chapter. Cyprus Plateau Mining Corporation (Cyprus) does not expect to impact water rights by the mining activity adversely.

Transfer of Wells

All exploration drillholes established by Cyprus within the Willow Creek permit area will either be sealed following completion of drilling, sampling, and logging or completed as monitoring wells. If a hole is to be utilized for monitoring it will be cased, completed, and developed as a monitoring well consistent with methods described in Section 4.6.2.1 of the PAP. When an existing well is no longer required for ground water monitoring, it will be sealed by filling the borehole or casing with cement to form a plug from the bottom of the hole to at least 20 feet above any zone of completion or water-bearing zone; filling the remainder of the hole to within 20 feet of the ground surface; and filling the remainder of the hole to the ground surface with cement to form a surface plug. A steel fence post will be placed in the center of the surface plug to provide a permanent marker of the location. Methods used to plug and seal boreholes and water monitoring wells will minimize the potential for mixing of surface and ground water

sources and will also limit the potential for communication and mixing between various ground water aquifers.

Discharges into an Underground Mine

Injection of a fine coal refuse slurry, consisting of process water and coal processing waste, into existing abandoned underground mine workings through two existing injection wells near the Castle Gate coal preparation plant, with recovery of clarified make-up water for the coal preparation plant through another well, have been approved by the Division as part of the current Castle Gate Mine MRP. The same slurry discharge-water recovery plan has been incorporated into the Willow Creek PAP. The discharges will minimize disturbance to the hydrologic balance on the permit area, prevent material damage outside the permit area and otherwise eliminate public hazards resulting from underground mining activities by recovering some coal processing water for reuse and by reducing to some small extent the volume of coal mine waste in the refuse pile. When such discharge occurs it will be at a known rate and quality.

Plan details on the construction, operation, and sealing at time of abandonment of the injection wells are provided in Exhibit 19, Castle Gate Information. The proposed operation is a closed system that will not discharge into local surface or ground water resources. The wells are cased to prevent contamination of the Price River alluvial aquifer, and transmissivities of the rocks in the abandoned mines have very low permeabilities. Recovered water will be used at the coal preparation plant. Any water escaping to the surface from the injection well will be routed to a sediment pond, and if discharge into the Price River is necessary it will be through the ponds UPDES discharge point. A Small Area Exemption (SAE) has been requested for the runoff from the recovery well site, but it isn't clear that such an exemption has been granted. New well sites may become necessary as portions of the underground workings are successfully backfilled. Estimated life of the project is 10 years. Solids for the slurry will come from a resin recovery circuit. Analysis results from a slurry sample are in Exhibit 19. Utilization of the slurry injection system will reduce the volume of material at the waste rock disposal site. When the system is in use, water quality samples will be collected quarterly from the injection wellhead and recovery wellhead. Field determinations will include pH, conductivity, and temperature. Laboratory analyses will include TDS, specific conductance, and other parameters listed in Exhibit 19. Injection rate will vary but should match the long term rate at which water will be removed through the recovery well, averaging approximately 150 to 250 gallons per minute. The slurry is estimated to contain 20% to 30% solids and estimated average amount of solid material in the slurry is 20 tons/hour of 60 to 400 mesh (200 average) material and 200 gal/minute of process water.

Analysis results reported in Exhibit 19 show the pH of the untreated effluent is greater than 6.0. This is typical for waters in the Book Cliffs and Wasatch Plateau coal fields and there is no reason to expect the effluent to have a pH of less than 6.0 in the future. Because the pH of the untreated effluent is greater than 6.0, the performance standards of 40 CFR 434 do not apply and therefore the portion of R645-301-751 that refers to 40 CFR 434 does not apply. Because the effluent will remain within the areas disturbed by coal mining and reclamation operations the remainder of R645-301-751 does not apply. These discharges will not result in a violation of water quality standards or effluent limitations. The requirements of R645-301-731.511.2 and R645-301-731.511.2 are satisfied.

The Willow Creek PAP contains a letter dated February 17, 1989 from the Mine Safety and Health Administration (MSHA) that gives approval of inject the slurry material into abandoned mine workings. Discharges will be limited to water and coal-processing waste. Water from one underground mine will not be diverted into other underground workings. With the exception of process water in the slurry that could be injected through these wells, water will not be diverted or discharged into any underground mine in conjunction with ongoing mining and reclamation operations at the Willow Creek Mine.

Gravity Discharges

There are no indications that the coals to be mined are acid-producing or iron-producing. Mine dewatering flows have been monitored and there is no evidence of any significant potential for development of acidic or toxic drainage as a result of any mine water discharge or resaturation following mine abandonment and sealing. The Willow Creek mine workings will progress down dip from the outcrop area and mine drainage will be controlled during active operations so there is little or no potential for direct gravity discharge of water from the mine. Upon completion of mining and related activities mine drainage control operations will cease and portions of the mine workings, especially the mine workings farthest down dip, are expected to gradually fill as ground water continuously discharges into the mined-out areas. To prevent any significant discharge from the mine openings following cessation of active mining operations and mine closure, Cyprus will seal and backfill the mine portals. Sealing practices are discussed in Section 5.4.2.3, Reclamation Practices, and Section 5.5.2.6, Casing and Sealing of Wells and Mine Openings.

Water-Quality Standards and Effluent Limitations

Water-quality standards and effluent limitations are addressed in Section 4.7.3.12. Water discharged from the permit area will be regulated by Utah Division of Water Quality (DWQ). Cyprus will apply for discharge permits for all discharge points and after approval by DWQ these permits will be included in Exhibit 4 of this MRP. Cyprus says that "historic and baseline monitoring data indicate no significant potential for water quality degradation as a result of planned mining and related activities." They do not anticipate acid or toxic drainage to result from mining activities.

Diversions

Diversions are addressed in Section 4.7.2.9, 4.7.2.10 and 4.7.3.7, and in Exhibit 13. Diversions are mapped on Maps 26A through 26F. First, Section 4.7.2.9 talks about how and why diversions will be used to protect environmental resources. Second, Section 4.7.3.7 discusses the design criteria used in planning diversions. Finally, Exhibit 12 has the designs and discussion of the designs for each diversion in the drainage and sediment control plan. The first two sections mentioned are general information about the use and the function of diversions. The last provides specific values used in the design.

Many of the undisturbed, particularly in the upper reaches of the main facilities area, are located such that they will be located on steep and rocky slope. It seems that these diversions will have to be cut into bedrock, which will be difficult in construction and reclamation.

Stream Buffer Zones

Stream buffer zones are addressed in Section 4.7.2.6, page 4.7-14 of the permit application package. Cyprus Plateau Mining Corporation (Cyprus) is requesting a variance from the 100-foot buffer zone requirement as shown on Map 16. Evidence is given which show that these activities will not cause or contribute to the degradation of water quality or the violation of any effluent limits.

Sediment Control Measures

Sediment control measures are covered in Sections 4.7.3.1, through 4.7.3.3, 4.7.2.8, 4.7.2.11 and 4.7.2.12 and specific designs are in Exhibit 13, Drainage and Erosion Control.

Plan details on the construction, operation, and sealing at time of abandonment of the injection wells are provided in Exhibit 19, Castle Gate Information. The proposed operation is a closed system that will not discharge into local surface or ground water resources. The wells are cased to prevent contamination of the Price River alluvial aquifer, and transmissivities of the rocks in the abandoned mines have very low permeabilities. Recovered water will be used at the coal preparation plant. Any water escaping to the surface from the injection well will be routed to a sediment pond, and if discharge into the Price River is necessary it will be through the ponds UPDES discharge points. A Small Area Exemption (SAE) has been requested for the runoff from the recovery well site, but it isn't clear that such an exemption has been granted.

Map 23A shows a Portal Collection Sump that is not part of the sediment control plan. These maps will be redrawn throughout construction and will not show this Sump.

Siltation Structures

Siltation structures are covered under Section 4.7.3.2 and designed in Exhibit 13. The only siltation structures that will be used are sediment ponds (and maybe sediment traps.)

Sediment Ponds

Sediment Ponds are covered under Section 4.7.3.3 and designed in Exhibit 13. These ponds are shown on Map 23A through 23F for ponds within the new development at the Willow Creek facilities. Ponds that are existing at the Castle Gate Facilities and in Crandall Canyon are included in Exhibit 19. Information and designs for the pond spillways are found in Section 4.2 in Exhibit 13, Sediment and Drainage Control.

Other Treatment Facilities

There are no other treatment facilities planned as stated in Section 4.7.3.6.

Exempt Areas

The Applicant has requested that three areas be exempt from siltation structures. These exempt areas are named and addressed in Exhibit 13, Section 4.4.3. These areas will not be exempt from sediment control but will have runoff contained or treated by alternate sediment measures.

Discharge Structures

Information about the designs of discharge structures is found in the section on sediment ponds, Section 4.7.3.3.

Impoundments

Impoundments are addressed in Section 4.7.3.4. The only impoundments proposed are the sediment ponds addressed in Section 4.7.3.3 of the application and previously in this analysis.

Casing and Sealing of Wells

In order to minimize any potential hazards to humans or livestock associated with open exploration holes or boreholes and to prevent potential mixing between ground water aquifers, Rules R645-301-631 and 641 require that all exploration holes and boreholes be cased if used for water monitoring, or permanently sealed if not used for monitoring or if no longer required for ongoing monitoring activities. All exploration boreholes established by Cyprus within the Willow Creek permit area will either be sealed following completion of drilling, sampling, and logging or completed as monitoring wells. Generally, a determination will be made either prior to or during completion of any exploration hole or borehole of whether or not the hole will be utilized for ground water monitoring. If a borehole is not to be used for monitoring, it will be plugged and sealed as soon as drilling, sampling, and logging operations are completed. If a borehole is to be utilized for monitoring it will be cased, completed, and developed as a monitoring well consistent with methods described in Section 4.6.2.1 of the PAP. When no longer needed for monitoring or other use approved by the Division, and unless approved for transfer as a water supply well, on-site monitoring wells will be sealed by filling the borehole or casing with cement to form a plug from the bottom of the hole to at least 20 feet above any zone of completion or water-bearing zone; filling the remainder of the hole to within 20 feet of the ground surface; and filling the remainder of the hole to the ground surface with cement to form a surface plug. A steel fence post will be placed in the center of the surface plug to provide a permanent marker of the location. There is no current plan to transfer monitoring wells to another owner for use as water supply wells or any other use.

Findings:

Groundwater Monitoring

Ground-water monitoring will be conducted according to the ground-water monitoring plan and ground-water monitoring data will be submitted every three months to the Division.

Ground-water monitoring will proceed through mining and continue during reclamation until bond release. Equipment, structures, and other devices used in conjunction with monitoring the quality and quantity of ground water onsite and offsite will be properly installed, maintained, and operated and shall be removed by the Operator when no longer needed.

The proposed operation plan for ground water monitoring is complete and accurate.

Acid- and Toxic-forming Materials and Underground Development Waste

The operation plan for acid- and toxic-forming materials and underground development waste is complete and accurate.

Transfer of Wells

There are currently no plans to transfer wells to another party for further use. The proposed operation plan for transfer of wells is complete and accurate.

Discharges into an Underground Mine

The proposed operation plan for discharges into an underground mine is complete and accurate.

Gravity Discharges from Underground Mines

The proposed operation plan for gravity discharges from underground mines is complete and accurate.

Diversions

All diversions have been designed to convey the appropriate design storms as mandated in R645-301-742.323 and R645-301-742.333.

Sediment Control Measures

The proposed operational sediment control measures information is complete and accurate.

Casing and Sealing of Wells

The proposed operation plan for the casing and sealing of wells is complete and accurate.

SUPPORT FACILITIES AND UTILITY INSTALLATIONS

Regulatory Reference: 30 CFR Sec. 784.30, 817.180, 817.181; R645-301-526.

Analysis:

The Operator has stated:

The proposed underground mining and related activities will require limited surface support facilities. The facilities to be utilized in conjunction with the proposed operations will include both existing facilities located in the Castle Gate, Gravel Canyon, and Crandall Canyon areas and new facilities to be constructed in the proposed Willow Creek mine surface facilities area. These facilities will provide the necessary infrastructure for effective management and handling of personnel, equipment, materials and supplies, and both coal and mine waste materials, and

will include a number of structures specifically designed to control or mitigate potential mining related impacts.

Construction of required surface structures and facilities has previously been discussed in Section 4.5.2.2, General Description of Mine Plans, Mining Methods, and Related Design Requirements. The surface structures and facilities will be operated, maintained, and ultimately reclaimed in a manner that prevents or controls erosion and siltation, water pollution, and damage to public or private property; and to the extent possible using the best technology currently available, minimizes damage to fish, wildlife, and related environmental values, and minimizes additional contributions of suspended solids to streamflow or runoff outside the permit area. Any contributions of suspended solids from mine disturbance areas will not exceed applicable effluent limitations under Utah or Federal law.

Required surface facilities are shown and identified on the Mine Surface Facilities Map (Map 18), and include the following specific structures and facilities:

Willow Creek Surface Facilities Area

- *Willow Creek Realignment Segment 1*
- *Willow Creek Realignment Segment 2*
- *Portal Area Collection Sump*
- *Sedimentation Pond 001*
- *Sedimentation Pond 002*
- *Willow Creek Soil/Substitute Stockpile*
- *Primary Road PR-1*
- *Main Access Road Bridge*
- *Willow Creek Culvert Crossing*
- *Primary Road PR-2*
- *Ancillary Road AR-1*
- *Ancillary Road AR-2*
- *Ancillary Road AR-3*
- *Ancillary Road AR-4*
- *Ancillary Road AR-5*
- *Mine Portal Structures*
- *Mine Ventilation Fans and Associated Structures*
- *Mine Ventilation Raise*
- *Rock Dust Storage Tank and Supply System*
- *Conveyor UG-1*
- *Run-of-Mine Coal Stacking Tube and Reclaim Tunnel*
- *Conveyor SC-1*
- *Conveyor SC-2*
- *Conveyor SC-3*
- *Conveyor SC-4*
- *Rock Tunnel No. 1*
- *Conveyor SC-5*
- *Rock Tunnel No. 2*
- *Run-of-Mine Coal Stockpile*
- *Administration/Bathhouse Facility*
- *Office Trailer*
- *Maintenance Shop Facility*
- *Warehouse Facility*
- *Tire and Drum Storage Shed*
- *Equipment Storage Area*
- *Explosive Storage Area*
- *Miscellaneous Structures*
- *Main Substation*
- *Mine Fan Substation*
- *Mine Fan Emergency Generator Bldg.*
- *Propane Storage Tanks - Fan Heaters*
- *Propane Storage Tanks - Administration/Bathhouse Facility*
- *Fire-Fighting Reserve Storage Tank*
- *Mine Water Tank*
- *Potable Water Tank*

The Operator has listed all the support facilities that will be used in conjunction with the mining operation and has committed to obeying all federal, state and local regulations.

Findings:

The Operator has met the minimum regulatory requirements.

UTILITY INSTALLATIONS

Regulatory Reference: 30 CFR Sec. 817.180

Analysis:

The Operator has committed to conduct all underground mining activities in a manner that minimizes damage, destruction, or disruption of services provide by oil, gas, and water wells, oil, gas, and coal-slurry pipelines, railroads, electric and telephone lines, and water and sewage line which pass over, under or through the permit area.

Findings:

The Operator has met the minimum regulatory requirements.

SIGNS AND MARKERS

Regulatory Reference: 30 CFR Sec. 817.11; R645-301-521.

Analysis:

Cyprus will post and maintain all required signs and markers in compliance with applicable regulatory provisions of Rule R645-301-521.200. Signs and markers will be constructed of durable materials and will be posted so as to be clearly visible. Mine identification signs listing the name, business address, and telephone number of the Permittee and the permit number for the permanent program permit authorizing mining and reclamation operations will be posted at each point of access to the permit area from a public road. Perimeter markers will be posted outlining all areas affected by surface operations or facilities prior to initiation of mining, buffer zones will be marked along their limits to prevent disturbance within the buffer zone, and soil/substitute stockpiles will be clearly marked for identification and to limit access and potential disturbance. Signs reading "Blasting Area" will be posted along the edge of any blasting area which comes within 100 feet of any public road right-of-way and at the point where any other road(s) provides access to the blasting area. All required signs and markers will be maintained or replaced during the period of active operations, site reclamation, and until final bond release is approved for all areas within the permit boundaries.

Basic soil handling and stockpile construction practices are described in Section 4.2.2, Soil Salvage, Handling, and Storage. The stockpiled material will be protected from erosion, contamination, and loss by placement in a controlled manner with side slopes at 3H:1V or less, seeding with a temporary vegetative cover, posting with durable signs reading "Soil Stockpile - Keep Off," and the use of appropriate drainage control measures.

Wherever practically possible a 100-foot buffer zone will be maintained between any mining related disturbance and the Willow Creek stream channel. To prevent disturbance within the buffer zone, the edges of the zone will be clearly posted at regular intervals with durable signs reading "Buffer Zone -Keep Out." Based on design plans, the 100 foot buffer zone can be maintained throughout the mine facilities area except in a segment approximately 200 feet long at the main access road bridge crossing, and in the 500 foot segment and 1,000 foot segment where the two Willow Creek realignment segments will be constructed.

The Operator has met the minimum regulatory requirements for placing signs and markers at the mine site.

Findings:

The Operator has met the minimum requirements.

USE OF EXPLOSIVES

Regulatory Reference: 30 CFR Sec. 817.61, 817.62, 817.64, 817.66, 817.67, 817.68; R645-301-524.

Analysis:

General Requirements

The Operator states:

All surface blasting will be conducted under the direction of a certified blaster. Blasters will be qualified through the Division's blaster certification program. A blaster and at least one other person will be present for all blasts.

The certified blaster responsible for blasting operations at the site will be familiar with the blasting plan and site specific performance standards and give on-the-job training to people who are not certified and who are assigned to the blasting crew or assist in the use of explosives.

Blasting may be required at the surface facilities of the Willow Creek Mine. A portion of this area is within 1,000 feet of the PacifiCorp Carbon Power Plant, and a portion of the area is within 500 feet of abandoned coal mines in the area. In addition, portions of the area are adjacent to Highways 50 & 6 and Highway 191.

The blast design, as illustrated by Table 15-1, is intended to show the general layout and present general blasting information. Any significant deviation from this plan will be presented to the Division prior to the blast.

The blasting plan presented in Exhibit 15 is a generic plan. The Division approves the concepts show in the plan. For all blasts that use more than 5 pounds of explosives the Operator will be required to submit a specific blasting plan.

Preblasting Survey

The Operator has committed to conduct a preblasting survey and notify all residents or owners of dwellings, structures, or utilities within one-half mile of any part of the permit area. Copies of the survey will be given to all persons requesting the survey and the Division.

General Performance Standards

Due to the potential explosion hazards related to both methane and coal dust blasting, any underground blasting activities will be limited and will be conducted in full compliance with applicable MSHA requirements. Limited surface blasting will be necessary in conjunction with the proposed construction activities and on an occasional basis during operations. Construction related blasting requirements will include the drilling and blasting activities necessary to widen the existing railroad tunnels to provide adequate clearance and maintenance access for the proposed surface conveyor system, limited blasting to fragment resistant rock in order to establish the design facilities area configuration, and small-scale blasting to fracture any large rocks so that they can be moved during the construction/development phase. Occasional operational blasting requirements may include small-scale surface blasting to fracture large rocks that may fall or roll from the adjacent steep cliffs and slopes into operating areas or onto roads, clear clogged chutes, or address potentially hazardous rock or slope conditions. Because of the nature of the required blasting, construction related blasting activities may require the use of more than 5 pounds of explosive, however, it is anticipated that operational blasting will generally not require more than 5 pounds of explosive.

Any surface blasting required in conjunction with the underground mining operation will be conducted in compliance with applicable provisions of Rule R645-301-524. All blasting will be conducted by a certified blaster and the responsible blaster will either carry documentation of blaster certification or the appropriate certificates will be retained on file at the mine or construction office. The responsible blaster and at least one other person will be present for all blasts and the responsible blaster or an individual under his direct supervision will load, connect, and initiate all blasts. Because the proposed Willow Creek surface facilities, where any required surface blasting would occur, are located within 1,000 feet of the PacifiCorp Carbon Generating Station, State Highway 191, and U.S. Highways 6 & 50, and within 500 feet of abandoned coal mines in the areas, a blasting plan is included in this permit application. Persons responsible for blasting operations will be familiar with site conditions and the explosive handling and blasting procedures as outlined by Exhibit 15, Blasting Plan.

Explosives and detonating caps will be stored separately in secure locked structures and explosive storage and handling will be conducted in accordance with all applicable State and Federal standards under current valid Bureau of Alcohol, Tobacco, and Firearms permits. It is anticipated that portable skid-mounted explosive magazines will be utilized and that any required explosives may be supplied and handled by an independent explosives contractor. Given this consideration and very limited anticipated operational blasting requirements, explosives may not be maintained on site at all times. For construction related blasting operations and any temporary or long term explosive storage during the operations phase, the designated explosive storage area will be located as shown on the Mine Surface Facilities Map, (Map 18), providing adequate

distances from surface structures and facilities as designated by the applicable regulatory requirements.

Blasting Signs, Warnings, and Access Control

The Operator states :

Blasting signs will be posted at the entrances to the Willow Creek Mine site warning all who enter thereon of blasting. There are four possible entrances to the site, at the entry road across from the Carbon Power Plant, on a dirt road at the north end of the Castle Gate preparation plant site, at the lower entrance in Willow Creek off of Highway 191 and at the upper entrance in Willow Creek off of Highway 191. The signs will be in accordance with R645-301-521.200 as follows:

Signs will be posted, maintained, and removed by Cyprus or its agents
Signs will be of uniform design that can be easily seen and read
Signs will be of durable material and conform to local laws and regulations
Signs will be maintained during all activities which they pertain

Signs reading "BLASTING AREA" will be placed at conspicuous places along the edge of Highway 191 adjacent to the Willow Creek Mine facilities and along Highway 56 & 6 adjacent to the Castle Gate preparation plant area where blasting may occur.

Signs reading "WARNING! EXPLOSIVES IN USE" will be placed in conspicuous locations at all entrances to the permit area. The signs will also clearly list and describe the meaning of the audible blast warning and all-clear signals, and explain the marking of blasting areas and charged holes awaiting firing within the permit area.

Control of Adverse Effects

Details for the airblast, ground vibrations and flyrock travel distance are found in Exhibit 15. The Division has determined that the generic blasting plan meets the minimum regulatory requirements. A specific blasting plan must be submitted to the Division for all blast that use more than 5 pounds of explosives.

Records of Blasting Operations

The Operator has committed to keeping all blasting records of a minimum of 3 years. The minimum regulatory requirements have been met.

Findings:

The Operator has met the minimum regulatory requirements for describing a general blasting permit. A specific blasting plan must be approved by the Division for each blast that uses more than 5 pounds of explosives. The Operator has met the minimum regulatory requirements for the preblasting survey. The Operator has met the minimum regulatory

requirements for general performance standards. The Division has determined that the Operator has met the minimum requirements for placing signs and other warnings for blasting and to control access to areas where blasting will occur.

The Operator has met the minimum regulatory requirements for a generic blasting plan. A specific blasting plan must be submitted for all blasts that use more than 5 pounds of explosives.

MAPS, PLANS, AND CROSS SECTIONS OF MINING OPERATIONS

Regulatory Reference: 30 CFR Sec. 784.23; R645-301-512, -301-521, -301-542, -301-632, -301-731, -302-323.

Analysis:

The PAP lists the information regarding maps as:

- Proposed mine permit and disturbance boundaries
- Existing land configurations
- Existing and proposed surface structures and facilities
- Location, extent, and sequencing of proposed underground mine development
- Extent of potential mining related subsidence, subsidence control features, and subsidence monitoring locations
- Location and design of coal refuse disposal facility
- Drainage and sediment control plans and designs for associated structures
- Existing and proposed roads and utility installations

Certification Requirements

The Permittee has stated that all maps, cross sections and drawings required to be certified will be prepared by, or under, the direction of a certified, registered professional engineer.

Findings:

The Permittee has met the minimum regulatory requirements.

RECLAMATION PLAN

GENERAL REQUIREMENTS

Regulatory Reference: PL 95-87 Sec. 515 and 516; 30 CFR Sec. 784.13, 784.14, 784.15, 784.16, 784.17, 784.18, 784.19, 784.20, 784.21, 784.22, 784.23, 784.24, 784.25, 784.26; R645-301-231, -301-233, -301-322, -301-323, -301-331, -301-333, -301-341, -301-342, -301-411, -301-412, -301-422, -301-512, -301-513, -301-521, -301-522, -301-525, -301-526, -301-527, -301-528, -301-529, -301-531, -301-533, -301-534, -301-536, -301-537, -301-542, -301-623, -301-624, -301-625, -301-626, -301-631, -301-632, -301-731, -301-723, -301-724, -301-725, -301-726, -301-728, -301-729, -301-731, -301-732, -301-733, -301-746, -301-764, -301-830.

Analysis:

The Operator has met the minimum regulatory requirements for providing the Division with a general reclamation plan. Specific details of the reclamation plan will be discussed in the following sections.

Findings:

The Operator has met the minimum regulatory requirements.

POSTMINING LAND USES

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

Analysis:

These regulations are not addressed in a dedicated portion of the application, but Section 5.3.1.2 mentions the postmining land use. It says the Applicant will reclaim surface disturbance areas to a postmining land use of wildlife habitat. It is assumed the postmining land uses of areas outside the proposed disturbed area will not change.

Section 3.4.2 contains detailed descriptions of the premining land uses and also constraints to other uses. The reclamation plans show how the premining land uses will be restored.

The Applicant solicited comments about the postmining land uses from land owners in the proposed permit area. A few responded that they agree with the proposed use, but several did not respond. If the Applicant receives further responses, they should be included in the application. Since the land owner for a major portion of the proposed permit area is the Applicant, the application can serve as its comments.

The areas of interest, from an engineering stand point, are:

(1) The Division grants a variance from approximate original contour restoration requirements.

(2) *The proposed use is designed and certified by a qualified registered professional engineer in conformance with professional standards established to assure the stability, drainage, and configuration necessary for the intended use of the site.*

(3) *The highwall is completely backfilled with spoil material, in a manner which results in a static factor of safety of at least 1.3, using standard geotechnical analysis.*

(4) *Only the amount of spoil as is necessary to achieve the postmining land use, ensure the stability of spoil retained on the bench, and all spoil not retained on the bench shall be placed in accordance with all other applicable regulatory requirements.*

The Operator has not asked for, nor has the Division granted, a variance from the approximate original contour requirements. Therefore, the Operator will be required to meet all AOC regulations.

Regulation R645-301-512 specifies that certain designated cross sections, maps and plans be prepared by or under the direction of a qualified Registered Professional Engineer and that certain maps and design plans be certified by a PE. Consistent with this requirement, the following components which relate to this permit section meet the regulatory supervision and certification requirements:

Previous Mining Activity Map (Map 10)
Regional Land Use Map (Map 9)
Mine Surface Facilities Map (Map 18)
Sedimentation Pond Maps, (Maps 24 through 27)
Willow Creek Diversion Design Maps, (Maps 28 through 29)
Mine Surface Facilities Area - Postmining Topography Map (Map 21)
Mine Surface Facilities Area - Premining/Postmining Cross Sections, (Map 22)

The Permittee and the Division acknowledge that the site was previously disturbed by coal mining activities and reclaimed to state and federal standards. Parts of the reclaimed site contain exposed highwall remnant. Both the Division and OSM determined that the highwall did not have to be completely backfilled in order to meet all state and federal reclamation requirements.

The Division has determined that highwall reclamation must meet or exceed the prior approved plan. Highwall remnant will be allowed but they cannot exceed the high or length of the highwalls that existed prior to redisturbance.

Findings:

This portion of the application is considered complete and accurate.

APPROXIMATE ORIGINAL CONTOUR RESTORATION

Regulatory Reference: 30 CFR Sec. 784.15, 785.16, 817.102, 817.107, 817.133; R645-301-234, -301-270, -301-271, -301-412, -301-413, -301-512, -301-531, -301-533, -301-553, -301-536, -301-542, -301-731, -301-732, -301-733, -301-764.

Analysis:

The Operator has not requested a variance from the Approximate Original Contour requirements.

Findings:

The Operator has met the minimum regulatory requirements.

BACKFILLING AND GRADING

Regulatory Reference: 30 CFR Sec. 785.15, 817.102, 817.107; R645-301-234, -301-537, -301-552, -301-553, -302-230, -302-231, -302-232, -302-233.

Analysis:

Following completion of mining and related operations and subsequent facility removal and sealing of mine openings the associated surface disturbance areas will be backfilled and regraded. As previously noted in Section 5.4.2.2, Reclamation Plan, there are a number of features in the mine facilities, preparation plant, and loadout areas which represent existing disturbance. Some of these features are related to existing structures that will be utilized in conjunction with the Willow Creek mining and related activities and mine design and facility layout have taken advantage of other existing features in order to minimize overall surface disturbance. Existing disturbance features are shown on the Mine Surface Facilities Map, (Map 18), and documented by Exhibit 7, Documentation of Existing Site Conditions, and include:

- Road cuts and bench cut in the Fire-Fighting and Mine Water Tank location
- Road cuts and fill bench in the Mine Ventilation Fan area
- Existing mine face-up area
- Fill bench and sidehill cuts in Run of Mine Coal Stockpile area
- Road cuts and bench cut in Potable Water Tank area
- Sidehill cuts along Conveyor SC-1 alignment
- Sidehill cuts and fills along most of the old railroad grade
- Rock Tunnels No. 1 and 2
- Cuts and fills along existing main access roads to the mine facilities area

For many of the existing disturbance features, backfilling and regrading to a pre-disturbance configuration would be difficult if not impossible since they involve very steep side slope cuts in competent or weathered rock and insufficient fill material exists within the Willow Creek disturbance area to completely backfill and regrade the existing disturbance. Given this constraint, planned backfilling and grading will involve selective placement of all available fill material consistent with applicable regulatory provisions for backfilling and grading (R645-301-

553 through 553.200), and previously mined areas (R645-301-553.500 through 524), and based on the following priorities:

1) Cover exposed coal seams, seal mine openings, and any solid waste disposal sites with a minimum of 4 feet of suitable material;

2) Backfill and/or regrade disturbed slopes to establish a stable configuration which provides for effective drainage and minimizes erosion potential;

3) Backfill and regrade steep cuts and highwall areas to partially or completely eliminate cut or highwall exposures.

The land configuration in the mine facilities area prior to development of the Cyprus Willow Creek operations is illustrated by the Facilities Area Soils Map (Map 4). This map shows that most of the mine surface facilities area consists of an elevated bench on the north and west side of Willow Creek with the existing face-up area and AML coal refuse fill at the northeast end, the existing railroad bed and rock tunnels along the northern and western limit of the facilities area, the existing access road running along the length of the area parallel to Willow Creek, and numerous roads and small disturbance areas breaking off from the main facilities area. The existing configuration in the Castle Gate preparation plant and loadout areas and the Crandall Canyon facilities area is addressed by the permit information for these two areas included as Exhibit 19, Castle Gate Information, and Exhibit 20, Crandall Canyon Information, in this permit submittal.

The design postmining configuration for the mine facilities area is shown by the Mine Surface Facilities Area - Postmining Topography Map (Map 21). This map reflects recovery of available fill from the original fill bench above Willow Creek and the original fill bench in the Run of Mine Coal Stockpile area; backfilling and grading to cover the sealed mine portals and exposed coal seam, the ventilation raise, and the solid waste disposal areas; elimination of the depression in the mine portal area; partial backfilling of the face-up area; grading along the conveyor alignment to reduce bench width and stabilize associate cut/fill slopes; and other backfilling and grading to establish stable slopes, promote effective drainage, and blend the reclaimed areas with the surrounding terrain. The reclaimed configuration for the Castle Gate preparation plant and loadout areas and the Crandall Canyon facilities area is addressed by the permit information for these two areas included as Exhibit 19, Castle Gate Information, and Exhibit 20, Crandall Canyon Information, in this permit submittal.

The design postmining configuration for the facilities area is based on utilization of all available spoil material to achieve the stated reclamation objectives within the constraints of site topography, drainage considerations, and the noted backfilling and regrading priorities. The limits of available fill material were determined by identifying all existing spoil fills in the facilities area and estimating fill thickness and area from both the available mapping and the geotechnical boring logs. Final backfilling and grading of the mine surface facilities area will require the movement of a total of approximately 277,000 cubic yards of material. Of the total, 242,000 cubic yards will be moved in the main facilities bench area, and 34,000 cubic yards will be moved in the vicinity of Pond 001. Comparison of the land configuration prior to site development with the design postmining topography based on the Facilities Area Soils Map (Map

4), the Mine Surface Facilities Area - Postmining Topography Map (Map 21), and the Mine Surface Facilities Area Premining and Postmining Cross-Sections, (Map 22), indicates that the design postmining topography will result in more stable slopes, reduce overall highwall and cut exposures, provide for more effective drainage, and offer better blending of the area with the surrounding terrain.

Backfilling and grading will involve the use of tractor scrapers, tracked dozers, wheel loaders and trucks, and motor graders, as necessary to recover, move, place, grade, and compact backfill materials. Generally, backfill material will be placed in relatively uniform lifts and will be compacted by normal equipment traffic. Backfilled areas will be sloped and graded to promote effective drainage and to the extend operationally feasible long unbroken fill slopes will be avoided to minimize sheet flow and potential resultant erosion. Fill slopes will be limited to a maximum slope of approximately 3H:1V and graded slopes in native material will vary dependent on material from less than 5H:1V to as much as 0.5H:1V in competent rock. Graded areas will incorporate undulations consistent with the surrounding terrain and the postmining drainage configuration and the surface of graded areas will be left in a roughened condition to minimize runoff and erosion in the interim before soil/substitute replacement, improve bonding between the regraded surface and soil/substitute materials, and increase infiltration to maximize soil moisture levels and promote revegetation. Regraded surfaces will be deep (up to 3 feet) ripped and finely chopped native hay from the current seasons crop will be applied to increase organic content, provide soil biota, and increase infiltration and moisture holding capacity.

Previously Mined Areas

Under the applicable regulatory provisions dealing with remining of previously mined areas (R645-301-553.500 through 524), the planned backfilling and grading operations will utilize all available spoil material to eliminate highwall exposed by redisturbance. Fill material placed against highwall and cut slope areas will be placed and graded to assure long-term stability and final slopes will provide for effective drainage and be compatible with both natural slopes in the area and the postmining land use of wildlife habitat. Highwall and cut slope exposures remaining after backfilling and regrading will be no more than 10 high, will be in competent rock materials similar to the natural cliff exposures in the immediate area which range from 10 to over 100 feet in height, and will have an aesthetic appearance and geomorphic characteristics similar to these natural rock exposures.

Slope stability calculation are shown in Exhibit 11 Geotechnical investigations. All reclaimed slopes will meet of exceed a safety factor of 1.3.

Findings:

The Operator has met the minimum regulatory requirements

MINE OPENINGS

Regulatory Reference: 30 CFR Sec. 817.13, 817.14, 817.15; R645-301-513, -301-529, -301-551, -301-631, -301-748, -301-765, -301-748.

Analysis:

The Division has approved the concept of sealing the ventilation raises with concrete plugs. Plugs may fail over time. Before the raises are sealed the Division will examine other methods of shaft sealing. If more effective methods exist then the Division will require the Operator to adopt the best shaft sealing method available.

The Division has approved the temporary seal of mine entrances.

Findings:

The Division approves the concept of sealing the ventilation raises with plugs. Since shaft sealing technology is currently developing it is possible that improved methods will be available when the area is reclaimed. During final reclamation the Division will evaluate currently available shaft sealing methods. It there are methods superior to plugs the Division will require the Operator to use the best available shaft sealing technique.

RECLAMATION TOPSOIL AND SUBSOIL

Regulatory Reference: 30 CFR Sec. 817.22; R645-301-232, -301-233, -301-234, -301-242, -301-243.

Analysis:

Section 5.2, SOIL REPLACEMENT PLANS, describes the soil reclamation plans for the Willow Creek Facilities area. Generally, soil replacement and revegetation efforts will be coordinated to allow the seed to "winter over" with spring germination when soil moisture conditions are elevated.

Following completion of final backfilling, grading, and drainage reestablishment for surface disturbance areas, stockpiled soil will be hauled and spread on the regraded surface. In order to provide for effective short and long-term surface stabilization and achieve optimal revegetation success, CPMC will utilize soil stabilization and enhancement measures in combination with surface drainage treatments. These measures include establishment of effective drainage, deep-ripping the regraded surfaces and application of finely chopped hay prior to soil material replacement, leaving the soil surface in a roughened condition, disking or plowing the soil prior to seeding, selective application of Alternative Sediment Control Measures, and mulching subsequent to seeding with straw or native hay. ASCM's include soil pitting, surface ripping, contour furrowing, and installation of silt fences and hay bales.

The final topsoil depth for the Willow Creek Facilities reclamation will depend on the final salvaged soil volumes; Willow Creek soil salvage average depth is projected at 17 inches with the reclamation bond set for 18 inches. Details for soil replacement plans for the

Willow Creek Facilities Area are found in Section 5.4.2, Reclamation Pans and Practices. Other details include the Castle Gate Prep Plant, Loadout, and Schoolhouse Canyon Refuse pile - Exhibit 19, Castle Gate MRP (Section 3.4); and Crandall Canyon - Exhibit 20, Crandall Canyon MRP (Section 3.7-5(5)).

Long-term storage of soil buried deep inside soil stockpiles results in soil degradation with increased erodible characteristics. Pedogenesis of buried soils is severely restricted. Physical-chemical changes most likely to occur include nutrient loss, loss of micro-biological life forms, existence of anaerobic conditions, loss of organic matter and resulting soil-building humic acid, and structural breakdown of the soils. As a result, buried soils will be sterile, void of organic matter and humic supporting structure. Therefore, final soil reclamation efforts must include restoration of the soil's living and structural integrity using best available technology to restore microbial activity, organic matter, and soil surface stabilization.

Following soil replacement, soil suitability analysis will be performed to assess the need for any corrective measures or soil amendments. Soil samples will be collected and analyzed for suitability parameters listed in Table 3.1-2, Overburden Evaluation for Vegetative Root Zone, and for fertility parameters which include available nitrogen, phosphorus and potassium. If analyses indicate potential suitability concerns, confirmation sampling will be completed at an increased sampling density. If confirmation sampling verifies potential suitability concerns, CPMC will consult DOGM and implement specific remediation plans.

Findings:

The reclamation topsoil and subsoil information is complete and accurate.

ROAD SYSTEMS AND OTHER TRANSPORTATION FACILITIES

Regulatory Reference: 30 CFR Sec. 701.5, 784.24, 817.150, 817.151; R645-100-200, -301-513, -301-521, -301-527, -301-534, -301-537, -301-732.

Analysis:

Certain roads within the mine facilities area will continue to provide access to specific areas during both reclamation and the extended liability period, although most roads will be removed and reclaimed during final site reclamation. Generally, the primary access roads will be removed and reclaimed in two phases. The first phase will involve ripping of these roads and removal of the associated road surfacing materials. This phase will occur in conjunction with facility demolition and removal and the surfacing materials removed will be placed in the designated solid waste disposal areas as previously discussed. The second phase of road removal for primary roads and removal and reclamation of all other roads will be sequenced to coincide with backfilling and grading of the areas that the roads either provide access to or pass through. When roads are no longer needed, they will be removed and the associated disturbance areas will be regraded and reclaimed.

Road reclamation will generally involve the use of tracked dozers to rip the road surface and grade any surfacing material into piles which will normally be recovered by wheel loader and either hauled directly or loaded into trucks for haulage to one of the designated disposal areas. Road surfaces will then be ripped to alleviate any compaction and the road area will be graded to blend with surrounding reclaimed areas. During final grading, any culverts will be removed and transported to a temporary steel debris storage site for either salvage or disposal off-site. Cut/fill areas will be reclaimed by pulling the fill material upslope into the cut and grading any remaining cut slope, the fill material, and disturbed downslope areas to a stable configuration consistent with natural drainage patterns and blending with the surrounding terrain. Any major road cuts will be reclaimed by partially backfilling the cut and grading any remaining cut slope exposures so that they are stable as described in the backfilling and grading plan discussion. Any major road fills which would interfere with postmining drainage will be removed and the associated disturbance areas regraded in conjunction with overall site grading activities.

In order to provide access to drainage and sediment control structures, soil/substitute stockpiles, and monitoring sites, several roads will be retained through the extended liability period. In addition, Primary Road PR-3 in the Castle Gate preparation plant area will be retained as a permanent road to provide continued access to existing facilities owned by Price City and Price River Water Improvement District. This road follows an existing rights of way and utility easement for several existing water mains and a main sewer line. It is anticipated that, following the first phase of road reclamation, the portion of the main mine access road from the west entrance to the office trailer and Sedimentation Pond 001 will be retained as a dirt surface ancillary road to provide access to both sedimentation ponds and the soil/substitute stockpile on the west side of the large rock outcrop. Access to these areas will be necessary for pond inspection, maintenance, and cleanout and later for removal and final reclamation of the pond areas. Given the existing bridge across the Price River, the short access road to the Castle Gate loadout area will also be retained to provide access to the west side of the river. Road PR-3 follows the old County road right-of-way through Price Canyon and is used by several parties for access to areas to the north. Given continuing access requirements there is no justification for either removal of this road or modification to an ancillary road.

The Division approves the engineering aspects of the road reclamation plan. The retention of some roads will be dealt with in the postmining land use section of the TA. Some roads may be left in during the early stages of reclamation to facilitate in reclamation and monitoring activities. The use of a road during the reclamation does not in and of itself justify retention of the road.

Findings:

The Operator has met the minimum engineering requirements for road removal.

RECLAMATION HYDROLOGIC INFORMATION

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

Analysis:

Surface-Water Protection

The reclamation sediment control measures are design as part of the surface-water protection plan. These practices are briefly discussed in Sections 5.4.2 and 5.5, and Exhibit 13, Section 4.5. A sediment pond will be used as sediment control until vegetation has established adequately to control erosion.

Sediment control will be accomplished in phases. The first phase will utilize the sediment pond and alternate sediment control measures. The second phase will include removal of the sediment pond after it is no longer needed to treat the reclaimed areas. Section 4.5.1.2 says that Cyprus will use alternate sediment control measures on the area to the reclaimed sediment pond.

Ground-Water Monitoring

In order to obtain maximum benefit from exploration drilling efforts and expenditures and more accurately define ground water conditions in the area, Cyprus may complete some future exploration drillholes as ground water monitoring wells. The decision to proceed with well completion will depend on specific information needs, drillhole location and depth, ground water occurrence as documented during drilling, and drillhole conditions at the time drilling is completed. Most of the wells installed in 1994 and 1995 will probably be lost due to interception by mine workings or to subsidence.

Cyprus will continue surface and ground water monitoring activities after completion of reclamation operations to document restoration of pre-mining hydrologic characteristics. Monitoring will be discontinued when untreated surface runoff meets applicable effluent limitations and the UDOGM approves removal of drainage and sediment control structures.

Surface-Water Monitoring

A reclamation surface-water monitoring plan is provided in Exhibit 12, Hydrologic Monitoring Plan (or Baseline Hydrologic Monitoring Plan). Figure 2 in that exhibit shows the location of monitoring locations. The same stations used for baseline and operational monitoring will continue through reclamation bond release.

Water Rights

The reclamation chapter of the permit application does not include information about water rights. There is information in Section 4.7-14, page 4.7-14, that is pertinent to water rights.

Acid- and Toxic-forming Materials

Chemical characteristics of coal and other materials to be disturbed in the Willow Creek Mine are discussed in Section 3.6.3.2. Of the 44 core samples of roof and floor rock collected in 1994, there were a few samples that exceeded DOGM Guideline values for SAR, boron, selenium, and acid-base potential. However, values from numerous samples of soil, mine waste, and coal refuse already at the surface indicate there is no significant potential for acid- or toxin-formation. The manners in which waste materials are typically handled during mining will most likely result in the smaller volumes of unacceptable materials being mixed with larger volumes of acceptable materials and the resulting buffering or dilution leaving material that falls within acceptable values. On page 3.6-27 is a statement that where mine waste rock or coal refuse materials are placed in surface stockpiles, testing these materials for suitability may be appropriate as part of the reclamation program. Cyprus commits to handling and disposing of any potentially acid or toxic forming materials encountered or exposed in compliance with the coal mining rules.

In addition, mine dewatering flows have been monitored and there is no evidence of any significant potential for development of acidic or toxic drainage as a result of any mine water discharge or resaturation following mine abandonment and sealing.

On completion of mining operations there will be a number of mining related features and some materials which, if not properly addressed, could pose a potential health or safety hazard to both humans and wildlife. Coal refuse materials, non-coal wastes, and mine waste materials could represent a potential hazard due to any toxicity characteristics associated with these materials and the potential flammability of certain non-coal wastes such as waste petroleum products.

Evaluation of coal roof and floor materials and overburden/interburden materials along with samples of existing coal refuse and mine waste materials indicates no significant toxicity concerns relative to these materials. In addition, specific operational placement and reclamation methods and plans will control or minimize any potential toxicity concerns for both coal refuse and mine waste materials. As described in Section 4.5.2.2, General Description of Mine Plans, Mining Methods, and Related Design Requirements, under the subtitle of Non-Coal Waste Disposal, all non-coal wastes will be collected and stored in appropriate containers and will be disposed of off-site by a licensed contract disposal firm. These disposal plans include any non-coal wastes remaining on completion of mining operations with the exceptions of concrete demolition debris and road surfacing materials resulting from facility removal which will be placed and buried in one of four designated disposal sites in the mine facilities, preparation plant, or loadout areas. Off-site disposal of most non-coal wastes and the planned disposal measures for demolition debris will effectively eliminate any potential associated hazards.

Transfer of Wells

All exploration drillholes established by Cyprus within the Willow Creek permit area will either be sealed following completion of drilling, sampling, and logging or completed as monitoring wells. If a hole is to be utilized for monitoring it will be cased, completed, and developed as a monitoring well consistent with methods described in Section 4.6.2.1 of the PAP.

When no longer needed for monitoring or other use approved by the Division, and unless approved for transfer as a water supply well, on-site monitoring wells will be sealed by filling the borehole or casing with cement to form a plug from the bottom of the hole to at least 20 feet above any zone of completion or water-bearing zone; filling the remainder of the hole to within 20 feet of the ground surface; and filling the remainder of the hole to the ground surface with cement to form a surface plug. A steel fence post will be placed in the center of the surface plug to provide a permanent marker of the location. There is no current plan to transfer monitoring wells to another owner for use as water supply wells or any other use.

Discharges into an Underground Mine

The existing approved Castle Gate Mine Permit includes provisions for injection of process water and fine coal refuse slurry into existing abandoned underground mine workings through two existing injection wells near the Castle Gate coal preparation plant. With the possible exception of process water and fine coal refuse slurry that could be injected through these wells, water will not be diverted or discharged into any underground mine in conjunction with ongoing mining and reclamation operations at the Willow Creek Mine.

Injection of a fine coal refuse slurry, consisting of process water and coal processing waste, into existing abandoned underground mine workings through two existing injection wells near the Castle Gate coal preparation plant, with recovery of clarified make-up water for the coal preparation plant through another well, have been approved by the Division as part of the current Castle Gate Mine MRP. The same slurry discharge-water recovery plan has been incorporated into the Willow Creek PAP. Discharges will be limited to water and coal-processing waste. Effluent waters will not be discharged from the areas disturbed by coal mining and reclamation operations. Water from one underground mine will not be diverted into other underground workings. With the exception of process water in the slurry that could be injected through these wells, water will not be diverted or discharged into any underground mine in conjunction with ongoing mining and reclamation operations at the Willow Creek Mine. Water from one underground mine will not be diverted into other underground workings.

Plan details on the construction, operation, and sealing at time of abandonment of the injection wells are provided in Exhibit 19, Castle Gate Information. Wells used for the injection of slurry and recovery of water will be plugged with cement from the top of the slurry material in the mine up to the land surface. Casing will be cut off at the surface and covered with soil. The slurry line will be removed. The water return line will be left in place with the ends cut off and buried. Final reclamation will be in accordance with the approved plan.

Gravity Discharges

There are no indications that the coals to be mined are acid-producing or iron-producing. Mine dewatering flows have been monitored and there is no evidence of any significant potential for development of acidic or toxic drainage as a result of any mine water discharge or resaturation following mine abandonment and sealing. The Willow Creek mine workings will progress down dip from the outcrop area and mine drainage will be controlled during active operations so there is little or no potential for direct gravity discharge of water from the mine. Upon completion of mining and related activities mine drainage control operations will cease and

portions of the mine workings, especially the mine workings farthest down dip, are expected to gradually fill as ground water continuously discharges into the mined-out areas. To prevent any significant discharge from the mine openings following cessation of active mining operations and mine closure, Cyprus will seal and backfill the mine portals. Sealing practices are discussed in Section 5.4.2.3, Reclamation Practices, and Section 5.5.2.6, Casing and Sealing of Wells and Mine Openings.

Water Quality Standards and Effluent Limitations

Sections 5.5.2.2 on page 5.5-2 is a statement that no permanent structure will be out of compliance with water quality effluent limitations. This section says, "effective restoration will include a determination of revegetation success and restoration of surface drainage characteristics such that contributions of suspended solids from untreated disturbed area runoff are within applicable water quality limitations."

Diversions

Reclamation diversion information is provided in Exhibit 13, Section 4.5.3, pages 60 through 66. Cyprus is proposing to construct a reclamation diversion in place of operational diversions which will rout flow from the main portion of the reclaimed area into the sediment pond. Four side drainage postmining ditches have been designed for the undisturbed flows (see Table EXDS-13), for which a culvert has been designed to convey disturbed flow over each. The disturbed diversion will be made up of diversions leftover from the operational drainage control system; however, these diversions will take on a greater amount of undisturbed flow in the reclamation phases. All temporary diversions will be reclaimed and all culverts will be pulled prior to final reclamation. A timetable in Exhibit 13, EX13-66 shows the timing for removal of diversions.

CPMC has not included a plan to reclaim the main Willow Creek culvert. This culvert is not needed for the postmining land use and must be reclaimed.

Stream Buffer Zones

The permit application addresses reclamation activities within the stream buffer zone in Sections 4.3.3.2 and 4.5.2.3. Many activities will occur within 100-feet of Willow Creek and Cyprus has developed a sediment control plan for most of these areas, but the permit application does not all stream buffer zones covered, nor has the application shown that reclamation activities will not cause or contribute to the violation of applicable Utah or federal water quality standards and will not adversely affect the water quantity and quality or other environmental resources of the stream.

The main Willow Creek crossing culvert will be reclaimed in the latter stages of reclamation work. Reclamation of the culvert is addressed in Sections 5.4.2.3 and 5.5.2.1 of the permit text and Section 4.5.1.3 of Exhibit 13. Exhibit 14 contains the reclamation channel design for the entire reconstructed channel. This design will be implemented on the reach where the culvert is located.

Sediment Control Measures

Cyprus proposes to remove siltation structures after sediment control requirements have been met. However, the proposed reclamation sediment control plan for the Willow Creek mine facilities will include an interim measure. The interim measure will utilize the main sediment pond (Pond 001) and many of the disturbed diversions that will be established in the active mining phase of operations. The land will be regraded to a large extent, so these drainage systems will require modification. A timetable in Exhibit 13, EX13-66 shows the timing for removal of diversions, and designs are included in Exhibit 13, Section 4.5.2 and shown on Figure 13-13.

Siltation Structures

Sediment Pond 001 from the operation mining plan will be utilized as interim sediment control. All other siltation structures will be removed in regrading the site. Pond 001 will be filled in after vegetation is found to be sufficient to control sediment. A timetable in Exhibit 13, EX13-66 shows the timing for removal of diversions.

Sedimentation Ponds

Pond 001 will be incorporated into the reclamation interim sediment control plan. Regrading of the mining site will eliminate many of the undisturbed diversions and cause a greater amount of water to flow into the pond in reclamation than during operations. The design of the pond has been shown to be adequate for an expanded treatment area. Pond 001 will be retained until sediment control requirements are met by vegetation, but Pond 001 will not need to be modified to include drainage from an expanded undisturbed area in reclamation. A timetable in Exhibit 13, EX13-66 shows the timing for removal of diversions.

Other Treatment Facilities

N/A

Exemptions for Siltation Structures

Cyprus's reclamation sediment control plan does not call for any exemptions from siltation structures.

Discharge Structures

Cyprus has proposed to use the same discharge structures and designs in Pond 001 during operation and reclamation. They have modeled the reclamation scenario using the reclaimed land configuration.

Impoundments

Sediment Pond 001 is the only impoundment considered for retention after reclamation. It will be removed after vegetation has established sufficiently to control sediment and erosion.

Structure Removal

All sediment control structures will be removed before final reclamation (section 5.5.2.1). Sediment Pond 001 will be retained through the first reclamation phases, until it is determined that vegetation is sufficient to control erosion and sediment. There is no time table for removal of sediment control and interim sediment control measures.

Casing and Sealing of Wells

In order to minimize any potential hazards to humans or livestock associated with open exploration holes or boreholes and to prevent potential mixing between ground water aquifers, Rules R645-301-631 and 641 require that all exploration holes and boreholes be cased if used for water monitoring, or permanently sealed if not used for monitoring or if no longer required for ongoing monitoring activities. All exploration boreholes established by Cyprus within the Willow Creek permit area will either be sealed following completion of drilling, sampling, and logging or completed as monitoring wells. If a borehole is not to be used for monitoring it will be plugged and sealed as soon as drilling, sampling, and logging operations are completed. If a borehole is to be utilized for monitoring it will be cased, completed, and developed as a monitoring well consistent with methods described in Section 4.6.2.1 of the PAP. When no longer needed for monitoring or other use approved by the Division, and unless approved for transfer as a water supply well, on-site monitoring wells will be sealed by filling the borehole or casing with cement to form a plug from the bottom of the hole to at least 20 feet above any zone of completion or water-bearing zone; filling the remainder of the hole to within 20 feet of the ground surface; and filling the remainder of the hole to the ground surface with cement to form a surface plug. A steel fence post will be placed in the center of the surface plug to provide a permanent marker of the location. There is no current plan to transfer monitoring wells to another owner for use as water supply wells or any other use.

Findings:

Groundwater Monitoring

Ground-water monitoring will be conducted according to the ground-water monitoring plan and ground-water monitoring data will be submitted every three months to the Division. Ground-water monitoring will proceed through mining and continue during reclamation until bond release. Equipment, structures, and other devices, i.e., water monitoring wells, used in conjunction with monitoring the quality and quantity of ground water onsite and offsite will be properly installed, maintained, and operated and will be removed by the Operator when no longer needed. The proposed reclamation plan for ground water monitoring is complete and accurate

Acid- and Toxic-forming Materials and Underground Development Waste

The reclamation plan for acid- and toxic-forming materials and underground development waste is complete and accurate.

Transfer of Wells

There are currently no plans to transfer wells to another party for further use. The proposed reclamation plan for transfer of wells is complete and accurate.

Discharges into an Underground Mine

The proposed reclamation plan for discharges into an underground mine is complete and accurate.

Gravity Discharges from Underground Mines

The proposed reclamation plan for gravity discharges from underground mines is complete and accurate.

Diversions

Cyprus has included diversion designs that are specific to reclamation. These designs are satisfactory, except CPMC must include a reclamation plan for the main Willow Creek culvert.

Stream Buffer Zones

The permit application does not specifically address reclamation activities for the main Willow Creek culvert.

Sediment Control Measures

The proposed reclamation plan for sediment control measures in complete and accurate; however, in Exhibit 19, Section 3.10 is a statement that a Small Area Exemption (SAE) has been requested for the runoff from the site of the well that will recover water from the slurry injection system. It isn't clear that such an exemption has been granted.

Sediment Ponds

Designs for the reclamation sediment pond are complete and accurate.

Casing and Sealing of Wells

The proposed reclamation plan for the casing and sealing of wells is complete and accurate.

REVEGETATION

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

Analysis:

Revegetation Methods

Revegetation methods are discussed in Section 5.3.

Generally, seeding will be accomplished as soon as possible following the cessation of mining and replacement of soil. Normally, this will be in the fall. Exceptions will be for newly established soil/substitute stockpiles, road cuts, newly constructed diversion and collection ditches, and small areas where erosion or other repairs have occurred. In these cases, revegetation will occur at any time when site and climatic conditions offer a reasonable chance for success.

Fall is considered the best seeding time in this area, but seeding is sometimes successful in the spring. The Applicant should definitely plan to try to seed in the fall. Seedings done at other times may need to be repeated.

Backfilling, grading, and soil replacement will be done to minimize compaction. Following grading, the regraded surface will be ripped up to three feet. The Applicant will then apply finely-chopped hay at a rate of about one and one-half tons per acre.

The soil surface will be left in a roughened condition. Surface manipulations will be minimized and generally limited to shallow chisel plowing, disking, or tine harrowing to break up the soil and provide a firm seedbed.

Leaving the surface rough is one of the most desirable revegetation practices in Utah. Many roughening techniques commonly used in other areas may not be large enough or last long enough for coal mining areas of Utah. Normally, disking and harrowing, similar to the methods proposed in the application, break up the soil too much and decrease the amount of roughness. Breaking up fine-textured soils tends to increase compaction and decrease infiltration. Although these are standard reclamation practices in other states, they do not work well in Utah. While the site may be reclaimable using these techniques, the Applicant is likely to have more difficulties achieving revegetation success. A recommended method is to make large gouges averaging one to two feet deep and two to four feet across.

The Applicant plans to drill seed most areas and to broadcast seed where the disturbance area is of limited size, where there are steep slopes, and in other areas where traditional agricultural equipment would be limited. The temporary seed mixture shown in Table 5.3-1 should do well if it is drilled. The plan shows that four species in the upland seed mixture would be broadcast seeded. Species in the riparian seed mixture can be drill seeded, but tufted hairgrass and spreading bentgrass (hereafter called redtop) have very small seeds that might be difficult to drill.

Some Operators drill most species then broadcast the rest before mulching. Others simply broadcast the entire mix. Either alternative is acceptable. However, the Division's experience is that broadcasting the entire mix usually results in more diverse composition than drilling. Drilling is a common practice is Wyoming and Montana, but it has not generally worked as well to establish a diverse vegetative cover in Utah. Also, drilling is more difficult on roughened surfaces and may tend to reduce the roughening.

Seed mixtures to be used for final reclamation are shown in Tables 5.3-2 and 5.3-3. Although the postmining land use is wildlife habitat, the Division of Wildlife Resources requested that the final reclamation upland seed mixture be composed of mostly unpalatable species. The reason for this is to reduce big game use near Highway 191 and, hopefully, also reduce big game vehicle collisions.

Although the mixture contains some palatable species, such as fourwing saltbush and some of the grasses, it is dominated by species that are less palatable, such as basin big sage, rubber rabbitbrush, and salina wild rye. This seed mixture meets the requirements of R645-301-342 and R645-301-353.

The application says introduced species were included in the seed mixtures due to their abilities to germinate and establish more rapidly than many native species, their value as sod-formers or nitrogen fixers, their specific value as wildlife browse and forage, and the fact that they have been previously approved by the Division and were used in the AMR revegetation work. The AMR program is not subject to the same introduced species performance standards as the Title V program. Introduced species used for permanent reclamation need to be justified for each site.

The upland seed mixture in Table 5.3-2 includes two introduced species. Yellow sweet clover is a legume that is normally included in seed mixtures in Utah. It is a pioneer species that increases soil microbial activity and is very palatable to wildlife and livestock. Although native legumes are available and perhaps should be included in the mixture, the natives do not perform the functions of these introduced species nearly as well. As discussed above, Wildlife Resources requested that alfalfa be removed from the seed mix. Yellow sweet clover is only palatable in the spring and early summer, times when it is not as important to keep big game away from the highway, so its use should not be a problem.

The other introduced species in the mixture is intermediate wheatgrass. It has been used extensively in the area and, as a rhizomatous grass, is very effective at reducing erosion. It is only moderately palatable because it tends to become very coarse as it matures.

The composition of the upland seed mix is heavily weighted toward big sage and rubber rabbitbrush. Mine Operators in Wyoming commonly have trouble establishing big sage, but this is not generally the case in Utah. Both big sage and rabbitbrush establish well from seedings, and they also invade reclaimed areas. Under both the proposed and recommended seed mixes, the Applicant would plant more seed of these species than generally recommended. However, enough seed of other species is included that it should be possible to achieve the diversity requirements.

The riparian seed mixture in Table 5.3-3 includes four grass and one legume species. Although the application does not indicate any of these species are introduced, redtop and strawberry clover are not native to Utah. Redtop was introduced to the United States before 1750 and is now circumboreal, so it can almost be considered native. It was also the main herbaceous component in riparian vegetation along the creek.

Strawberry clover, although not native, is a legume that spreads by both rhizomes and stolons. It is considered to be adapted to areas with periodic flooding. There were no native legumes encountered in vegetation sampling in the riparian areas, and, for reasons discussed above, it is desirable to have legumes planted in disturbed areas.

Seeds of all the grasses in the riparian mixture are very small. Two pounds per acre PLS of each of these is probably more seed than is needed. It is recommended that the seeding rates be reduced for the four grasses by about one-half. Also, the Applicant could add Kentucky bluegrass and blueleaf aster at one pound PLS per acre each (drilled).

The Applicant plans to plant Fremont cottonwoods, coyote willows, and serviceberries or currants at a total rate of 108 to 116 cuttings or seedlings per 100 feet of linear channel disturbance. This statement is interpreted to mean this is the total number of seedlings or cuttings to be planted on both sides of the stream. Normal seedling transplant methods will be used for the transplants. Willow cuttings will be obtained from existing natural growth along the Willow Creek channel during early spring. Transplants will be protected from wildlife by net enclosures.

Following seeding, straw or native hay mulch will be applied to most reseeded areas at a rate of about two tons per acre. This will be crimped or anchored using a disk or similar agricultural equipment. In areas with increased erosion potential, other methods, including dozer tracking, application of geotextiles, and hydromulching at a rate of 1.5 tons per acre, may be used. The Applicant will use weed-free straw or native hay mulch to most reseeded surface disturbances and will utilize other surface protection measures in conjunction with or as an alternative to mulching for areas with increased erosion potential.

Dozer tracking, although useful in some areas, does not normally provide enough surface roughness that it is beneficial for erosion control. It does not crimp straw or hay very much, and the cleat tracks are not nearly large enough to trap enough water to benefit establishing vegetation.

Straw or hay applied at the rate of about two tons per acre has been shown in several studies to provide better erosion control and seedling establishment than most other mulches. However, crimping the mulch with a disk is likely to reduce the amount of surface roughness. One method of anchoring straw or hay mulch without particularly decreasing the roughness is to crimp it with the teeth of the bucket on a trackhoe.

According to a Forest Service publication, hydromulch is only effective for 30 days after application. In the Division's experience, it may inhibit seedling growth when used in lower precipitation zones because it forms a mat that is difficult for seedlings to penetrate. This would be especially true at the relatively high rate shown in the application.

Geotextiles have shown promise in use for erosion control. However, the Applicant would need to receive approval for the specific method and materials before using them.

The Applicant does not intend to irrigate reclaimed areas. Regular inspections of the reclaimed areas will include checks for significant noxious weeds infestations or insect damage. If problems are discovered, the Applicant will consult with the Division and with Carbon County Weed Control to develop and implement appropriate control measures. If pesticides are to be used, the Applicant will only use chemicals approved for the particular use and will limit control to spot applications.

Any noxious weed infestations have the potential of spreading to other areas. Some parts of the proposed disturbed area have had noxious weed infestations, and it is likely reclaimed areas will also. The Applicant should plan to control any noxious weeds that appear on reclaimed areas. In addition, downy brome is one of the dominant species on disturbed sites in the area, including reclaimed areas. It may be necessary to control this weed.

Success Standards

Revegetated areas will be sampled four, eight, nine, and ten years after initial permanent revegetation seeding and planting. The Applicant plans to sample ground cover, productivity, and woody plant densities on all permanently revegetated areas and will evaluate revegetation success on the basis of these parameters. Sampling methods will be essentially the same as used for baseline data collection.

Four distinct vegetation types are proposed to be disturbed and were sampled. These are the riparian, pinyon-juniper, disturbed, and reclaimed areas. The application says in order to evaluate revegetation success for reclaimed areas, areas identified as disturbed or reclaimed, and pinyon-juniper in the baseline evaluation will be sampled together as a unit and areas identified as riparian in the baseline sampling effort will be sampled as separate units. Cover and production values resulting from revegetation success monitoring will be compared with weighted average values based on reference area values for disturbed, reclaimed and pinyon-juniper types.

Although weighing the values in this manner is not conventional, it can be justified. Except for riparian areas, the Applicant will use the same revegetation techniques on the entire area proposed for disturbance. The established woody plant density success standard is about the same as baseline data for the undisturbed areas. Cover values were actually less in the reference area than in the previously disturbed area. Species present in disturbed and undisturbed areas differed somewhat, but relative cover values for grass, forb and shrub life forms were generally very similar.

The Applicant intends to use two reference areas to judge revegetation success. These are the Royal Coal Pile and a pinyon-juniper reference area. Range conditions of seeded areas are not rated by Natural Resources Conservation Service (NRCS) methods; therefore, it is impossible to determine a range condition for the Royal Coal Pile reference area. If it could be done, the range condition of this area would probably be fair or good. The pinyon-juniper reference area was rated according to NRCS criteria and found to have a range condition of "fair."

Section 3.2.2.7 also discusses the similarity of the reference areas to areas proposed to be disturbed. Cover values and species compositions are very similar for the proposed disturbed pinyon-juniper areas compared to the reference area. Statistical comparisons of previously disturbed areas that are proposed to be disturbed to the Royal Coal Pile reference area would probably not be appropriate since the data were gathered in different years. However, the cover values are very similar. Production appeared to be greater on the reference area, but this was likely due to an unusually wet spring and early summer.

The application says that for the riparian community, the cover comparison will be based on canopy cover. The riparian area included some trees with diameters at breast height of four inches or greater. Canopy cover from these trees was 2.5%. Mature trees are an important part of the riparian community. Fremont cottonwoods are to be planted in the riparian area, and these grow very rapidly. It is reasonable to expect 2.5% canopy coverage even only ten years after planting.

After consulting with the Division of Wildlife Resources, it was decided to set woody plant density success standards at 1700 plants per acre for upland areas and 4000 stems per acre for riparian areas. These success standards have been included in the application.

The woody plant density in the pinyon-juniper reference area was 1715 per acre. Even with this many shrubs, grasses contributed more cover than shrubs. Establishing 1700 shrubs per acre is both possible and desirable.

The dominant plant in the riparian area was coyote willow. These willows can establish very dense stands, and a standard of 4000 stems takes into account that most coyote willow stems come from rhizomes from limited numbers of individual plants.

The Applicant proposes to use Sorensen's Similarity Index as outlined in the Division's "Vegetation Information Guidelines," Appendix B, to compare seasonality, diversity, and permanence. It is assumed the standard will be 70% similarity as discussed in the guidelines. While this standard is acceptable, it is anticipated better ways of judging these parameters will be developed in the future and could be used.

Formation of rills and gullies on reclaimed areas would be limited to a maximum of nine inches. General erosion will be evaluated using Mark Humphrey's Erosion Condition Classification System as adapted from the Bureau of Land Management's Erosion Condition Classification System. It is assumed reclaimed areas will be compared with adjacent undisturbed areas for comparison.

This method quantifies qualitative judgments of erosion. Although the method is not precise, trained people usually obtain similar values The method takes into account various kinds of erosion and is acceptable for use in measuring for erosion control. It is anticipated better methods will be developed before the area is reclaimed.

Fish and Wildlife Plan

The application discusses the realignment of Willow Creek and the measures to be used to stabilize it and to recreate aquatic habitat. Pool habitat will be created by placing multiple meanders in the stream and using a concentration of boulders below the bends. The riffle/pool ratio will be about 1:2. Reestablished riparian vegetation will provide effective cover for fish and aquatic species once it becomes established. Boulders will be placed in such a manner as to allow fish movement throughout the realigned sections. Stream restoration will also be used to mitigate habitat loss and modifications resulting from construction of the proposed main access road bridge and the replacement of the existing culvert crossing.

Many aspects of the restored stream would be very similar to current conditions, but certain enhancement features were incorporated in the plan. These include replacement of the silty substrate with a rock and gravel substrate designed to flush naturally and provide improved aquatic habitat. Also, selective placement of rocks will help eliminate barriers to fish movement. The Division has reviewed the realignment plans and is aware of extensive reviews by the Army Corps of Engineers and the Division of Wildlife Resources.

The application says recommendations from the Division of Wildlife Resources were reviewed in developing the reclamation seed mixture. As discussed above, the Division of Wildlife Resources' comments were that they would rather have less palatable species, and the seed mixture was developed accordingly.

Four potential enhancement projects are shown in the application. These are discussed under "Fish and Wildlife Protection Plan." These projects are considered primarily mitigation proposals for the operations phase.

Other enhancement options may become available based on improved technology or changing habitat conditions through the life of the mine. If this happens, the Applicant will need to incorporate those considered to be within the definition of the best technology currently available.

Findings:

This portion of the applications is considered complete and accurate.

MAPS, PLANS, AND CROSS SECTIONS OF RECLAMATION OPERATIONS

Regulatory Reference: 30 CFR Sec. 784.23; R645-301-323, -301-512, -301-521, -301-542, -301-632, -301-731.

Analysis:

Information presented on the reclamation maps and cross-sections includes:

- Anticipated final surface configuration
- Postmining drainage features

- Location of any structures and facilities which will be retained as permanent structures following the completion of mining
- Any roads to be retained in conjunction with the postmining land use

Reclamation Facilities Maps

Reclamation facilities can be found on Map 21, Mine Surface Facilities Area Postmining Topography. Included on this map is the location of one sediment pond, temporary and permanent reclamation diversions, and reclamation topography.

Final Surface Configuration Maps

Final surface configuration is found on Map 21, Mine Surface Facilities Area Postmining Topography. The Castle Gate Facilities final surface configuration is generally included in the exhibit on those facilities; however, new facilities to be added with the work from this project are not covered in those maps.

Reclamation Monitoring and Sampling Location maps

The permit application does not included a map that shows the specific locations of the reclamation monitoring and sampling locations.

Findings:

The Permittee has meet the minimum regulatory requirements.

BONDING AND INSURANCE REQUIREMENTS

Regulatory Reference: 30 CFR Sec. 800; R645-301-800, et seq.

Analysis:

The Division has determined that the reclamation bond amount adjusted for inflation till 2001 must be $11,949,205. The Permittee has agreed with the amount and posted the bond on April 16, 1996.

Findings:

The Permittee has meet the minimum regulatory requirements.

CUMULATIVE HYDROLOGIC IMPACT ASSESSMENT (CHIA)

WILLOW CREEK
AND
PRICE RIVER BASINS

Castle Gate Mine
ACT/007/004

Willow Creek Mine
ACT/007/038

Carbon County, Utah

April 12, 1996

I. INTRODUCTION

The Castle Gate Mine and proposed Willow Creek Mine are located approximately 5 miles north of the town of Helper, Utah, where the Price River and Willow Creek have cut deep canyons through the western Book Cliffs Coal Field (Figure 1). The two mines lie entirely within the Price River drainage, Willow Creek being a major tributary to the perennial Price River. The United States Geological Survey (USGS) has recorded no flow in Willow Creek many times, although year-round flow is common. The Price River and Willow Creek drainages extend north into Utah and Duchesne Counties. Intermittent discharge from Spring Canyon, a major drainage of the Book Cliffs west of the Price River, joins the Price River at Helper (Figure 2). Approximately 5 miles downstream of Helper is the city of Price, and from there the Price River flows southeast between the Book Cliffs and the San Rafael Swell to its confluence with the Green River. US Highway 6 and the mainline of the Denver and Rio Grande Railroad parallel the Price River through Price Canyon, and State Highway 33 follows Willow Creek canyon.

Many mines have gained access to coal in the western Book Cliffs Coal Field from the Price Canyon, Spring Canyon, and Willow Creek drainages. Other mines have accessed the coal in the Willow Creek area from the south through portals in the Book Cliffs escarpment. Generally, mining and other development has been limited to valley bottoms and adjacent lower valley slopes, with little development of high plateau and steep ridge areas.

During the first half of the twentieth century numerous mines were opened in the Book Cliffs west of the Price River. The Royal (Rolapp) Mine in Bear Canyon closed in the mid-1950's, and the nearby New Peerless Mine operated only from 1930 to 1931. In the Spring Canyon drainage the Peerless Mine and eight other mines located upstream from Sowbelly Gulch had all ceased operations by the 1950's. The Liberty Fuel (Latuda) Mine remained open until 1966 and the Spring Canyon Mine in Sowbelly Gulch was open until 1970. Operations in this western area that became part of the Castle Gate Mine operation included the #1 adit (Utah Fuel) in the west wall of Price Canyon, #2, #3 and #4 (Carbon Fuel/Castle Gate) in Hardscrabble Canyon, and #5 in Sowbelly Gulch. Two large shafts were excavated in Crandall Canyon (Figure 2).

On the east side of Price Canyon, the Ketchum Mine operated from near the turn of the century until the 1930's. The Utah Fuel No. 3 Mine opened in the early 1920's and closed in 1937 due to flooding of the Price River. Located at the mouth of Panther Canyon below the Willow Creek confluence, U. S. Fuel's Heiner Mine operated from 1914 to the 1930's.

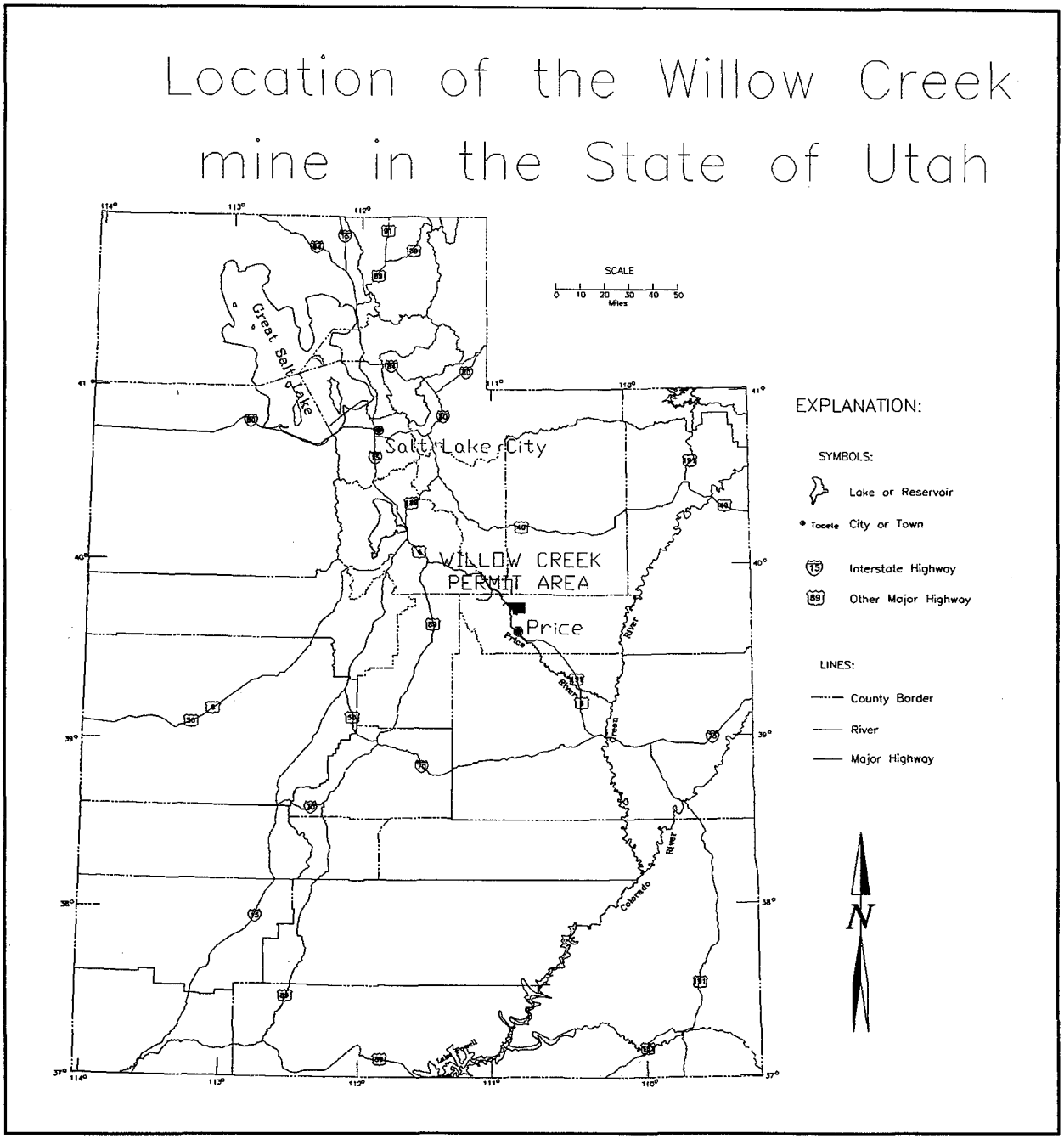

Figure 1 - Location Map

A loadout and coal prep-plant were built on the old Castle Gate townsite in the mid-1970's by McCullough Oil Company. A waste rock disposal site was built in Schoolhouse Canyon in the late-1970's by AEP, and a conveyor system was built to transport coal beneath Highway 89 and over the Price River, from the #1 adit to the prep-plant. These became part of the Castle Gate Mine operations.

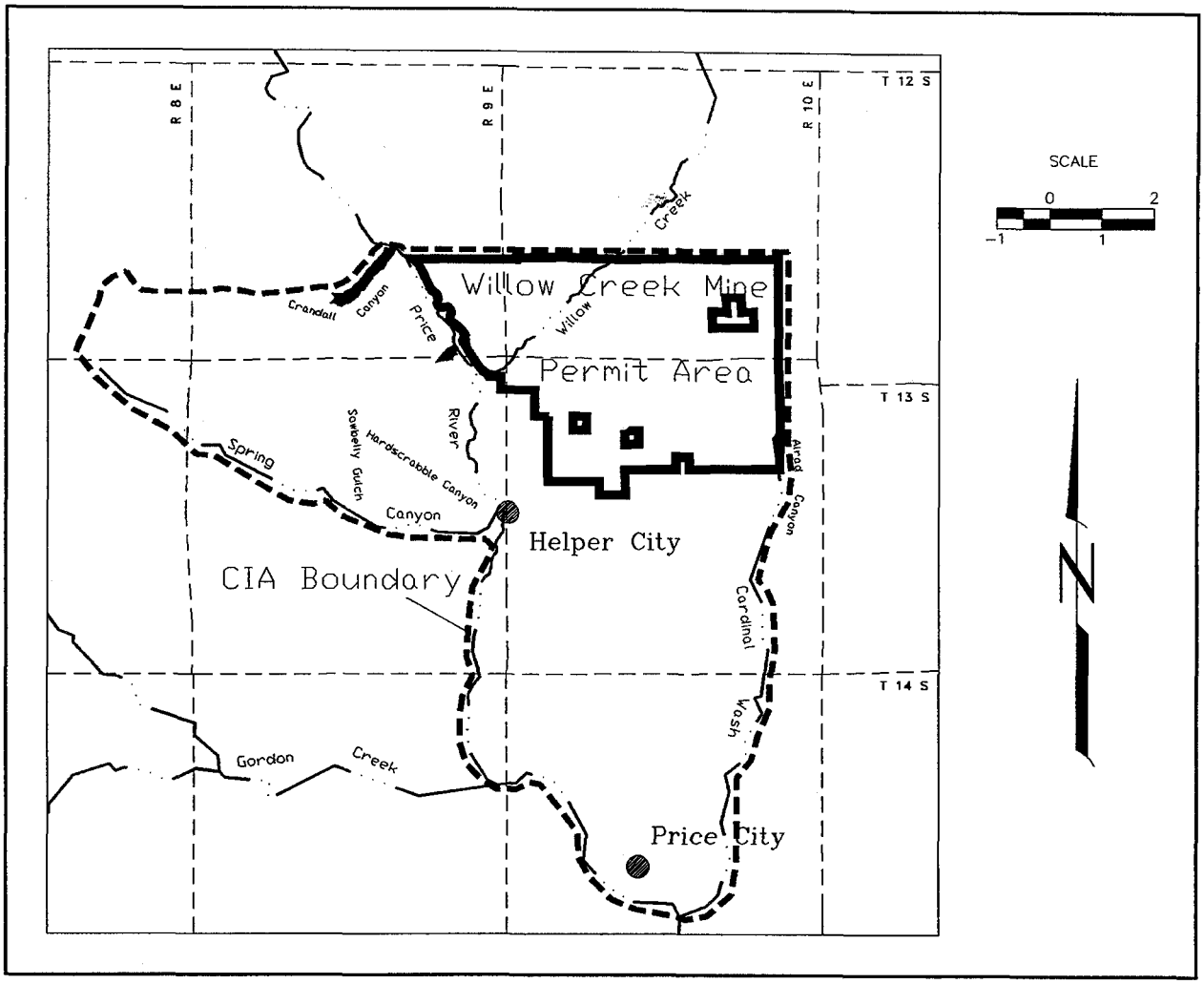

Figure 2 - CIA Boundary

Mining in Willow Creek drainage began in 1890 with the opening of the No. 2 mine by the Utah Fuel Company. Five portals for entry and ventilation were opened on the south bank of Willow Creek. A mine explosion in 1924 killed 172 miners, most of whom are buried in the nearby Castle Gate Cemetery. There was a second explosion in 1928. The No. 2 mine was operated continuously from 1890 to 1972: by Utah Fuel from 1890 to 1950, by Kaiser Steel from 1950 to 1952, by Independent Coke and Coal from 1952 to 1968, and by North American Coal Company from 1968 to 1972. The facilities and reserves were then sold to a succession of companies but the mine was not reopened. The No. 4 mine was opened in 1958 by Independent Coal and Coke and closed in 1970 by North American Coal Company. From 1938 to 1972 coal was transported from the No. 2 and No. 4 mines to an old coal preparation plant, located at the mouth of Schoolhouse Canyon, on narrow gauge rail that ran along the base of the bluffs and through tunnels on the north side of Willow Creek. Waste was disposed of along the canyon floor, and in adjacent canyons north of Willow Creek.

From 1938 to 1972 coal was transported from the No. 2 and No. 4 mines to an old coal preparation plant, located at the mouth of Schoolhouse Canyon, on narrow gauge rail that ran along the base of the bluffs and

through tunnels on the north side of Willow Creek. Waste was disposed of along the canyon floor, and in adjacent canyons north of Willow Creek.

In 1971 most coal reserves in the western Book Cliffs were consolidated into a single unit by McCullough Oil Company, and mining activities were undertaken by the Braztah Corporation. Operations were transferred from Braztah to the Price River Coal Company (PRCC) in December 1979, Braztah and PRCC both being subsidiaries of American Electric Power (AEP). Price and Plantz (1987) state that coal was being mined at the Braztah Mines in the lower Willow Creek drainage during the 1979 to 1984 water years, when the USGS was monitoring streams in the coal fields of Utah. Castle Gate Coal Company (CGCC) obtained the PRCC western coal reserves (generally west of the Price River) in 1986, but the eastern reserves were transferred to Blackhawk Coal Company, another subsidiary of AEP.

Coal production from the Castle Gate Mine ended in 1989. Amax Coal Company purchased CGCC in 1991 and is the current operator of the inactive Castle Gate Mine. Cyprus Plateau Mining Corporation (CPMC) has acquired rights to the coal in the eastern reserves and has applied for a coal mining permit to open the Willow Creek Mine. Amax Coal Company and CPMC are both subsidiaries of Cyprus Amax Minerals Company.

The channel of Willow Creek was realigned and a pad and a portal face-up highwall constructed by Blackhawk Coal Company just to the northeast of the No. 4 Mine in 1974-1975 in preparation for underground mining, but portals and adits into the coal seam were never built. The graded area has been used for refuse disposal, equipment storage, and as a construction staging area. Under an agreement with Blackhawk Coal Co. executed in 1989, Utah Division of Oil, Gas, and Mining's (UDOGM) Abandoned Mine Reclamation Program (AMRP) used 9.5 acres of this pad and surrounding area for disposal of underground development waste that was transported to the site from several AMRP projects. AMRP assumed all responsibility for reclamation and regulatory compliance for this area. AMRP was able to reduce the faceup and return the surface to a more natural contour, establish vegetative cover and other erosion controls, and stabilize and enhance 1,500 feet of Willow Creek streambank.

Under current plans the old Blackhawk pad and portal area reclaimed by AMRP is to be redisturbed for construction of a mine pad and portals for the Willow Creek Mine. Amax Coal Company and CPMC also plan eventually to transfer the prep-plant, loadout, and Schoolhouse Canyon waste disposal site from the Castle Gate permit to the Willow Creek permit and reclaim the remainder of the Castle Gate Mine permit area.

Cyprus Plateau began acquiring baseline data in 1994 with the objective of obtaining a permit to mine coal south of Willow Creek in acreage acquired from American Electric Power (AEP). Additional acreage was subsequently acquired north of Willow Creek. The Castle Gate properties were purchased from Amax Coal Co. in 1994. Access for the proposed Willow Creek mine is planned to be through portals north of Willow Creek in the vicinity of the old Castle Gate cemetery. AEP had several portals in this area that were reclaimed after operations ceased. The Willow Creek Mine will possibly gain access to the coal by uncovering and reopening old portals.

This Cumulative Hydrologic Impact Assessment (CHIA) is a findings document involving an assessment of the cumulative impact of all anticipated coal mining operations on the hydrologic balance within the Cumulative Impact Area (CIA). The CHIA is not a determination if coal mining operations are each designed to prevent material damage beyond their respective permit boundaries when considered individually, but rather is a determination if there will be material damage resulting from effects that become cumulative outside the individual permit boundaries.

The objectives of a CHIA document are to:

1. Identify the Cumulative Impact Area (CIA). (Part II)

2.	Describe the hydrologic system.	(Part III)
3.	Document the baseline conditions of surface and ground water quality and quantity.	(Part IV)
4.	Identify which hydrologic resources are likely to be impacted and determine which parameters are important for predicting future impacts to those hydrologic systems.	(Part V)
5.	Identify relevant standards against which predicted impacts can be compared.	(Part VI)
6.	Estimate probable future impacts of mining activity with respect to the parameters identified in 4.	(Part VII)
7.	Assess probable material damage.	(Part VIII)
8.	Make a statement of findings.	(Part IX)

Material damage is not defined in either the Utah or Federal regulations. Criteria that are used to determine material damage to hydrologic resources in coal mining programs administered by other states or by the Federal Office of Surface Mining (OSM) include:

- Actual or potential violation of water quality criteria established by federal, state, or local jurisdictions.
- Changes to the hydrologic balance that would significantly affect actual or potential uses as designated by the regulatory authority.
- Reduction, loss, impairment, or preclusion of the utility of the resource to an existing or potential water user.
- Short term (completion of reclamation and bond release) impairment of actual water uses that cannot be mitigated.
- Significant actual or potential degradation of quantity or quality of surface water or important regional aquifers.

This CHIA has been prepared by the Utah Division of Oil, Gas, and Mining. It complies with Federal and Utah coal regulations as found in 30 CFR 784.14(f) and R645-301-729, respectively. The last CHIA for the area was prepared sometime between 1982 and 1989 for permitting of the Price River Coal Company (PRCC) complex. In addition to data sources cited in the References section and the Willow Creek Permit Application Package (PAP), the Mining and Reclamation Plans (MRP) for the Castle Gate Mine (ACT/007/004), Price River Coal Company (also ACT/007/004), and Blackhawk Coal Company (ACT/007/004) were used as information sources.

II. CUMULATIVE IMPACT AREA (CIA)

The Cumulative Impact Area (CIA) is shown on Figure 2. This is the area within which the actual and anticipated coal mining activities may interact to affect the surface and ground water. The CIA is determined based on anticipated mining activities, knowledge of surface and ground water resources, and anticipated impacts of mining on those water resources. Both surface and ground water CIA's have been delineated, but the ground water CIA lies entirely within the surface water CIA.

The only anticipated mine operations within the CIA are the proposed Willow Creek Mine, including the coal processing, loading, and waste rock disposal facilities at Castle Gate, and reclamation of the Castle Gate Mine.

Coal mining in Willow Creek and Price River areas dates back over 100 years. Previous mining has left areas of unreclaimed and unvegetated land in most watersheds. Hydrologic impacts from these previous operations are incorporated in the baseline information.

The surface water CIA extends upstream to the boundaries of the Willow Creek and Castle Gate permit areas, plus Deep Canyon that receives north-flowing drainage from the northeast corner of the Willow Creek permit area. The CIA extends downstream to where Spring Canyon joins the Price River from the west at Helper and to where Cardinal Wash joins the Price River from the east, approximately one mile downstream of the city of Price (Figure 2).

Hydrologic impacts from coal mining operations should be diluted by the Price River to the extent that the impacts will not be detectable downstream of the CIA. All surface water within the CIA eventually flows onto the outcrop of the Mancos Shale and water quality can be expected to deteriorate downstream from there. The impacts of coal mining operations on water quality will probably be minor in comparison to impacts from contact with the Mancos Shale.

There are coal mining and reclamation operations farther east along the Book Cliffs that have a potential to effect water quality in the Price River. The nearest of these, Andalex' Centennial Project, is drained mainly by Deadman Creek/Hayes Wash, which enters the Price River approximately two miles downstream of Cardinal Wash. However, the western edge of that project impinges on Alrad Canyon at the eastern edge of the Willow Creek CIA.

In the Wasatch Plateau, drainage from Cyprus/Plateau's Starpoint and Utah Fuel's Hiawatha mines reaches the Price River several miles below Hayes Wash by way of Miller Creek; other mines in the Wasatch Plateau do not drain to the Price River. There are also coal preparation or loadout facilities along the Price River. None of these permitted coal mining and reclamation operations have been included in the CIA.

A ground water CIA should include all areas between the anticipated mining operations and the aquifer discharge points. Ground water can be found in alluvial/colluvial, perched, and regional aquifers in the Price Canyon - Willow Creek area. Alluvial/colluvial systems correspond closely with the stream channels. Shallow, perched aquifers are recharged within relatively small areas around the seeps and springs where they discharge. The extent of the regional aquifer to the north is not known; however, the potentiometric surface should generally correspond to surface topography and rise to the north and the northern boundary of the ground water CIA has been made coincident with that of the surface CIA. The regional aquifer extends south to the outcrop of Mancos Shale at the base of the Book Cliffs. All ground water systems have been included in a single ground water CIA that coincides with the surface water CIA.

III. HYDROLOGIC SYSTEM

The area is characterized by rolling uplands and open parks above the steep sides of deeply incised canyons. Vegetation varies from Grassland-Sagebrush and Desert Shrub communities at lower elevations to Spruce/Fir/Aspen and Mountain Meadow communities at higher elevations. Areas north of the CIA are characterized by steep canyonlands with mixed pinon-juniper and sagebrush. These communities are generally used for wildlife habitat and livestock grazing. Alluvial fans covered with desert scrub line the Price River from its confluence with Willow Creek to Helper.

Land within the CIA is used for extensive underground mining activities, electric power generation, and transportation facilities. The remainder of the CIA generally consists of undeveloped lands utilized for low-intensity grazing, wildlife habitat, limited dispersed recreation, and very limited timber production. Anticipated post-mining uses are for wildlife habitat, grazing, and recreation. Water within the CIA is used for watering livestock and wildlife, mining coal, domestic use, fisheries, and recreation. Downstream, the water is additionally used for irrigation and industrial needs.

Climate

The closest active meteorological reporting station is located at PacifiCorp's Carbon Generating Station. Climatic characterization is based on historical climate data from this station and general regional climatic information. Evaporation and infiltration rates in the proposed lease and adjacent areas vary with vegetation, soil type, and time of year. Average annual potential evapotranspiration in the Price Canyon - Willow Creek area is 18 to 25 inches per year (Atlas of Utah, 1981). Much of the precipitation is lost to runoff, evaporation, and sublimation, minimizing the amount of water available for ground water recharge.

Temperature

Generally, the climate of the area is temperate. Temperatures in the area normally reflect a typical seasonal pattern with gradual warming beginning in mid to late-March, high seasonal temperatures in July and early August, a gradual cooling beginning in late August to early September, and seasonal lows in late-December through mid-February. Summer high temperatures range from 60° to 75°F (15° to 24°C) and winter lows typically vary from 10° to 20°F (-12° to 7°C). The recorded high temperature for the area is 90°F (32°C) and the low is -10°F (-23°C). The average frost-free period in this area ranges from approximately 60 to 120 days.

Precipitation

The climate in the area is arid to semi-arid, with annual precipitation ranging from 13 to 20 inches and averaging 14.8 inches. Monthly average precipitation ranges from 0.65 inches (June) to 1.86 inches (September) and the high average monthly snowfall is 9.9 inches (December). The majority of the precipitation occurs as snowfall during the months of December, January, February, and March. Rainfall comes typically as brief, high-intensity thunderstorms, with most thunderstorm activity occurring during late summer and early fall and peaking in August. Price and Arnow (1979) estimate probably less than 5% of the precipitation recharges the ground water system, which would be 0.6 to 1 inch per year.

Wind

Monitoring at the Carbon Generating Station has not included wind speed or direction. General regional information indicates that prevailing winds are from the west and northwest, and average wind velocities generally do not exceed 20 miles per hour. During the winter the prevailing wind direction can shift for extended periods and blow from the northeast. Exposure of plateau and ridgeline areas may produce higher wind velocities than in more sheltered slope, basin, and valley areas. Surface air movements are strongly affected locally by natural drainage patterns and diurnal temperature variations (up and down canyon winds).

Surface Water

Perennial streams in the area are the Price River, Willow Creek, Sulphur Canyon creek, and Summit Creek, and a major intermittent stream flows through Spring Canyon. Mathis, Deep, and Buck Canyons and the main stem of Antone Creek exhibit perennial flows in certain reaches with intermittent or ephemeral flows in others. All other area drainages are characterized by flow in response to precipitation only.

Headwaters of the Price River are north and west of the proposed Willow Creek Mine, along the eastern escarpment of the Wasatch Plateau. Total length of the Price River drainage is roughly 85 miles. Elevations range from approximately 9,800 near Scofield Reservoir and Soldier Summit to 5,800 feet at Helper and 4,100 feet at the confluence with the Green River. The Price River watershed above USGS monitoring station 09313000 (near the town of Heiner) drains an area of approximately 415 square miles (265,600 acres) and includes three major tributaries: White River, Beaver Creek, and Willow Creek.

Willow Creek originates on the Green River Formation of Tertiary age at an altitude of about 9,200 feet, on the southern flanks of Reservation Ridge on the West Tavaputs Plateau. The headwaters are east and north of the proposed Willow Creek Mine permit area. Willow Creek drains an area of approximately 77.4 square miles (49,536 acres), and drainage length is approximately 9.3 miles. The stream descends more than 3,000 feet through progressively older geologic formations to its confluence with the Price River at about 6,100 feet. Willow Creek is one of the primary tributaries of the upper Price River drainage. The confluence of the two streams is on the coal-bearing Blackhawk Formation.

Between Emma Park and its confluence with Price River, the Willow Creek drainage is characterized by steep canyonlands with mixed pinon-juniper and sagebrush. Intermittent and ephemeral tributary drainages to Willow Creek that drain the east and northern slopes of the Book Cliffs in the CIA include Dry, Mathis, and Deep Canyons. Stream flow from these drainages is commonly very low. Willow Creek traverses Emma Park, an open terraced park that separates the Book and Roan Cliffs, where vegetation is a sagebrush/grassland community. Summit Creek, a major perennial tributary to Willow Creek, drains Emma and Whitmore Parks and adjacent portions of the Book and Roan Cliffs, but not any portion of the CIA. Upstream of Emma Park, Willow Creek drains a section of the Roan Cliffs, which are characterized by rolling uplands with mixed coniferous/aspen forests.

Spring Canyon creek originates at an altitude of about 9,800 feet, at the juncture of the Wasatch Plateau and Book Cliffs. The canyon descends approximately 4,000 feet to its confluence with the Price River. Burnt Tree Fork, Ciochetto and Rains Canyons, and Robinson, Gilson, and Sowbelly Gulches are the main tributary drainages.

There are no natural or man-made lakes or reservoirs within the CIA. Several small man-made sedimentation ponds, associated with past and present coal mine facilities, are located within the CIA. These include ponds in the former Blackhawk Coal Company permit area adjacent to Willow Creek, the Price River Coal Company permit area adjacent to the Price River, and the Utah Power and Light Carbon Generating Station facilities adjacent to the Price River. The sedimentation structures exist solely for containment and retention of disturbed area runoff, which allows settling of suspended solids prior to discharge of runoff to natural drainages. Active sedimentation ponds are monitored on a regular basis to verify compliance with regulatory provisions and effluent discharge limitations. Because they are utilized for temporary retention of storm water runoff, no water rights or beneficial uses are associated with existing sedimentation structures.

There are a number of very small stock-watering ponds scattered throughout the area, typically in the headwaters of ephemeral watersheds. Stock ponds are commonly associated with a spring, and spring/stock tank combinations in or adjacent to the CIA can be found in Panther, Deep, Buck, and Mathis Canyons, and possibly Dry Canyon.

Surface Water Usage

A number of individuals, water user associations, government agencies, and corporate entities hold surface water rights on the Price River, Willow Creek, and some of the larger tributary drainages. Beneficial surface water use is generally limited to; 1) Domestic water supply; 2) Industrial uses; and 3) Limited agricultural use.

The Price Water Supply and Treatment Plant is located next to the Price River, across from Bear Canyon and near the abandoned Royal townsite. The Price River and associated tributaries above the water treatment plant are considered a municipal watershed. Areas downstream from the plant are not within the municipal watershed. The Willow Creek and Castle Gate permit areas include both municipal and non-municipal watershed areas.

Agricultural uses include small stock watering ponds in the upper reaches of many of the small ephemeral tributaries. Water supply wells in alluvium along the Price River produce from the shallow unconfined aquifer that is interconnected with the river. Along the Price River valley, especially near Heiner, Martin, and Helper, numerous individuals and corporations have significant water rights that are used for irrigation purposes.

Cyprus Plateau Mining Corporation (CPMC) has rights to water from the Price River through Amax Western Coal Company, and PacifiCorp has rights to water from the Price River and Willow Creek. Cooling water for the PacifiCorp Carbon power generating station comes from the "UGW" well located next to the Price River near the abandoned Royal townsite.

The area covered by the willow Creek MRP provides potential habitat for eighteen fish species, and there are potentially 67 species of fish in the Price River and Willow Creek drainages. Willow Creek and Price River are considered to be a Class 4 fisheries by UDWR, which are streams with low recreational fishing potential. Game fish species expected to occur in these two streams include rainbow trout, Yellowstone cutthroat trout, and brown trout. Also, channel catfish are expected in the Price River.

With the exceptions of the Price River and the extreme lower reaches of Willow Creek, the rugged broken terrain and high intensity, short duration flows typical of area drainages result in small, deeply incised drainages with little or no defined floodplain. Floodplain areas of both lower Willow Creek and the Price River around Castle Gate have been extensively disturbed and significantly altered by historic mining operations, highway and railroad construction, residential development at the now abandoned townsites of Royal and Castle Gate, and construction of the existing PacifiCorp Carbon Power Station and associated facilities. Based on available information, these floodplain areas have no history of irrigation or farming.

Ground Water

Ground water is found principally in four configurations within the CIA: numerous small, localized perched systems related to discontinuous sandstone lenses in the Blackhawk Formation, a continuous regional system in the coal seams and adjacent rocks of the lower Blackhawk Formation and the underlying sandstones, a stored mine water system, and an alluvial/colluvial aquifer system. A principal factor influencing the distribution and availability of ground water in these systems is the geology.

There are a number of very small stock-watering ponds scattered throughout the area, and they are typically associated with a spring in the headwaters of ephemeral watersheds such as Panther, Deep, Buck, Mathis, and Dry Canyons. Water rights have been filed on some of the stock ponds.

Thin marginal soils and limited vegetative cover result in rapid runoff and consequent low infiltration rates, especially in steep slope areas. Reported net infiltration rates for unfrozen soils under similar conditions to those found in the region are about 0.50 inches per day. Price and Arnow (1979) estimate probably less than 5% of the precipitation recharges the ground water system, which would be 0.6 to 1 inch per year.

Geology

The area is characterized as deeply incised "plateau topography" with flat-topped ridges that rise above adjacent high desert lands. Moderately nonresistant, fine-grained units interfinger with thick, resistant sandstone units. Erosion produces moderate to steep weathered slopes interspersed with vertically exposed resistant ledges and cliffs. The regions characteristic high topographic relief incised by steep-walled canyons is the result of extensive erosion along zones of weakness. Surface elevations vary from 5500 feet to 9000 feet within the CIA, with Blackhawk Formation outcrops forming most of this relief.

Major canyons are Price River Canyon that drains from the north-west and Willow Creek canyon that drains from the north-east into the Price River. Elevations in the general area range from over 9,000 feet above sea level on the tops of the flat-topped ridges to about 5,500 feet above sea-level along the Price River south of the CIA.

Stratigraphy and General Lithology

Stratigraphy Lithology of the Book Cliffs and Wasatch Plateau Coal Fields consists of a thick accumulation of Upper Cretaceous and Tertiary strata (Figure 3). The Upper Cretaceous sediments of the section were deposited along the western margins of a north-south oriented interior seaway. A rapidly rising mountain belt to the west supplied clastic material for shoreline construction in wave-dominated delta systems. Throughout Cretaceous time, this seaway underwent a series of onlap (transgressive or advancing) and offlap (regressive or retreating) phases that deposited a number of broad delta and prodelta sheet sandstones. These sandstone tongues thicken westward and grade into back barrier, coastal and delta plain, and continental deposits. Seaward there is thinning and fining of sediment sizes. Major coal deposits found in Utah are usually formed immediately landward of shoreline delta sandstone pinchouts and on top of these offlap delta deposits.

Landward of the often thick shoreline coal accumulations, delta plain depositional influences such as splays, small channels, and levee deposits have generally created a series of splits in the coal section. Additional transgressive-regressive events commonly invaded the swamp systems and left interdeltaic features such as storm washover fans, tidal inlet deltas, and lagoonal muds. Coal deposited in these environments are often thinner due to decreased time available for peat deposition. Coals that formed on delta sandstone sheets are usually very planar and continuous whereas coal seams found in the delta or lower coastal plain are much more likely to exhibit rolls or undulations, scouring by fluvial channels, and discontinuous or lenticular geometry.

In ascending order the strata exposed in the area are the Masuk Shale member of the Mancos Shale, the coal-bearing Blackhawk Formation, the unconformably overlying Castlegate Sandstone, the Price River Formation, and the North Horn Formation.

The Mancos Shale consists of marine shales interbedded with sandstones and minor amounts of limestone. The Mancos Shale, which forms the valley floor and lower slopes of the prominent cliffs, is over 4,000 feet thick in the area and consists primarily of interbedded marine shales. The Masuk Shale, the uppermost member of the Mancos, grades upward into the basal sandstones of the Blackhawk Formation, and westward thinning wedges of Mancos Shale intertongue with the sandstones. The Mancos is a clay-rich unit and the shale beds are good aquicludes, with low horizontal and vertical permeabilities even near faults.

The base of the Blackhawk Formation is locally comprised of five cliff-forming sandstone members, the Panther, Storrs, Spring Canyon, Aberdeen, and Kenilworth Sandstones, in ascending order. The basal Blackhawk sandstones were deposited in a barrier-beach environment and intertongue with the Mancos Shale below. The sandstone tongues thicken westward and grade into the backbarrier, coastal plain, and deltaic deposits of the Blackhawk Formation. The Panther, Storrs, and Spring Canyon sandstones merge to the west into one massive sandstone unit, up to 1000 feet thick, called the Star Point Sandstone. Lithologies are usually comprised of gradationally sorted sandstones; medium-grained and cross-bedded at the top and fine-grained to silty at their base. These sandstones are generally poor aquifers, due in part to low permeability shale lenses, but ground water transmission is greatly enhanced where these rocks are faulted, fractured, and jointed.

System	Series	Stratigraphic Unit		Thickness (feet)	Description
TERTIARY	Paleocene	Wasatch Group	Flagstaff Limestone	200 - 1,500	Dark yellow-gray to cream colored, dense, cherty, lacustrine limestone with thin interbeds of gray and gray-green shale. Minor amounts of sandstone and volcanic ash, with pink calcareous siltstone at the base in places. Ledge former. Many springs originating from this unit have large discharge rates shortly after snowmelt with rapid decrease, indicating large transmissivity and small storage capacity characteristic of solution-cavity ground water systems.
CRETACEOUS	Danian?		North Horn Formation (Lower Wasatch)	500 - 2,500	Variegated shale and mudstone interbedded with sandstone, conglomerate, and limestone, all of fluvial and lacustrine origin. Ledge former. Many springs originate where low permeability layers intersect the land surface, indicating perched ground water systems.
	Maestrichtian				
	Campanian	Mesaverde Group	Price River Formation	500 - 1,000	White to gray, gritty, calcareous to argillaceous sandstone interbedded with subordinate carbonaceous shale and conglomerate. Ledge and slope former.
			Castlegate Sandstone Member	100 - 500	Coarse grained fluvial sandstone, pebble conglomerates, and subordinate zones of mudstone. Cliff former. High permeability but largely unsaturated. Seeps and springs with seasonal variability are common.
			Blackhawk Formation	900 - 1,400	Fine to medium grained, thin to thick bedded, massive fluvial channel sandstone, alternating with subordinate siltstones, carbonaceous shales and mudstones, and coal. Fluvial channel sandstones are more common in the upper portion. Thick, discontinuous coal seams in the lower 500 feet. Slope former with sandstone ledges. Poor aquifer material even where faulted due to the discontinuous nature of the channel sands and the swelling properties of the shales. Relatively low transmissivities. Springs have seasonal variability. In-mine flows of up to 200 gpm with rapidly decreasing discharges. The lower Blackhawk and Starpoint are considered to be one aquifer.
			Kenilworth, Aberdeen, *Spring Cyn., *Storrs, and *Panther Sandstones (*Star Point)	90 - 1,000	Fine to medium grained, massive, moderately well sorted coarsening upward sandstones. Cliff forming. Subordinate siltstones and carbonaceous shale. Intertongues with the Mancos Shale below and the Blackhawk Formation above. Uppermost portion contains fluvial channel sandstones. Generally poor aquifer material yielding < 10 gpm. Springs have low seasonal variation, indicating large aquifer storage coefficient. Transmissivities are relatively large where rock is fractured and faulted with yields up to 300 gpm.
	Santonian	Mancos Shale	Masuk Shale	300 - 1,300	Slope forming sandy marine shales interbedded with sandstones and minor amounts of limestone. Grades upward into and intertongues with the overlying Star Point Sandstone. A good aquiclude.

After Doelling, 1972

Figure 3 - Generalized Stratigraphic Section

CHIA - WILLOW CREEK AND ADJACENT AREAS

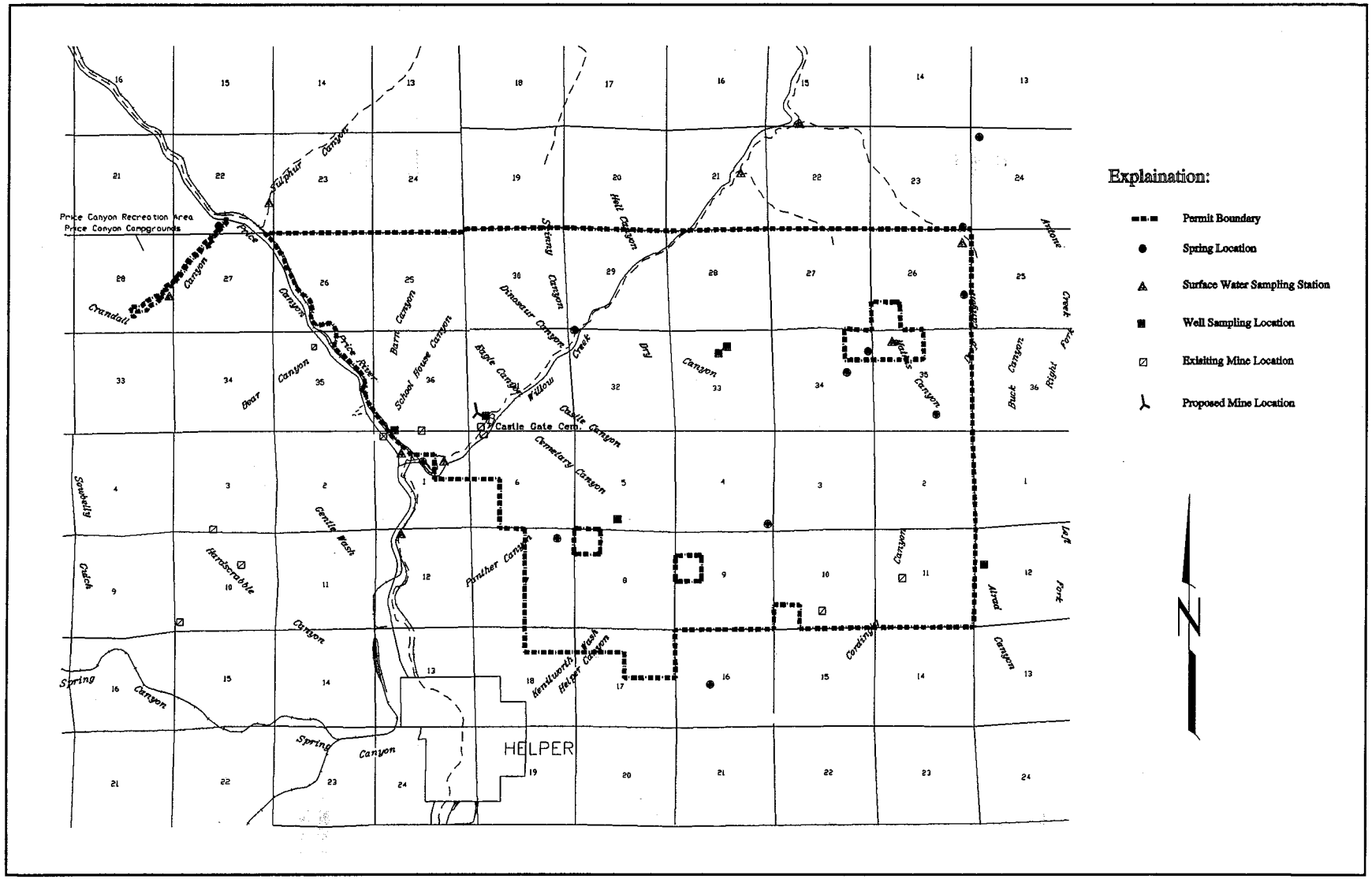

Figure 4 - Monitoring Points

The aggregate thickness for the Blackhawk Formation in the area is roughly 900 to 1,400 feet thick. The Blackhawk Formation is the primary coal-bearing formation in the Book Cliffs and Wasatch Plateau Coal Fields. The important coal seams occur in the lower 500 feet. Thick and laterally extensive seams are closely associated with shoreline barrier-beach sands. Resting on and landward of the barrier-beach sandstones are lenticular sediments including reworked tidal channel-fill sandstones, fluvial sandstones, mudstones, siltstones, claystones, and coals deposited in backbarrier, lower coastal plain, and deltaic environments. Claystones contain high percentages of montmorillonite and other swelling clays.

There are five coal seams of economic interest at present. These seams are the basal A (Castlegate A/Aberdeen) Seam, generally developed on the Aberdeen Sandstone, the B Seam that splits off the A Seam, the C Seam at the base of the Kenilworth Sandstone, the Kenilworth (K) Seam developed on and shorewards of the Kenilworth Sandstone, and the D Seam approximately 100 feet above the Kenilworth Seam.

Fluvial channel sandstones are found in the lower Blackhawk but are more frequent toward the top of the formation. These sandstones are local in extent, generally fine grained, and well cemented. They have localized high clay content. The discontinuous character of these channel sandstones and the abundance of clay throughout the Blackhawk Formation produce perched aquifers and favor formation of local flow systems that discharge through numerous seeps and springs.

Unconformably overlying the Blackhawk Formation are the massive, fluvial pebble conglomerates and coarse grained sandstones of the Castlegate Sandstone, which is the basal member of the Price River Formation. The Castlegate Sandstone is good aquifer material, with seeps and springs common at the Castlegate-Blackhawk contact. In the Price River area the Castlegate can be subdivided into three generic members with an aggregate thickness of about 630 feet. The Castlegate represents offlap coastal and fluvial deposition during the rapid retreat of the Upper Cretaceous Seaway in the area. Castlegate Sandstone is exposed along the ridge in the northern part of the CIA. Tertiary rocks of the Wasatch Group form the uppermost exposures in areas south of the CIA.

The remainder of the Price River Formation is comprised of fine-grained sandstones and slope-forming mudstones and siltstones totaling approximately 650 feet in thickness. Deposition of the upper Price River Formation took place from southwest to northeast indicating major reorientation of area drainage patterns between the periods represented by the Castlegate Sandstone and the Price River Formation, and the contact appears unconformable at some locations.

The North Horn Formation, the youngest consolidated rocks exposed within the CIA, has a total thickness of about 2,400 feet. This unit mainly consists of basal mudstones (170 feet), a middle zone of sandstones (860 feet), mixed thin limestones and claystones (330 feet), and an upper 1,000 foot sequence of sandstones and limey sediments. Lenticular, cliff-forming (10 feet) sandstones comprise about 10 to 15% of the section. The basal 170 feet of the formation represents the uppermost of the Mesozoic strata in the area. Tertiary (Paleocene) fluvial and lake deposits appear from the top of the basal mudstones to the top of the section.

Structure The CIA lies at the western end of the Book Cliffs at a three-way structural transition zone between the Colorado Plateau, the Uinta Basin, and the Wasatch Plateau structural provinces. This places the western Book Cliffs coal reserves at the north end of the north-plunging limb of the San Rafael Swell and north of the north-west trending strike-slip Fish Creek Graben that delineates the local northern border of the hypothesized Castle Valley thrust. The location and relationship of the reserve block to these regional features may account for the lack of significant structural features, including faulting and folding within the western Book Cliffs (Greg Hunt, consulting geologist, in Willow Creek PAP).

Average strike of strata within the proposed Willow Creek permit area ranges from N 80° W in the east to N 85° W in the northwest. Dip averages 8.5° N-NE. This attitude is a result of the location between the north-plunging end of the San Rafael Swell and the south flank of the Uinta basin. Localized dips up to 15° occur as a result of depositional variations such as the limited area where the Kenilworth Seam dips 15° west, having been warped or draped over the landward pinchout of the Kenilworth Sandstone.

Faults

The western Book Cliffs area was apparently isolated from geologically recent tensional forces by the Fish Creek Graben to the west. Existing fractures encountered during drilling or other exploration work appear to be relatively tight with some evidence of fracture fillings. North-south trending structure is quite minor (Greg Hunt, consulting geologist, in Willow Creek PAP). In addition to examining mine maps and drill data, CPMC learned from discussions with miners who worked in the Castlegate No. 2 Mine that faults large enough to impact mining operations do not occur within the old mine works and probably do not exist within the Willow Creek reserve block.

Doelling (1972) mapped an inferred or poorly defined fault, with unknown throw, striking approximately N 50° E through the center of Sections 4 and 9, T. 13 S., R. 10 E., extending from Panther Canyon to the head of Dry Canyon. No evidence of this structure is known from underground workings in the area, and CPMC's inquiries to the Utah Geological Survey (UGS) did not find any original data or further documentation to support mapping of a fault at this location.

Joints and Cleats

A fracture study of the Willow Creek area was completed in late 1991 (Anderson) and additional joint and cleat data have been collected by CPMC from underground exposures. Anderson's work, based on sixteen locations, indicates that the joint trend on the Willow Creek property is N 60° W. A secondary set of joints trends about N 75° E. Most dips of discontinuities are 5° to 7° off vertical. The coal cleat was found to have a very strong N 60° W face cleat and a butt cleat about N 35° E. Density of fractures was highly dependant upon the type and thickness of the bed in which the trends are measured. Thinner beds and finer grained rocks (siltstones and mudstones) have a tendency to have a greater density of joints than thicker beds and homogeneous sandstones. Many joint sets are truncated by shale partings and other vertical changes in lithology.

A cursory examination by Anderson in the Price River area found that typical joint densities were:

Formation	Range	Average
Price River Fm.	1/1 feet - 1/8 feet	1/1.5 feet
Castlegate SS.	1/1 feet - 1/30 feet	1/2 feet
Aberdeen SS	1/3 feet - 1/10 feet	1/3 feet
Spring Canyon SS	1/3 feet - 1/13 feet	1/3 feet

Joint continuity in the proposed Willow Creek permit area is not pronounced. Cross-cutting major joint trends appear to be spaced about every 200 feet in massive sandstones. Observations of mudstone roof of coal seams where exposed, revealed joint spacings ranging from 0.1 foot to over 3.0 feet with high density zones appearing only periodically.

Notes on fractures and fracture filling in core descriptions prior to the 1994 drilling project is sparse, but CPMC found some holes document compactional slickensides in clay-rich zones and calcite filling of open fractures in sandstones and sandy siltstones. CPMC's drill hole W94-12-1 (Alrad Canyon) was cored intermittently from 140.0 to 398.7 feet without the documentation of a single joint discontinuity. Core from hole W94-5-1 in the Panther Canyon area displayed only very rare irregular vertical fractures that may have been drilling induced. Coring in hole W94-31-1 (Willow Creek fan site) recovered samples of sandstone with smooth or irregular fractures spaced at intervals down the hole. Rarely fractures were found to be filled with calcite but were usually open and rough. Site W94-33-1, in Dry Canyon, was cored from 900 feet to 1,275 feet with only one encounter with an irregular/rough joint at 1,131 feet. Occasional compactional slickensides were noted in clay-rich mudstones (Willow Creek PAP).

The Kenilworth and A Seams exhibit a well-developed face cleat oriented roughly N 60° to N 70° W. Cleat spacing generally ranges from 0.1 to 0.4 feet. The butt cleat is very poorly developed. In-filling on cleats is rare but where it occurs is either calcite or gypsum. Available photos of the old mine works show strong rib lines and wide entry spans with little sign of deterioration after 25 to 75 years of exposure under varying overburden depth.

Inspection of mine works by CPMC during 1992 - 1993 showed coal cleats to be present and well-developed. Former miners who worked in the Castlegate No. 2 Mine commonly told CPMC that they could recall almost no cleats in the seams, but they consistently recalled that a continuous miner could cut east-west much easier than other directions, indicating a limited cleat did exist (Willow Creek PAP).

Aquifer Characteristics

Information obtained from borehole drilling and well installation, geologic and geophysical logging, observations of water during borehole drilling, aquifer testing, routine water level monitoring, and routine ground water quality analyses has been used by CPMC to characterize ground water aquifers within and adjacent to the proposed Willow Creek Mine. Four primary aquifer systems have been identified:

- Alluvial/Colluvial Aquifer System
- Perched Ground Water System
- Stored Mine Water System
- Regional Ground Water System

Alluvial/Colluvial Aquifer System The alluvial/colluvial aquifer system consists of shallow, unconfined ground water in the limited alluvial/colluvial deposits associated with surface drainages in the area. These aquifers are closely tied to the surface water systems, with ground water recharge occurring during periods of high flow and ground water discharge becoming more pronounced during periods of low flow as stream levels drop below the water table. The regional aquifer system may also be a source of recharge to alluvial/colluvial systems; however, the extensive underground mine workings that locally drain the regional aquifer and the low permeability of the rocks of the regional aquifer probably limit the amount and significance of recharge to alluvial/colluvial aquifers from the regional aquifer.

The only alluvial/colluvial aquifers of any significance in the CIA occur along the channels of the perennial drainages of the Price River and Willow Creek and are generally confined to the active stream channel, immediately adjacent areas, and any hydrologically connected inactive or abandoned channel segments. In the smaller drainages, these alluvial/colluvial deposits are very narrow and may store and transmit relatively minor amounts of ground water.

In 1994 CPMC bored fifteen holes in the shallow alluvial/colluvial aquifers of the Price River and Willow Creek to evaluate foundation conditions at the Castle Gate coal prep plant, the AMRP Blackhawk reclamation site, and proposed facilities along Willow Creek. Ground water was encountered in three of the holes. Ground water at the AMRP site appeared to be at least 20 feet below the buried refuse and to be flowing towards Willow Creek. Thickness of alluvial/colluvial material along Willow Creek was found to vary from a few inches up to five feet, and in the Price River drainage up to approximately 60 feet. The alluvial/colluvial materials consisted of loose to compact brown sandy silt with gravel, cobbles, and boulders. Relatively coarse, generally high permeability colluvial material dominates the alluvial/colluvial deposits because steep terrain and brief, high-intensity runoff result in high erosion and sediment transport rates.

Price and Wadell (1973) indicate that wells completed in the Price River alluvial/colluvial deposits frequently provide sustained yields of up to 500 gpm. No wells exist in the Willow Creek alluvial/colluvial deposits and specific aquifer test information is not available, but expected ground water yields along Willow Creek would be significantly less than along the Price River because of lower surface water flow volumes and thinner alluvial/colluvial deposits.

Perched Ground Water System Perched aquifers in the Wasatch Plateau and Book Cliffs typically occur in numerous small, localized lithologic units that have sufficient permeability to store and transmit ground water. They are found at shallow depths in the Flagstaff, North Horn, and Price River Formations and upper portions of the Blackhawk Formation, which are dominantly interbedded sequences of shale, siltstone, and fluvial channel sandstones. Fine grained, well cemented sandstones are typically the water-bearing unit with lower permeability siltstones and relatively impermeable shales acting to confine ground water movement. Burned-out

coal zones also have good permeability and can be perched aquifers. Isolated perched water tables may occur deeper in the rock, surrounded by unsaturated strata.

Perched aquifers in the Wasatch Plateau and Book Cliffs are of limited areal extent and thickness because of the discontinuous or lenticular shape of the sandstone bodies. Variations of permeability within the sandstone bodies further limit storage and movement of water, and perched aquifers can be breached and truncated by deeply eroded surface drainages. The discontinuous character of the sandstones and the abundance of clay throughout the formations favor formation of local flow systems that discharge through numerous small seeps and springs. Perched aquifers are separated by unsaturated rock.

Discharge from perched aquifers is primarily from seeps and springs at outcrops of sandstone-shale interfaces. Discharge from the perched ground water system to the regional ground water system can also occur due to fracture or fault related secondary permeability; however, such vertical movement is probably not significant in the CIA because of the lack of faulting and fracturing.

Perched aquifers are generally recharged within small areas in the immediate vicinity of the seeps and springs where they discharge. Recharge is almost exclusively by infiltration of direct precipitation and snowmelt, and discharge from these aquifers closely tracks precipitation rates. The combination of steep terrain and relatively low permeabilities, which probably limit infiltration to less than 5 percent of annual precipitation (Price and Arnow, 1979), and the limited areal extent of the water-bearing strata result in low recharge rates to the perched ground water system.

CPMC identified 3 active seeps and 12 active springs in the proposed Willow Creek permit and adjacent areas, which all appear to discharge from the perched aquifer system. Measured seep and spring discharge typically varies from negligible flow to approximately 5 gpm with isolated flows of up to 10 gpm. Discharge from the perched ground water system exhibits significant seasonal variation with maximum discharge following spring snowmelt and many springs and seeps drying up during late summer and early fall.

Subsurface ground water was intercepted in each of CPMC's 1994 exploratory drill holes, at depths ranging from 85 feet (in a burn zone level with an adjacent dry streambed) to 1,300 feet (interbedded sandstones approximately 45 feet below the top of the Aberdeen Sandstone), and at flow rates of 1/4 to 7 gpm. The well in Dry Canyon (B331/B331A) encountered a significant amount of natural gas and 15-20 gpm ground water from an interval of thinly-bedded sandstones at a depth of 900 feet, with natural gas flow probably generating the higher ground water flow. Water was found in the Aberdeen and Kenilworth Sandstones, other unidentified sandstones, and in the burn zone already mentioned.

In the Willow Creek water monitoring well, the static water level was measured at a depth of about 95 feet in a thick (20 foot) sandstone just above the D Seam. This level is close to the natural stream level of nearby Willow Creek and may represent either a perched aquifer or the regional aquifer system.

Regional Aquifer System The regional aquifer system includes the coal bearing zones and the barrier-beach sandstones of the lower Blackhawk Formation and extends into the underlying Mancos Formation. The primary water-bearing unit is the Aberdeen sandstone, but the regional aquifer is not tied to any specific stratigraphic unit. Because it includes the primary coal-bearing sequence, the regional aquifer system will be directly affected by the mining operations. Limited recharge and generally low permeabilities result in minimal ground water storage and movement in the regional aquifer system and limit its significance in the regional hydrologic system.

The regional aquifer is unconfined. Most stratigraphic units associated with the regional aquifer system transmit water poorly, with fine to medium grain size, cementation, and cross-bedding contributing to low overall permeabilities; however, all units lying below the normal water table and having sufficient permeability contain and transmit ground water to some degree. Water table elevations generally form a subdued replica of surface topography, and elevations of the regional water table in the western Book Cliffs are expected to increase northward: in addition structural dip is north to northeast, so to the north the regional water table is anticipated to

lie successively higher in the stratigraphic section. Drainage into the incised, deeply eroded canyons and into mines can lower the regional water table surface locally.

Hydraulic conductivity values measured in water-bearing units in wells MC-205 and MC-206 (Figure 4) are on the order of $1x10^{-7}$ to $1x10^{-6}$ cm/sec ($2.8x10^{-4}$ to $2.8x10^{-3}$ ft/day). Measured transmissivities for these wells range from 5 to 70 gpd/ft. Similar values of hydraulic conductivity and transmissivity were found in the coal-bearing sequence of the Blackhawk Formation in well MC-207, near the Kenilworth adit in Crandall Canyon. Aquifer tests in wells B121 and B331A indicated hydraulic conductivity values of $3.0x10^{-7}$ cm/sec and $4.6x10^{-7}$ cm/sec ($8.5x10^{-4}$ and $1.3x10^{-3}$ ft/day), respectively.

Based on pump tests and core analyses from the Trail Mountain area in the Wasatch Plateau, transmissivity of the regional aquifer in the coal bearing zones and the barrier-beach sandstones of the lower Blackhawk Formation probably ranges from 20 to 200 ft^2/day. Storage coefficient probably averages about 10^{-6} for confined conditions and about 0.05 for unconfined (Lines, 1985, p. 15). Horizontal and vertical hydraulic conductivities in Starpoint Sandstone from the Skyline Mines area in the Wasatch Plateau, as measured by Core Laboratories, Inc. in Dallas, Texas, are on the order of 10^{-2} ft/day. Sandstones in the Blackhawk Formation have hydraulic conductivities similar to those of the Starpoint Sandstone. Horizontal hydraulic conductivities in shales of the Blackhawk range from no measurable permeability to 10^{-8} ft/day, and in siltstones from 10^{-9} to 10^{-7} ft/day. Vertical hydraulic conductivities of shales and siltstones may be greater or smaller but are within one order of magnitude of the corresponding horizontal hydraulic conductivity (Lines, 1985, Table 3).

Recharge to the regional aquifer system appears to occur primarily where outcrop zones are exposed to direct precipitation and near-surface infiltration. Recharge percolates from the surface downward until shale is encountered, and then moves downdip following discontinuous but more permeable sandstones. Water either continues to move downdip until it is discharged at the surface or resumes vertical flow where more permeable zones are encountered, and recharge eventually reaches the regional aquifer. Vertical ground water movement through the overlying sediments is minimal due to the low permeability of the overlying units and the presence of relatively impermeable shales. Steep slopes and relatively small outcrop exposure areas are two factors that limit recharge. Faults and fractures do not seem to be important ground water conduits in the western Book Cliffs.

Some recharge of the regional aquifer system may occur where the associated formations are exposed in deep canyons and come into direct contact with surface discharge or the alluvial/colluvial aquifer system: such exposures are not common in the area. Such direct recharge is limited by low permeabilities.

The regional aquifer extends to the outcrop of Mancos Shale along the base of the Book Cliffs. Water is unable to flow downward through the Mancos in any significant amount but will flow laterally through more permeable overlying strata until it discharges at the surface. The regional aquifer discharges at springs along the Blackhawk - Mancos contact in Spring Canyon, but there are no springs at this contact in other areas of the western Book Cliffs. Within and downdip of the proposed Willow Creek permit area, discharge from the regional aquifer system appears to be limited to inflows to the stored mine water system where mine workings extend below the potentiometric surface. Leakage to the Mancos and other units underlying the regional aquifer should be minimal.

The extent and character of the regional aquifer to the north is not known. Monitoring well data have not been used to construct a map of the potentiometric surface. However, the potentiometric surface should generally correspond to surface topography and rise to the north, and overall flow in the regional system would be to the south. Water in the regional system flows beneath the headwater drainages and probably has minimal influence on seeps and springs of the shallower perched systems. Water levels in observation wells in the regional aquifer in the Wasatch Plateau fluctuate seasonally, the changes lagging snowmelt and rainfall events by up to two months, and long-term decline of water levels in the wells, typically less than 3 feet per year, is attributed to long-term decreases in precipitation and to dewatering of the aquifer by mining (Coastal, 1993, PHC2-4).

Faulting has no importance in the Blackhawk Formation or Starpoint Sandstone in the western Book Cliffs. As a result, secondary permeability created by fracturing does not increase the mobility of water through the regional system here as it does in areas of the Wasatch Plateau.

Stored Mine Water System Coal mining has resulted in extensive underground mine workings in the area. Where the mine workings are below the local ground water table or where subsidence has opened fractures connecting with the perched ground water system, significant quantities of stored ground water have accumulated in the underground workings.

Abandoned mine workings that extend beneath the regional water table serve as sinks in the regional aquifer system. However, seepage into the mines is extremely slow. In the western coal reserves area, mine inflows appear to be greatest where extensive retreat mining has produced substantial subsidence. However, regardless of subsidence conditions or mining method, the overall inflow rate is low. Mine inflow monitoring by PRCC indicated inflow rates of 2.9, 12, 30 and 30 gpm for the Aberdeen, Utah Fuels No. 1, Royal, and Kenilworth mines, respectively. Similar monitoring by Castle Gate Coal Company for the No. 3 and No. 5 Mines resulted in measured inflow rates of 41 gpm (average), and 3.5 gpm for the No. 5 Mine (Table 1).

Table 1 (after TABLE 3.7-2 - Willow Creek PAP)

SUMMARY OF AVAILABLE MINE DISCHARGE/INFLOW AND GROUND WATER RECHARGE DATA

Mine	Measured Inflow gpm	Mine Area Acres	Yield/Unit Area gpm/acre	Recharge in./yr
A - Inflow to Abandoned Mines				
Aberdeen	2.9	770	0.004	0.08
Utah Fuel No. 1	12	680	0.018	0.35
Royal	30	1250	0.024	0.46
Kennilworth	30	2790	0.011	0.21
B - Inflow to Castle Gate Coal Company's Carbon County Mines				
No. 3 (11/3/82) *No. 3 (1/26/83)*	*48.7* *33.4*	*920* *920*	*0.053* *0.036*	*1.02* *0.70*
No. 3 (average)	41.0	920	0.044	0.86
No. 5 (1/26/83)	3.5	232	0.015	0.29
Unweighted average			0.019	0.37
Total	119.4	6642 (10.4 mi^2)		

The total volume of ground water storage in the old mine workings in the eastern coal reserves is unknown, although it is probably substantial. There are few known instances of mine water discharge from old workings to the surface because most of the abandoned mine workings in the area have been sealed and water accumulates predominantly in down-dip workings behind the seals. Ground water inflow to the old mine workings will continue until equilibrium is established between inflow, discharge to the surface, recharge into the subsurface, and the local ground water table.

Mine inflow rates in the eastern coal reserves are expected to be similar to the western coal reserves. Measured inflow to the 10.4 square miles of existing mine workings in the Willow Creek area is approximately 120 gpm (0.3 cfs). This is the equivalent of 0.34 inch/year, well below recharge estimates (5% of annual precipitation) of 0.56 to 1.00 inch/year. Drawdown of the regional aquifer has the potential of inducing greater recharge from the surface (Freeze, 1971), but the thickness and overall low permeability of the overburden in this area would probably render such an effect undetectable. Assuming that the mine area is 19.8 square miles at the

end of mine operations, i.e., old and new mine workings extending beneath approximately 90% of the proposed Willow Creek permit area, the amount of groundwater that will be intercepted annually by the mine is estimated to be 230 gpm (0.5 cfs).

Seeps and Springs

CPMC's spring and seep inventory in June 1994 and subsequent investigations have identified 3 active seeps and 12 active springs in and adjacent to the proposed Willow Creek permit area. Locations of the known springs and seeps are shown on Figure 4, and these seeps and springs are included in CPMC's ongoing monitoring program initiated in June 1994. Measured seep and spring discharges typically vary from negligible flow to approximately 5 gpm, with isolated flows of up to 10 gpm. Discharges from perched ground water systems exhibit significant seasonal variation; maximum discharge following spring snowmelt with many springs and seeps drying up during late summer and early fall.

Seeps and springs often issue at a shale-sandstone interface. There is little or no faulting in the Castle Gate/Willow Creek area. Flow along faults and fractures through the Blackhawk Formation appears minimal, and the secondary porosity that makes the Starpoint and related sandstone units good aquifers in other areas of the Wasatch Plateau and Book Cliffs is not found here in the western Book Cliffs.

Stream Seepage

Seepage studies were done in Spring Canyon creek and Willow Creek (Price and Plantz, 1987). A slight gain in flow was noted where Willow Creek crossed the North Horn Formation, but no significant increase of flow was associated with any other geologic unit. The confluence of Willow Creek with the Price River is on the Blackhawk Formation. In the creek in Spring Canyon there was a marked increase of base flow near the contact of the Starpoint Sandstone and Mancos Shale, probably from springs issuing near that contact.

Water in Mines

The coal seams that are mined are in the lower Blackhawk Formation. Ground water flow into mines in the Wasatch Plateau has been characterized as: 1) seepage from the coal seams and associated channel sandstones, 2) flow from Blackhawk channel sandstones that have been fractured by faulting and folding, or 3) flow up from the underlying barrier-beach sandstones by way of faults and fractures. Because there is little or no faulting and no folding in the Castle Gate/Willow Creek area, faults and fractures have no apparent significance in ground water flow into the mines of this area. The secondary porosity that makes the Starpoint and related sandstone units good aquifers in other areas of the Wasatch Plateau and Book Cliffs is not found here in the western Book Cliffs.

Personnel from CPMC investigated the Castlegate No. 2 Mine during 1992 - 1993. Ground water was noted at several locations, the most significant in the Kenilworth Seam workings. Advancing from west to east through the old works, investigating teams found water flowing westward along the East Mains at an estimated 2.5 gpm. This water ultimately flows north (down-dip) into old entries that are sealed at 6,230 feet elevation. Based on such available information, it can be assumed that the water level is less than 6,230 feet in this area and that the general rate of mine inflow is low.

A number of mine entries were found to be partially flooded during CPMC's 1993 inspections. Ponded, stagnant water was encountered in the East Mains in the Kenilworth Seam workings of the Castlegate No. 2 Mine, but water marks along the ribs and on timbers suggested the water level had actually dropped 6 to 12 inches. A thick oil slick was floating on the water. Stagnant water covered with an oil slick was also encountered in the C Seam works of the No. 2 Mine. Maps dating from late 1972 indicate that most water accumulations were confined to sump and adjacent areas.

Water is assumed to be originating from the underlying Kenilworth Sandstone. Analyses of a mine flow sample collected in the Kenilworth works reveal an alkaline water fairly rich in dissolved magnesium and sodium/potassium, supporting a supposition that the water flows through or is otherwise in contact with a marine unit.

Ground Water Usage

Of the four primary aquifer systems, only the alluvial/colluvial aquifer yields sufficient water to serve as a reliable source of water for beneficial use. A number of individuals, water user associations, government agencies, and corporate entities hold ground water rights for alluvial/colluvial wells in area drainages, shallow wells that intercept perched aquifers, and numerous small springs and seeps. Water rights have been filed on mine inflow or stored mine water in four mines in the area.

Actual ground water use within the hydrologic basin is primarily limited to large volume municipal and irrigation use or small volume stock watering applications. The Price River Water Improvement District extracts water for municipal use from ground water wells in Sections 23 and 24 of T. 12 S., R. 10 E. Along the Price River valley, especially near Heiner, Martin, and Helper, numerous individuals and corporations have significant water rights that are used for irrigation. Additionally, PacifiCorp owns significant water rights for water from their UGW well located in Section 35 of T12S, R9E.

In certain areas the perched ground water and stored underground mine water systems may provide water of sufficient quantity and quality for specific uses such as stock watering.

IV. BASELINE CONDITIONS OF SURFACE AND GROUND WATER QUANTITY AND QUALITY.

Surface Water

Surface water has been and is currently monitored for quantity and quality at various stations operated by the USGS and coal mine operators. Locations are shown on Figure 4 and analysis results are found in the Castle Gate Mine MRP, the Willow Creek Mine PAP, and USGS publications. Monitoring has been infrequent or irregular at some stations. For some of the surface water monitoring locations listed in Table 3.7-11 in the Willow Creek PAP, CPMC has combined analysis results from a new monitoring station with those from a nearby, older station, e.g., CPMC B-151 and CGCC/PRCC B-1. These combined data are used in the surface water quality tables in this CHIA. Both new and old locations are shown on Map 15 in the Willow Creek PAP.

Surface Water Quantity

Price River

USGS monitoring station 09313000, near the town of Heiner, has been operated for 41 years (1935-1969, 1980-1981, and 1991-1994) as part of the USGS statewide network. Scofield Reservoir regulates flow in the upper Price River, but between Scofield Reservoir and USGS station 09313000 the Price River receives significant inflows from the White River, Beaver Creek, and Willow Creek. In the general vicinity of the proposed Willow Creek permit area and upstream of the confluence with Willow Creek, Sulphur Canyon creek has been identified by CPMC as a perennial tributary to the Price River, and major intermittent drainages include Bear Canyon and Crandall Canyon. Spring Canyon, a principal drainage of the Book Cliffs west of the Price River, joins the Price River at Helper. Hardscrabble Canyon and Panther Canyon are the two major intermittent drainages tributary to the Price River between Willow Creek and Spring Canyon. Helper Canyon/Kenilworth Wash, an adjacent unnamed drainage in which the town of Kenilworth actually lies, and Cordingly and Alrad Canyons/Cardinal Wash drain south from the area proposed for mining in the Willow Creek Mine PAP and join the Price River downstream of Spring Canyon (Figure 2).

Mean annual discharge of the Price River, as measured at station 09313000 during 41 years of record, is 108 cfs (78,190 ac-ft/yr) (USGS, 1994). Relatively uniform year-round flow results from regulation at Scofield Reservoir but short term peaks occur, chiefly in August and September due to thunderstorms over one or more of the tributary drainage basins. The maximum recorded peak flow was 9,340 cfs on September 13, 1940. This flow resulted from thunderstorm activity over the drainage basins of White River and Beaver and Willow Creeks and caused considerable flood damage in Price and Helper. Minimum recorded flow was 0.40 cfs on Aug. 21, 1961.

Willow Creek

The USGS operated Station 09312800 on Willow Creek, approximately 4 miles upstream of the portals of the proposed Willow Creek Mine, from October 1962 to September 1989 as part of the statewide USGS network. Daily average flow was 9.6 cfs for this twenty-seven year period. Monthly flows were typically greatest in April through June due to snowmelt from the West Tavaputs Plateau. Lowest monthly flows were in July through September, but high daily flows frequently occurred during these same months in response to intense, local thunderstorms. Maximum measured discharge was 836 cfs on Aug. 6, 1973. Periods of no-flow were recorded during several different years, during months ranging from August through May.

USGS Station 09312900 on lower Willow Creek, near the confluence with the Price River, was monitored during water years 1980-81. Data collected at that station supplement the long-term record at upstream station 09312800. The annual mean flow of Willow Creek at station 09312900 was 17.3 cubic feet per second in water year 1980 and 4.58 cubic feet per second in water year 1981. A comparison of the two years of overlapping records from the two gaging stations indicates that with an average flow rate of 9.6 cfs (7,000 ac-ft/year) at the upper site, an average discharge of approximately 10.5 cfs (7,600 ac-ft/year) can be expected at the mouth of Willow Creek. This represents an increase of approximately 9% between the two sites.

Seven sets of base-flow measurements were made along Willow Creek downstream from station 09312800 during August 1978-August 1981. Measurements show a slight gain in flow where the stream crosses the North Horn Formation but virtually no change in flow where it crosses older rocks, including the coal-bearing Blackhawk Formation.

Spring Canyon

USGS monitoring station 09313040 was located near where Spring Canyon creek crosses the Blackhawk Formation - Mancos Shale contact just west of Helper, at an altitude of 6,110 feet, and monitored the combined flow from all the main drainages during water years 1979-1981. During the three year monitoring period at station 09313040, coal was actively mined in Spring Canyon at the Braztah (or PRCC) Mines. Most of the water produced by the mines was consumed in the mining operations, but a small, unknown quantity was intermittently discharged to Spring Canyon creek. Most of the flow in the creek originates from seeps or springs (Price and Plantz, 1989). Average daily flow data from station 09313040 indicate an average annual discharge rate of 0.296 cfs (214 acre-feet) for the three year monitoring period.

Annual mean flow at station 09313040 during the 3 years of record ranged from 0.12 cfs during water year 1979 to 0.41 cfs during water year 1981. Flow varied considerably, and short-term increases during June-November probably resulted from thunderstorms. The maximum recorded peak flow, 271 cfs on July 12, 1981, resulted from a thunderstorm. Base-flow measurements made in Spring Canyon creek upstream from station 09313040 show a marked increase in base flow beginning about 2.5 miles upstream from the station. This increase probably reflects increased spring inflow to the canyon near the contact between the Mancos Shale and the Star Point Sandstone (Price and Plantz, 1987).

Other Drainages

Three years (February 1980 through October 1983) of flow measurements collected by PRCC and CGCC on Sulphur Canyon creek indicate an average annual discharge rate of 1.11 cfs. One period of no-flow was measured when the stream was frozen.

Field measurements conducted by CPMC during 1994 at proposed Willow Creek Mine surface-water monitoring sites and surface-water flow data collected previously from intermittent and ephemeral drainages in the region suggest that surface water yields from ephemeral and intermittent tributary drainages in the proposed Willow Creek permit area

Previous mine operators initiated monitoring of flow and water quality for selected drainages in the area of the proposed Willow Creek Mine beginning in 1977; however, little or no monitoring information is available for many of the minor drainages, most of which are dry over much of the year. In June 1994 CPMC began monitoring all major and minor drainages within the proposed Willow Creek Mine permit area that showed evidence of recent flow. Surface water monitoring locations are shown on Figure 4. Limited data collected during 1994 on intermittent and ephemeral drainages do not show a pronounced seasonal variation in flow, but suggest that flow in these drainages results from precipitation events. Rapid runoff as a result short-duration high-intensity precipitation causes relatively brief, high velocity flows in the smaller drainages. Intermittent and ephemeral drainage channels generally contain flowing water only during snowmelt or precipitation events. Measured flows ranged from 0 cfs to 0.17 cfs in the intermittent and ephemeral drainages.

There are a number of very small stock-watering ponds scattered throughout the area, and each is typically associated with a spring in the headwaters of ephemeral drainages such as Panther, Deep, Buck, Mathis, and Dry Canyons. Water rights have been filed on some of the stock ponds.

Surface Water Quality

Above the Price City Price Water Supply and Treatment Plant, water in the Price River and its tributaries is classified by the Utah Division of Water Quality as:

- 1C - protected for domestic use with prior treatment,
- 2B - protected for recreational uses except swimming,
- 3A - protected for cold water species of game fish and other cold water aquatic life,
- 4 - protected for agricultural uses.

Below the water treatment plant the water is classified as:

- 2B - protected for recreational uses except swimming,
- 3C - protected for non game fish and other aquatic life, and
- 4 - protected for agricultural uses.

These classifications and the water quality standards for these waters are in Standards of Quality for Waters of the State of Utah - R317-2, Utah Administrative Code (Feb. 16, 1994). Even though Willow Creek is not protected for game fish, it is considered to be a Class 4 fishery by UDWR, which is defined as a stream with low recreational fishing potential. Cold water game fish such as rainbow trout, Yellowstone cutthroat trout, and brown trout are expected to be found. There are potentially sixty-seven species of fish in the Willow Creek drainage, although the area of the CIA provides potential habitat for only eighteen fish species.

There are a number of very small stock-watering ponds scattered throughout the area, and each is typically associated with a spring in the headwaters of ephemeral watersheds such as Panther, Deep, Buck, Mathis, and Dry Canyons. Monitoring of water in the stock ponds is done at the associated springs. Water rights have been filed on some of the stock ponds.

Objectives of surface water quality monitoring, initiated in 1977 under the Utah coal program and continued by CPMC, include; 1) definition of baseline water quality conditions; 2) identification of any seasonal variations in water quality and correlation to flow levels; and 3) identification of any mining related changes in surface water quality. Surface water monitoring has typically included measurement of flow, temperature, pH, electrical conductivity (conductance), and dissolved oxygen in the field and collection of water samples for laboratory analyses.

Chemically, surface water in the Price River is a calcium-bicarbonate type, but surface water in Willow Creek is more of a mixed type with calcium or magnesium and bicarbonate as dominant ions. Waters from ephemeral and intermittent tributaries also are calcium-bicarbonate chemical type. Springs and seeps are typically a calcium-bicarbonate type; however, some have a calcium-sulfate or sodium-bicarbonate composition.

Surface water quality varies temporally and appears to be flow dependent. Specific conductivity, TDS, and sulfate concentrations all appear to decrease during high-flow and increase during low-flow. Observed iron concentrations tend to increase with higher flows and decrease under low flow conditions. This process potentially skews the water quality data. Average concentrations of some analytes have exceeded water quality standards at one or more surface water monitoring locations.

Water quality samples have been collected at several sites (Figure 4) over various periods of time extending back to 1978. CPMC has concluded that specific conductance, TDS, and sulphate show an inverse relationship to flow in surface waters. Data from several sites indicate a direct relationship of total iron levels to flow, and concentrations of both total iron and total manganese are directly proportional to suspended solids concentrations.

Dissolved Solids (Total Dissolved Solids and Specific Conductance

Total Dissolved Solids (TDS) concentrations in the Price River (Table 2) average just over 300 mg/L and range from 190 to 1,080 mg/L. In Willow Creek (Table 3) the range is 340 to 1,200 mg/L and averages are over 500 mg/L. Samples from Sulphur Creek and Crandall Canyon (Table 2) have TDS concentrations similar to Willow Creek. TDS levels at each station in Mathis Canyon (Table 3) have fallen within narrow respective ranges, and there is a notable downstream increase in TDS between the two stations. CPMC's attributes relatively high TDS values to direct discharge of shallow perched ground water systems to surface drainages and the effect of extended dry periods that may significantly reduce stream flows, concentrate existing dissolved solids, and minimize dilution of ground water contributions. TDS measurements in Spring Canyon, average of 2,260 mg/L measured by the USGS (Table 2), are much higher than in Willow Creek or the Price River because the creek flows across the Mancos Shale before reaching the USGS sampling station. The Utah water quality standard for TDS is 1200 mg/L in Class 4 waters, the only water quality standard for TDS.

Price River conductivity measurements generally are less than those in Willow Creek. The range in the Price River is 235 to 930 μmhos/cm, while conductivity in Willow Creek ranges from 315 to 1,350 μmhos/cm. Waters in Sulphur Creek (Table 2) have specific conductance similar to Willow Creek. As with TDS, specific conductance in Mathis Canyon (Table 3) increases downstream. Specific conductance of waters sampled in Buck Canyon is similar to that of water at the upper Mathis Canyon station. The intermittent and ephemeral drainages exhibit ranges of conductivity measurements similar to Willow Creek. Spring Canyon has the highest specific conductance, averaging 2,890 μmhos/cm. There are no water quality standards for conductivity.

TDS concentrations in 24 samples collected from the Price River at USGS station 09313000 during 1979 through 1981 water years ranged from 200 to 580 mg/L and averaged 367 mg/L (Table 4). Calcium and magnesium were the dominant dissolved cations and bicarbonate was the dominant dissolved anion.

TABLE 2
Total Dissolved Solids (mg/L) and Specific Conductance (μS/cm @ 25° C) in Price Canyon and Spring Canyon drainages

Monitoring Station	Date	Average	Maximum	Minimum
Crandall Canyon				
B-25 location unknown	4/81 - 10/83 (*one sample only)	* *	*410 mg/L *514 μS	*410 mg/L *514 μS
B-26 middle Crandall Canyon (no specific conductance measured)	4/81 - 10/83	774 mg/L	1,480 mg/L	395 mg/L
Price River, just above confluence with Sulphur Creek				
CGCC/PRCC B-20	02/80 - 10/83	314 mg/L 380 μS	880 mg/L 575 μS	189 mg/L 235 μS
Sulphur Creek				
CPMC BN-221 (CGCC/PRCC B-19)	6/78 - 3/95	562 mg/L 667 μS	840 mg/L 1,350 μS	348 mg/L 328 μS
Price River, just below (above) Bear Canyon				
CPMC B-6 (CGCC/PRCC B-6)	6/78 - 3/95	319 mg/L 435 μS	910 mg/L 710 μS	190 mg/L 250 μS
Price River, just above confluence with Willow Creek (at confluence with Barn Canyon)				
CPMC B-5 (CGCC/PRCC B-5)	6/78 - 3/95	329 mg/L 447 μS	1,080 mg/L 795 μS	198 mg/L 253 μS
Price River, at Heiner				
USGS 09313000	10/79 - 9/81	367 mg/L 579 μS	580 mg/L 930 μS	200 mg/L 330 μS
Spring Canyon, below Sowbelly Gulch				
USGS 09313040	10/79 - 9/81	2,260 mg/L 2,890 μS	2,600 mg/L 3,200 μS	481 mg/L 770 μS

Specific Conductance measured in the field

Dissolved-solids concentrations in 37 streamflow samples taken from Spring Canyon creek at station 09313040 ranged from 481 to 2,600 mg/L and averaged 2,260 mg/L. Magnesium and sulfate were the dominant cation and anion. Strontium was the dominant trace element, with concentrations as large as 1,400 μgm/l (Price and Plantz, 1987).

CPMC's monitoring station B-151 is at or near the same location as USGS gaging station 09312800, near the head of Willow Creek canyon. USGS station 09312800 was monitored for flow and Specific Conductance only. TDS measurements for Willow Creek are summarized in Table 3. Data in Table 3 do not indicate significant variation in dissolved solids over the monitored section of Willow Creek, although it must be remembered that these data are temporally scattered and possibly determined by a variety of methods.

USGS station 09312900, on Willow Creek near PacifiCorp's Castle Gate Generating Plant, was operated continuously during water years 1980 and 1981. Chemical analyses of 24 streamflow samples are summarized in

Table 4. TDS concentrations ranged from 350 to 810 mg/L and averaged 591 mg/L. Magnesium and bicarbonate were the dominant cation and anion in most of the samples regardless of the total dissolved-solids concentrations. Strontium was found in concentrations as large as 1,100 μg/L (Price and Plantz, 1987).

TABLE 3
Total Dissolved Solids (mg/L) and Specific Conductance (μS/cm @ 25° C) in Willow Creek drainage

Monitoring Station	Date	Average	Maximum	Minimum
Buck Canyon, just below Deep Canyon - Buck Canyon confluence				
CPMC B-253 (no TDS determination)	7/94 - 9/94	530 μS	548 μS	513 μS
Willow Creek, near the head of the canyon, at the confluence with Buck Canyon, just below Emma Park				
USGS 09312800 (no TDS determination)	1969 - 1989 *1989 only	*924 μS	*990 μS	*850 μS
CPMC B-151 ✓ (CGCC/PRCC B-1)	6/78 - 3/95	579 mg/L 707 μS	1,198 mg/L 1,150 μS	365 mg/L 365 μS
Mathis Canyon				
CPMC B-353 upper Mathis Canyon	7/94 - 3/95	272 mg/L 528 μS	296 mg/L 573 μS	248 mg/L 517 μS
CPMC B-211 at Willow Creek confluence	6/94 - 3/95	426 mg/L 760 μS	444 mg/L 910 μS	408 mg/L 704 μS
Willow Creek, between Mathis and Hell Canyons				
CGCC/PRCC B-1 ✓ (see CPMC B-151)	-	-	-	-
Willow Creek, between Dinosaur and Castle Canyons				
CGCC/PRCC B-2 ✓	6/78 - 3/95	562 mg/L 667 μS	840 mg/L 1,350 μS	348 mg/L 328 μS
Lower Willow Creek, near PacifiCorp's Castle Gate generating plant				
USGS 09312900	10/79 - 9/81	591 mg/L 920 μS	810 mg/L 1,280 μS	350 mg/L 450 μS
CPMC BN-3 ✓ (CGCC/PRCC B-3)	2/80 - 3/95	536 mg/L 703 μS	720 mg/L 1,152 μS	345 mg/L 315 μS

Specific Conductance measured in the field

The impact of the Mancos Shale on water quality is very evident in the samples collected at USGS Station 09313040 in Spring Canyon (Table 2). However, even though the Price River begins flowing on the Mancos Shale approximately one mile upstream of the USGS monitoring station at Heiner, TDS and specific conductance appear little affected at that location because of the larger discharge of the Price River.

TABLE 4

Summary of chemical analyses of streamflow in the Price River, Willow Creek, and Spring Canyon creek Water years 1980-81 (Price and Plantz, 1987)
USGS stations 09313000, 09312900, and 09313040
[< indicates actual value is smaller than the detectable limit value shown]

Properties and constituents	Price River 09313000			Willow Creek 09312900			Spring Canyon creek 09313040		
	No. of analyses	Mean	Minimum-maximum	No. of analyses	Mean	Minimum-maximum	No. of analyses	Mean	Minimum-maximum
Streamflow (cubic feet per second)	25	124	6.8-918	25	12.1	0.35-173	37	1.4	0.05-38.0
Water temperature (degrees Celsius)	25	9.4	.0-20.0	25	10.0	.0-27.0	37	11.4	4.0-26.0
Specific conductance (microsiemens per centimeter at 25° Celsius)	25	579	330-930	25	920	450-1,280	37	2,890	770-3,200
pH (units)	25	--	8.1-9.0	25	--	8.1-8.8	37	--	7.8-8.4
Sodium-absorption ratio	25	.7	.3-1.0	25	1.8	.9-2.0	37	1.6	.3-5.5
--------mg/L--------	--------mg/L--------			--------mg/L--------			--------mg/L--------		
Dissolved solids, sum of constituents	24	367	200-580	24	591	350-810	37	2,260	481-2,600
oxygen, dissolved (O_2)	25	9.8	7.5-13.1	25	9.3	6.4-12.0	37	9.0	7.0-11.2
Carbon dioxide, dissolved (CO_2)	24	1.4	.5-3.9	24	1.9	.7-4.7	36	4.9	1.9-7.7
Alkalinity ($CaCO_3$)	24	217	140-290	24	284	210-350	36	382	100-430
Bicarbonate (HCO_3) [1]	24	250	170-400	24	331	230-420	36	468	120-520
Carbonate (CO_3) [1]	24	5.8	.0-22	24	7.3	.0-16	36	--	.0-2
Nitrogen, dissolved (N)	8	.70	.20-.94	8	.45	.15-.74	7	7.1	3.1-8.5
Nitrogen, organic dissolved (N)	4	.35	.11-.52	4	.37	.11-.63	8	.71	.40-1.4
Nitrogen, ammonia dissolved (N)	4	--	<.01-.050	4	--	<.01-.030	8	--	<.01-.190
Nitrogen, nitrite dissolved (N)	4	--	<.010	4	--	.01	3	--	<.01-.020
Nitrogen, nitrate dissolved (N)	4	--	<.05-.50	4	--	<.05-.06	7	5.9	5.0-6.8
Nitrogen, nitrite+nitrate (N)	8	.27	.03-.50	8	--	<.01-.27	12	6.0	1.5-7.8
Phosphorus, dissolved (P)	4	.075	.010-.270	4	--	<.01-.240	4	--	<.01-. 220
Phosphorus, ortho, dissolved (P)	4	--	<.001-.010	4	--	.001-.010	8	--	<.001-. 030
Carbon, organic dissolved [c]	8	7.0	2.2-15	8	6.2	1.5-14	8	8.7	2.6-28
Hardness, (as ($CaCO_3$)	25	255	160-390	25	342	180-500	37	1,440	370-2,100
Hardness, (as noncarbonate, ($CaCO_3$)	24	44.8	0-130	24	65	.0-150	36	1,190	270-1,700
Calcium, dissolved (Ca)	25	57	36-85	25	56	32.0-82	37	202	79-230
Magnesium, dissolved (Mg)	25	27	16-47	25	49	20-72	37	258	42-380
Sodium, dissolved (Na)	25	27.7	7.9-56.0	25	77	30-100	37	143	15-360
Potassium, dissolved (K)	25	1.9	.9-3.2	25	2.7	1.7-3.6	37	17.5	1.7-21
Chloride, dissolved (Cl)	25	17.2	5.8-41.0	25	26.1	9.8-45	37	84.9	36-120
Sulfate, dissolved (SO_4)	25	88	28-200	25	194	70-300	37	1,300	200-1,500
Fluoride, dissolved (F)	17	.2	.1-.3	17	.26	.20-0.50	21	.4	.3-.5
Silica, dissolved (SiO^2)	25	8.1	3.3-14.0	25	12.2	6.8-15	37	11.4	5.0-16
-------- µg/L--------	-------- µg/L--------			-------- µg/L--------			-------- µg/L--------		
Arsenic, dissolved (As)	6	1.7	1.0-3.0	6	2.2	2.0-3.0	11	--	<1-3
Barium, dissolved (Ba)	2	--	<100-200	12	150	100-200	2	150	100-200
Boron, dissolved (B)	17	136	20-610	17	97	60-180	21	--	<10-700
Cadmium, dissolved (Cd)	2	--	<1-2	2	--	<1-1	3	--	<1-1
Chromium, dissolved (Cr)	6	--	<10-20	5	--	<10-10	7	--	<10-30
Copper, dissolved (Cu)	2	3.0	2.0-4.0	2	2.5	2-3	3	5	2-10
Iron, dissolved (Fe)	17	--	<10-30	17	--	<10-80	21	34	10-60
Lead, dissolved (Pb)	6	--	<1-5.0	6	--	<1-2	11	--	<1-81
Lithium, dissolved (Li)	6	--	<10-30	6	28	20-40	10	173	150-190
Manganese, dissolved (Mn)	17	11.2	3.0-30	17	12.2	2-30	21	23	10-50
mercury, dissolved (Hg)	2	--	<.1	2	--	<.1	3	--	<1-1
Nickel, dissolved (Ni)	2	8	2-14	2	--	<1	3	2.7	1-6
Selenium, dissolved (Se)	6	--	<1-3.0	6	1.7	1.0-3.0	11	15	3-21
Strontium, dissolved (Sr)	6	455	300-630	6	717	350-1,100	10	1,200	1,000-1,400
Zinc, dissolved (Zn)	6	--	<3-20	6	4.2	3.0-7.0	11	20	10-40
Phenols	7	--	<1-10	8	7.2	1.0-33	8	--	<1-14

[1] Fixed-end-point determined by titration in the field.

Sulfate

There is no Utah water quality standard for sulfate. Sulfate concentrations appear to be slightly elevated in Willow Creek with respect to other area surface drainages. The sulfate concentration in Willow Creek generally ranges from 150 to 230 mg/L. Measured concentrations in the Price River tend to range from 20 to 100 mg/L. The limited data for intermittent and ephemeral tributaries suggests sulfate concentrations range from 20 to 140 mg/L. Natural sulfur springs have been identified in Sulphur Canyon, along Willow Creek canyon, and in a number of other area drainages. Hydrogen sulfide gas (H_2S) has been documented in area wells. In essentially all cases, elevated sulfate values in surface waters can be correlated to nearby natural sources.

Iron and Manganese

The State standard for dissolved iron is 1000 mg/L maximum in all Class 3 waters and there is no standard for dissolved manganese. Secondary drinking water (SDW) standards for total iron and manganese are, respectively, 0.3 mg/L and 0.05 mg/L.

Total iron concentrations in surface water appear to be similar in the Price River and Willow Creek (Tables 5 and 6). Concentration in the Price River range from less than 0.5 to approximately 25 mg/L. Concentrations in Willow Creek are slightly higher, with maximum measured concentrations of approximately 36 mg/L. The limited data for the intermittent and ephemeral drainages show total iron concentrations typically ranging from 0.03 to 0.3 mg/L. Antone Creek appears to be an exception, with measured concentrations ranging from 0.04 to 2.71 mg/L.

It appears that these total iron concentrations are due to natural processes because both the downgradient and upgradient Willow Creek monitoring stations have similar total iron concentrations. Many lithologic units in the area show visible evidence of iron cementation, and considering the direct correlation between elevated iron levels and high levels of suspended solids it is reasonable to assume the observed elevated iron levels can be correlated to natural sources and the processes of weathering, oxidation, erosion, and sediment transport.

Other Metals or Ions

The standard for copper (12 μg/L four day average or 18 μg/L one hour average) for Class 3 waters has been exceeded at B-1 and B-3 in Willow Creek and at B-151 in Willow Creek, and copper and zinc (110 μg/L four day average or 120 μg/L one hour average) standards has been exceeded in Crandall Canyon at B-26.

Chemical analyses of 24 streamflow samples collected at USGS station 09312900 on Willow Creek during the 1980 and 1981 water years are summarized in Table 4. Magnesium and bicarbonate were the dominant cation and anion in most of the samples. Trace elements were found in concentrations that did not exceed Utah Water Quality or USEPA standards, although strontium was found in concentrations as high as 1,100 μg/L (Price and Plantz, 1987).

Dissolved solids concentrations in 37 streamflow samples taken from Spring Canyon creek at station 09313040 ranged from 481 to 2,600 mg/L and averaged 2,260 mg/L. Magnesium and sulfate were the dominant cation and anion. Strontium was the dominant trace element, with concentrations as large as 1,400 μg/L. Of the trace elements analyzed, lead and selenium were found in concentrations that exceeded both USEPA and Utah Water Quality criteria: both the maximum and mean concentrations of selenium exceeded the USEPA criterion of 10 μg/L (Price and Plantz, 1987). Chromium was found in concentrations up to 30 μg/L, exceeding the Utah Water Quality standard of 16 μg/L for Class 3 type waters.

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TABLE 5
Iron and Manganese (in mg/L) in Price Canyon and Spring Canyon drainages

Monitoring Station	Date	Iron - total		Iron - diss.		Manganese -total		Manganese - diss.	
		Avg.	Range	Avg.	Range	Avg.	Range	Avg.	Range
Crandall Canyon									
B-25 location unknown	4/81 - 10/83 (*one sample only)	*	*4.16	-	-	*	*0.16	-	-
B-26 middle Crandall Canyon	4/81 - 10/83	17.7	0.36 - 42.5	-	-	0.26	0.005 - 0.78	-	-
Price River, just above confluence with Sulphur Creek									
CGCC/PRCC B-20	02/80 - 10/83	3.8	0.21 - 25.8	0.07	0.02 - 0.13	0.18	<0.001 - 1.2	-	-
Sulphur Creek									
CPMC BN-221 (CGCC/PRCC B-19)	6/78 - 3/95	0.055	0.015 - 4.25	0.38	<0.02 - 1.04	0.04	0.004 - 0.16	<0.01	<0.01
Price River, just below (above) Bear Canyon									
CPMC B-6 (CGCC/PRCC B-6)	6/78 - 3/95	2.73	0.01 - 25.3	0.023	<0.01 - 0.04	0.145	0.006 - 1.22	0.009	<0.005 - 0.02
Price River, just above confluence with Willow Creek (at confluence with Barn Canyon)									
CPMC B-5 (CGCC/PRCC B-5)	6/78 - 3/95	2.9	0.09 - 30.5	0.16	<0.01 - 0.68	0.15	0.016 - 1.3	0.009	<0.005 - 1.3
Price River, at Heiner									
USGS 09313000	10/79 - 9/81	-	-	0.034	<0.010 - 0.030	-	-	0.0112	0.003 - 0.030
Spring Canyon, below Sowbelly Gulch									
USGS 09313040	10/79 - 9/81	-	-	0.034	0.010 - 0.060	-	-	0.023	0.010 - 0.050

TABLE 6
Iron and Manganese (in mg/L) in Willow Creek drainage

Monitoring Station	Date	Iron - total		Iron - diss.		Manganese -total		Manganese - diss.	
		Avg.	Range	Avg.	Range	Avg.	Range	Avg.	Range
Buck Canyon, just below Deep Canyon - Buck Canyon confluence									
CPMC B-253	7/94 - 9/94	-	-	-	-	-	-	-	-
Willow Creek, near the head of the canyon, at the confluence with Buck Canyon, just below Emma Park									
USGS 09312800	1969 - 1983	-	-	-	-	-	-	-	-
CPMC B-151 (CGCC/PRCC B-1)	6/78 - 3/95	55.2	0.04 - 1,230	0.016	<0.01 - 0.04	0.033	<0.01 - 0.085	0.21	<0.01 - 1.7
Mathis Canyon, at the confluence with Willow Creek									
CPMC B-253 upper Mathis Canyon	7/94 - 3/95	0.185	0.08 - 0.29	0.015	<0.02 - 0.02	0.013	<0.01 - 0.02	0.008	<0.01 - 0.01
CPMC B-211 at Willow Creek confluence	6/94 - 3/95	0.055	0.03 - 0.08	<0.02	<0.02	<0.01	<0.01	<0.01	<0.01
Willow Creek, between Mathis and Hell Canyons									
CGCC/PRCC B-1	-	-	-	-	-	-	-	-	-
Willow Creek, between Dinosaur and Castle Canyons									
CGCC/PRCC B-2	6/78 - 3/95	6.7	0.06-33.8	0.02	0.02 - 0.02	0.25	0.002 - 1.7	-	-
Lower Willow Creek, near PacifiCorp's Castle Gate generating plant									
USGS 09312900	10/79 - 9/81	-	-	-	<0.010 - 0.080	-	-	0.0122	0.002-0.030
CPMC BN-3 (CGCC/PRCC B-3)	2/80 - 3/95	6.9	0.09-35.6	0.15	<0.01 -0.69	0.194	<0.01-0.02	0.01	<0.01-0.02

pH

Extreme pH values measured in the field range from 6.4 to 9.6 but averages range from 7.9 to 8.6, indicating overall neutral to moderately alkaline conditions. Utah water quality standards are 6.5 to 9.0 for all classes of water. High pH values are relatively common in the arid western United States and reflect the alkaline geochemistry of the dominant stratigraphic units. When pH values for stations above and below existing mine disturbance areas are compared, available monitoring data indicates no significant variance and thus no significant impact from these activities (Tables 7 and 8).

TABLE 7
pH (measured in the field) in Price Canyon and Spring Canyon drainages

Monitoring Station	Date	Average	Maximum	Minimum
Crandall Canyon				
B-25 location unknown	4/81 - 10/83 (*one sample only)	*	*8.2	*8.2
B-26 middle Crandall Canyon	4/81 - 10/83	8.4	9.2	7.7
Price River, just above confluence with Sulphur Creek				
CGCC/PRCC B-20	02/80 - 10/83	8.1	9.5	6.7
Sulphur Creek				
CPMC BN-221 (CGCC/PRCC B-19)	6/78 - 3/95	8	9.2	6.4
Price River, just below (above) Bear Canyon				
CPMC B-6 (CGCC/PRCC B-6)	6/78 - 3/95	8.1	9.5	7.1
Price River, just above confluence with Willow Creek (at confluence with Barn Canyon)				
CPMC B-5 (CGCC/PRCC B-5)	6/78 - 3/95	8.2	9.6	7
Price River, at Heiner				
USGS 09313000	10/79 - 9/81	-	9.0	8.1
Spring Canyon, below Sowbelly Gulch				
USGS 09313040	10/79 - 9/81	-	8.4	7.8

Where both acidity and alkalinity have been determined, alkalinity is typically at least one order of magnitude greater, and often as much as four to five orders greater, than acidity.

TABLE 8
pH (measured in the field) in Willow Creek Canyon

Monitoring Station	Date	Average	Maximum	Minimum
Buck Canyon, just below Deep Canyon - Buck Canyon confluence				
CPMC B-253	7/94 - 9/94	8.36	8.44	8.3
Willow Creek, near the head of the canyon, at the confluence with Buck Canyon, just below Emma Park				
USGS 09312800	1969 - 1983	-	-	-
CPMC B-151 (CGCC/PRCC B-1)	6/78 - 3/95	8.1	9.4	6.8
Mathis Canyon, at the confluence with Willow Creek				
CPMC-353 upper Mathis Canyon	7/94 - 3/95	8.6	9	8.3
CPMC B-211 at Willow Creek confluence	6/94 - 3/95	8.4	8.6	7.9
Willow Creek, between Mathis and Hell Canyons				
CGCC/PRCC B-1	-	-	-	-
Willow Creek, between Dinosaur and Castle Canyons				
CGCC/PRCC B-2	6/78 - 3/95	8.2	9.2	7.5
Lower Willow Creek, near PacifiCorp's Castle Gate generating plant				
USGS 09312900	10/79 - 9/81	-	8.8	8.1
CPMC BN-3 (CGCC/PRCC B-3)	2/80 - 3/95	-	-	7.1

Phenols

Utah water quality standard for phenols is 0.01 mg/L for all Class 3 waters. At USGS station 09312900 on Willow Creek, eight of the twenty-four water samples collected from October 1979 to September 1981 were analyzed for phenols and measurable concentrations (0.001 mg/L or greater) were found in all eight. Average concentration was 0.0072 mg/L and 0.033 mg/L was the maximum. During the same period, phenol concentrations in seven samples from USGS station 09313000 on the Price River ranged from below detection to 0.01 mg/L (Price and Plantz, 1987).

Elevated phenol levels were found by CPMC in at least one sample from each of the following: B-1, B-2, and B-3 in Willow Creek; B-5, B-6, B-20, and B-21 in the Price River; B-26 in Crandall Canyon; and B-19 in Sulphur Canyon. The average phenol concentration exceeded the 0.01 mg/L criterion at B-1, B-3, B-5, B-6, B-19, and B-20. These high phenol levels cannot be associated with any known disturbance or mining activities. Because phenols are a common product of natural oxidation and in-situ combustion of coal, the observed elevated phenol levels may be due to natural processes.

Solids

Considering the topography and climate of the area, high Total Suspended Solids (TSS) values are to be expected during spring runoff and following major thunderstorms. Extremely steep natural slopes and channel gradients combine with short duration, high-intensity flows from snowmelt and thunderstorms to produce significant surface erosion and sediment transport. Weathering and mass wasting produce colluvial deposits on

lower slopes and in drainages, with runoff then mobilizing and transporting the smaller size colluvial particles. There are water quality standards for turbidity but not for suspended solids.

Analyses of stream-bottom sediments at USGS station 09312900 indicate that those sediments consist of as much as 2.3 percent coal, upstream coal storage or mine spoils being the most likely sources for this coal. Two benthic invertebrate samples were collected during water year 1980 and five phytoplankton samples were collected during water year 1981. Benthic invertebrates had fairly good diversity indicating an apparently unpolluted streambottom environment. The phytoplankton showed considerable variation (Price and Plantz, 1987).

Concentrations of suspended sediment in 21 samples collected at USGS station 09313000 ranged from 58 to 1,520 mg/L during water year 1980 and from 21 to 4,270 mg/L during water year 1981 (Table 9). Instantaneous suspended-sediment loads ranged from 2.7 to 3,770 tons/day during water year 1980 and from 0.59 to 1,090 tons/day during water year 1981. Coal was as much as 8 percent of the stream-bottom sediments sampled at the station. Two samples of benthic invertebrates collected during the 1980 water year had good diversity indicating an apparently unpolluted stream bottom at the station. Five samples of phytoplankton collected during water year 1981 showed a uniform distribution of green algae with good diversity (Price and Plantz, 1987).

TABLE 9
Total suspended solids (in mg/L) in Price Canyon and Spring Canyon drainages

Monitoring Station	Date	Average	Maximum	Minimum
Crandall Canyon				
B-25 location unknown	4/81 - 10/83 (*one sample only)	*	*475	*475
B-26 middle Crandall Canyon	4/81 - 10/83	367	736	54
Price River, just above confluence with Sulphur Creek				
CGCC/PRCC B-20	02/80 - 10/83	314	880	189
Sulphur Creek				
CPMC BN-221 (CGCC/PRCC B-19)	6/78 - 3/95	27.9	215	<0.1
Price River, just below (above) Bear Canyon				
CPMC B-6 (CGCC/PRCC B-6)	6/78 - 3/95	200	1,633	0.5
Price River, just above confluence with Willow Creek				
CPMC B-5 (CGCC/PRCC B-5)	6/78 - 3/95	188.6	1,604	<1
Price River, at Heiner				
USGS 09313000	10/79 - 9/81	-	4,270	21
Spring Canyon, below Sowbelly Gulch				
USGS 09313040	10/79 - 9/81	-	99,800	3

At station USGS 09312900 during the 1980 and 1981 water years, suspended-sediment concentrations in 20 samples ranged from 2 to 4,820 mg/L. Calculated instantaneous suspended-sediment loads ranged from 0.02 to 902 tons/day in water year 1980 and from 0.01 to 547 tons/day in water year 1981 (Price and Plantz, 1987).

Suspended-sediment concentrations in 25 samples collected at USGS station 09313040 during water years 1980 and 1981 ranged from 3 mg/L on December 6, 1981 to 99,800 mg/L on July 12, 1981. Instantaneous suspended-sediment loads ranged from 0.05 to 0.07 tons/day during water year 1979, 0.01 to 0.43 tons/day in water year 1980, and from less than 0.01 to 10,200 tons/day in water year 1981. No determinations were made of the composition of suspended sediment in samples collected during the monitoring period. On August 29, 1969, however, Spring Canyon creek, while flowing at a rate of 0.6 cfs, had a suspended-sediment concentration of 2,260 mg/L and about 90 percent of the suspended sediment was coal. Price and Plantz (1987) identified coal spills, mine spoils, and coal-loading facilities associated with the earlier mines in the canyon as the most likely sources of the coal particles (Price and Plantz, 1987).

Measured TSS concentrations in the Willow Creek drainage ranged from 1 to 4,310 mg/L (Table 10).

TABLE 10
Total Suspended Solids (in mg/L) in Willow Creek drainage

Monitoring Station	Date	Average	Maximum	Minimum
Buck Canyon, just below Deep Canyon - Buck Canyon confluence				
CPMC B-253	7/94 - 9/94	-	-	-
Willow Creek, near the head of the canyon, at the confluence with Buck Canyon, just below Emma Park				
USGS 09312800	1969 - 1983	-	-	-
CPMC B-151 (CGCC/PRCC B-1)	6/78 - 3/95	334	2,622	1
Mathis Canyon, at the confluence with Willow Creek				
CPMC B-353 upper Mathis Canyon	7/94 - 3/95	<2	-	-
CPMC B-211 at Willow Creek confluence	6/94 - 3/95	2	-	-
Willow Creek, between Mathis and Hell Canyons				
CGCC/PRCC B-1	-	-	-	-
Willow Creek, between Dinosaur and Castle Canyons				
CGCC/PRCC B-2	6/78 - 3/95	436	4,310	1
Lower Willow Creek, near PacifiCorp's Castle Gate generating plant				
USGS 09312900	10/79 - 9/81	-	4,820	2
CPMC BN-3 (CGCC/PRCC B-3)	2/80 - 3/95	465	4,105	<2

Nitrogen and Phosphorus

Nitrate is the only form of nitrogen consistently monitored. Nitrate is considered an indicator of pollution in concentrations greater than 4 mg/L (as N) in class 1C, 2A, 3A, 3B, and 3C waters. The average nitrate level found by USGS monitoring in Spring Canyon was 5.9 mg/L (Tables 4 and 11). When analysis has been done for nitrite, concentrations have generally been below detection limits: the highest concentration reported was 0.04 mg/L in a sample from Sulphur Canyon. Dissolved nitrogen, dissolved organic nitrogen, and dissolved ammonia were determined by the USGS for the three stations listed in Table 4, and the highest concentrations for all three forms of nitrogen were found in Spring Canyon.

Phosphate (as phosphorus) concentrations in excess of 0.05 mg/L, considered an indicator of pollution for Class 2A, 2B, 3A and 3B waters, have been found in Willow Creek (Table 12) at B-2, BN-3 (B-3), and B-151 (B-1); in the Price River at B-5, B-6, B-20, and B-21; in Crandall Canyon at B-25 and B-26; and in Sulphur Canyon at BN-221 (Table 11).

TABLE 11
Nitrogen and Phosphorus (in mg/L) in Price Canyon and Spring Canyon drainages

Monitoring Station	Date	Nitrate (as N)		Phosphate (as P)	
		Average	Range	Average	Range
Crandall Canyon					
B-25 location unknown	4/81 - 10/83 (*one sample only)	*	*0.06	*	*0.13
B-26 middle Crandall Canyon	4/81 - 10/83	-	-	0.12	0.01 - 0.30
Price River, just above confluence with Sulphur Creek					
CGCC/PRCC B-20	02/80 - 10/83	0.118	<0.01 - 0.56	0.09	0.002 - 0.29
Sulphur Creek					
CPMC BN-221 (CGCC/PRCC B-19)	6/78 - 3/95	0.05	<0.01 - 0.51	0.053	<0.001 - 0.23
Price River, just below (above) Bear Canyon					
CPMC B-6 (CGCC/PRCC B-6)	6/78 - 3/95	0.14	<0.01 - 0.63	0.08	<0.01 - 0.35
Price River, just above confluence with Willow Creek (at confluence with Barn Canyon)					
CPMC B-5 (CGCC/PRCC B-5)	6/78 - 3/95	0.158	<0.01 - 0.64	0.09	<0.01 - 0.55
Price River, at Heiner					
USGS 09313000	10/79 - 9/81	-	<0.05 - 0-.50	-	<0.001 - 0.010
Spring Canyon, below Sowbelly Gulch					
USGS 09313040	10/79 - 9/81	5.9	5.0 - 6.8	-	<0.001 - 0.030

TABLE 12
Nitrogen and Phosphorus (in mg/L) in Willow Creek drainage

Monitoring Station	Date	Nitrate (as N)		Phosphate (as P)	
		Average	Range	Average	Range
Buck Canyon, just below Deep Canyon - Buck Canyon confluence					
CPMC B-263	7/94 - 9/94	-	-	-	-
Willow Creek, near the head of the canyon, at the confluence with Buck Canyon, just below Emma Park					
USGS 09312800	1969 - 1983	-	-	-	-
CPMC B-151 (CGCC/PRCC B-1)	6/78 - 3/95	0.08	<0.01 - 0.58	0.1	0.005 - 0.55
Mathis Canyon, at the confluence with Willow Creek					
CPMC B-353 upper Mathis Canyon	7/94 - 3/95	<0.02	-	<0.005	-
CPMC B-211 at Willow Creek confluence	6/94 - 3/95	0.04	0.02 - 0.06	<0.005	-
Willow Creek, between Mathis and Hell Canyons					
CGCC/PRCC B-1	-	-	-	-	-
Willow Creek, between Dinosaur and Castle Canyons					
CGCC/PRCC B-2	6/78 - 3/95	0.09	<0.01 - 1.02	0.23	<0.01 - 3.26
Lower Willow Creek, near PacifiCorp's Castle Gate generating plant					
USGS 09312900	10/79 - 9/81	-	<0.05 - 0.06	-	0.001 - 0.010
CPMC BN-3 (CGCC/PRCC B-3)	2/80 - 3/95	0.08	<0.01 - 0.63	0.10	0.01 - 0.39

Oil and Grease

Analysis for oil and grease was done regularly by mine operators up until approximately 1994, when Freon needed to do the extraction became unavailable. CPMC has continued monitoring for oil and grease by simple visual inspection.

As can be seen in Tables 13A and 13B, there have been high levels of oil and grease in most of the area streams at some time. There is no water quality standard for oil and grease, but a limit of 10 mg/L oil and grease is common in UPDES permits. A 10 mg/L limit does not protect fish and benthic organisms from soluble oils such as those used in longwall hydraulic systems, and UDWR has recommended soluble oils be limited to 1 mg/L (Darrell H. Nish, Acting Director UDWR, letter dated April 17, 1989 to Dianne R. Nielsen, Director UDOGM).

TABLE 13A
Oil and Grease (in mg/L) in Price Canyon and Spring Canyon drainages

Monitoring Station	Date	Average	Maximum	Minimum
Crandall Canyon				
B-25 location unknown	4/81 - 10/83 (*one sample only)	*	*0.8	*0.8
B-26 middle Crandall Canyon	4/81 - 10/83	1.5	3.8	<0.2
Price River, just above confluence with Sulphur Creek				
CGCC/PRCC B-20	02/80 - 10/83	4.4	57	<0.1
Sulphur Creek				
CPMC BN-221 (CGCC/PRCC B-19)	6/78 - 3/95	2.27	24.2	<0.01
Price River, just below (above) Bear Canyon				
CPMC B-6 (CGCC/PRCC B-6)	6/78 - 3/95	2.5	28.4	<0.1
Price River, just above confluence with Willow Creek (at confluence with and Barn Canyon)				
CPMC B-5 (CGCC/PRCC B-5)	6/78 - 3/95	3.02	40	<1
Price River, at Heiner				
USGS 09313000	10/79 - 9/81	-	-	-
Spring Canyon, below Sowbelly Gulch				
USGS 09313040	10/79 - 9/81	-	-	-

TABLE 13B
Oil and grease (in mg/L) in Willow Creek drainage

Monitoring Station	Date	Average	Maximum	Minimum
Buck Canyon, just below Deep Canyon - Buck Canyon confluence				
CPMC B-253	7/94 - 9/94	-	-	-
Willow Creek, near the head of the canyon, at the confluence with Buck Canyon, just below Emma Park				
USGS 09312800	1969 - 1983	-	-	-
CPMC B-151 (CGCC/PRCC B-1)	6/78 - 3/95	1	7.6	<0.1
Mathis Canyon, at the confluence with Willow Creek				
CPMC B-353 upper Mathis Canyon	7/94 - 3/95	2	2	2
CPMC B-211 at Willow Creek confluence	6/94 - 3/95	<1	<1	<1
Willow Creek, between Mathis and Hell Canyons				
CGCC/PRCC B-1	-	-	-	-
Willow Creek, between Dinosaur and Castle Canyons				
CGCC/PRCC B-2	6/78 - 3/95	0.92	6.4	<0.1
Lower Willow Creek, near PacifiCorp's Castle Gate generating plant				
USGS 09312900	10/79 - 9/81	-	-	-
CPMC BN-3 (CGCC/PRCC B-3)	2/80 - 3/95	1.6	10.6	<0.1

Temperature

Water temperatures in streams fluctuate greatly, especially when low flows and turbulence act to rapidly equilibrate water temperatures with air temperatures. In the CIA temperatures as high as 35°C (95°F) have been reported in Willow Creek and 32°C (90°F) in Sulphur Canyon, and maximum temperatures of 20 to 25°C (68 to 77°F) are common (Tables 14 and 15). The reported minimum is typically 0°C (32°F) . Average temperatures reported increase consistently downstream for the Price River (7.8, 8.1, 8.7, and 9.4 °C) but not for Willow Creek. The maximum allowable temperature for Class 3A and 3C waters is 27°C (80°F) and maximum allowable temperature change due to discharge from a point source is 4°C (7.2°F).

TABLE 14
Temperature (in °C) in Price Canyon and Spring Canyon drainages

Monitoring Station	Date	Average	Maximum	Minimum
Crandall Canyon				
B-25 location unknown	4/81 - 10/83 (*one sample only)	*	*23	*23
B-26 middle Crandall Canyon	4/81 - 10/83	6.4	11	2
Price River, just above confluence with Sulphur Creek				
CGCC/PRCC B-20	02/80 - 10/83	7.8	20	0
Sulphur Creek				
CPMC BN-221 (CGCC/PRCC B-19)	6/78 - 3/95	13.3	32	-4
Price River, just below (above) Bear Canyon				
CPMC B-6 (CGCC/PRCC B-6)	6/78 - 3/95	8.1	9.5	7.1
Price River, just above confluence with Willow Creek (at confluence with Barn Canyon)				
CPMC B-5 (CGCC/PRCC B-5)	6/78 - 3/95	8.7	20.4	0.2
Price River, at Heiner				
USGS 09313000	10/79 - 9/81	9.4	20	0
Spring Canyon, below Sowbelly Gulch				
USGS 09313040	10/79 - 9/81	11.4	26	4

TABLE 15
Temperature (in °C) in Willow Creek drainage

Monitoring Station	Date	Average	Maximum	Minimum
Buck Canyon, just below Deep Canyon - Buck Canyon confluence				
CPMC B-263	7/94 - 9/94	11.05	21.1	1
Willow Creek, near the head of the canyon, at the confluence with Buck Canyon, just below Emma Park				
USGS 09312800	1969 - 1983	-	-	-
CPMC B-151 (CGCC/PRCC B-1)	6/78 - 3/95	9.5	23	0
Mathis Canyon, at the confluence with Willow Creek				
CPMC B-353 upper Mathis Canyon	7/94 - 3/95	14	21	9.3
CPMC B-211 at Willow Creek confluence	6/94 - 3/95	13.8	25.1	1.5
Willow Creek, between Mathis and Hell Canyons				
CGCC/PRCC B-1	-	-	-	-
Willow Creek, between Dinosaur and Castle Canyons				
CGCC/PRCC B-2	6/78 - 3/95	8.7	22	0
Lower Willow Creek, near PacifiCorp's Castle Gate generating plant				
USGS 09312900	10/79 - 9/81	10	27	0
CPMC BN-3 (CGCC/PRCC B-3)	2/80 - 3/95	14.6	35	-1

Fish, Invertebrates, and Aquatic Habitat (see Willow Creek PAP)

Analyses of stream-bottom sediments from USGS station 09312900 on lower Willow Creek indicate that those sediments consist of as much as 2.3 percent coal, upstream coal storage or mine spoils being the most likely sources for this coal. Two benthic invertebrate samples were collected during water year 1980 and five phytoplankton samples were collected during water year 1981. Benthic invertebrates had fairly good diversity indicating an apparently unpolluted stream bottom environment. The phytoplankton showed considerable variation (Price and Plantz, 1987).

Benthic invertebrates collected at USGS station 09313040 in Spring Canyon during the 1979 and 1980 water years showed only fair diversity. Five samples of phytoplankton during the 1981 water year showed a fairly uniform dispersion of green algae; however, blue-green algae were also well represented in the samples (Price and Plantz, 1987).

Discussions between CPMC and Utah Division of Wildlife Resources (UDWR) resulted in an initial decision to conduct aquatic habitat and biology studies during the fall of 1994 and spring/summer of 1995. However, because of drought conditions in 1994, only preliminary site-specific surveys were conducted in October 1994 to provide basic permitting data on habitat and biological communities. A fish population survey was done 28-29 June 1995, which involved two passes through each of the six sections. Results of both surveys are summarized in Table 16.

Site-specific aquatic studies were conducted on October 10 through 12, 1994 to provide habitat, benthic macroinvertebrate, and fisheries information for Willow Creek. Six sampling locations were used to characterize aquatic biota, while seven locations were examined for aquatic habitat. Information on stream depth, width, velocity, pool/riffle ratio, pool and riffle lengths, and substrate was collected or recorded during site-specific habitat surveys. The benthic macroinvertebrate survey involved the collection of two replicate samples at each location using a Surber sampler. A backpack electroshocker was used to sample fish populations within a segment of Willow Creek approximately 300 feet long at each sampling location.

Game Fish The permit area provides potential habitat for eighteen fish species. Willow Creek is considered to be a Class 4 fishery by UDWR, which is defined as a stream with low recreational fishing potential. Game fish species expected to occur in Willow Creek include rainbow trout, Yellowstone cutthroat trout, and brown trout. Only one rainbow trout, 8.5 inches in length, was collected at WC-3 during the electroshocking survey conducted on October 12, 1994. Results of the 1994 fish sampling efforts are summarized by Table 16. CPMC's discussions with UDWR indicated that trout species likely occur in relatively low numbers in Willow Creek. Because spawning conditions are poor in this section of Willow Creek, the primary use by trout species is considered to be as a migration route. The sporadic occurrence of trout in lower Willow Creek is primarily related to seasonal spawning migrations and habitat limitations. Rainbow and Yellowstone cutthroat trout are suspected to move from the Price River into Willow Creek and other tributaries during their spring spawning periods (usually early May through June for Yellowstone cutthroat and mid-March through June for rainbow). Brown trout move into tributary streams in October. After spawning, adult fish migrate back to the Price River.

TABLE 16
(Adapted from TABLES 3.3-2 and 3.3-2A - Willow Creek PAP)

NUMBER OF FISH COLLECTED IN WILLOW CREEK, OCTOBER 12, 1994							
Common Name	**Scientific Name**	**WC-1R**	**WC-2**	**WC-3**	**WC-4**	**WC-5**	**WC-6**
Mountain sucker	*Catostomus platyrhynchus*	26	18	28	14	13	5
Speckled dace	*Rhinichthys osculus*	30	12	17	13	12	9
Rainbow trout	*Oncorhynchus mykiss*	0	0	1	0	0	0
Total		76	30	46	27	25	14
FISH POPULATION SURVEY - WILLOW CREEK, JUNE 28-29, 1995							
Common Name	**Scientific Name**	**WC-1R**	**WC-2**	**WC-3**	**WC-4**	**WC-5**	**WC-6**
Mountain sucker	*Catostomus platyrhynchus*	50	29	15	21	9	9
Speckled dace	*Rhinichthys osculus*	40	8	13	18	33	34
Rainbow trout	*Oncorhynchus mykiss*	0	0	1	0	3	0
Bullhead Sucker	*Catostomus discobolus*	4	1	0	3	0	0
Redside Shiner	*Richardsonius balteatus*	0	0	0	1	1	5
Weighted Total	(see Willow Creek PAP)	78	40	29	41	43	41

Trout in Willow Creek also may originate from upstream sources. Prior to 1994, fingerling rainbow trout were stocked in the upper portions of Willow Creek, although the UDWR has indicated that stocking of rainbow

trout in Willow Creek may be discontinued. During high flow periods, trout may be washed downstream into the lower portions of Willow Creek.

The Price River is also considered a Class 4 fishery. Game fish populations in the Price River downstream of the Willow Creek confluence are comprised of both warmwater and coldwater species. Game fish species include brown trout, Yellowstone cutthroat trout, rainbow trout, and channel catfish. Population studies on a section of the Price River upstream of the Willow Creek confluence, completed in 1981 for UDWR, indicated a trout density of 64 ± 6 for the sampled reaches. This population estimate would also be representative of the Price River from the Willow Creek confluence downstream to Helper. Fingerling rainbow trout and brown trout are stocked in the Price River by UDWR. Yellowstone cutthroat trout occur in small tributaries to the Price River but are no longer stocked in the Price River drainage.

Non-game Fish Non-game fish species in Willow Creek consist of speckled dace and mountain sucker. The results of the October 1994 survey indicated that species abundance varied from 5 to 30 individuals/300-ft section at the six sampling locations as shown by Table 16. During years with higher flows, other minnow species that are found in the region may occur in Willow Creek.

Non-game fish species in the Price River downstream of the Willow Creek confluence are similar to regional lists. UDWR surveys have collected flannelmouth sucker, mountain sucker, bluehead sucker, mottled sculpin, carp, Utah chub, longnose dace, speckled dace, and redside shiner.

Macroinvertebrates CPMC's October 1994 macroinvertebrate sampling in Willow Creek revealed relatively low macroinvertebrate densities, number of taxa, and species diversities at all locations. Total densities ranged from 12.5 individuals/ft^2 at WC-5 to 53 individuals/ft^2 at WC-1R. The lowest number of macroinvertebrate taxa was found at two of the downstream locations (7 at WC-4 and 9 at WC-5). The other four locations supported 13 to 20 taxa, which is considered a low number of taxa in a Surber sample. The EPT Index (the number of Ephemeroptera [mayflies], Plecoptera [stoneflies], and Trichoptera [caddisflies] taxa) and the EPT abundances (total EPT individuals/ft^2) also were low at all locations. Macroinvertebrate densities and the EPT Index were slightly higher at the upstream locations (WC-1R, WC-2, and WC-3) compared to the downstream locations (WC-4, WC-5, and WC-6). The relatively low densities and few taxa found for these indicator groups indicate water quality and habitat conditions were low. The drought conditions in 1994 likely contributed to the low macroinvertebrate productivity.

CPMC calculated Shannon species diversity indices for each sampling location, which provided an indication of the density distribution among the various taxa. Diversity values less than 2 generally indicate a possible stressed biological community, as shown by the dominance of relatively few, tolerant taxa. In the Willow Creek study, the upstream locations (WC-1R, WC-2, and WC-3) showed mean diversities ranging from 1.78 to 2.31. In contrast, diversity indices at the downstream locations (WC-4, WC-5, and WC-6) were lower, with values from 1.15 to 1.66.

The most abundant taxon at five of the six sampling locations was the mayfly, *Tricorythodes*, which comprised about 18 to 45 percent of the total macroinvertebrate densities. This particular mayfly is tolerant of silt conditions. Other dominant taxa (greater than 5 percent of the total densities at a location) included Tanypodinae chironomid midges, oligochaetes (worms), caddisflies, mayflies, Elmidae beetles, and dragonflies. The midges, oligochaetes, and beetles also are able to tolerate silt conditions.

Aquatic Habitat The overall quality of aquatic habitat in this section of Willow Creek is limited due to erosion, siltation, and relatively low flows during most months, except during spring runoff and after large thunderstorm events. Based on a habitat characterization survey conducted on October 10 and 11, 1994, a thick silt/clay layer was evident on the rock surfaces in both pools and riffles. The dominant substrate sizes in pools were clay, silt, and rubble (cobble), and riffle substrates were dominated by clay, silt, rubble, and boulder sized materials. Riffles represented the major type of habitat at most of the habitat characterization locations. Due to the low flow (approximately 1.5 cubic ft/sec) at the time of the survey, depths and velocities were low in both pools and riffles. Maximum depths in most pools ranged from about 1 to 2 ft. Pool habitat was created by

numerous large boulders at scattered locations throughout the stream. A series of five pools was found immediately downstream of an existing road culvert (approximately 400 ft upstream of location H-5), which collectively represent the largest quantity of deep, pool habitat along Willow Creek in the proposed mining area. Total length of the pools was approximately 100 ft, with maximum depths of approximately 1 to 3.5 ft. A series of concrete steps that were constructed by UDWR serve as a fish ladder.

The quality of cover for fish communities is limited due to relatively low flows during most months. During the October 1994 survey, limited amounts of cover were provided by rubble and boulder substrates, overhanging riparian vegetation (mainly small willows and grasses), and instream debris such as tree limbs. Undercut banks were generally absent throughout this section of Willow Creek. The accumulation of boulders at several locations in the stream create vertical drops of about 1 to 2 ft, which would restrict upstream fish movement during low flow periods. However, increased depths during spring runoff and after storm events would allow upstream fish movement. The quantity of substrate cover for fish also would increase in response to increased water volumes during high flow periods. The presence of the thick silt/clay layer on the stream substrates limited aquatic vegetation growth and the development of a productive and diverse macroinvertebrate community.

Habitat attributes in Willow Creek were rated as low quality, with little submerged aquatic vegetation, cover ranging from about 10 to 25 percent of the total area surveyed, stream widths ranging from about 2 to 6 feet, and average velocities ranging from 0.25 to 0.49 ft/sec. The low abundance and diversity of fish and macroinvertebrate communities in Willow Creek are a reflection of the limiting habitat conditions. Resident fish populations are comprised of non-game species such as speckled dace and mountain sucker. Although these data suggested slight improvements in habitat and water quality conditions in the upper portion of the study area, the overall quality rating would still be considered low.

Aquatic habitat in the lower portion of Willow Creek is limited due to the silt/clay layer on the rock surfaces, the small size of the stream, relatively low flows during most months, and limited amounts of cover provided by substrates, instream debris, and overhanging riparian vegetation. Increased surface flows in average and wet years would provide some additional cover and habitat for fish and macroinvertebrate communities, although cover is still expected to be limited.

Threatened, Endangered, and Sensitive Species Potential habitat for two Federal candidate (Category 2) fish species, roundtail chub and leatherside chub exists in Willow Creek. Although these species historically occurred in the Price River and its tributaries, CPMC cites UDWR information that neither species has been recently identified or observed in Willow Creek. Leatherside chub has been collected recently in the Price River upstream of the Willow Creek confluence.

Seven Federally listed or candidate fish species occur or could potentially occur in the Price River below the Willow Creek confluence. Potential habitat exists for three Federal candidate Category 2 species: roundtail chub, leatherside chub, and flannelmouth sucker.

Ground Water

Ground Water Quality

The major ion composition of ground water is variable, but ground water in the Willow Creek Mine area is typically a weak calcium sulfate or sodium sulfate chemical type. Ground water in the western coal reserve area, including mine discharge and inflow, is typically a weak calcium sulfate chemical type, with a sodium bicarbonate type in one well.

Available water quality information is summarized in Tables 17 through 19. Locations of seeps and springs sampled are shown on Figure 4. Samples are rarely taken during the first quarter because of snow cover at most locations.

Ground water quality is dependent on the source of recharge, flow path, nature of the strata through which the water flows, and discharge mechanism. Generally, water quality for alluvial/colluvial ground water sources is

very similar to that of surface water in the associated drainages and reflects the close interaction between the two systems. On the other hand, the quality of ground water from perched, stored mine water, and the regional aquifer ground water systems reflects some degradation relative to surface water sources due to contact with and dissolution of minerals and salts in the geologic sequence. Interception of ground water by abandoned mine workings may reduce further downward percolation and resulting degradation of water within the regional ground water aquifer.

Of the ground water encountered within the mines, water quality data are available only from cross-cut 3 of the Royal Mine between March 1985 and April 1992. Water from this location was slightly alkaline and pH averaged 8.2 and ranged from 7.4 to 8.6 with no apparent seasonal variation. Calcium/magnesium and bicarbonate were the dominant ions. TDS averaged 647 mg/L and ranged from 275 to 1060 mg/L. Total iron averaged 2.42 mg/L and ranged from less than 0.02 to 12.70 mg/L, and total manganese averaged 0.09 and ranged from 0.01 to 0.46 mg/L. Both total iron and manganese appear directly proportional to suspended solids concentrations; however, suspended solids were probably the result of sampling error rather than solids in the ground water. No seasonal variations were evident.

A relatively short flow path between the recharge area and discharge point for most perched ground water results in limited water quality degradation. Generally, TDS concentrations are less than 500 mg/ in springs issuing from the Flagstaff or North Horn Formations but 800 to 1000 mg/L in springs issuing from the Price River Formation. For both stored mine water and the regional ground water aquifer water quality is generally lower the deeper in the geologic sequence the water is found, the downward percolating water dissolving anions and cations from all units, and salts from shale members in particular: TDS concentrations in deeper portions of the regional aquifer such as the Mancos Shale frequently exceed 3000 mg/L. Data from the Castle Gate mines indicate that TDS values for the regional ground water aquifer and stored mine water in the western coal reserve area are within the same range, and there is no indication that mine inflow, water accumulation, and long-term ground water storage in abandoned mine workings results in any significant ground water quality degradation.

There is some potential that ground water and surface water quality in the permit and adjacent areas may be affected by a coalbed methane degassification project located north of the proposed Willow Creek Mine and adjacent areas. The Cockrell Oil Company is extracting water from approximately 25 coalbed methane wells in the Blackhawk Formation, primarily from the Aberdeen sandstone, to desorb methane from the coal matrix. Methane is removed from the water, the water stream is treated to reduce TDS and volume, and the remaining water is injected into the Price River Formation. Injected water may increase the discharge rate from springs and seeps downgradient of the degassification project, quality of spring and seep discharges may be degraded by the injected concentrate, and quality of water in the Price River may eventually be affected. Both the extraction and injection wells are outside areas covered by Willow Creek Mine MRP maps, but water injected into the Price River Formation could extend further than projected by the environmental analysis for the degassification project and encroach into the Willow Creek permit area. Water quality impacts could be locally significant within the Willow Creek permit area and the resulting degradation of ground water quality due to the coalbed methane project could be misinterpreted as being related to Willow Creek mining activities.

There are a number of very small stock-watering ponds scattered throughout the area, and they are typically associated with a spring in the headwaters of ephemeral watersheds such as Panther, Deep, Buck, Mathis, and Dry Canyons. The stock ponds and associated springs are monitored at sites B41, B71, B261, B341 and B342. The water quality of these springs is summarized in Tables 17 through 19. Water rights have been filed on some of the stock ponds.

Total Dissolved Solids (TDS)

Monitored springs and seeps issuing from strata above the Blackhawk Formation have average TDS values in the range of 300 to 400 mg/L. Concentrations go from a low of 255 mg/L to a high of 422 mg/L (Table 17A).

TDS levels recorded for the two monitored springs issuing from the Blackhawk Formation (Table 17A) range from 1,090 mg/L to 4,104 mg/L. Although there are only two springs that are monitored and only one sample

from one of those springs, TDS concentrations in ground water at the top of the Blackhawk appear to be less than in ground water lower in the formation. TDS concentrations in the six wells or drill holes that have been monitored (Table 17B) fall between 850 mg/L to 2,450 mg/L, although four of the wells have had only one sample each. TDS concentrations in the mines (Table 17B) range from a high of 4,420 mg/L in the #3 Mine to a low of 700 in the Royal Mine. Average TDS for the #3 Mine, 2,910 mg/L, is roughly 2000 mg/L higher than average TDS in the Royal Mine.

Average TDS values for the single Mancos Shale spring (Table 17A) are 1,025 mg/L (1980-1983) and 2,824 mg/L (1993-94), which is less than for the Blackhawk in the #3 Mine and the spring in Panther Canyon (B-71).

TABLE 17A

Total Dissolved Solids (mg/L) and Specific Conductance (μS/cm @ 25° C) in springs and seeps

Monitoring Station	Date	Average	Maximum	Minimum
Flagstaff Limestone				
unnamed drainage				
B-241 T12S, R10E, nw nw Sec. 24 Possibly Historic Robb Spring	6/94 - 3/95 (*one sample only)	* *	*340 mg/L *688 μS	*340 mg/L *688 μS
Deep Canyon				
B-261 T12S, R10E, ne se Sec. 26 Pace Spring	6/94 - 3/95 (*one sample only)	* *	*290 mg/L * 630 μS	*290 mg/L * 630 μS
North Horn Formation				
Deep Canyon				
B-262 T12S, R10E, ne ne Sec 26 unnamed spring	7/94 - 3/95	358 mg/L 714(?) μS	418 mg/L 845 μS	320 mg/L 645 μS
Mathis Canyon				
B-32 T12S, R10E ne ne Sec 27 unnamed spring	6/80 - 10/83	313 mg/L 453 μS	352 mg/L 529 μS	288 mg/L 270 μS
B-33 T12S, R10E sw nw Sec 27 unnamed spring	5/78 - 6/79	338 mg/L - μS	396 mg/L - μS	255 mg/L - μS
B-341 T12S, R10E, se ne Sec. 24 Mathis Spring	6/94 - 3/95	409 mg/L 802 μS	422 mg/L 848 μS	398 mg/L 748 μS
B-342 T12S, R10E, ne ne Sec. 34 unnamed spring	6/94 - 3/95	356 mg/L 796μS	360 mg/L 842 μS	352 mg/L 750 μS
B-351 T12S, R10E, sw se sec. 35 unnamed spring	6/94 - 3/95 (*one sample only)	* *	*294 mg/L *643 μS	*294 mg/L *643 μS
Price River Formation				
Dry Canyon				
B-41 T13S, R10E, se se Sec. 4 Jack Spring	6/94 - 3/95	328 mg/L 469 μS	338 mg/L 469 μS	333 mg/L 469 μS
Castlegate Sandstone				
* No springs or seeps *				

Specific Conductivity measured in the field

TABLE 17A (cont)
Total Dissolved Solids (mg/L) and Specific Conductance (μS/cm @ 25° C) in springs and seeps

Blackhawk Formation				
Willow Creek canyon (upper Blackhawk)				
B-321 T12S, R10E, nw nw Sec. 32 Willow Creek/Sulphur Spring	9/94 - 3/95 (*one sample only)	* *	*1,090 mg/L *1,563 μS	*1,090 mg/L *1,563 μS
Panther Canyon (middle Blackhawk)				
B-71 T13S, R10E, ne ne Sec. 7 unnamed spring	6/94 - 3/95	3,827 mg/L 2,855 μS	4,104 mg/L 4,230 μS	3,430 mg/L 416 μS
Starpoint Sandstone				
* no springs or seeps *				
Mancos Shale				
unnamed drainage near town of Kenilworth				
MC-207 T13S, R10E, ne sw Sec. 16 near Kenilworth adit	6/80 - 8/83	1,025 mg/L 1,675 μS	1,679 mg/L 1,820 μS	1,120 mg/L 1,350 μS
B-161 (same location as MC-207)	6/94 - 3/95	2,824 mg/L 2,833 μS	2,890 mg/L 4,090 μS	2,732 mg/L 410 μS

Specific Conductivity measured in the field

Except for B-71, B-331, and B-161 (Table 17A), observed electrical conductivity (EC) values generally correlate well with TDS values, with EC to TDS ratios roughly between 1:2 to 1:1.

TABLE 17B
Total Dissolved Solids (mg/L) and Specific Conductance (μS/cm @ 25° C) in monitoring wells and mines

Blackhawk Formation				
Panther Canyon				
B-51 Aberdeen Ss. - TD unknown T13S, R10E, se sw Sec. 5 Panther Canyon well	6/94 - 3/95 (*one sample only)	* *	*2,450 mg/L *3,020 μS	*2,450 mg/L *3,020 μS
Alrad Canyon				
B-121 Aberdeen Ss. - TD unknown T13S, R10E, sw nw Sec. 12 Alrad Canyon well	9/94 - 3/95 (*one sample only)	* *	*1,270 mg/L *1,226 μS	*1,270 mg/L *1,226 μS
Dry Canyon				
B-331 Aberdeen Ss - TD 1,330 T12S, R10E, ne nw Sec. 33	10/94 - 3/95 (*one sample only)	* *	*2.070 mg/L *1,226 μS	*2.070 mg/L *1,226 μS
B-331A Blackhawk Fm. - TD 660 (twin to B-331)	10/94 - 3/95 (*one sample only)	* *	*1,300 mg/L *3,350 μS	*1,300 mg/L *3,350 μS
Sowbelly Gulch				
MC-205 TD unknown T13S, R9E, se ne Sec 5	6/80 - 8/83	1,109 mg/L 1,724 μS	1,320 mg/L 1,990 μS	856 mg/L 1,496 μS
Bear Canyon				
MC-206 TD unknown T13S, R9E, ne se Sec 33	6/80 - 8/83	1,363 mg/L 1,962 μS	1,652 mg/L 2,550 μS	1,160 mg/L 1,500 μS
Mine #3 Discharge				
B-001	7/78 - ?	2,910 mg/L 5,150 μS	4,420 mg/L *	1,400 mg/L *
Royal Mine				
BM-25 (bottom of mine)	6/77 - 4/78	1,081 mg/L 1,646 μS	1,350 mg/L 2,060 μS	906 mg/L 1,390 μS
BM-26	6/77 - 4/78	861 mg/L 1,313 μS	1,300 mg/L 1,990 μS	700 mg/L 1,060 μS
BM-27	6/77 - 4/78	1,082 mg/L 1,510 μS	1,200 mg/L 1,790 μS	964 mg/L 1,060 μS
BM-28	6/77 - 4/78	1,007 mg/L 1,539 μS	1,240 mg/L 1,850 μS	896 mg/L 1,380 μS

Specific Conductivity measured in the field

Iron and Manganese

Total iron concentrations (Table 18A) are small in springs and seeps, generally below 1 mg/L and with many below the lower detection limit of 0.02 mg/L. Spring water from the marine Mancos Shale had the highest total iron concentrations, ranging from 0.112 to 4.55 mg/L, but there is no clear indication that total iron concentrations are higher in older strata.

Dissolved iron concentrations are also low, most being below the lower detection limit of 0.02 mg/L. The highest value, 0.16 mg/L, was found in water from the middle Blackhawk Formation at the spring in Panther Canyon.

In the one reported analysis of water from Sulphur (Willow Creek) Spring in the upper Blackhawk Formation total manganese was 0.78 mg/L and dissolved manganese was 0.81 mg/L. Most samples from other sites have concentrations for both forms of manganese that are below detection limits.

Total iron concentrations are considerably higher in water samples from the monitoring wells and mines (Table 18B) than from the springs. The two wells in the western coal tract have higher total iron values than those in the eastern tract, although there has been less sampling in the three eastern tract wells. Average total iron was 37.2 mg/L in well MC-205 in Sowbelly Gulch with a high of 70.6 mg/L. Well MC-206 in Bear Canyon averaged 11.8 mg/L dissolved iron, and the high was 23.6 mg/L. However, manganese concentrations appear to be higher in the eastern tract wells, where total manganese was 0.16 to 1.08 mg/L and dissolved manganese less than 0.005 to 0.86 mg/L, than in the western tract, where the range of values was 0.02 to 0.88 mg/L total manganese and dissolved manganese has been below detection limits. Total iron and total manganese concentrations in the mine water samples were similar to those in the monitoring wells except the maxima were not as high. Mine waters have not been analyzed for dissolved iron or dissolved manganese.

Many lithologic units in the area show visible evidence of iron cementation, and it is reasonable to assume the observed elevated iron levels can be correlated to natural sources and the processes of weathering, oxidation, erosion, and sediment transport. However, the higher levels of iron in the drill holes and mines may indicate contamination from drilling or coal production operations.

The Utah standard for dissolved iron is 1000 mg/L maximum in all Class 3 waters, but there is no standard for dissolved manganese. Secondary drinking water (SDW) standards for total iron and manganese are, respectively, 0.3 mg/L and 0.05 mg/L.

TABLE 18A
Iron and Manganese (in mg/L) in springs and seeps

Monitoring Station	Date	Iron - total		Iron - diss.		Manganese -total		Manganese - diss.	
		Avg.	Range	Avg.	Range	Avg.	Range	Avg.	Range
Flagstaff Limestone									
unnamed drainage									
B-241 T12S, R10E, nw nw Sec. 24 Historic Robb Spring (?)	6/94 - 3/95 (*one sample only)	*	*0.73	*	*<0.02	*	*<0.01	*	*<0.01
Deep Canyon									
B-261 T12S, R10E, ne se Sec. 26 Pace Spring	6/94 - 3/95 (*one sample only)	*	*0.07	*	<0.02	*	*0.22	*	*0.19
North Horn Formation									
Deep Canyon									
B-262 T12S, R10E, ne ne Sec 26. (?) unnamed spring	7/94 - 3/95	0.41	<0.02 - 1.14	0.17	<0.02 - 0.03	<0.01	<0.01 - <0.01	<0.01	<0.01 - <0.01
Mathis Canyon									
B-32 T12S, R10E ne ne Sec 27 unnamed spring	6/80 - 10/83	0.57	0.04 - 1.2	-	-	0.02	<0.01 - 0.03	-	-
B-33 T12S, R10E sw nw Sec 27 unnamed spring	5/78 - 6/79	0.3	0.006 - 1.2	-	-	-	-	-	-
B-341 T12S, R10E, se ne Sec. 24 Mathis Spring	6/94 - 3/95	<0.02	<0.02 - <0.02	<0.02	<0.02 - <0.02	<0.01	<0.01 - <0.01	<0.01	<0.01 - <0.01
B-342 T12S, R10E, ne ne Sec. 34 unnamed spring	6/94 - 3/95	0.09	0.07 - 0.11	<0.02	,0.02 - <0.02	0.013	<0.01 - 0.02	<0.01	<0.01 - <0.01
B-352 T12S, R10E, sw se Sec. 35 unnamed spring	6/94 - 3/95 (*one sample only)	*	*0.63	*	*<0.02	*	*<0.03	*	*<0.01

TABLE 18A (cont)
Iron and Manganese (in mg/L) in springs and seeps

Price River Formation									
Dry Canyon									
B-41 T13S, R10E, se se Sec. 4 Jack Spring	6/94 - 3/95	0.21	0.1 - 0.32	<0.02	<0.02 - <0.02	<0.01	<0.01 - <0.01	<0.01	<0.01 - <0.01
Castlegate Sandstone									
* No springs or seeps *									
Blackhawk Formation									
Willow Creek canyon (upper Blackhawk)									
B-321 T12S, R10E, nw nw Sec. 32 Willow Creek/Sulphur Spring	9/94 - 3/95 (*one sample only)	*	*0.08	*	*0.02	*	*0.78	*	*0.81
Panther Canyon (middle Blackhawk)									
B-71 T13S, R10E, ne ne Sec. 7 unnamed spring	6/94 - 3/95	0.07	0.04 - 0.14	0.11	<0.01 - 0.16	<0.01	<0.01 - <0.01	<0.01	<0.01 - <0.01
Starpoint Sandstone									
* no springs or seeps *									
Mancos Shale									
unnamed drainage near town of Kenilworth									
MC-207 T13S, R10E, ne sw Sec. 16 near Kenilworth adit	6/80 - 8/83	1.4	0.12 - 4.55	-	0.08	0.033	0.012 - 0.14	-	<0.0002
B-161 (same location as MC-207)	6/94 - 3/95	0.21	0.07 - 0.3	0.04	<0.01 - 0.06	<0.01	<0.01 - ,0.01	<0.01	,0.01 - <0.01

CHIA - WILLOW CREEK AND ADJACENT AREAS

TABLE 18B
Iron and Manganese (in mg/L) in monitoring wells and mines

Monitoring Station	Date	Iron - total		Iron - diss.		Manganese -total		Manganese - diss.	
		Avg.	Range	Avg.	Range	Avg.	Range	Avg.	Range
Blackhawk Formation									
Panther Canyon									
B-51- Panther Canyon well Aberdeen Ss. - TD unknown T13S, R10E, se sw Sec. 5	10/94 - 3/95 (*one sample only)	*	*15.7	*	*0.39	*	*0.89	*	*0.86
Alrad Canyon									
B-121 - Alrad Canyon well Aberdeen Ss. - TD unknown T13S, R10E, sw nw Sec. 12	10/94 - 3/95 (*one sample only)	*	9.9	*	*<0.01	*	*0.16	*	*<0.005
Dry Canyon									
B-331 Aberdeen Ss. - TD 1,330 T12S, R10E, ne nw Sec. 33	10/94 - 3/95 (*one sample only)	*	*6.49	*	<0.01	*	*0.28	*	*0.23
B-331A Blackhawk Fm. - TD 660 (twin to B-331)	10/94 - 3/93 (*one sample only)	*	*0.17	*	*<0.02	*	*1.08	*	*0.44
Sowbelly Gulch									
MC-205 T13S, R9E, se ne Sec 5	6/80 - 8/83	37.2	1.5 - 70.6	-	-	0.25	0.17 - 0.3	-	-
Bear Canyon									
MC-206 T13S, R9E, ne se Sec 33	6/80 - 8/831	4.6	0.13 - 26.4	11.8	0.09 - 23.6	0.38	0.02 - 0.88	-	<0.0002
Mine #3 Discharge									
B-001	7/78 - ?	0.292	0.091 - 0.565	-	-	-	-	-	-
Royal Mine									
BM-25 (bottom of mine)	6/77 - 4/78	1.076	0.072 - 3.42	-	-	0.073	0.023 - 0.218	-	-
BM-26	6/77 - 4/78	6	0.051 - 16.43	-	-	0.13	0.021 - 0.227	-	-
BM-27	6/77 - 4/78	0.32	0.149 - 0.409	-	-	0.06	0.004 - 0.156	-	-
BM-28	6/77 - 4/78	2.92	0.436 - 4.39	-	-	0.28	0.039 - 0.395	-	-

Other Metals and Ions

The Utah water quality standard for copper, 18 μg/L one hour average (12 μg/L four day average) for Class 3 waters has been exceeded in samples from drill holes MC-205, MC-206 and springs MC-207, B-32, and B-33. The standard for zinc in Class 3 waters, 120 μg/L one hour average (110 μg/L four day average) has been exceeded in samples from drill holes MC-205 and MC-206; spring MC-207; and two locations in the Royal Mine.

Additionally, samples from drill holes MC-205 and MC-206 have exceeded Utah Water Quality Class 3 standards, and in some cases Class 1 and 4 standards also, for cadmium, chromium, and silver. Standards for arsenic and lead were exceeded in some samples from drill hole MC-206 and spring MC-207, and for fluoride in MC-206.

The presence of so many contaminants in samples from drill holes MC-205 and MC-206 may indicate contamination from drilling and well completion procedures rather than ground water conditions.

In one sample from spring B-71 and in several samples from BM-25 at the bottom of the Royal Mine, selenium concentrations exceeded the 10 μg/L Utah Water Quality criterion.

Oil and Grease

There is no water quality standard for oil and grease, but a limit of 10 mg/L oil and grease is common in UPDES permits. A 10 mg/L limit does not protect fish and benthic organisms from soluble oils such as those used in longwall hydraulic systems, and UDWR has recommended soluble oils be limited to 1 mg/L (Darrell H. Nish, Acting Director UDWR, letter dated April 17, 1989 to Dianne R. Nielsen, Director UDOGM).

Analysis for oil and grease was done regularly by mine operators up until approximately 1994, when Freon needed to do the extraction became unavailable. CPMC has continued monitoring for oil and grease by simple visual inspection.

Oil and grease analysis results for ground water are summarized in Tables 19A and 19B. Concentrations ranging from 1 to 6 mg/L have been recorded in waters from monitoring wells B-51, B-121, B331, and B-331A. These values are at or slightly above the detection limit and may be a reflection of naturally occurring petroleum in the sedimentary sequence or of contamination from constituents used during the construction and installation of the monitoring wells. Drill holes MC-205 and MC-206 in the western tract had maximum oil and grease concentrations of 1.4 and 52.2 mg/L, respectively. Oil and grease concentrations of 107.2 and 25,000 mg/L were recorded for spring MC-207 in 1981. During CPMC's 1993 inspections of the old mine workings, oil slicks floating on water were observed in the No. 2 Mine. Water samples collected from the Royal Mine in 1977 to 1978 found oil and grease concentrations to range from below detection to 4,070 mg/L. Oil and grease in springs and seeps (other than the 1981 MC-207 samples) ranges from below detection to 23 mg/L. No oil and grease has been detected in B-41, B-241, B-261, B-321, B-342, and B-351, but some of these springs have been sampled only once.

TABLE 19A
Oil and Grease in ground water in springs seeps

Monitoring Station	Date	Average	Maximum	Minimum
Flagstaff Limestone				
unnamed drainage				
B-241 T12S, R10E, nw nw Sec. 24 Possibly Historic Robb Spring	6/94 - 3/95 (*one sample only)	*<1	*	*
Deep Canyon				
B-261 T12S, R10E, ne se Sec. 26 Pace Spring	6/94 - 3/95 (*one sample only)	*<1	*	*
North Horn Formation				
Deep Canyon				
B-262 T12S, R10E, ne ne Sec 26 unnamed spring	7/94 - 3/95	<1	15	5.3
Mathis Canyon				
B-32 T12S, R10E ne ne Sec 27 unnamed spring	6/80 - 10/83	<0.1	3.2	1.4
B-33 T12S, R10E sw nw Sec 27 unnamed spring	5/78 - 6/79	<1	4.6	1.6
B-341 T12S, R10E, se ne Sec. 24 Mathis Spring	6/94 - 3/95	<1	23	8
B-342 T12S, R10E, ne ne Sec. 34 unnamed spring	6/94 - 3/95	<1	<1	<1
B-351 T12S, R10E, sw se sec. 35 unnamed spring	6/94 - 3/95 (*one sample only)	*<1	*	*
Price River Formation				
Dry Canyon				
B-41 T13S, R10E, se se Sec. 4 Jack Spring	6/94 - 3/95	<1	<1	<1
Castlegate Sandstone				
* No springs or seeps *				

TABLE 19A (cont)
Oil and Grease in ground water in springs and seeps

Blackhawk Formation				
Willow Creek canyon (upper Blackhawk)				
B-321 T12S, R10E, nw nw Sec. 32 Willow Creek/Sulphur Spring	9/94 - 3/95 (*one sample only)	*<1	*	*
Panther Canyon (middle Blackhawk)				
B-71 T13S, R10E, ne ne Sec. 7 unnamed spring	6/94 - 3/95	<1	4	1.67
Starpoint Sandstone				
* no springs or seeps *				
Mancos Shale				
unnamed drainage near town of Kenilworth				
MC-207 T13S, R10E, ne sw Sec. 16 near Kenilworth adit	6/80 - 8/83	107.2	25,000	12,554
B-161 (same location as MC-207)	6/94 - 3/95	<1	17	6

TABLE 19B
Oil and Grease in monitoring wells and mines

Blackhawk Formation				
Panther Canyon				
B-51 Aberdeen Ss. - TD unknown T13S, R10E, se sw Sec. 5 Panther Canyon well	6/94 - 3/95 (*one sample only)	*2	*	*
Alrad Canyon				
B-121 Aberdeen Ss. - TD unknown T13S, R10E, sw nw Sec. 12 Alrad Canyon well	9/94 - 3/95 (*one sample only)	*3	*	*
Dry Canyon				
B-331 Aberdeen Ss - TD 1,330 T12S, R10E, ne nw Sec. 33	10/94 - 3/95 (*one sample only)	*6	*	*
B-331A Blackhawk Fm. - TD 660 (twin to B-331)	10/94 - 3/95 (*one sample only)	*1	*	*
Sowbelly Gulch				
MC-205 T13S, R9E, se ne Sec 5	6/80 - 8/83	<0.2	1.4	0.83
Bear Canyon				
MC-206 T13S, R9E, ne se Sec 33	6/80 - 8/83	<0.1	52.2	16.9
Mine #3 Discharge				
B-001	7/78 - ?	<1	-	-
Royal Mine				
BM-25 (bottom of mine)	6/77 - 4/78	3.4	4,070	599.3
BM-26	6/77 - 4/78	1.7	13.6	6.9
BM-27	6/77 - 4/78	<1	5.2	2.8
BM-28	6/77 - 4/78	<1	7.4	3.2

pH

The range of pH in ground water from springs, seeps, wells, and mines is 6.7 to 9.3. Most values fall between 7 and 8, indicating neutral to moderately alkaline conditions. High pH values are relatively common in the arid western United States and reflect the geochemistry of the dominant stratigraphic units. The pH of 9.3 is from B-121, a recently completed monitoring well in Alrad Canyon and is the only recorded pH greater than 9. The lowest pH was also from a well, MC-205 in Sowbelly Gulch. Where both acidity and alkalinity have been determined, alkalinity is typically 5 to 10 times acidity.

Nitrogen and Phosphorus

Nitrate is the only form of nitrogen consistently monitored. The average nitrate level in spring B-71 in Panther Canyon is 6.6 mg/L and the lowest reported concentration is 5.5 mg/L. As much as 9 mg/L nitrate has been detected at station BM-25 in the Royal Mine, and nitrite also was detected consistently at that location. In addition to B-25, water samples from springs B-41, B-71, and B-262 and wells B-331 and 331A have had detectable nitrite, but nitrite has been below the detection limit at most locations. For comparison, nitrate is considered an indicator of pollution in concentrations greater than 4 mg/L (as N) in many classes of surface water.

Phosphate (as phosphorus) concentrations in excess of 0.05 mg/L, considered an indicator of pollution for Class 2A, 2B, 3A and 3B waters, have been found in springs B-241, B-262, and B-32, on the east side of the CIA. In the Royal Mind, analysis reports show ortho phosphate concentrations from two of the sampling locations and total phosphate concentrations at all four locations are consistently above 0.05 mg/L: no analyses for phosphates were done for the #3 Mine. Total phosphate is also high at drill holes MC-205 and MC-206 and at spring MC-207

Ground Water Quantity

Average flow from springs B-32 and B-33 in Mathis Canyon has been 0.02 cfs. Otherwise, flow of springs and seeps that have been monitored is small, generally on the order of 0.001 to 0.01 cfs. Recharge for most of these springs and seeps probably originates in the small surface depressions or basins in the immediate vicinity. Higher flows occur during spring snowmelt, and flows in the autumn are often lower by an order of magnitude. Some seeps dry completely during the summer. Flows are also sensitive to the amount of precipitation during the winter. (Are there data to back these statements?)

Wadell (1987) documented average baseflow of approximately 0.2 cfs of from the Blackhawk-Starpoint aquifer to the creek in Spring Canyon, mainly through the Starpoint Sandstone. However, in Willow Creek Wadell detected approximately 0.4 cfs baseflow from the North Horn Formation, with only approximately 0.1 cfs baseflow from all underlying strata, including the upper Blackhawk Formation. Wadell did not determine baseflow for the Price River.

Ground water was intercepted in each of the 1994 drill holes. Several strata flowed water at up to 7 gpm. One thinly-bedded sandstone unit flowed 15 to 20 gpm, but significant gas and gas pressure encountered in this interval was possibly exaggerating actual ground water flow rates. B-331/331A was a dual completion because of inflows of 1 to 5 gpm at multiple depths in the original drill hole. A pump tests in two of the four 1994 holes indicated a recharge rate of about 0.25 gpm.

Water is found in old mine workings, and some of the old workings are now flooded, but inflow occurs as small volumes from roof drippers or through the floor. Flow rates have been recorded for the #3 Mine and three of the four Royal Mine in-mine monitoring points. The largest average flow reported is 0.04 cfs at the #3 Mine, and for the three Royal Mine stations the averages are 0.01 cfs or less. No significant point sources have been identified by CPMC.

V. IDENTIFICATION OF HYDROLOGIC RESOURCES

(IDENTIFY HYDROLOGIC RESOURCES THAT ARE LIKELY TO BE AFFECTED AND DETERMINE WHICH PARAMETERS ARE OF IMPORTANCE FOR PREDICTING FUTURE IMPACTS TO THOSE HYDROLOGIC SYSTEMS.)

A number of individuals, water user associations, government agencies, and corporate entities hold surface water rights on the Price River, Willow Creek, and some of the larger tributary drainages. There are filings for 66 surface water rights: 54 for stockwatering and 12 for various combinations of stockwatering, irrigation, domestic, industrial, municipal, power, mining, and "other". Most perennial and ephemeral streams in the CIA have water rights filed on them, many dating to the 1860's.

Ground water rights have been filed on alluvial/colluvial wells in area drainages, shallow wells that intercept perched aquifers, mine tunnels, and numerous small springs and seeps. Of the 51 ground water rights filed, 28 list municipal as the use, but many of those are unapproved rights filed by the Price River Water Improvement District on poor quality water from the methane extraction wells. Stockwatering, industrial, domestic, and "other" are listed as uses for the remainder of the water rights. Springs and seeps are also important to wildlife, though there are no filed rights that declare this as a use.

Actual ground water use within the hydrologic basin is primarily large volume municipal and irrigation use and small volume stock watering applications. Of the four primary aquifer systems, only the alluvial/colluvial aquifer yields sufficient water to serve as a reliable source of water for beneficial use. Water supply wells in alluvium along the Price River produce from the shallow, unconfined aquifer that is interconnected with the river. Along the Price River valley, especially near Heiner, Martin, and Helper, numerous individuals and corporations have significant water rights that are used for irrigation purposes. Water rights have been filed on some of the very small stock-watering ponds scattered throughout the area. The ponds are typically associated with a spring in the upper reaches of small, ephemeral watersheds such as Panther, Deep, Buck, Mathis, and Dry Canyons.

The Price River Water Improvement District extracts water for municipal use from ground water wells in Sections 23 and 24 of T. 12 S., R. 10 E. PacifiCorp owns significant water rights for water from their UGW well located in Section 35 of T12S, R9E. Water rights have been filed on mine inflow or stored mine water in four mines in the area.

The Willow Creek and Castle Gate permit areas include both municipal and non-municipal watershed areas. The Price Water Supply and Treatment Plant is located next to the Price River, across from Bear Canyon and near the abandoned Royal townsite. The Price River and associated tributaries above the water treatment plant are considered a municipal watershed, but areas downstream from the plant are not within the municipal watershed.

Recharge for springs and seeps in the CIA probably originates in small drainages or basins in the immediate vicinity. Fractures may be only locally important in recharge and ground water flow, but flows into the mines that persist for more than 30 days should be considered as possibly intercepting surface water through a natural or subsidence induced fracture system. Perched systems have limited storage and recharge capacities, and when they are intercepted by mining operations the resulting in-mine flows decline rapidly. Draining of perched systems may cause individual springs or seeps to disappear but should have little impact on the hydrologic balance of the area.

Operations in the mines can cause drawdown of the potentiometric surface of the regional aquifer, which can in turn induce increased recharge and downward flow through the overlying unsaturated zone. This would probably have a minimal or undetectable effect on perched aquifers and soil moisture because of the generally low hydraulic conductivity of the Blackhawk Formation. The cone of depression and any resulting effects on overlying unsaturated or saturated strata will diminish with time after mining ceases.

The Class 3A waters in the CHIA, which are the Price River and its tributaries above the Price Water Supply and Treatment Plant, are protected for cold water species of game fish and other cold water aquatic life including

the necessary aquatic organisms in the food chain. Below the water treatment plant the Price River and its tributaries, which include Willow Creek, are Class 3C, protected for nongame fish and other aquatic life. Willow Creek and the Price River are considered by UDWR to be Class 4 fisheries, which are streams with low recreational fishing potential. Game fish species expected to occur in Willow Creek include rainbow trout, Yellowstone cutthroat trout, and brown trout, but habitat are limited. Spawning conditions are poor in lower Willow Creek, but the sporadic occurrence of trout in this part of the stream is perhaps related to seasonal spawning migrations. Adult trout may move from the Price River into Willow Creek and other tributaries during their spawning periods, and after spawning migrate back to the Price River.

Periods of high suspended solids in the streams are normally also periods of high runoff, so fine sediments are flushed from the streambed and clean gravel beds for trout spawning are left. When runoff is low, fine sediments may remain and make spawning gravels unavailable. Fine sediments increase trout egg and fry mortality through suffocation. Invertebrates are also impacted by sedimentation through loss of habitat or mortality. Invertebrate diversity may decrease but resistant or adaptive species will remain. Impacts on invertebrates may reduce the supply of food for fish. Construction, mining, and other activities can produce the same negative impacts by decreasing flow or increasing sedimentation beyond the capacity of the stream to flush itself. Coal fines have the same negative impacts as natural, fine sediments. The nature of the streambed below the mines has not been characterized.

Toxic materials in the water will reduce trout and invertebrate populations through mortality or avoidance. Nitrite concentrations in excess of 0.06 mg/L result in trout mortality. The long term LC_{50} exposure level for trout to nitrate is 1060 mg/L. Phosphorus in excess of 0.04 mg/L is not toxic to trout but does lead to eutrophication. There is no water quality standard for TDS for aquatic wildlife, but 1200 mg/L is the limit for agricultural use.

Table 20 lists potential impacts to the hydrologic resources, indicates if there is a possibility for cumulative impact outside the permit areas, and identifies analytical parameters or other indicators that need to be monitored to track potential impacts of the permitted mines.

Table 20

POTENTIAL HYDROLOGIC IMPACTS	Possible Cumulative Effect Outside Permit Areas	Parameters of Importance and Other Indicators for Predicting Future Impacts
• *Increased sediment yield from disturbed area* - Alteration or loss of fisheries in streams. Coal spillage from hauling operations and storage. Loss of riparian habitat.	YES	• Sediments • Fish and Macroinvertebrates
• *Flooding and streamflow alteration* - increase or decrease in streamflow.	YES	• Flow • Sediments • Fish and Macroinvertebrates
• *Contamination of ground water and surface water from acid- and toxic-forming materials* - Contamination of surface water from coal hauling operations and storage. Hydrocarbon contamination from above-ground storage tanks or from the use of hydrocarbons in the permit area. Contamination from road salting. Gypsum used in dust control contaminating mine discharge. Nutrients in mine discharge.	YES	• Sediments • TDS • pH • Nutrients • Specific cations and anions • Oil and Grease • Fish and Macroinvertebrates
• *Subsidence damage to springs and streams* - Increased sediment load, diminution of flow, physical barriers to fish migration.	YES	• Flow • Sediments • Fish and Macroinvertebrates
• *Alteration or destruction of fisheries and aquatic habitats* - Loss of flow, loss of access to stream, loss of fish spawning habitat, increased sediment load, acute or chronic toxicity, eutrophication, loss of food supply.	YES	• Flow • Sediments • Fish and Macroinvertebrates • TDS • pH • Nutrients • Specific cations and anions
•*Loss of ground water or surface water availability* - water rights, wildlife uses.	YES	• Flow
• *Reduction of flow due to interbasin transport of intercepted water.*	NO	• Flow

VI. MATERIAL DAMAGE CRITERIA - RELEVANT STANDARDS AGAINST WHICH PREDICTED IMPACTS CAN BE COMPARED.

Water within the CIA is used for watering livestock and wildlife, mining coal, domestic use, fisheries, and recreation. Downstream, the water is additionally used for irrigation and domestic and industrial needs. Land within the CIA is used for wildlife habitat, grazing, recreation, and mining coal. Anticipated post-mining uses are for wildlife habitat, grazing, and recreation.

Quality

Water quality standards for the State of Utah are found in R317-2, Utah Administrative Code. The standards are intended to protect the waters against controllable pollution. Waters, and the applicable standards, are grouped into classes based on beneficial use designations.

Above the Price City Price Water Supply and Treatment Plant, water in the Price River and its tributaries is classified by the Utah Division of Water Quality as:

- 1C - protected for domestic use with prior treatment,
- 2B - protected for recreational uses except swimming,
- 3A - protected for cold water species of game fish and other cold water aquatic life,
- 4 - protected for agricultural uses.

Below the water treatment plant the water is classified as:

- 2B - protected for recreational uses except swimming,
- 3C - protected for non game fish and other aquatic life, and
- 4 - protected for agricultural uses.

Surface waters located within the outer boundaries of a USDA National Forest, with specific exceptions, are designated by the Utah Division of Water Quality as High Quality Waters - Category 1 and are subject to the state's antidegradation policy. This antidegradation policy is that waters shall be maintained at existing high quality and new point source discharges of wastewater, treated or otherwise, are prohibited (Utah Administrative Code, R317-2-3.2 and R317-2-12.1). None of the lands within the CIA are USDA Forest Service lands, so these additional restrictions do not apply.

The Utah Department of Environmental Quality, Division of Water Quality can authorize a coal mine to discharge into surface waters under the Utah Pollutant Discharge Elimination System (UPDES). The permits for the mines contain site-specific limitations on total dissolved solids, total suspended solids (or total settleable solids for precipitation events), iron, oil and grease, pH, plus any other water quality parameters for which monitoring is determined necessary by the Division of Water Quality.

Water quality standard for nitrate in Class 1C waters is 10 mg/L. Nitrate levels above 4 mg/L are considered an indicator of pollution, usually from sewage, in all waters. For trout, the long term LC_{50} exposure level to nitrate is 1060 mg/L.

There is no water quality standard for nitrite, but concentrations in excess of 0.06 mg/L produce mortality in cutthroat trout (UDWR, 1988).

The water quality standard for Class 3A waters for phosphorus is 0.05 mg/L. Levels in excess of 0.04 mg/L are not toxic to trout but are excessive and promote eutrophication (UDWR, 1988). By state standards for Class 1C, 2A, 3A, and 3B waters, phosphate in excess of 0.05 mg/L is a pollution indicator.

There is no water quality standard for oil and grease, but UPDES permits typically have a limit of 10 mg/L. A 10 mg/L oil and grease limit does not protect fish and benthic organisms from soluble oils such as those used in longwall hydraulic systems, and UDWR has recommended soluble oils be limited to 1 mg/L (Darrell H. Nish, Acting Director UDWR, letter dated April 17, 1989 to Dianne R. Nielsen, Director UDOGM).

There is no water quality standard for TDS for aquatic wildlife, but 1200 mg/L is the limit for Class 4, agricultural use.

The National Academy of Sciences recommends suspended sediment limits of 26 to 80 mg/L to provide moderate protection of fish populations.

The maximum temperature for Class 3A waters is 20 degrees C (68 degrees F). The maximum allowable change for Class 3A waters is 2 degrees C (3.6 degrees F).

Physical or chemical indicators alone do not fully evaluate water quality in streams. Macroinvertebrates are excellent indicators of stream quality and can be used to evaluate suitability of a stream to support a trout fishery and other aquatic life. Cutthroat trout populations in particular are excellent indicators of stream quality. Baseline studies of aquatic habitat and biology in 1994 and 1995 provide standards against which actual stream conditions can be evaluated.

Sedimentation

Changes in sediment size distribution in streams can be determined by comparison with past studies. Winget (1980) identified 15% or more of materials finer than 0.85 mm in diameter as a critical measure of biotic potential, that is whether or not fish eggs and fry and many macroinvertebrates would be suffocated.

Interbasin Diversion

There will be no interbasin diversion of water in the CIA covered by this CHIA.

VII. ESTIMATE OF THE IMPACTS OF MINING ON THE HYDROLOGIC RESOURCES

CPMC's planned mining and related activities have the potential to generate temporary impacts to surface water resources. These impacts will typically be localized, being confined to those segments of area drainages directly impacted by mining activities, although in some cases impacts may have the potential to also effect downstream drainage areas. New surface disturbance associated with the Willow Creek mining and related operations will involve a relatively limited area, and potential mining related surface water impacts are small. Potential surface water impacts should be effectively mitigated through control of diversion of surface water for mine water supply, operation of a comprehensive drainage and sediment control system, compliance with monitoring requirements and discharge effluent standards under the required UPDES permits, and reclamation of surface disturbance areas and restoration of surface drainage characteristics.

Changes in Streamflow - Loss of Surface Water Availability

Mining, related coal processing operations, and support activities will require a consistent water supply with adequate capacity to meet all operational mine water supply requirements. Based on preliminary estimates of anticipated mine inflow volumes and mine water use requirements, it is anticipated that most if not all mine inflows can be either recycled through the operational mine water system or stored underground. CPMC plans to construct a 750,000 gallon mine water storage tank and will have significant additional mine water storage capacity in inactive areas of the underground mine workings. This storage capacity can be utilized to good advantage during seasonal low flow periods to limit required stream withdrawals. If it becomes necessary to discharge any excess mine drainage to the surface, discharge will be routed through the drainage and sediment control network to Sedimentation Pond 001 where it will be retained, treated if necessary, and sampled prior to discharge. Given that potential mine water discharge requirements are expected to be minimal, any potential changes in streamflow resulting from mine water discharge should be minimal.

Recycling of mine drainage to supplement the operational mine water system will significantly reduce requirements for diversion of surface water. Additional mine water requirements will be supplied from a point of diversion on the Price River using CPMC's existing active water rights and through recycling of mine inflows. Anticipated mine water supply withdrawals are projected at 730 acre feet per year (1.0 cfs) which is only 0.9% of the average annual streamflow for the Price River (81,140 acre feet per year based on an average flow of 112 cfs). Use of the Price River as a water supply source has the potential of reducing stream flow downstream of the point of diversion, however, any reductions will be on the order of the historic reductions associated with the Castle Gate Mine and previous mine operations by previous operations. CPMC does not anticipate that the full amount allowed under the existing water rights will actually be withdrawn and the available excess will serve as an effective buffer to limit potential impacts on downstream flows.

Potable and sanitary water requirements will be addressed through a water supply connection to the existing Price River Water Improvement District water main located in Price Canyon.

Sedimentation ponds tend to reduce discharge flow volumes and extend the period of effective flow from snowmelt and thunderstorm events, which are the source of most runoff in the Willow Creek area. Most retained runoff is returned to the surface drainage system. Minor alteration of the timing of runoff flows is significant only if the delay and the corresponding volume of retained runoff reduces flows during critical low flow periods or if the deferral of runoff discharge involves significant time delays. With the exception of Pond 003, which is designed as a non-discharging structure, the Willow Creek Mine sedimentation ponds are designed to gradually release impounded runoff following required retention for sediment control. Maximum designed detention time is only 3.4 days, with discharge occurring continuously once the pond level reaches the discharge orifices. Sedimentation Pond 003 is designed with a maximum storm retention capacity of only 0.41 acre-feet, which is a negligible amount relative to flow volume for the receiving watershed.

There should be no noticeable change of flow in Willow Creek or the Price River. Because most erosion occurs during spring runoff, there should be little change in erosion or in the ability of the streams to flush themselves of fine sediment periodically.

Subsidence Damage to Springs and Seeps - Loss of Ground Water Availability

The Willow Creek Mines are designed to restrict subsidence to the permit areas; however, where overburden is minimal or fracturing is extensive, there is potential for the capture of ground water or surface water by subsidence cracks. Ground water impacts resulting from the planned mining and related activities will be minimal due to limited ground water occurrence, low overall permeabilities and consequent limitations on the effective area of influence, and the low level of beneficial ground water use in the potentially affected areas. In particular, potential subsidence effects on perched ground water systems and associated springs and seeps are expected to be negligible due to the isolated nature of such ground water occurrences. Ground water diverted from seeps or springs fed by perched systems would most likely emerge nearby at another surface location rather than drain down into the mine. Subsidence impacts are largely related to extension and expansion of existing fracture systems and upward propagation of new fractures. Vertical and lateral movement of ground water in the permit area appears to be largely controlled by fracture conduits, so readjustment or realignment of the conduit system may potentially produce changes such as increased flow along fractures that are enlarged and diversion of flow along new fractures. Increased flow rates would potentially reduce residence time and improve water quality. Some of the perched, localized aquifers could be dewatered.

There is little potential for the effects from dewatering perched aquifers to extend beyond the permit area because the perched aquifers of the Blackhawk Formation are lenticular and localized, the stratigraphic sequence has low overall permeability and lacks significant vertical hydraulic continuity, and the proposed mining operations will be relatively deep.

Where mining and subsidence occur within the saturated rocks of the regional aquifer there will be a large increase in permeability locally. Sealing of subsidence cracks by clays in the Blackhawk is expected to minimize long term effects of subsidence on the hydrologic systems. With time, permeability will decrease as fractures close and the potentiometric surface establishes a new equilibrium. Residual impacts should be restricted to the previously mined area and will probably be negligible.

Temporary increases in runoff from surface disturbance areas

In general, probable hydrologic consequences for surface water resources resulting from CPMC's mining operations will be limited by the relatively small mine facilities areas. Impacts will be effectively mitigated by operation of the drainage and sediment control system and ultimate reclamation of mine disturbance areas.

Proposed new mining related surface disturbance will involve removal of vegetation and soil/substitute materials and grading of disturbance areas for specific mining related uses. These disturbance activities will reduce infiltration potential and evapotranspiration due to elimination of vegetation and will increase surface runoff and erosion potential. For existing disturbance areas within the Castle Gate preparation plant and loadout area and the Crandall Canyon facilities area these impacts have already occurred and runoff effects are ongoing. Total runoff from all mine disturbance areas including the mine facilities area, Castle Gate preparation plant and loadout area, and the Crandall Canyon facilities area, for the 10-year, 24-hour storm event is only 9.14 acre-feet, which can be compared with a total average annual runoff volume of 81,140 acre-feet for the Price River.

On completion of mining operations, disturbed areas will be reclaimed by backfilling and grading, reestablishing natural drainage patterns, replacing soils or soil substitutes, and revegetation. It is anticipated that reclamation will effectively restore infiltration and runoff patterns to baseline conditions currently existing for the surface disturbance areas.

Changes in surface water chemistry

Runoff from surface disturbance areas, infiltration and drainage from coal refuse and mine waste storage areas, and surface discharge of excess mine drainage may result in changes in runoff water chemistry. The most probable potential change in runoff water chemistry would be a shift toward a sodium sulfate type due to the weathering and leaching of exposed materials.

CPMC's proposed surface drainage and sediment control measures will be effective in limiting exposure of runoff to disturbed materials and consequent leaching. None of the materials that will be exposed, including overburden, soils, coal refuse, and mine waste materials, have been conclusively documented to be potentially acid- or toxic-forming. While minor changes in runoff water chemistry may occur as a result of mining and related operations, limited surface disturbance areas and small disturbed area runoff volumes will minimize the potential for significant changes in water chemistry for the receiving drainages. Disturbed area runoff flows will be diluted by significantly greater volumes of runoff from other drainage basin areas.

Increases in the levels of TDS, TSS, and certain individual chemical constituents

Surface water in the mine area is generally neutral to moderately alkaline with naturally elevated levels of TDS, TSS, sulfate, iron, and phenols. A probable consequence of surface disturbance and the resultant erosion will be increases in sediment loading and TSS levels for the disturbed area runoff. Contact between disturbed area runoff and materials exposed to weathering and oxidation, drainage from coal refuse and mine waste storage areas, and discharge of excess mine drainage flows may result in increases in TDS and in individual chemical constituents. Mining and related activities will probably not result in any significant change in surface water pH, although TDS, TSS, and sulfate levels may increase slightly. The restricted size of the disturbed area, small runoff volumes, and mitigation measures have the potential to limit increases in TSS, TDS, and individual chemical constituents. Potential increases may be effectively addressed on a short-term basis by establishment and operation of the drainage and sediment control system and compliance with monitoring requirements and discharge effluent limitations of the UPDES permit. Reclamation and restoration of effective surface drainage conditions should address potential mining and related surface water impacts over the long-term.

Potential Effects on Aquatic and Riparian Resources, Including Sensitive Species

The primary potential impacts on fish and aquatic species, aquatic habitat, and riparian vegetation that may result from the mining and related activities include; 1) Sedimentation from construction activities; 2) Temporary loss of low quality habitat and limited riparian vegetation as a result of realignment of portions of the Willow Creek channel, construction of the primary access road bridge, and replacement of an existing culvert crossing; and 3) Any significant changes in stream water quality or flow rates. Secondary potential impacts include risks associated with petroleum spills or leaks from equipment used near the stream and minor fugitive coal dust or coal sediment inputs to the stream resulting from coal handling and other mining related operations.

Scheduling of required construction activities during the seasonal low flow period and the use of alternative sediment controls should effectively minimize potential sediment contributions and impacts on fish movements or migrations. Sediment contributions from construction of mine surface facilities will be controlled by a combination of temporary control measures and designed drainage and sediment control structures to be established prior to construction disturbance.

Realignment of two stream segments will result in the temporary loss of low quality habitat and riparian vegetation. The existing segments of the Willow Creek channel that are to be realigned represent habitat for benthic macroinvertebrates and resident fish such as mountain sucker and speckled dace, are migratory routes for several trout species, and support limited riparian vegetation in a thin zone bordering the channel margins. Potential habitat exists for two Federal candidate (Category 2) species, roundtail chub and leatherside chub, in Willow Creek. Habitat for three Federal candidate (Category 2) species (roundtail chub, leatherside chub, and

flannelmouth sucker) exists in the Price River, although the closest known occurrence of any of these species is approximately 70 miles downstream on the Green River.

Planned stream realignments will reduce the total length of existing stream habitat by approximately 110 feet. Assuming an average stream width of 6 feet at low flow, the amount of stream habitat disturbed would be approximately 7,260 square feet. Stream realignment will also impact approximately 1.5 acres of riparian vegetation. Shallow riffle habitats with clay, silt, rubble, and boulder substrates are characteristic of Willow Creek within the proposed mine facilities area. Overall aquatic habitat quality and value are limited primarily by the clay and silt deposits. Pool habitat is generally limited in terms of depth and areal coverage except for the series of five man-made pools, located below the existing culvert crossing, that are to be removed in conjunction with construction of the lower stream channel realignment and new culvert crossing. The loss of existing stream habitat and riparian vegetation will be effectively mitigated by construction of designed channel segments and revegetation. Designed channel segments will have essentially the same hydrologic and geomorphic characteristics as the existing stream segments they will replace, yet they will incorporate specific design considerations and construction practices that will, overall, enhance the aquatic and riparian habitat values.

Construction activities for the main access road bridge and replacement of the existing culvert crossing will result in a relatively limited, temporary disturbances to aquatic and riparian habitats. The estimated area of disturbance is approximately 300 square feet at each location. Construction is to occur during low flow, and disturbed areas would be returned to their approximate pre-disturbance condition and configuration following completion of construction activities .

The use of construction equipment near the Willow Creek stream channel represents a potential risk because a petroleum spill or leak could result in stream contamination with potential toxic effects on fish and macroinvertebrates. The magnitude and duration of the impact would depend on the location and amount of the spill, the type of material spilled, and flow conditions at the time of the spill. No long term damage is to be expected , but short term effects to aquatic habitats and all forms of life in the stream could be catastrophic.

Stormwater runoff from disturbed areas is a potential source of additional sediment contributions to Willow Creek. Sediment contributions should be effectively controlled by construction, operation, and maintenance of drainage and sediment control systems. Siltation and erosion are existing problems in the lower portion of Willow Creek and it is important to minimize additional sediment inputs. Previous water quality studies for Willow Creek have resulted in reported total suspended solids levels ranging from about 5 to 700 mg/L, with an average of 363 mg/L (USDI BLM 1992). A limit of 26 to 80 mg/L suspended sediment has been recommended as the limit for moderate protection of fish populations. Implementation of drainage and sediment control measures as described in the PAP should keep suspended sediments within background concentrations, and mining related sediment contributions would result in little or no significant impact on fish and macroinvertebrate communities or aquatic habitat values.

To the extent reasonably feasible within topographic limitations, coal storage and handling facilities and equipment have been located as far as possible from Willow Creek and the Price River. Wind-blown dust from the stockpiles could deposit coal dust in or near stream channel areas. The conveyor system will be covered to minimize exposure and dispersion of coal fines during transport and all transfer points will be partially or fully enclosed and will incorporate Best Available Current Technology (BACT) emission controls. Small amounts of coal dust or fines will probably escape from the conveyor system and minor spillage may occur in the area immediately adjacent to the conveyor. Most of the conveyor system will be at least 200 feet from Willow Creek, which will minimize the potential for coally material to enter the stream. Approximately 1200 feet of the conveyor system will be located within 150 to 180 feet of the stream. The planned realignment of two sections of Willow Creek will increase the effective distance between the creek and the conveyor. A 100 foot stream buffer zone and, where feasible, a full-length protective berm are to be established between the mine facilities and stream channel. While coal dust and other coally materials may be deposited in or near Willow Creek and the Price River, potential associated impacts to aquatic communities or habitat values are anticipated to be negligible due to the limited amounts and the relatively inert nature of the coal.

A Section 7 consultation process under applicable U.S. Fish and Wildlife Service regulations is anticipated to be part of the review process for the Federal Mine Plan Approval associated with the Federal leases. In the event such consultation results in a determination that the proposed water use represents a new depletion, a biological assessment of potential effects on endangered fish species and associated critical habitat designations in the Green and Colorado Rivers would be completed. Three Federal candidate Category 2 species (roundtail chub, leatherside chub, and flannelmouth sucker) for which both the Price River and lower portions of Willow Creek may provide potential habitat would be included in any biological assessment.

VIII. MATERIAL DAMAGE DETERMINATION

Increased Sediment Yield

Fine sediments in Willow Creek may increase as a result of road construction and coal mining activities, with a notable increase in coal fines during the period of mine operation. Because clay and silt deposits are common in the Willow Creek stream substrate, the impact of the increase in fine sediments should be negligible. After mining and reclamation activities cease, Willow Creek should be able to flush itself of excessive fine sediments. No material damage from increased sediment yield is expected.

Flooding or Stream Flow Alteration

Potential mine water discharge requirements are expected to be minimal. Use of the Price River as a water supply source has the potential of reducing stream flow downstream of the point of diversion, however, any reductions will be on the order of the historic reductions associated with the Castle Gate Mine and previous mine operations. There should be no noticeable change of flow in Willow Creek or the Price River. Because most erosion occurs during spring runoff, there should be little change in erosion or in the ability of the streams to flush themselves of fine sediment periodically. There is no present or foreseen material damage resulting from changes in flow due to present or projected discharge from the mines or withdrawals of water from the streams.

Water Quality

Water quality problems are not expected from construction or operation of the mine and related facilities. No material damage to water quality is expected.

Subsidence Damage to Springs and Seeps

There is little potential for the effects from dewatering perched aquifers to extend beyond the permit area because the perched aquifers of the Blackhawk Formation are lenticular and localized, the stratigraphic sequence has low overall permeability and lacks significant vertical hydraulic continuity, and the proposed mining operations will be relatively deep. No material damage to springs or seeps from subsidence or other coal mining activities is expected.

Alteration or Destruction of Fisheries and Aquatic Habitat

Short term disruptions to sections of Willow Creek aquatic habitat are expected during construction of mine facilities. No material damage to fisheries or aquatic habitat is expected.

Loss of Ground Water or Surface Water Availability

There should be no noticeable change of flow in Willow Creek or the Price River. There is little potential for effects from dewatering of aquifers to extend beyond the permit area because perched aquifers are lenticular and localized, the stratigraphic sequence has low overall permeability and lacks significant vertical hydraulic continuity, and the proposed mining operations will be relatively deep. No material damage from loss of surface or ground water availability is expected.

IX. STATEMENT OF FINDINGS

No evidence of material damage from actual mining operations has been found. No probability of material damage from actual or anticipated mining operations has been found.

X. REFERENCES

Anderson, P., 1991, consultants report referenced in Willow Creek mining and reclamation plan but not included as part of the plan.

Atlas of Utah, 1981, Wayne L. Wahlquist, *ed.*, Brigham Young University Press, 300 p..

Coastal, 1993, Skyline Mines mining and reclamation plan, on file with Utah Division of Oil, Gas, and Mining.

Doelling, H. H., 1972, Central Utah coal fields: Sevier-Sanpete, Wasatch Plateau, Book Cliffs and Emery: Utah Geological and Mineralogical Survey Monograph No. 3, 571 p.

Freeze, R. A., 1971, Three-dimensional, transient, saturated-unsaturated flow in a groundwater basin, Water Resources Research, v. 7, no. 2, p. 347-366.

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, 32 p.

Price, D. and Arnow, T., 1974, U. S. Geological Survey Professional Paper 813-C, Summary appraisals of the nation's ground-water resources-- Upper Colorado Region.

Price, D. and Plantz, G. G., 1987, Hydrologic monitoring of selected streams in coal fields of central and southern Utah--summary of data collected, August 1978-September 1984: U. S. Geological Survey Water Resources Investigations Report 86-4017, 102 p.

Price, D. and Waddell, K. M., 1973, Selected hydrologic data in the Upper Colorado River Basin, U. S. Geological Survey Hydrologic Investigations Atlas HA-477.

UDWR, 1988, letter dated October 17, 1988 from Larry B. Dalton, UDWR Analyst, to Lowell Braxton, UDOGM

USDI-BLM, 1992. Final EIS for the Castle Gate Coalbed Methane Project, Carbon County, Utah. USDI-BLM Moab District, Price River Resource Area.

USGS, 1994, Water resources data - Utah - water year 1994, U. S. Geological Survey Water-Data Report UT-94-1.

Winget, R. N., 1980, Aquatic ecology of surface waters associated with the Skyline Project, Coastal States Energy Company - general aquatic description -, *in* Coastal States, 1993, Skyline Mines mining and reclamation plan, Appendix Volume A-3.